BDNVF

Bangladesh National Veterinary Formulary 2023

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Directorate General of Drug Administration
Ministry of Health & Family Welfare
Health Services Division

In Association with
Promoting the Quality of Medicines Plus (PQM+) Program
USP Bangladesh

1st Edition

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BDNVF- 2023

An official publication about veterinary drugs and related items officially used in Bangladesh for rapid reference and includes all the available information for prescribing and dispensing veterinary drugs and related items.

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Preface

The rational use and access to quality-assured, safe, and effective medical products are essential for both humans and animals from one health perspective. The common concern between regulators, physicians, practitioners, pharmaceutical manufacturers, suppliers, marketing authorization holders, and the public as end users is essential to promote better access and rational use for the mitigation of challenges associated with the treatment and supply chain of medical products. After the year 1982, Bangladesh made remarkable progress with local production and access to medical products for humans and consequently increased access to veterinary medical products. The veterinary pharmaceutical market is gradually growing through local production and imports toward economic and safer use for animal health.

Human health and animal health are interlinked in one health aspect, whereas scientific evidence and therapeutic information are the keys to practicing the rational use of medical products for humans and animals equally important. Anti-microbial resistance (AMR) is a global threat associated with human health, animal health, and environmental health. The Directorate General of Drug Administration (DGDA) is the sole responsible authority for the regulation of medical products for humans and animals toward ensuring better access and risk mitigation associated with quality, safety, efficacy, and reliability.

The Government of Bangladesh is aware of the growing concerns over antimicrobial resistance (AMR). To combat the AMR, the Government of Bangladesh is highly committed and has developed a National Action Plan (NAP) involving multi-sectoral stakeholder engagement for successful implementation. The DGDA has several major roles in the National Action Plan (NAP) to control AMR. Fighting AMR requires the collaboration of many stakeholders working in the human and animal health sectors. To put equal significance on both human and animal health harmonized regulatory systems for all medical products are being implemented. The DGDA established a mechanism of monitoring and reporting consumption and use for Anti-microbial containment. The government of Bangladesh adopted the WHO Access, Watch, and Reserve (AWaRe) classification of antibiotics, for the first time in the world through the 5th version of the Bangladesh National Formulary (BDNF) for humans.

In these contexts, the DGDA took the initiative to develop and implement the Bangladesh National Veterinary Formulary (BDNVF) to promote evidence-based, economically rational use and better access to medical products for animal health care. Several attempts were made by the DGDA, relevant organizations, development partners, stakeholders, and specialists for the successful development and implementation of the BDNVF.

For the alignment of efforts for the development and implementation of the BDNVF, DGDA formulated a broad-based Advisory Committee, Editorial Committee, and Working Committee. The committees were formulated including relevant experts and professionals from the Department of Livestock, Academia, Veterinary Clinicians, Bangladesh Association of Pharmaceutical Industries (BAPI), Bangladesh Veterinary Association, Importers Association, Agrovet Farmers Association, Development Partners, etc.

The ‘Working Committee’ worked to develop the draft of the BDNVF with technical support from the USAID-funded Promoting the Quality of Medicines Plus (PQM+) Program led by the United States Pharmacopoeia (USP). The draft version of the BDNVF was submitted to the ‘Editorial Committee’ and the Editorial Committee reviewed and edited the draft in collaboration with the Consultant of PQM+. And, through the ‘Editorial’ and ‘Advisory’ Committee meeting the BDNVF is finalized for printing, publication, dissemination, and implementation.

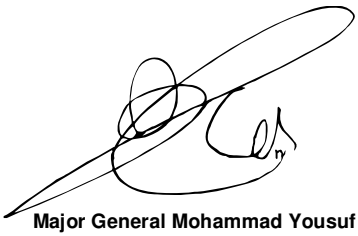
The Bangladesh National Veterinary Formulary (BDNVF) is an official publication of the Directorate General of Drug Administration (DGDA), Government of the People's Republic of Bangladesh. The BDNVF is intended to provide sound up-to-date information about the use of drugs to veterinarians, pharmacists, and other registered veterinary health care professionals. It will provide evidence-based reference and access to key information for prescribing and dispensing of Drugs that are generally prescribed in Bangladesh and registered with the Directorate of Drug Administration (till July 2023 are included in this version), but no information is provided on any formulation and manufacturing of medical products. The BDNVF includes key information on the cost-effective selection, prescribing, dispensing, and administration of medical products that are generally prescribed and available in the local market that support the veterinary health care providers to prescribe and dispense the most cost-effective drug therapy. The BDNVF comprises sound and updated information about the use of drugs with their properties such as presentation, dosage and administration, side effects, cautions, indications, contraindications, proprietary preparations, price etc. to veterinarian, pharmacists and other veterinary healthcare professionals. The BDNVF will be a hopeful national reference guide for veterinary professionals to keep pace with the latest developments and update their professional knowledge. DGDA hopes to publish the BDNVF with regular updates in a timely manner.

DGDA acknowledges the contribution of the USAIDs Promoting the Quality of Medicines Plus (PQM+) Program led by the United States Pharmacopoeia (USP) for high-level technical and generous financial support for the development, review, editing, finalization, printing, publication, dissemination, and implementation of the Bangladesh National Veterinary Formulary (BDNVF).

Despite best efforts, unintentional mistakes and lapses might remain which we hope to correct in the next edition. All of the constructive criticisms, comments, suggestions, and useful information from relevant professionals and experts will be most welcomed and reviewed for consideration in the subsequent editions to improve the quality, and the contents of BDNVF.

I believe that the BDNVF will be widely used by the veterinarians and the veterinary professionals of Bangladesh for whom it is intended.

I wish the successful implementation of the BDNVF for better animal health care in the “One Health Approach”



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BDNVF User's Guide

While compiling the Bangladesh National Veterinary Formulary (BDNVF), the Working Committee has tried to follow the style in which the Bangladesh National Formulary (BDNF) and British National Formulary (BNF) have been arranged. This is because of the fact that the target users of the BDNVF of Bangladesh, are already used to making use of the BDNF and BNF.

All the veterinary drugs (both locally manufactured and imported), which are registered by the Directorate of Drug Administration up to 31st December 2022 and are in current use in Bangladesh, are included in the BDNVF. Each of them is described individually. They are first grouped into Chapte rs according to their pharmacological or physiological or other pharmacological category. The 1st edition of the BDNVF has such 21 Chapters. Each Chapter is again subdivided into sections using numerical proceeds according to more distinct co-relations between the items included in each section. Each of these sections begins with a brief description of the subject matter, i.e., the drug or its group, which is expected to be useful for the target users. Description of the drug is followed by brief notes on its indications, side effects, cautions, contra indications, warnings, drug interactions, doses, names of the Proprietary Preperations containing the said drug, names of the manufacturers, the available dosage forms of the drug and their strengths, withdrawal period and price.

The 1st edition of the BDNVF also includes chapters on abbreviations used in the Formulary, Index of Manufacturers, Adverse Drug Reactions Monitoring, a General Index and 18 Appendices.

For readers convenience the body of the text and index is composed in double columns with no colors in the main captions, but the sub-heads and sub-sub-heads in the body are printed in colors. Rulers are used above all sub-heads, thickness of which are varied using black color depending on the importance of the heads. Names of the microorganisms are printed in Italics. Names of the generic drugs are printed in bold letters. Proprietary names are kept in bold regular but the company names are in Italics. Separate superscript symbols are used to denote essential drugs (ED), controlled drugs (CD). The AWaRe categorization of antibiotics is also done by separate superscript symbols as Access (A), Watch (W) & Reserve (R).

Indications, Cautions, Contra indications, Side effects, Interactions and Doses are printed in regular and bold types. Generic items are printed in capital and bold letter.

It should be noted here that the price of the individual drug, which is sold and used in Bangladesh is also mentioned in the 1st edition and are flexible.

Guidance on Prescribing

General Guidance

Appropriate prescribing implies the choice of medicines based on efficacy, safety, suitability and cost relative to other drugs or treatments that may be available in Bangladesh. Medicines should be prescribed only when they are necessary for animal/birds. Taking time to explain to the owner of the animal about the treatment options, as well as the rationale and potential risks of chosen treatment regimen encourages the owner to administered/use the medicines for their animal/birds as prescribed. Successful therapy comprises much more than choosing an appropriate drug; it requires knowledge, judgment, skill, wisdom, responsibility and above all the owner and doctor compliance.

Drug Information: Role of BDNVF

Most veterinarian recognize that they need unbiased drug information to choose from the various medicines available in the market, which are often selectively promoted to them by pharmaceutical companies.

Bangladesh National Veterinary Formulary (BDNVF) aims to provide prescribers and pharmacists with up-to-date information about use of veterinary medicines.

It provides key information necessary for the selection, prescribing, dispensing and administration of veterinary medicines, registered and approved by the Directorate General of Drug Administration, Bangladesh.

Information on medicines provided in BDNVF has been drawn from manufacturers product literature, verified by professional experts with standard veterinary, medical and pharmaceutical literature like BNF, BP, USP and national guidelines. Generic and International Non-proprietary Names (INN) where applicable have been provided. Proprietary or brand names are as registered by the Drug Administration. The doses mentioned are intended for general guidance only. The BDNVF advocates caution that 'prescription-only drugs' and 'controlled drugs' need to be prescribed only by a registered veterinarian.

Prescription Writing

Prescription should be legible and dated containing the name and address of the owner and details description of the animal/bird (age, sex, breed, body weight) should be signed in ink by the registered veterinarian. A declaration that the drug is prescribed for an animal/bird or herd under his/her care.

A prescription ordering 'prescription-only drugs' or 'controlled drugs' must in addition specify the prescriber's name, address and signature, the formulation and strength of the Proprietary Preperations, and the total quantity of the Proprietary Preperations to be supplied (or the number of dose units) in both words and figures. A prescription ordering a 'controlled drug' should clearly mention that it can be dispensed only once and it's refilling is not permitted. The words 'For Animal Treatment Only' may also be written since it is the legal requirement in prescriptions for controlled drugs.

Drug Names in Prescription

Names of drugs or medicinal products should be written clearly and not abbreviated. Printed prescription forms are permissible and time saving. Drugs prescribed may be either in non-proprietary (generic) or in proprietary (brand) names.

There are growing awareness for using generic names in prescribing for obvious advantages uniformity, convenience, economy, and better comprehension. Prescribing in non-proprietary (generic) names is also less taxing on the memory of the prescriber.

However, when it is considered important to ensure consistency of a product in respect of its quality or bioavailability, and when it is thought that the control over the quality relative to other manufactured products may not be as rigorous as one would expect, a veterinarian may opt to prescribe by proprietary names.

In the prescription, unit dose strength should be clearly stated

- Avoid unnecessary use of decimal point; e.g. 5 mg instead of 5.0 mg.
- Quantities in grams should be written as 1 g or 1.2 g etc.
- Quantities less than 1 gram should always be written in milligrams; e.g. 500 mg instead of 0.5 g.
- Quantities less than 1 mg should be written in micrograms; e.g. 100 micrograms instead of 0.1 mg
- Micrograms or nanograms should not generally be abbreviated, because it may create confusion with milligrams.
- ml (for milliliter) should only be written and not cc (for cubic centimeter).
- When decimals are unavoidable for quantities less than one, a zero should be written before the decimal; e.g. 0.5 g instead of .5 g.

The quantity to be supplied may be specified in numbers or volume; it may also be stated by indicating the number of days of treatment required.

The directions for use should preferably be in a language that is understood by the patient and should be without any abbreviations.

Prescribing Controlled Drugs

Narcotic and psychotropic drugs, which are under dual control of Directorate of Drug Administration and Department of Narcotics Control (under The Narcotics Control Act, 1990; Act no. XX of 1990) are permissible for use as medicinal products in Bangladesh, are included as monographs in the BDNVF. Such drugs are distinguished throughout in the BDNVF by the symbol [CD], meaning “Controlled Drugs”. A list of controlled drugs is shown in *Appendix-xi.*

Storage and Dispensing of Controlled Drugs

1. Controlled Drugs, especially A-Class and B-Class narcotics and psychotropic drugs (*see Appendix-xi*), should be stored in pharmacies and in hospitals or health centers or clinics in a secured place under lock and key.
2. The name and address of the seller/dispenser and the date on which the prescription is dispensed must be recorded on the prescription by the pharmacist/ dispenser.
3. The prescription for a controlled drug shall not be dispensed more than once (*see Section 13(3) of Narcotics Control Act, 1990*).
4. It is recommended that pharmacies maintain a separate register for dispensing of all A-Class and B-Class narcotics and psychotropic drugs (*see Appendix-iv*), wherein the name and address of both the prescriber and the patient, and name and quantity of the drug dispensed along with the date of dispensing are recorded.
5. A pharmacist is not allowed to dispense a controlled drug unless all the required information is given on the prescription.

Adverse Reactions to Drugs

Any drug may produce unwanted or unexpected adverse reactions. Rapid detection, management and reporting of adverse drug reaction is of utmost importance. Some reactions like nausea, vomiting, allergic rashes, convulsions etc may appear soon enough after the administration of a drug. Some other reactions like malignancy, agranulocytosis, retinopathy, retroperitoneal fibrosis, etc. may appear months or years after the exposure. Any suspicion of such an association should be carefully investigated and reported.

When an infant is born with some congenital abnormality or there is an abortion of a malformed fetus, veterinary doctors should consider whether this might be an adverse reaction to a drug taken by the mother during pregnancy. Veterinarian should be particularly careful and alert about adverse reactions to drugs in the elderly and in infants.

To prevent adverse drug reactions:

1. Do not prescribe a drug unless there is a good indication. If the patient is an infant or a pregnant or fancy animal/bird, do not use a drug unless the need for it is imperative.
2. Specially be careful in prescribing drugs for a animal/bird with previous history of allergy or any adverse drug reactions.
3. Find out whether the patient is already taking some other medicines and avoid possible drug interactions while prescribing.
4. Age and hepatic or renal disease may alter metabolism and excretion of drugs, so that much smaller doses may be needed to avoid adverse side effects.
5. Prescribe as few drugs as possible. Simplify the drug regimen and provide clear instructions so that the owner has no difficulty in understanding.
6. Whenever possible, use a familiar or established drug which is already included in an official pharmacopoeia. Be especially careful in prescribing ‘new drugs’.
7. If serious adverse reactions are known to be associated with a drug, warn the owner while prescribing it.

Reporting Adverse Drug Reactions

Veterinary Doctors working in veterinary hospitals or in private veterinary hospitals/clinics or engaged in private veterinary practice have a special responsibility of reporting suspected adverse reactions to any therapeutic agents including blood products, vaccines, contrast medias, herbal products; and all cases of adverse reactions that were fatal, life-threatening, disabling or which needed hospitalization.

Detection management and reporting of adverse drug reactions, especially those in respect of ‘new drugs’, is of vital importance.

There is an Adverse Drug Reactions Monitoring (ADRM) cell in the office of the Directorate General of Drug Administration, which works in collaboration with WHO.

Chapter 1

1. ANTIMICROBIAL DRUGS

General consideration for suitable drug selection

Bacterial sensitivity: Antibacterial drugs are often used unnecessarily and sometimes (as in uncomplicated diarrhoea) when they are clearly contraindicated. However, when antibacterial therapy is essential, there is a rational basis for deciding which antibacterial drug to use in a specific case. For time dependent bactericidal drugs and bacteriostatic drugs, the aim of therapy is to maintain an effective concentration of the drug at the site of infection to ensure eradication of the causal organisms. An effective concentration is defined as that sufficiently in excess of the minimum inhibitory concentration (MIC) of the drug to be effective for sufficient time to inactivate the causal micro-organisms. Effective therapy is thus dependent on the susceptibility of the micro-organisms to the drug and the pharmacokinetics which determine its ability to attain and maintain effective concentrations at the infection site.

Except in the rare cases where sensitivity data are available, assessment of the potential sensitivity of the micro-organisms concerned depends firstly upon accurate clinical diagnosis and secondly upon the knowledge that these are the micro-organisms likely to be implicated and of their susceptibility to antibacterial drugs. Fortunately, detailed knowledge of MIC values is not required because microbial sensitivity to a drug can be expressed in terms of the concentrations attained in body tissues. In this chapter, a microorganism will be deemed 'sensitive' to a drug if, following administration according to the recommended dosage regimen, tissue concentrations are likely to be in excess of the MIC for that micro-organism for a major part of the time between doses. Having narrowed the list of possible drugs to those likely to be active against the microorganism or microorganisms concerned, the final choice is based on the following criteria.

Species, breed, and age differences affect an animal's ability to eliminate antibacterial drugs; the following of which are examples. Cats are less able than other species to metabolise chloramphenicol, which may accumulate following prolonged administration in this species. The young of all species are similarly deficient in their ability to metabolise drugs. Antibacterial action can disrupt bacterial fermentation and therefore animals with a functional rumen should not be given broad-spectrum antibacterials by mouth. Many antibacterials and particularly tetracyclines by any route may be associated with a fatal enterocolitis in horses subjected to stress. Penicillins, macrolides, and lincosamides should not be administered to gerbils, guinea pigs, hamsters, or rabbits in which they are likely to cause a fatal enterotoxaemia.

Predisposition to toxicity: Certain conditions may exacerbate the toxicity of antibacterial drugs; the following are examples. Renal disease may predispose animals, especially cats, to the toxic effects of aminoglycosides because they are eliminated solely by renal excretion and so will accumulate in renal failure.

Tetracyclines are contraindicated in bitches and queens in late pregnancy when they may cause enamel defects and discoloration in the offsprings' milk teeth. In growing dogs and cats, fluoroquinolones may cause an arthropathy.

Site of infection: Special considerations apply to the treatment of infections at particular sites. For example, antibacterials such as chloramphenicol and the macrolides are extensively metabolised and so are not used to treat urinary tract infections. For these infections, drugs that are excreted unchanged in the urine are preferred. In addition, in the treatment of urinary tract infections it is important to choose a drug with actions that are favoured by the prevailing urinary pH to maximise efficacy. In particular, aminoglycosides are much more active in alkaline urine.

Some compartments, notably the brain and the internal structures of the eye, are penetrated only by lipophilic drugs that are able to cross intact cell membranes. Permeability is increased by inflammation. Although chloramphenicol and sulphonamides normally enter the brain, ampicillin and doxycycline do so only in the presence of inflammation. Similarly, milk is separated from the general circulation by an intact membrane through which only the non-ionised lipophilic form of a drug may pass. When the non-ionised form of a basic drug such as a macrolide enters the relatively acidic milk it dissociates and so becomes trapped resulting in high concentrations in milk – the so called 'ion-trap'. Conversely, acidic drugs such as benzylpenicillin are largely excluded from the healthy udder. Both factors cease to operate in the presence of inflammation so that drugs penetrate the acutely inflamed mammary gland to the same extent as any other inflamed tissue.

Mode of antibacterial action: As noted in the sections dealing with individual groups of drugs, some are bactericidal, that is they are able to kill bacteria, whereas others are bacteriostatic, only inhibiting multiplication and hence relying upon host defences to clear the infection. Although the advantages of bactericidal drugs have probably been exaggerated in the past, there are certain situations in which their use is essential. These include the treatment of endocarditis, and in cases of immunosuppression occurring either naturally or due to administration of corticosteroids.

Before commencing therapy: The **dose** of an antibacterial drug expressed as weight of drug per kg body weight will vary with a number of factors including intercurrent disease, severity of the infection, and size of the animal. In serious infections high doses are administered more frequently. DepotProprietary Preperations are long acting but attain relatively low plasma-drug concentrations; they are not suitable for the treatment of severe acute infections. In general, the larger the animal the smaller the dosage per unit body weight.

The dosing regimen used should also reflect the mode of action of the antibacterial drug. For bactericidal drugs, such as beta-lactams, which operate time dependent killing mechanisms, and bacteriostatic drugs, it is important to maintain tissue concentration of the drug above the MIC for as long as possible during the inter dosing interval. For bactericidal drugs, such as aminoglycosides and fluoroquinolones, which operate concentration dependent killing mechanisms, the most successful dosing regimen is one which produces a peak tissue concentration of the drug which greatly exceeds the MIC value for the bacterium and the time the concentration of the drug is above the MIC is much less significant.

The **duration of therapy** depends upon the nature of the infection and the response to treatment. In general,, therapy should continue for 2 to 3 days beyond the clinical cure for acute infections and for 1 to 2 weeks beyond the clinical cure for chronic infections. However, this guidance does not apply in all instances. For example, acute cystitis in the bitch often responds very quickly to antibacterial drugs (24 to 48 hours) but if treatment is

not continued for 7 to 10 days, relapses may well occur. This more extended period of treatment allows the important mucosal defence mecha-nisms within the bladder to heal fully and therefore be effective in preventing re-infection when the treatment stops. Clinical experience has shown that some chronic infections may require more prolonged duration of therapy (for example, deep pyodermas, chronic prostatitis and osteomyelitis in dogs). Empirically, therapy for 4 to 6 weeks may be required in these cases.

The **route of administration** depends upon the severity of the disease and ease of administration. In the treatment of severe infections, it is advantageous to give the initial dose by the intravenous route in appropriate cases. In companion animals subcutaneous injection may be preferred to the more painful intramuscular route. In order to attain effective concentrations in the cerebrospinal fluid, an initial intrathe-cal injection may be administered. However, penicillins should not be administered by the intrathecal route because seizures may result.

Combination Therapy: In most cases treatment with a single drug is sufficient. But in some special cases, two or more antimicrobials are indicated, for example: (i) to prevent development of resistance in tuberculosis; (ii) to broaden antibacterial spectrum in case of mixed infection e.g. peritonitis; (iii) to obtain potentiation e.g. penicillin with gentamicin.

Selecting an Antimicrobial: Ideally, the selection should base on identification of the causative organism(s) and their susceptibility to antimicrobials (Definitive therapy). In practice, however, the choice often follows from clinical diagnosis defining as precisely as possible, the sites and nature of infection, responsible pathogen(s) and known sensitivity to drugs (Empiric therapy). Samples (blood, pus, urine, sputum, CSF, etc.) should be collected before starting any 'blind' antimicrobial therapy to confirm clinical diagnosis and drug sensitivity. Removing barriers such as draining an abscess, obstruction in urinary or respiratory tract, etc. is important to facilitate entry of antimicrobials to site(s) of infection.

Patients who receive Empiric antimicrobial therapy, to which the causative pathogen is resistant, suffer significantly. This underscores the importance of selecting an empiric antimicrobial that possesses activity against the range of suspected pathogens. One or more antimicrobials, suggested by knowledge of likely organism and its sensitivity pattern, is then judged by the drug's specificity, safety (risk-benefit ratio), kinetic considerations and cost effectiveness in respect to the patient factors to make the final choice. Factors related to patient include history of drug allergy, renal and hepatic function, susceptibility to infection (i.e. whether immunoco-mpromised), severity of illness, ability to tolerate drugs, concomitant use of other drugs, ethnic origin, age and sex; and if female, whether pregnant or milk producing animals or brest feeding pet.

Although oral medication given with food is often conven-ient, it may considerably reduce the amount of drug absorbed. For example, ampicillin (unlike amoxicillin) is poorly absorbed in dogs if administered following a meal. Milk, iron salts, and antacids all interfere with the absorp-tion of tetracyclines from the gastro-intestinal tract. How-ever, in some cases, for example ketoconazole, administration with food will reduce side effects such as nausea. In other cases, giving the drug with food is impor-tant to aid in its absorption, for example griseofulvin is highly lipid soluble and requires biliary secretion to allow optimal absorption from the gastro-intestinal tract.

1.1.1 Penicillins

Types: Penicillins are Procain Penicillin, Penicillin G (Benzyl penicillin), Penicillin V (Phenoxymethyl Penicillin), Benzathine Penicillin, Amoxicillin, Ampicillin, Oxacillin, Cloxacillin, Dicloxacillin, Methicillin, Nafcillin, Ticarcillin, Piperacillin.

1.1.1.1 Narrow-spectrum penicillins

Benzylpenicillin, also known as penicillin G, was the first of the penicillins, and remains an important and useful anti-

bacterial. It is particularly active against Gram-positive bacteria. Sensitive micro-organisms include Gram-positive aerobes such as *Staphylococcus aureus*, streptococci, most *Actinomyces* spp., *Erysipelothrix*, and *Bacillus* spp. Most anaerobic bacteria including *Clostridium* and some *Bacter-oides* spp. (not *B. fragilis)* are also sensitive. Benzylpenicillin has activity against the more fastidious Gram-negative aerobes such as *Haemophilus*, *Pasteurella*, *Leptospira*, and some *Actinobacillus* spp. Benzylpenicillin is broken down by the beta-lactamase enzymes produced by staphylococci and *Bacteroides* spp. A high proportion of strains of these micro-organisms are now resistant to benzylpenicillin. Other organisms mentioned retain their sensitivity to benzylpenicillin because of their inability to produce betalactamase.

Benzylpenicillin is inactivated by gastric acid and so is not administered by mouth. It is available as a range of salts that differ in their solubility and hence their duration of action. The sodium salt is very soluble and rapidly absorbed following injection, but gives effective concentrations for no more than 4 hours, unless the organisms involved are highly sensitive.

Procaine benzylpenicillin is slightly soluble. Following parenteral administration, it forms a 'depot' which slowly releases free benzylpenicillin into the circulation, maintaining effective concentrations against the more susceptible micro-organisms for up to 24 hours. It is thought that the procaine component of procaine benzylpenicillin may give rise to a febrile reaction and abortions in sows infected with *Erysipelothrix*.

BENZYLPENICILLIN[A]

(Penicillin G, Penethamate hydriodide)

Indications. Penicillin-sensitive infections

Contra indications. Penicillin or cephalosporin hypersensitivity; should not be administered to gerbils, guinea pigs, hamsters, rabbits

Side effects. Allergic reactions; diarrhoea

Warnings. Penicillins and cephalosporins may cause hypersensitivity (allergy) following self-injection, inhalation, ingestion, or skin contact. Operators with known hypersensitivity should not handle these drugs. Clinical signs of allergic reaction in operators include skin rash, swelling of the face, lips, or eyes, or difficulty breathing. Operators should seek medical advice

Dose. *Horses*: *by intravenous injection*, 10 mg/kg twice daily for 1 day.

PROCAINE BENZYLPENICILLIN[A]

(Procaine penicillin)

Indications: The treatment of infections caused by bacteria sensitive to penicillin in horses, cattle, sheep, dogs and cats: Actinomycosis, anthrax, black quarter, calf diphtheria, foot rot, leptospimsis, malignant oedema, pneumonia, navel ill, abscess, mastitis, metritis, strangles, bacterial influenza, bronchitis, castration, pyogenic infections, urinary tract infections.

Contraindications: Penicillin hypersensitivity; should not be administered to gerbils, guinea pigs, hamsters, rabbits, horses. Not to be used in sheep producing milk for human consumption. Not to be used when it is known that penicillinase producing staphylococcus organisms are present. Do not use in horses intended for human consumption. Not recommended for intravenous or intrathecal administration.

Side effects: Allergic reactions; diarrhea. Swelling and redness at the site of injection may occur. Contact dermatitis may also result.

Precaution: To minimize local irritation at the site of injection, the area should be rubbed gently. As penicillin hypersensitivity may give rise to skin rash and anaphylaxis. An antihistaminic injection may be administered to avoid such reaction.

Dose: Dosages vary, for guidance.

Horses: 22,000–44,000 IU/kg, IM, q 12–24 h
Cattle: 22,000–66,000 U/kg, IM or SC, q 24 h
Sheep/Goat: 22,000-66,000 units/kg q24h IM
Dogs, cats: 15,000 U/kg or 8–10 mg/kg, PO, q 6–8 h
Pigs: 15,000-25,000 units/kg q24h IM.

Withdrawal Periods: Meat: Cattle: 4-10 days, Calf: 7 days, Sheep, goat: 8-9 days, Swine: 6-7 days; Milk 48-72 hours

Proprietary Preperation:
Combipen Vet *(Acme)*, Inj., 8 lac vial,
Bipen-Vet *(Square)*, Inj., 40 lac Inj 1 Vial, Tk. 64/Vial,
Penbacllin *(ACI)*, Inj., 40 lac vial, Tk. 58/Vial,
Pronapen *(Renata)*, Inj., 40 lac vial, Tk. 45/Vial,
Pronacillin *(Techno)*, Inj., 40 lac vial, Tk. 60/Vial,
Vetopen *(Opsonin)*, Inj., 40 lac vial, Tk. 46/Vial,
Duplocillin LA *(Bengal)*, Inj., 100ml,

Procaine penicillin + Benzathine penicillin + Dihydrostreptomycin sulphate

Indications: It is indicated for treatment of infections caused by bacteria sensitive to these antibiotics combination in cattle, sheep, goats, pigs, dogs and cats. In cattle, it is indicated for the treatment of pneumonic pasteurellosis, septicaemia, metritis, leptospirosis and reticulo-peritonitis. In sheep and goats, it is indicated to treat arthritis and septicaemia.

Contraindications: Do not administer to animals hypersensitive to penicillin or procaïne. Do not administer to animals under anaesthesia. Do not administer to animals with an impaired kidney function.

Preperation:
Strepto-P (0.5) (*ACI*), Inj., 4lac, TK 513/vial,
Strepto-P (2.5) (*ACI*), Inj., 20lac, TK 83.38 /vial,
Procaben (Vet) *(Bengal)*, Inj., 40lac, TK 58/vial,
Pronavet 40 *(Ethical)*, Inj., 40lac,
Vetopen *(Opsonin)*, Inj., 40 lac vial, Tk. 46/Vial,
Proben Vet *(Popular)*,inj, 40lac,
Combipen Vet *(Acme)*, Inj., 40 lac vial,
Penstrep VET *(Ethical)*, 20lac, ijn.,
Strepcin-G 2.5, *(Opsonin)*, inj., 20lac, TK 77/vial,
Streptopen (2.5), *(Renata)*, inj., 20 lac, TK 93/vail,
Streptocillin (2.5), *(Techno)*, inj., 20 lac, TK 50/vail,
Sp-Vet (.5) (*ACME*), inj., 24lac,
Pen-M Inj *(Pharma & Firm)*, inj., 50ml and100ml vial, Tk. 671.9 an Tk. 1194.32/vial

1.1.1.2 Broad-spectrum penicillins

Ampicillin and **amoxicillin** have slightly less activity than benzylpenicillin against Gram-positive bacteria and obligate anaerobes but considerably greater activity against Gram-negative bacteria, although their action is poor against *Klebsiella*, some *Proteus* spp., and *Pseudomonas* spp. In addition, they are broken down by beta-lactamases, both the staphylococcal enzymes and those produced by Gram-negative organisms such as *E. coli* and *Haemophilus* spp. Acquired resistance in such organisms has limited the usefulness of these antibiotics.

Amoxicillin is better absorbed following administration by mouth than ampicillin, giving higher plasma and tissue concentrations. Its absorption is less affected by the presence of food in the stomach. Ampicillin should be given to fasted animals and at least an hour should then elapse before food is provided. Ampicillin and amoxicillin are excreted into both bile and urine.

Clavulanic acid has no significant antibacterial activity, but is a potent beta-lactamase inhibitor. Therefore, its inclusion inProprietary Preperations of amoxicillin (co-amoxiclav) renders the combination active against most strains of *Staph. aureus*, some *E. coli* spp., in addition to *Bacteroides* and *Klebsiella* spp.

AMOXICILLIN[A]

(Amoxycillin)

Description: Amoxicillin is a time-dependent, bactericidal (usually) agent. It binds to several enzymes (carboxypeptidases, transpeptidases, and endopeptidases) within the bacterial cytoplasmic membrane.

Mode of action: Inhibits cell wall synthesis and thereby decreasing cell wall strength and rigidity, affecting cell division, growth and septum formation. The bacterial cell wall will be osmotically unstable and cell lysis will occur.

Indications: Amoxicillin-sensitive infections; It is used for a variety of infections in all species. Useful in urinary tract and other soft tissue infections, respiratory infections (Pneumonia). It is more effective for Gram positive bacterial infections. Also effective against Gram negative aerobes (*E. coli*, *Proteus, Haemophilus spp.*) infection.

Contraindications: Do not administer to rabbits, guinea pigs, hamsters, horses,

gerbils or any other small herbivore. Do not use in animals with known hypersensitivity to penicillins or other ß-lactam antibiotics or to the excipient. Do not administer to animals with renal disease including anuria or oliguria. oral administration to horses or calves with a functional rumen.

Side effects. Allergic reactions; diarrhea.

Precaution: Penicillins may cause hypersensitivity following injection, inhalation, ingestion, or skin contact; operators should wear suitable protective clothing; operators with known hypersensitivity should not handle these drugs.

Dose: Dosages vary. For guidance.

Cattle: by intramuscular injection, 7 mg/kg daily by depot intramuscular injection, 15 mg/kg, repeat after 2 days

calves: by mouth, 8 mg/kg twice daily

Sheep and goats: by intramuscular injection, 7 mg/kg daily by depot intramuscular injection, 15 mg/kg, repeat after 2 days.

Dogs, cats: by mouth, 10 mg/kg twice daily by subcutaneous or intramuscular injection, 7 mg/kg daily by depot subcutaneous or intramuscular injection, 15 mg/ kg, repeat after 2 days

Poultry: by addition to drinking water, 15–20 mg/kg.

Pigeons, ducks: by addition to drinking water, 20 mg/kg.

Withdrawal period:
Meat-25 days & Milk-3 days 6 hours. (inj.)

Calves – 4 days, Broiler – 3 days, Layer – 10 days. (powder)

Proprietary Preperations:

Amoxy 50 (Haychem BD) Power, 100g packet, Tk 550/packet
Fimox Vet *(Popular)*, Inj., 1g vial, Tk.55/Vial, Per os., 100g packet, TK 272/packet, 500g packet, TK 1270/packet, 1kg packet, TK 2404/packet,
Fimox DS Vet *(Popular)*, Inj., 2g vial,
Acimox *(ACI)*, Inj., 1g vial, Tk. 67 /Vial, Per os., 100g, 267/packet, 500g, 1300/packet,
Acimox-DS*(ACI)*, Inj., 2g vial, Tk. 100.38 /Vial
Moxacil-Vet *(Square)*, Inj., 1g vial, Tk. 74/Vial, Per os., 100 g Sachet, TK. 268.10/Sachet, 500g packet, TK. 1286.26/Sachet,
Amoxyvet *(Techno)*, Inj., 1g vial, Tk. 67/Vial,
Amoxyvet-30*(Techno)*, Per os., 100g packet, 355/packet,
Amoxyvet-30*(Techno)*, Per os., 500g packet, 1525/packet,
Hicomox *(Opsonin)*, Inj., 1g vial, Tk.74/Vial, Per os., 100g, TK 210/packet, 500g, Tk 970/packet, 1kg, Tk. 2612/packet,
Moxilin Vet *(Acme)*, Bolus, 1g, Tk.10/Bolus
Moxilin Vet *(Acme)*, Inj., 1g/vial,
Moxilin Vet LA*(Acme),* inj., 15g/vial,
Moxilin Vet 15%*(Acme)*, Per os., 100g packet, Tk.150/packet, 500g packet, Tk. 1254/packet
Moxilin Vet DS*(Acme),* Per os., 100g packet, 500g packet,
Renamox *(Reneta),* Inj., 1g/vial, Tk. 74/Vial, 2g/vial, Tk. 100/Vial
Renamox *(Reneta)*, Tab., 500mg, Tk. 6.5/Tab,
Renamox 30% *(Renata)*, Per os., 100g packet, Tk. 250/packet, 500g packet, Tk. 1250/packet, 1kg packet, Tk. 2400/packet,
Navamox Vet *(Navana)*, Tab., 500mg, Tk.6/Tab, Per os., 100g packet, TK. 268/packet, Per os., 500g packet 1286/packet
Kamoxy Vet *(Kemiko),* Tab., 500mg, Tk. 6/Tab, Per os., 100g packet, Tk. 276/packet, 500g packet, Tk. 1304/packet,
Mimox *(Albion)*, Tab., 500mg, Tk.6/Tab,
Mimox 30% *(Albion)*, Per os., 100g packet, TK. 148/packet, 1kg packet, Tk.1225/packet,
MX 30 *(Theep)*, Per os., 100g packet,
Eskamox 300 *(Eskayef)*, Per os., 100g packet, Tk 205/packet, 1kg packet, Tk. 1932/packet,
AJECT *(Eskayef),* Inj., 1 gm/Vial. Tk. 67/vial, 2 gm/Vial
AJECT DS (Eskayef), Inj, 2gm /vial, Tk. 100/vial
Amoxicillin-20 *(Nutec)*, Per os., 100g packet, 1kg packet,
Invemox 15% LA *(ACI)*, Inj., 10ml vial, 50ml vial, 100ml vial,
Al-molin Vet *(Al-Madina),* Tab., 500gm/Tab, Tk. 6/tab, 1kg packet, Tk. 1997/packet,
Amoxycil *(Chemist),* Tab., 500gm/Tab, Tk. 6. 23/tab, 100g packet, Tk. 265/packet,
Moxipen *(Ethical),* Power, 100gpacket,
AxF PLUS *(FnF)*, power, 100g/packet, Tk. 155/packet
Ultramox *(Globe),* Tab., 500gm/Tab, Tk. 6/tab, 100g packet, Tk. 270/packet,
Amoxgard *(Guardian)*, powder, 100g packet, Tk. 268/packet, 500g packet, Tk. 2006/packet

Vetamox V *(Medicon),* powder, 100g packet, Tk. 80/packet,
Loxyvet *(MedRx),* Tab., 500gm/Tab, Tk. 6/tab,
Rampamox *(Rampart),* powder, 100g packet, Tk. 267/packet,
Amvion-Vet *(Vision),* powder, 100g packet,
V-Moxcef *(Vision),* powder, 100g packet,
Amimox Inj. *(Pharma & Firm),* 50ml/100ml, 50ml-685tk, 100ml-1250tk

AMOXICILLIN with CLAVULANIC ACID

Indications: Amoxicillin sensitive infections including beta-lactamase producing micro-organisms. For the treatment of clinical mastitis caused by the following bacteria susceptible to the combination of amoxicillin and clavulanic acid:

Staphylococci (including β-lactamase producing strains), Streptococci (including *S. agalactiae, S. dysgalactiae* and *S. uberis*), *Escherichia coli* (including β-lactamase producing strains)

Contraindications: Penicillin hypersensitivity; gerbils, guinea pigs, hamsters, rabbits; oral administration to horses or calves with a functional rumen.

Side effects. Allergic reactions; diarrhoea

Precaution: Penicillins may cause hypersensitivity (allergy) following injection, inhalation, ingestion, or skin contact. Operators with known hypersensitivity should not handle these drugs.

Dose: Expressed as amoxicillin

Cattle: by intramuscular injection, 7 mg/kg once daily

calves: by mouth, 5–10 mg/kg twice daily

Dogs, cats: by mouth, 10–20 mg/kg twice daily by subcutaneous or intramuscular injection, 7 mg/kg once daily.

Withdrawal period:
Meat: 42 days
Milk: 80 hours.

Proprietary Preperations:
Amoxclav *(Techno),* powder, 100 mg + 25 mg/gm, 100g packet, Tk. 370/packet, 500g packet, Tk. 1575/packet
Moxilin CV Vet *(ACME),* powder, 100 mg + 25 mg/gm, 100g packet,
Augment Vet *(Eskayef),* bolus, 800 mg + 200 mg, Tk. 33/bolus
Augment 500 *(Eskayef),* bolus, 400 mg + 100 mg, Tk.20/bolus
Augment Vet 1.2gm *(Eskayef)*, Inj, 1 gm + 200 mg, Tk. 280/Vial
Augment Vet 2.4gm *(Eskayef)*, Inj, 2 gm + 400 mg, Tk. 450/Vial
Augment Vet Powder *(Eskayef)*, Powder, 10% + 2.5%, Tk. 300/100 gm packet, Tk. 1400/500gm packet
Moxaclav-Vet *(Square)*, inj., 140 mg + 35 mg/ml,
Amoclav Bolus Vet *(Techno),* bolus, 400 mg + 100 mg, Tk. 20/bolus
Amoclav Bolus Vet DS *(Techno),* bolus, 800 mg + 200 mg, Tk. 33/bolus
Moxilin-CV Vet *(ACME),* inj., 140 mg + 35 mg/ml,
Moxilin-CV Vet *(ACME),* bolus, 400 mg + 100 mg/bolus,
Moxilin-CV Vet DS *(ACME),* bolus, 800 mg + 200 mg/bolus,

AMPICILLIN[A]

Description: Ampicillin is a semi-synthetic aminopenicillin. Ampicillin anhydrous and trihydrate occur as practically odorless, white, crystalline powders. Ampicillin is lightly soluble in water and at usual temperatures (<42°C), ampicillin anhydrous is more soluble in water than the trihydrate. Ampicillin sodium occurs as an odorless or practically odorless, white to off-white, crystalline hygroscopic powder. Potency of ampicillin salts is expressed in terms of ampicillin anhydrous

Mode of action: Inhibits cell wall synthesis and thereby decreasing cell wall strength and rigidity, affecting cell division, growth and septum formation. The bacterial cell wall will be osmotically unstable and cell lysis will occur.

Indications: Generally, it is used in skin and soft tissue infections, urinary tract infections, Gram-positive bacterial (except beta-lactamase–producing strains of Staphylococcus) infections and Gram-negative aerobes infections In animals it ia

indicated in pneumonia, foot rot, enteritis, salmonellosis, calf scour, infected wound, fever, colibaciliosis, enteritis, mastitis, pyelonephritis, black quarter, joint infection, renal infection, haemorrhagic septicemia etc.

Contraindication: See under Amoxicillin

Side effects: See under Amoxicillin

Precaution: Hypersensitive patient

Doses and administration: Cattle: For respiratory infections:Ampicillin sodium 22 mg/kg SC q12hAmpicillin trihydrate: 11 mg/kg IM q24h; Horse:Ampicillin sodium: 10-50 mg/kg IV or IM q8h; Ampicillin trihydrate: 5-20 mg/kg IM q12h; Ampicillin sodium: 11-15 mg/IM or IV q6-8h; Foals: Ampicillin sodium 11 mg/kg q6h IM or IV; For intrauterine infusion: 1-3 gm, intrauterine; Dog, Cat:For Gram-positive infections: 10-20 mg/kg PO q12h; 5 mg/kg IM, SC q12h; 5 mg/kg IV q8h; For Gram-negative infections: 20-30 mg/kg PO q8h; 10 mg/kg IM, SC q8h; 10 mg/kg IV q6h

Withdrawal Periods: Cattle: IM: 6 days (Meat), 48 hours (Milk)**;** Swine: IM: 6 days (Meat), Chicken: 6 days (Oral)

Proprietary Preperations:
Bipilin *(Opsonin)*, Inj., 1g vial, Tk. 37/Vial,
Bipilin DS*(Opsonin)*, Inj., 2g vial, Tk.48/Vial,
Picilin vet *(Popular)*, Inj., 2g vial,
Ampicin-Vet *(Square)*, Inj., 2g vial, Tk. 60.50/Vial,
Acipillin *(ACI)*, Inj., 2g vial, Tk.50/Vial,
Ampicin Vet *(Square),* inj., 2g vial,
Ampicin *(Square),* inj., 1g vial,

Dicloxacillin Sodium[A]

Description: An isoxazolyl-penicillin, dicloxacillin sodium is a semisynthetic, penicillinase-resistant penicillin. It is available commercially as the monohydrate sodium salt that occurs as a white to off-white, crystalline powder that is freely soluble in water. 1 mg of dicloxacillin sodium contains not less than 850 µg of dicloxacillin. Dicloxacillin (anti-staphylococcal penicillin), penicillinase-resistant penicillin has a narrower spectrum of activity than the natural penicillins.

Mode of action: Its antimicrobial efficacy is aimed directly against penicillinase producing strains of gram-positive cocci, particularly Staphylococcal species. Like other penicillins, it inhibits bacterial cell wall synthesis by binding to penicillin-binding proteins and weakening the cell wall.

Indications: Prevention and treatment of mastitis caused by *Staphylococcus, Streptococcus, Corynebacterium* during dry period.

Contraindication: Use cautiously in animals allergic to penicillin-like drugs

Side effect: Hypersensitivity reactions: Rashes, fever, eosinophilia, neutropenia, agranulocytosis, thrombocytopenia, leukopenia, anemia, lymphadenopathy, or full-blown anaphylaxis. Dog: Neurotoxicity (ataxia), tachypnea, dyspnea, edema and tachycardia

Precaution: Hypersensitive patient

Dose and administration:4g/day

Drug Interactions:

Aminoglycosides: In vitro evidence of synergism with dicloxacillin against *S. aureus* strains

Cyclosporine: Dicloxacillin may reduce levels

Probenecid: Competitively blocks the tubular secretion of dicloxacillin, thereby increasing serum levels and serum half-lives

Tetracyclines: Theoretical antagonism (not recommended to use)

Warfarin: Dicloxacillin may cause decreased warfarin efficacy

Proprietary Preperations:

Diloxa udder ointment *(Rafique)*, Ointment, 7.5g syringe,

1.1.1.3 Cephalosporins

The cephalosporins comprise a large group of antibacterials containing the beta-lactam ring. They are closely related to the penicillins. Like the penicillins they

are bactericidal, are relatively non-toxic, and less likely to cause allergic reactions.

It is difficult to generalise about the spectrum of activity of cephalosporins and each individual drug can be different. The tradition of classifying these drugs as first, second and third generation can cause confusion particularly as newer drugs are developed. The first-generation drugs are active against a range of both Gram-positive and Gram-negative organisms comprising staphylococci (including beta-lactamase producing strains), *Pasteurella*, *E. coli*, *Actinobacillus*, *Actinomyces*, *Haemophilus*, *Erysipelothrix*, *Clostridium*, and *Salmonella* spp. However, *Pseudomonas* and many *Proteus* spp. are resistant.

Successive generations of cephalosporins are characterised by being less well absorbed following oral administration (so that only first generation cephalosporins are available as oralProprietary Preperations and most other cephalosporins are not suitable for oral administration), have increased stability to Gram-negative beta-lactamases, and generally increased activity against Gram-negative organisms, but reduced activity against Gram-positive organisms particularly staphylococci.

As a general rule, the second generation cephalosporins have good activity against Gram-positive organisms and the Enterobacteriaceae but are not effective against the most intractable Gram-negative organisms such as *Klebsiella* spp. or *Pseudomonas aeruginosa.* Further developments among the cephalosporins have been made to produce drugs which are effective against *Klebsiella* spp. or *Pseudomonas aeruginosa* or to produce drugs which are effective against the refractory anaerobes, such as *Bacteroides fragilis*. These developments have been made sometimes at the expense of the Gram-positive spectrum, such that potency against *Sta-phylococcus* spp, in particular, may be reduced. Cefoperazone is an example of a cephalosporin (third generation) with activity against *Pseudomonas aeruginosa.* Cefoxitin is a cephalosporin which is noted for its activity against *Bacteroides fragilis*. Cefquinome is the most recently developed cephalosporin for veterinary use (sometimes termed fourth generation). It is extremely broad-spectrum being highly active against Enterobacteriaceae, staphylococci (including methicillin resistant strains), and enterococci. In addition, it is not destroyed by the most common plasmid or chromosomal beta lactamases of *Klebsiella* spp. and *Pseudomonas aeruginosa*.

Ceftriaxone[W]

Description: Ceftriaxone is a third-generation cephalosporin. Its action is similar to other beta-lactam antibiotics. Ceftriaxone is resistant to β-lactamase.

Mode of action: Ceftriaxone inhibit synthesis of bacterial cell wall leading to cell death.

Indications: Ceftriaxone is used to treat serious infections. Treatment of respiratory disease in cattle, horses, sheep, and swine; urinary tract infections and soft tissue infections in dogs and cats.Intramammary treatment of mastitis in cattle.Meningitis and CNS infections.Skin infections in dogs and cats.Bacterial endocarditis in dogs.Acute bacterial otitis media, skin infection, bone and joint Infection.Bacterial septicemia, intra-abdominal Infection. Bronchopneumonia, mastitis, metritis, abscess. Hemorrhagic septicemia, calf scour, actinobacillosis. Soft tissue infections and post-operative antibiotic treatment

Contraindication: Ceftriaxone is contraindicated in hypersensitive patients. It should be used with caution in patients with vitamin K utilization or synthesis abnormalities (e.g., severe hepatic disease). Adjust dosage in renal failure; but are not generally required unless severely uremic, or concomitant hepatic impairment present. Prolonged use may result in overgrowth of non-susceptible organisms

Side effects: Eosinophilia (6%), thrombocytosis (5%), leukopenia (2%) and, more rarely, anemia, neutropenia, lymphopenia and thrombocytopenia; Alterations in prothrombin times have occurred rarely in animals; Hypersensitivity:

Skin rash, urticaria, anaphylaxis; Increased serum concentrations of liver enzymes, BUN, creatinine, and urine casts have been described in about 1-3% of patients; Pain on IM injections, bone marrow depression; Pruritus, fever or chills, hemolytic anemia, prolongation of the prothrombin time, diarrhea, flatulence, dyspepsia, palpitations

Precaution: Hypersensitive patient. Do not administer to rabbits, guinea pigs, chinchillas, hamsters, etc. or serious enteritis and clostridial enterotoxemia may occur.

Doses and administration: General: 10-25 mg/kg, IV, IM; Ruminants: 10-50 mg/kg, IM, IV; Dogs:15-50 mg/kg IM, IV, SID; For meningitis/borreliosis: 15-50 mg/kg (maximum single dose in humans is 1 gram) IV or IM q12h for 4-14 days; For preoperative/intraoperative use: 25 mg/kg IM or IV one time; For skin, genitourinary infections: 25 mg/kg IM once daily (q24h) for 7-14 days; For infectious endocarditis and documented resistance against or other contraindications for fluoroquinolones and aminoglycosides in dogs: 20 mg/kg IV q12h; Cats: For systemic infections: 25-50 mg/kg IV, IM or Intraosseous q12h as long as necessary; Horse: 20 mg/kg IV q12h.

Proprietary Preperations:

Acicef-3 vet inj *(ACI)*, Inj., 1g vial, Tk. 150 /Vial, 2g vial, Tk. 270 /Vial
Powercef vet *(Chemist),* 0.5 g vial, Tk. 95, 1 g vial, Tk. 145, 2 g vial, Tk. 260
Cefixon Vet *(Techno)*, Inj., 1g vial, Tk. 145/Vial, 2g vial, Tk. 270/Vial
Eracef Vet *(Popular)*, Inj., 1g vial, 2g vial,
Renacef *(Renata)*, Inj., 1g vial, Tk.148/Vial, 2g vial, Tk.275/Vial
Taxovet *(Opsonin)*, Inj., 2g vial, Tk.272/Vial
Topcef Vet *(Navana)*, Inj., 500mg vial, Tk. 98/Vial,
Topcef Vet *(Navana)*, Inj., 1g vial, Tk. 143/Vial,
Topcef Vet *(Navana)*, Inj., 2g vial, Tk. 270/Vial,
Triject-Vet *(Eskayef)*, Inj., 1g vial, Tk.160/Vial, 2g vial, Tk.285/Vial, 500mg vial, Tk. 105/vial
Trizon Vet *(Acme)*, Inj., 1g vial, Tk. 144/Vial, 2g vial, Tk. 270/Vial
Ceftron-Vet *(Square)*, Inj., 1g vial, Tk.143.93/Vial,
Ceftron-Vet *(Square)*, Inj., 2g vial, Tk. 270.82 /Vial,
Remexon (Vet) *(Bengal),* Inj., 1g vial, Tk. 143/Vial, 2g vial, Tk. 270/Vial,
Nilicon IV *(Ethical),* Inj., 1g vial, 2g vial,
Tribac Vet *(Globe),* Inj., 1g vial, Tk.143/Vial, 2g vial, Tk.270/Vial
Bovixon-Vet *(Incepta),* Inj., 1g vial, Tk.144/Vial, 2g vial, Tk.260/Vial
Vertex Vet *(Orion),* Inj., 1g vial, Tk.144/Vial, 2g vial, Tk.270/Vial
Eracef Vet (*Popular*), Inj., 1g vial, Tk.142/Vial, 2g vial, Tk.272/Vial
Cefixon *(Techno),* Inj., 500mg vial, Tk. 98/Vial, 1g vial, Tk.142/Vial, 2g vial, Tk.272/Vial

CEFALEXIN[A]

(Cephalexin)

Description: A semi-synthetic oral cephalosporin (1st generation), cephalexin monohydrate occurs as a white to off-white crystalline powder which is slightly soluble in water and practically insoluble in alcohol.

Mode of action: Cephalexin is bactericidal against susceptible bacteria and act by inhibiting mucopeptide synthesis in the cell wall resulting in a defective barrier and an osmotically unstable spheroplast

Indications: Effective against *Staphylococcus spp., Streptococcus spp., Escherichia coli, Proteus mirabilis,* and *Klebsiella spp*In poultry, it is effective in infectious coryza, fowl typhoid, fowl cholera, secondary bacterial infection in infectious bursal disease and newcastle disease

Contraindication: Oral systemic antibiotics should not be administered in patients with septicemia, shock or other grave illnesses as absorption of the medication from the GI tract may be significantly delayed or diminished

Side effects:GI effects: Anorexia, diarrhea; Hypersensitivity: Rashes, fever, eosinophilia, lymphadenopathy

Precaution: Hypersensitive patient

Doses and administration:

Cattle and buffalo: 5-10mg/kg Bwt BID.

Poultry: 35 - 50 mg/kg B.W PO qid.

Horses: 22 - 33 mg/kg B.W PO q6h

Dogs, cats: by mouth, 10–25 mg/kg twice daily by subcutaneous or intramuscular injection, 10 mg/kg once daily.

Withdrawal Periods: Cattle: slaughter 19 days, milk withdrawal period nil.

Proprietary Preperations:
Cefa-1 Vet *(Popular)*, Oral Powder, 7.5g/100g packet, Tk. 50/packet, 500g packet, 1kg packet,
Micro Safe *(Bimco)*, Oral Powder, 100g packet, 500g packet,
Cefalexin Vet *(Albion),* Oral Powder, 7.5g/100g packet, Tk. 75/packet,
Cromax *(Super Power),* Oral Powder, 7.5g/100g packet, Tk. 36/packet,
Cefavet Powder *(Techno),* Oral Powder, 7.5g/100g packet, Tk. 380/packet,

CEFQUINOME[R]

Description: Cefquinome is a fourth-generation cephalosporin which has been developed solely for veterinary use. It shows antimicrobial activity against a broad spectrum of Gram-positive and Gram-negative bacterial species, and is regarded as being highly stable to ß-lactamases

Indications: Treatment of infections caused by bacteria sensitive to cefquinome, such as: Acute *E. coli* mastitis with signs of systemic involvement Respiratory tract infections caused by *Pasteurella multocida* and *Mannheimia haemolytica.* Digital dermatitis, infectious bulbar necrosis and interdigital necrobacillosis (foul in the foot). Calf- *E. coli* septicaemia.

Contraindications: Hypersensitivity to cephalosporins is rare, however cefquinome should not be administered to animals which are known to be hypersensitive to ß-lactam antibiotics.

Precaution: Penicillins and cephalosporins may cause hypersensitivity (allergy) following injection, inhalation, ingestion, or skin contact. Operators with known hypersensitivity should not handle these drugs.

Dose: By intramuscular injection.

Cattle: 1 mg/kg daily; calves: 2 mg/kg daily.

Withdrawal Period:
Cattle: Milk- 1 day, Meat- 5 days

Proprietary Preperations:
Supercef *(Chemist),* inj., 2.5 gm/100 ml vail,
Cefa-4 *(Pharma & Firm)*, 20ml- 695tk, 50ml-1504Tk

CEFTIOFUR[W]

Ceftiofur Sodium

Description: Ceftiofur sodium is a semisynthetic 3rd generation cephalosporin. It is a weak acid and is acid stable and water-solubleantibiotic which is active against a variety of gram-positive and gram-negative bacteria.

Mode of action: Like other cephalosporins, it inhibits bacteria cell wall synthesis, is usually bactericidal and is a time-dependent antibiotic.

Indications: Cattle: Bovine respiratory disease (shipping fever, pneumonia) associated with *Mannheimia haemolytica, Pasteurella multocida* and *Haemophilus somni*. It is also indicated for treatment of acute bovine interdigital necrobacillosis (foot rot, pododermatitis) associated with *Fusobacterium necrophorum and Bacteroides melaninogenicus*; Sheep, goat: sheep/caprine respiratory disease (sheep/goat pneumonia) associated with *Mannheimia haemolytica* and *Pasteurella multocida*; Swine: Treatment and control of swine bacterial respiratory disease (swine bacterial pneumonia) associated with *Actinobacillus* (*Haemophilus*) *pleuropneumoniae, Pasteurella multocida, Salmonella choleraesuis* and *Streptococcus suis*; Horse: Treatment of respiratory infections in horses associated with *Streptococcus zooepidemicus*; Dog: Treatment of canine urinary tract infections associated with *E. coli* and *Proteus mirabilis*; Day old chicks/poults: Control of early mortality, associated with *E. coli* organisms susceptible to ceftiofur

Contraindication: Animals prone to sensitivity to beta-lactams.

Side effects: Signs of immediate and transient local pain to the animal; SC injection at neck region: Small areas of discoloration may persist beyond five days, potentially resulting in trim loss of edible tissues; Localized post-injection bacterial infections leads to abscess formation; Horse: Stress condition: Acute diarrhea that could be fatal; Rashes, fever, eosinophilia, lymphadenopathy, or full-blown anaphylaxis

Precaution: Hypersensitive patient. Patients in renal failure may need dosage adjustments

Doses and administration: Cattle: 1.1-2.2 mg/kg, IM, SC,q24h**;** Sheep, goat: 1.1-2.2 mg/kg, IM, SC, q24h for 3-5 days**;** Horse:2.2-4.4 mg/kg q24h IM or, 2.2 mg/kg q12h IM**,** Intrauterine: 1 gm for 3-7 days**;** Foal: 2.2-5 mg/kg IM q12h; Swine: 3-5 mg/kg, IM, q24h for 3 days; Dog, cat:For UTI: 2.2 mg/kg SC once daily for 5-14 days; For systemic, soft tissue infections: 2.2 mg/kg q12h or 4.4 mg/kg q24h SC for 5-14 days; Day Old Chicks:0.08-0.20 mg ceftiofur/chick; Day Old Turkey Poults: 0.17-0.5 mg ceftiofur/poult

Withdrawal Periods: Cattle: IM, SC: 4 days (Meat), 0 day (Milk); Goat, sheep: IM: 0 day (Meat, Milk); Swine: IM: 4 days (Meat); Poultry: SC: 0 day (Meat)

Dose:

Horses: by intramuscular injection, 2 mg/kg once daily

Cattle: by subcutaneous injection, 1 mg/kg once daily.

Withdrawal periods- Cattle: Meat and offal: 8 days. Milk: zero days.

Proprietary Preperations:

ACICEF-4 Vet *(ACI),* Inj., 500mg vial, Tk. 230/Vial, 1g vial, Tk.450/Vial,

Dedicef Vet *(Eskayef),* Inj., 500mg vial, Tk. 250/Vial, 1g vial, Tk.500/Vial

Cefgard *(Guardian),* inj., 1g vial, Tk.502/Vial,

Resuf Vet *(Navana),* Inj., 250mg vial, Tk. 130/Vial, 500mg vial, Tk. 250/Vial, 1g vial, Tk.500/Vial,

Ceftiren *(Renata),* inj., 500mg vial, Tk. 250/Vial, 1g vial, Tk.500/Vial,

Xfur *(Techno),* inj., 500mg vial, Tk. 250/Vial, 1g vial, Tk.500/Vial,

Tifur *(ACME),* inj., 500mg vial, Tk. 250/Vial, 1g vial, Tk.448/Vial,

Penicillin	Species	Dosage	Notes
Sodium penicillin G			
	Cattle	20,000 U/kg, IV or IM, q 6 h	ELDU
	Horses	10,000–20,000 U/kg, IV or IM, q 6 h 20,000–25,000 U/kg, IV, q 6–8 h	Doses up to 44,000 U/kg have been used in refractory cases
Potassium penicillin G	Turkeys	1.5 million U/gal, PO in drinking water, q 24 h for 5 d	Meat withdrawal time, 1 d
	Horses	20,000–25,000 U/kg, IV, q 6 h	Doses up to 44,000 U/kg have been used in refractory cases; injectable potassium penicillin G contain considerable potassium content (1.7 mEq/million U) and should be used with caution in horses with HYPP and other sensitive patients
Procaine penicillin G	Cattle	22,000–66,000 U/kg, IM or SC, q 24 h	Doses >6,600 U/kg/d constitute ELDU
	Horses	22,000–44,000 U/kg, IM, q 12–24 h	
	Swine	15,000–40,000 U/kg, IM, q 24 h	Doses >6,600 U/kg/d constitute ELDU
	Camelids	22,000–44,000 U/kg, SC, q 12–24 h	ELDU
Benzathine penicillin G	Beef cattle and calves	12,000–40,000 U/kg, IM, q 48 h	Greatly extended withdrawal times for production animals should be anticipated; doses >8,800 U/kg constitute ELDU
Penicillin V	Dogs and cats	15,000 U/kg or 8–10 mg/kg, PO, q 6–8 h	
Dicloxacillin sodium monohydrate	Dogs	11–55 mg/kg, PO, q 8 h	
Cloxacillin sodium	Lactating dairy cattle	200 mg/quarter, intramammary, q 12 h for 3 doses	Meat withdrawal time, 10 d; milk withdrawal time, 48 h

Penicillin	Species	Dosage	Notes
Cloxacillin benzathine	Dry dairy cattle	500 mg/quarter, intramammary, once at dry-off	Meat withdrawal time, 28 d
Ampicillin sodium	Cats	6.6–20 mg/kg, IV, IM, or SC, q 8–12 h	
	Dogs	10–40 mg/kg, IV, IM, or SC, q 6–12 h	
	Horses	15–40 mg/kg, IM or IV, q 6 h	20–40 mg/kg IV, q 6 h for foals
	Cattle	4.4–11 mg/kg, IM, q 24 h; or 22 mg/kg, SC, q 12 h	ELDU
	Small ruminants and camelids	10–20 mg/kg, IV, IM, or SC, q 8–12 h	ELDU
	Swine	22 mg/kg, SC, q 12 h	ELDU
Ampicillin trihydrate	Dogs, cats	6.6 mg/kg, IM or SC, q 12 h	Injection is a suspension; should not be administered IV due to risk of anaphylaxis and death
	Cattle	4.4–11 mg/kg, IM, q 24 h	
	Swine	6.6 mg/kg, IM, q 12–24 h	
Ampicillin-sulbactam	Dogs, cats	10–30 mg/kg, IV, q 6–8 h; 3.75–8.3 mg/kg/h, IV as a constant-rate infusion	
Amoxicillin	Dogs, cats	11–30 mg/kg, PO, SC, or IV, q 8–24 h	
	Poultry	100–125 mg/kg, PO, q 8–12 h	ELDU; antimicrobials administered via medicated feed to food-producing species require a VFD in the US
Amoxicillin-clavulanate	Cats	62.5 mg per cat, PO, q 12 h; 10–20 mg/kg, PO, q 8 h	
	Dogs	12.5–25 mg/kg, PO, q 8–12 h	
	Poultry	125 mg/kg, PO, q 8–12 h	ELDU
Ertapenem	Dogs	30 mg/kg, SC, q 12 h	Reserved class, not for empiric treatment
	Cats	30 mg/kg, IV or SC, q 8 h as needed	Reserved class, not for empiric treatment
Imipenem cilastatin sodium	Dogs, cats	5 mg/kg, IV, q 6–8 h	Reserved class, not for empiric treatment. May lower seizure threshold.
	Horses	10–25 mg/kg, IV, q 6 h	Reserved class, not for empiric treatment
	Foals	5 mg/kg, IV infused over 20 minutes, q 6–8 h	Reserved class, not for empiric treatment
Meropenem	Dogs, cats	8 mg/kg, SC, q 12 h; 12–24 mg/kg, IV, q 8 h	Reserved class, not for empiric treatment
Ticarcillin-clavulanate	Dogs, cats	25–50 mg/kg, IV or SC, q 8 h	Reserved class, not for empiric treatment
ELDU, extralabel drug use. HYPP, hyperkalemic periodic paralysis. VFD, veterinary feed directive.			

1.1.2 Tetracyclines

The tetracyclines are broad-spectrum antibacterials active against *Mycoplasma*, *Chlamydophila*, and *Rickettsia* in addition to bacteria. They are active against a range of Gram-positive and Gram-negative bacteria but have little useful activity against *E. coli*, *Salmonella*, *Proteus*, or *Pseudomonas* spp. Tetracyclines are bacteriostatic and acquired resistance is now widespread among bacteria.

CHLORTETRACYCLINE[A]

Description: Chlortetracycline is a tetracycline antibiotic. It occurs as yellow, odorless crystals and is slightly soluble in water. As a broad-spectrum antibiotic with a wide range of bacteriostatic activity against both Gram positive and negative bacteria.

Mode of action: It appears to act by inhibiting the binding of aminoacyl-tRNA to the mRNA ribosome complex, thereby preventing the bacterial protein synthesis.

Indications: Mycoplasma, spirochetes (including the Lyme disease organism), chlamydia, and rickettsial infections. Gram positive bacteria: *Staphylococcus* and *streptococci, Actinomyces spp., Bacillus anthracis, Clostridium perfringens* and *tetani, Listeria monocytogenes,* and *Nocardia* infections. Gram negative bacteria: *Bordetella, Brucella, Bartonella, Haemophilus spp., Pasturella multocida, Shigella*, and *Yersinia pestis* infections. Poultry: Gastrointestinal and respiratory tract infections*Bordetella, Campylobacter, Chlamydia, E. coli, Haemophilus, Mycoplasma, Pasteurella, Rickettsia, Salmonella, Staphylococcus* and Streptococcus spp.; Calf: Bacterial diarrhea, bacterial pneumonia and shipping fever.

Contraindication: See under Oxytetracycline. Oral administration to ruminants with a functional rumen is not recommended; renal impairment; last 2–3 weeks of gestation in pregnant animals and up to 4 weeks of age in neonates, avoid use in patients with dysphagia or diseases accompanied by vomiting. Hypersensitivity to tetracyclines. Administration to animals with a serious impaired renal and/or liver function. Concurrent administration with bactericidal agents like penicillins, streptomycin.

Side effects: Young animals: Discoloration of teeth to a yellow, brown, or gray color; High dosages or chronic administration may delay bone growth. Antianabolic effect that can cause an increase in BUN and/or hepatotoxicity, particularly in patients with preexisting renal dysfunction. Ruminants: Ruminal microflora depression and ruminoreticular stasis. Small animal: Nausea, vomiting, anorexia, and diarrhea. Cat: Can't tolerate well when administered orally, signs of colic, fever, hair loss, and depression may be seen. Dog: Long term use: Urolith formation may occur. Photosensitivity reactions and, rarely, hepatotoxicity or blood dyscrasias. Long term use: Superinfectionby non-susceptible bacteria or fungi.

Precaution: Hypersensitive, hepatotoxic and nephrotoxic patient, Calcium deficient patient

Doses and administration: Cattle, swine: 6-10 mg/kg IV or IM; 10-20 mg/kg PO; Calf: 10-20 mg/kg, PO BID for 3-5 days; Dog, cat: 25 mg/kg PO q6-8h; Chickens: 20-50 mg/kg by addition to feed, 300-400 g/ton feed; Turkeys, ducks: 10-30 mg/kg body-weight; 300-400 g/ton feed; Pigeons: 50 mg/kg PO q6-8h; or 1000-1500 mg/gallon drinking water.

Withdrawal Periods:
Chicken, turkey: 3 days (Meat); Calf, goat, sheep: 8 days (Meat); Cattle: 1 day (Meat); Swine: 5 days (Meat)

Proprietary Preperations:
CTC*(Tazan)*, Per os., 1kg bucket, 25kg bucket,
CTC Gold *(Rafique)*, Per os., 1kg bucket, 5kg bucket,
Eon-CTC *(Eon)*, powder, Per os., 20 gm/100 gm, Tk. 174/packet,
Eska-CTC *(Eskayef)*, powder, Per os., 20 gm/100 gm, 100 gm packet, Tk. 185/packet, 500 gm packet, Tk. 875/packet
Maxtor *(Eskayef)*, powder, 45gm / 100gm, Tk. 400/packet

Cotra-Vet *(Square)*, Powder, Per os., 20 gm/100 gm, Tk. 173.42/Container,500 gm Container, Tk. 817.77/Container
Chlorimed Vet *(MedRx)*, Per os., 100g packet,
Captor *(Elanco)*, Per os., 100g packet,
Chlorel *(Adova)*, powder, Per os., 20 gm/100 gm, Tk. 800/packet
ACI-CTC *(ACI)*, powder, Per os., 45 gm/100 gm,
AL-CTC Vet *(Al-Madiana)*, powder, Per os., 20 gm/100 gm,
CTLIN Vet *(Bridge)*, powder, Per os., 20 gm/100 gm,
Chlortrimed *(MedRx)*, powder, Per os., 20 gm/100 gm, Tk. 405/packet
Captor *(Naafco)*, powder, Per os., 45 gm/100 gm, Tk. 420/packet
CTC 20% WSP *(Opsonin)*, powder, Per os., 20 gm/100 gm, Tk. 173/packet
CTC Vet *(Popular)*, powder, Per os., 20 gm/100 gm, Tk. 173/packet, 45 gm/100 gm, Tk. 410/packet

DOXYCYCLINE[A]

Indications: Indicated for the prevention & treatment of Chronic Respiratory Disease (CRD), Infectious Coryza, Colibacillosis, Fowl cholera, Fowl typhoid, Infectious synovitis, Mycoplasmosis & Salmonellosis, Chlamydiosis & Necrotic enteritis etc. in poultry. Indicated in the treatment of primary and secondary respiratory infections caused by Pasteurella haemolytica. Pasteurella multocida, Actinobacillus spp. Bordetella bronchoseptica, Streptococcus, Mycoplasma spp.etc in cattle. It is also indicated in Pyoderma caused by Staphylococcus; in otitis media, Prostitis, Calf scour etc.

Contraindications: Hepatic impairment; pregnant ani-mals; up to 4 weeks of age in neonates, see notes above; avoid use in patients with dysphagia or diseases accompa-nied by vomiting

Side effects: Vomiting, oesophagitis, diarrhoea, photoder-matitis; hepatic damage and oesophageal ulcers with long-term treatment

Precaution: Avoid use during reproductive period of birds; manufacturer advises that birds do not participate in races during treatment; deionised or distilled water should be used; mineral salts, citric acid, ferrous products can affect absorption.

Dose:

Dogs: by mouth, 10 mg/kg daily, given with food
Cats: by mouth, 10 mg/kg daily
Feline chlamydophilial infections, *by mouth*, 5 mg/kg 1–2 times daily
Large Animal: 15-30 mg. / kg body weight for 3-7 days.
Pigeons, caged birds: *by addition to drinking water,* 15 mg/ kg *or* 260 mg/2 litres drinking water.
For birds with low daily water intake, 260 mg/500 mL drinking water.

Withdrawal Period:
For large animal is 8 days & Broiler is 4 days.

Proprietary Preperations:
Doxacil-Vet *(Square)*, Per os., 10g sachet, Tk.17.38/sachet, 100g packet, Tk.168.51/sachet, 500g Container Tk.829.99/Container
Doxy-A Vet *(Acme)*, Per os., 10g packet, 100g packet, 1kg packet,
Anti-Dox *(ACI)*, Per os., 20g packet, 100g packet,
Doxivet *(Renata)*, Per os., 100g packet, Tk. 167.57/packet,
Doxy-100 *(Theep)*, Per os., 100g packet,
D-Vet *(Navana)*, Per os., 100g packet, Tk. 180/packet,
Doxipol Vet *(Gentry)*, Per os., 100g packet,
Doxin-Al *(Albion)*, Per os., 100g packet,
Doxyvet-200 *(Nutec)*, Per os., 100g packet,
SI Doxy Plus Powder *(Shinil Pharma Ltd.)*, 20gm, 50gm,100gm, 500gm, 1KG

OXYTETRACYCLINE[A]

Description: A tetracycline derivative obtained from *Streptomyces rimosus*. Oxytetracycline base occurs as a pale yellow to tan, crystalline powder that is very slightly soluble in water and sparingly soluble in alcohol. It occurs as a bitter-tasting, hygroscopic, yellow, crystalline powder. It is freely soluble in water and sparingly soluble in alcohol. Oxytetracycline is bacteriostatic and broad-spectrum antibiotic.

Mode of action: Oxytetracycline reversibly inhibits bacterial protein synthesis by binding to the 30S ribosome and preventing attachment of aminoacyl tRNA to the mRNA-ribosome complex and

blocks the addition of amino acids to the growing peptide chain

Indications: It is indicted in the treatment and control of a wide range of common systemic, respiratory and local infection caused by or associated with organisms sensitive to oxytetracycline in cattle, sheep and Goats. Treatment of infections caused by pathogenic bacteria, certain *Rickettsiae, Chlamydia, Actinomycetes, Mycoplasma,* protozoa and some large viruses.

Contraindications: Oral administration to ruminants with a functional rumen; renal impairment; last 2–3 weeks of gestation in pregnant animals and up to 4 weeks of age in neonates, see notes above; avoid use in patients with dysphasia or diseases accompanied by vomiting; avoid subcutaneous injection or concurrent corticosteroids in horses; intravenous injection in dogs should be avoided. Dilution with solutions of calcium salts will cause precipitation and should be avoided.

Side effects: May cause vomiting, diarrhea; photo-dermatitis; transient swelling at site of injection. After long-term treatment, complications may occur due to vitamin B and vitamin K deficiencies, which are caused by disturbances in the microbiological digestion.

Precaution: Care with use in animals with renal or hepatic impairment. The use of tetracyclines during the period of tooth and bone development, including late pregnancy, may lead to discoloration.

Dose. Dosages vary. For guidance.

Horses: by intramuscular or intravenous injection, 2–10 mg/kg daily

Cattle, sheep, goats: by intramuscular or intravenous injection, 2–10 mg/kg daily by depot intramuscular injection, 20 mg/kg, repeat after 2– 4 days or 30 mg/kg (preparations containing oxytetracycline 300 mg/ mL), repeat after 6 days

calves: by mouth, dosage varies, for guidance 10–30 mg/kg 1–2 times daily but see also manufacturer's information

Dogs: by mouth, 25 mg/kg twice daily by subcutaneous or intramuscular injection, 2–10 mg/kg daily.

Cats: by subcutaneous or intramuscular injection, 2–10 mg/kg daily

Poultry: by addition to drinking water, 7–27 g/100 liters.

Withdrawal periods
Cattle - milk: 144 hours (6 days)

Cattle - meat: 21 days.

Sheep/Goat - meat: 14 days.

Proprietary Preperations:
OTC 100 Vet *(Popular)*, inj., 2 gm + 10 gm/100 ml, Tk 65/vial
Etracin *(Ethical),* inj., 2 gm + 10 gm/100 ml, Tk 65/vial
Chemycin 100 *(Chemist),* inj., 2 gm + 10 gm/100 ml, Tk 190/vial
Oxyvet *(ACI),* inj., 2 gm + 10 gm/100 ml,
Technomycin LA *(Techno),* inj., 2gm + 20 gm/100 ml, Tk 50/vial
Technomycin 50 *(Techno),* inj., 2gm + 5 gm/100 ml, Tk 68/vial
Renamycin AF*(Renata)*, Per os., 500mg tablet, Tk. 60.20/Tab,
Renamycin-50 *(Renata)*, Inj., 10ml vial, Tk.17.62 /Vial,
Renamycin Powder Per os., 100g packet, Tk. 100 /packet, 1kg packet, Tk. 740/packet,
Renamycin-100*(Renata)*, Inj., 10ml vial, Tk.26.60/Vial, 100ml vial, Tk.192.85/Vial,
Renamycin LA*(Renata)*, Inj., 10ml vial, Tk.52.52/Vial,
Technomycin-50*(Techno)*, Inj., 10ml vial, Tk. 17.57/Vial,
Technomycin DS*(Techno)*, Per os., 1g bolus, Tk. 6/bolus,
Tetravet *(Acme)*, Inj., 10ml vial, Per os., 500mg tablet, 100g/packet, 1kg/packet,
Tetravet-100 *(Acme)*, Inj., 10ml vial, 100ml vial,
Tetravet LA *(Acme)*, Inj., 10ml vial,
Otetra-Vet *(Square)* 500mg tablet, Tk. 2.96/Tab,
Otetra-Vet 50 *(Square)*, Per os.,500g Container, Tk. 936.93/Container,
Otetra-Vet 20 *(Square)*, Per os.,100g Sachet, Tk. 95/ Sachet,1 kg, Tk.750/ Container,
Otetra-Vet LA *(Square)*, Inj., 10ml vial, Tk.52.16/Vial,
Bactitab *(ACI)*, Per os., 500mg tablet, 64 /Tab, 100g packet, 90 /packet, 1kg packet, 721.16 /packet,
Vetomycin *(Opsonin)*, Per os., 500mg tablet, 100g packet, 1kg packet,
Vetomycin-100 *(Opsonin)*, Inj., 10ml vial, 100ml vial,

Oxytetracycline-10% *(Arifs)*, Inj., 50ml vial, 100ml vial,
Oxytetracycline-20 LA *(Arifs)*, Inj., 50ml vial, 100ml vial,
O.T.C Feed Premix *(Dier)*, Per os., 500g packet,
Kemimycin Vet *(Kemiko)*, Per os., 500mg tablet, 100g packet, 500g packet,
OTC Vet *(Popular)*, Per os., 500mg tablet, 100g packet, 1kg packet,
Ovet *(Eon)*, Per os., 500mg tablet,
Oxin *(Navana)*, Per os., 500mg tablet, 3/Tab,
Oxin WS *(Navana)*, Per os., 100g packet, 80/packet, 1kg packet, 716/packet,
Tetra-20 *(Nutec)*, Per os., 100g packet,
Oxysentin *(Elanco)*, Per os., 500mg tablet, 100g packet, 1kg packet,
Oxytetracycline *(Albion)*, Per os., 500mg tablet, 10g/packet, 100g/packet, 500g/packet, 1kg/packet,
Oxyba Vet *(Gentry)*, Per os., 500mg tablet, 100g, 500g, 1kg,
Biomycin *(Biopharma)*, Per os., 500mg tablet, 100g, 500g, 1kg/packet,
Oxtramed Vet *(MedRx)*, Per os., 500mg tablet, 100g, 500g /packet, 1kg/packet,
Shinamycin Bol./ Shinamycin LA Inj., *(Shinil Pharma)* Bol. 5x4 Strip- 60tk,

TETRACYCLINE HYDROCHLORIDE[A]

Indications: For prevention and treatment of a wide variety of infections of the respiratory, GI, genital and urinary tract in large and small animals and birds.

Contraindications: Use in late pregnancy or in neonates can cause permanent discoloration of rapidly growing teeth. Broad spectrum antibiotic use may result in over growth of non-susceptible organisms, particularly monolia; if new infections appear during treatment, appropriate measures should be taken. Prolonged oral antibiotic therapy combination with restricted diet may indicate use of concurrent multivitamin supplementation.

Dose:

Large animals: - 2.5 - 5 g/15 kg body weight
Small animals: - 1g/kg body weight
Poultry: 60 mg/kg; 55 g/100 litres drinking water.
Withdrawal Period: Meat Cattle- 22 days, Milk- 7 days

Proprietary Preperations:

1.1.3 Aminoglycosides

This group includes **streptomycin**, **dihydrostreptomycin**, **neomycin**, **framycetin**, **gentamicin**, **paromomycin, amikacin, tobramycin,** and **apramycin**. All are bactericidal and active against Gram-negative organisms and some Gram-positive organisms, but not streptococci. Amikacin, gentamicin, and tobramycin are active against *Pseudomonas aeruginosa*. Aminoglycosides are taken up into bacteria by an oxygen-dependent process and are therefore inactive against anaerobic bacteria. They are more active in alkaline media, which is of particular importance when treating urinary infections. Aminoglycosides show synergism with beta-lactam antibacterials.

Bacteria may rapidly acquire resistance to these antibiotics. Enteric bacteria may gain the ability to produce a range of aminoglycoside-inactivating enzymes particularly if a sub-therapeutic dose is given. The different members of the group vary in their susceptibility to these inactivating enzymes.

The aminoglycosides are not absorbed from the gastro-intestinal tract following oral administration; therefore, this route is used for the treatment of gastro-intestinal infections and hepatic encephalopathy. The treatment of systemic infections, including invasive enteric organisms, requires that the drug is administered by injection. Aminoglycosides are poorly distributed into body compartments such as the brain, cerebrospinal fluid, and the eye. Elimination is solely by renal excretion.

The important side effects of aminoglycosides are vestibular or auditory ototoxicity, and nephrotoxicity. Risk of toxicity following systemic administration

varies with different members of the group. Neomycin is particularly toxic to the auditory and renal systems. Streptomycin and dihydrostrep-tomycin are ototoxic and gentamicin is ototoxic and nephrotoxic. Due to their potential nephrotoxic effect, they should be used with care and for short periods of time. The toxic effects on the kidney vary with the individual drugs but dosing regimens that have short interdosing intervals are more likely to cause damage to the kidneys than dosing regimens where long interdosing intervals are used. As these drugs kill by a concentration-dependent mechanism, giving the daily dose once rather than dividing and giving it every 8 hours is also more likely to be successful since higher peak concentrations of the drug will be achieved by the former method. If there is renal impairment, an alternative drug should be chosen. If this is not possible, the inter-dosing interval should be increased on the basis of the animal's plasma-creatinine concentration and the plasma levels of the drug should be monitored. The trough drug concentration should be measured just before the next dose is given to ensure that, in the case of gentamicin, it has fallen below 1 micro-gram/mL to avoid toxicity.

Simultaneous administration with other potentially ototoxic drugs such as loop diuretics should be avoided. Aminoglycosides may impair neuromuscular transmission particularly if used perioperatively in association with anaesthesia. They should not be given to animals with myasthenia gravis. These drugs are well absorbed from the peritoneal cavity and instillation during surgery may result in drug overdose and transient respiratory paralysis.

AMIKACIN[A]

Description: A semi-synthetic aminoglycoside derived from kanamycin, amikacin occurs as a white, crystalline powder that is sparingly soluble in water. The sulfate salt is formed during the manufacturing process. 1.3 grams of amikacin sulfate is equivalent to 1 gram of amikacin50,600 Units of amikacin sulfate are equal to 50.9 mg of base. The commercial injection is a clear to straw-colored solution and the pH is adjusted to 3.5-5.5 with sulfuric acid. Amikacin is considered a bactericidal concentration-dependent antibiotic, leading to a marked post-antibiotic effect, allowing pulse-dosing regimens (which may reduce toxicity). Susceptible bacteria are the Enterobacteriaceae including gentamicin-resistant*Enterobacter spp., E. coli, Klebsiella spp., Proteus spp*., and *Serratia spp. Shigella spp., Mycoplasmaspp*.etc. Among Gram-positive bacteria, *Nocardia spp.* and *Staphylococci* are susceptible. Amikacin is typically more active than gentamicin against *P. aeruginosa*. Antimicrobial activity of amikacin is enhanced in the alkaline environment

Mode of action: Amikacin acts on susceptible bacteria presumably by irreversibly binding to the 30_S ribosomal subunit thereby inhibiting protein synthesis.

Indications: Amikacin is a broad-spectrum, bactericidal drug. It is useful for severe infections in animals, such as Gram-negative septicemia caused by gentamicin-resistantorganisms and multidrug-resistant staphylococcal infections. Animal: Mare: Approved for intrauterine infusion; Foal: Intra-articular injection to treat gram-negative septic arthritis. Pneumonia, bronchitis, laryngitis, peritonitis, gastroenteritis; Diarrhea, septicemia, nephritis, cystitis, endometritis, mastitis; Arthritis, foot root, strangles, distemper, wound, laceration.

Contraindication: Consider risk factors for the development of toxicity include age (both neonatal and geriatric patients), fever,

sepsis and dehydration. Use with caution in birds, as it is toxic. Careful dosage adjustment in neonatal or geriatric animals can potentiate neuromuscular blockade so avoid use in combination with neuromuscular blocking agents.When given via IV route, it should be diluted into suitable IV diluent (normal saline, D5W etc.) and administered over at least 30 minutes.

Side effects: Nephrotoxicity is the most dose-limiting toxicity. Ototoxicity and vestibulotoxicity also are possible. Can also cause neuromuscular blockade, facial edema, pain/inflammation at injection site, peripheral neuropathy and hypersensitivity reactions.

Precaution: Do not use in animals with renal insufficiency or renal failure.

Doses and administration: Cattle:10 mg/kg IM q8h or 25 mg/kg q12h; 22 mg/kg/day IM divided three times daily; Adult: 10 mg/kg SC, IM, IV q24h; Calf (<2 weeks of age): 20 mg/kg IV, IM q24h. Horse:Adults: 10 mg/kg SC, IM, IV q24h; Foals (<30 days): 20-25 mg/kg SC, IM, IV q24h); Dog, cat: Sepsis: 20 mg/kg IV q24h; Dog: 15-30 mg/kg IV, IM, SC q24h; Cat: 10-15 mg/kg IV, IM, SC q24h; Birds: 10-20 mg/kgSC, IM, IV q8-12h.

Withdrawal Periods: Cattle, swine: 2% concentration (injection): 14 days

Proprietary Preperations:

Komi Amikacin *(Rafique)*, Per os., 100ml bottle

GENTAMICIN [A]

Description: Gentamicin is an aminoglycoside antibiotic. It is obtained from cultures of *Micromonaspora purpurea*. Gentamicin sulfate occurs as a white to buff powder. Gentamicin sulfate is soluble in water and insoluble in alcohol. The commercial product is actually a combination of gentamicin sulfate C1, C2, and C3, but all these compounds apparently have similar antimicrobial activities. Commercially available injections have a pH from 3-5.5. Gentamicinis considered concentration-dependent bactericidal antibiotic.

Mode of action: Gentamicin irreversibly binds to the 30S ribosomal fragment and inhibit the rate of protein synthesis and the fidelity of mRNA translation which results in the synthesis of abnormal proteins. Their uptake by bacteria includes an energy-dependent step (EDP1), which is oxygen linked and is inhibited by an anaerobic or acidic environment and by Ca^{2+} or Mg^{2+}. It is bactericidal against Gram (-) aerobes and are synergistic with β-lactams against many Gram (+) pathogens.

Indications: General: Activity against many aerobic gram-negative and some aerobic gram-positive bacteria, including most species of *E. coli*, *Klebsiella*, *Proteus*, *Pseudomonas, Salmonella*, *Enterobacter*, *Serratia*, and *Shigella*, *Mycoplasma*, and *Staphylococcus*. It can be used with beta-lactam antibiotics because it broadens the spectrum when used with drugs such as penicillins or cephalosporins

Contraindication: Patient with compromised renal function. Contraindicated during **pregnancy** period. Contraindicated in hypersensitive patient.

Side effects: Nephrotoxicity: It is due to the damage of the membranes of proximal tubular cells resulting in a loss of brush border enzymes, impaired absorption, proteinuria, and decreased glomerular filtration rate. Ototoxicity (8th cranial nerve toxicity) and vestibulotoxicity: Due to progressive damage to cochlear sensory cells and/or vestibular cells of the inner ear resulting in deafness and ataxia, respectively. Neuromuscular blockade, facial edema. Pain/inflammation at the injection sites.Peripheral neuropathy, hypersensitivity reactions.Rarely, GI clinical signs, hematologic and hepatic effects found.

Precaution: Care should be taken for dehydrated patient.

Doses and administration: General: 5-10 mg/kg, IV, IM, SC SID-BID; Cattle:4.4-6.6 mg/kg/day IM, IV divided three times daily, Intramammary: 100-150 mg q12h; Calf: >2 weeks: 12-15 mg/kg q24h IV or IM; Horse: Adult: 4-6.6 mg/kg q24h IM or IV, Foals: 7 mg/kg IV or IM once daily (q24h); Dog, cat:2-4 mg/kg q8h IV, IM or SC

Withdrawal Periods:12 days (Meat), 3 days (Milk, Egg); Swine: Meat: 14 days (PO), 40 days (IM), 10 days (idw); Chicken: Meat: 35 days (SC); Turkeys: Meat: 63 days (SC)

Proprietary Preperations:

Gentaren *(Renata)*, Inj., 100 mg/ml, 30ml vial, Tk.130.41/Vial, 100ml vial, Tk.389.31/Vial,
Gentaren-20 Vet *(Renata),* powder, 20 gm/100 gm,
Genta-10 *(Acme)*, Inj., 100 mg/ml, 10ml vial, Tk120/Vial, 30ml vial, Tk. 390/Vial,
Gentabac Vet *(Popular)*, Inj., 10 gm/100 ml, 50ml vial, 100ml vial,
Gentabac (*Popular*), powder, 20 gm/100 gm, Tk 3700/kg
Genacyn-Vet 10 *(ACI)*, Inj., 10ml vial, 100ml vial,
Acigent-10 *(ACI)*, inj.,10ml vial, Tk. 45.31 /Vial, 100ml vial, Tk. 360 /Vial,
Acigent Vet 20 *(ACI)*, powder, Tk. 1750/ 500g packet, 365 /100 gm packet, 70/20 gm packet,
Algenta-Vet *(Al-Madina),* inj., 100mg/ml, 10ml vial, Tk.44/Vial, 100ml vial, Tk.390/Vial, powder, 20 gm/100 gm,
Gentacin 5% *(Techno)*, Inj., 10ml vial, Tk. 40/Vial, 50ml vial, Tk. 185/Vial,
Mastanil *(Techno)*, Infusion, 7.5g tube, Tk.85/tube,
Gentamax *(Techno),* powder, 20 gm/100 gm, Tk 825/packet
Genta 50 *(Nutec)*, Inj., 50ml vial,
Gentamicin 5% *(Arifs)*, Inj., 100ml vial,
Gentamast *(Arifs)*, Infusion, 7.5g tube,
Gentipra 5% *(Nasco)*, Inj., 100ml vial,
Genset *(Eon)*, Inj., 100 mg/ml,10ml vial, Tk.388/Vial,
Gentamed-20 Vet *(MedRx)*, Per os., 50g packet, 100g packet,
Gentanor *(Albion),* inj., 100 mg/ml, 10ml vial, Tk. 43/Vial, 100ml vial, Tk. 375/Vial,
Genta-Al *(Albion),* powder, 20 gm/100 gm, Tk. 80/100gm Tk. 115/ 500g packet,
Regenta *(Bengal),* inj., 100 mg/ml, 10ml vial, Tk. 45/Vial, 100ml vial, Tk. 380/Vial,
GENTASON PLUS *(Chemist),* powder, 20 gm/100 gm, Tk. 750/packet
Gentasone Plus *(Chemist*), inj., 10 gm/100 ml, TK. 420/vial
Gentest Vet *(Eskayef),* Powder, 20gm/100gm, 100 gm packet, Tk.900/packet
Emicin *(Ethical),* inj., 50 mg/ml, 10ml vial,
Gentavet *(FnF),* inj., 100 mg/ml, Tk 45/ml, 50 mg/ml, 10ml vial, Tk 390/vial
G-20 VET *(Gentry),* powder, 20 gm/100 gm,
Gentagard *(Guardian),* inj., 100 mg/ml, Tk. 45/ml
Intamycin Vet *(Incepta)* powder, 20 gm/100 gm, TK 825/100g packet, TK 3800/500g packet
Gentamed 20 *(MedRx*), powder, 20 gm/100 gm, Tk 824/packet
GM 20% Vet (*Newtec*), powder, 20 gm/100 gm, Tk 750/packet
GentaMax Vet (*One Pharma*), inj., 100 mg/ml,
Getamin 5% (*Opsonin*), inj., 50 mg/ml, Tk 164/vial
Genacyn (*Square*), inj., 50 mg/ml, 100 mg/ml,
Genvion-Vet *(vision),* powder, 20 gm/100 gm,

NEOMYCIN SULFATE[A]

(Neomycin sulphate)

Description: An aminoglycoside antibiotic obtained from *Streptomyces fradiae*. The commercially available product almost entirely consists of the sulfate salt of neomycin B. It occurs as an odorless or almost odorless, white to slightly yellow, hygroscopic powder or cryodessicated solid. It is freely soluble in water and very slightly soluble in alcohol. Oral or injectable (after reconstitution with normal saline) solutions of neomycin sulfate have a pH from 5-7.5.

Mode of action: Neomycin inhibits bacteria protein synthesis via binding to 30_S ribosome. It is bactericidal with a broad spectrum of activity except against streptococci and anaerobic bacteria.

Indications: Skin, eyes and ears infections, enteric infections. Necrotic enteritis, salmonellosis, collibacillosis, shigellosis. Also effective against Staphylococcus and Streptococcus bacteria

Contraindication: Oral neomycin is contraindicated in the presence of intestinal obstruction or if the patient is hypersensitive to aminoglycosides. Chronic usage of oral aminoglycosides may result in superinfections.

Side effects: Rarely, oral neomycin may cause ototoxicity, nephrotoxicity, severe diarrhea, and intestinal malabsorption

Precaution: Careful during ototoxic and neprhrotoxic patient, debilitated animal

Doses: Calves: 10mg/kg.

Dogs, cats: bacterial infections, 11 mg/kg daily in divided doses.

poultry: by addition to drinking water, 11 mg/kg by addition to feed, 230 g/ton feed.

Withdrawal Periods: Meat: Calves: 21 days; Poultry: 7 days.

Proprietary Preperations:

Neoren *(Renata),* Per os, 100g packet, Tk.290/packet
Neovet-70 *(Techno)*, Per os, 100g packet, Tk.700/packet,
Neo-Max Vet *(Gentry)*, Per os, 100g packet,
Neotracin *(ACME),* ointment, 500 IU + 5 mg/gm, TK 18/tube
Neoxel Vet *(Eskayef)*, Powder, 500mg/gm, 10gm packet. Tk.40/packet, 100 gm Sachet, Tk. 291.88/Packet, 500 gm Container, Tk.1326/Cont., 1 kg Container, Tk.2525.07/Cont.
Neoxel 70 Vet *(Eskayef)*, Powder, 700mg/gm, 100 gm packet, Tk.400/packet, 500gm packet, Tk. 1750/packet, 1 kg packet, Tk. 3250/packet
Germicin vet (*Chemist*), Powder, 70 gm/100 gm, Tk. 390/100 gm
Neoshin 50 WSP *(Shinil Pharma Ltd.),* 100gm
Neosulcin Vet *(Navana)*, WSP, 500 mg/g, 290/100g

STREPTOMYCIN[A]

Indications. Streptomycin-sensitive infections.

Side Effects: Streptomycin can be nefrotoxic, neuro-musculo toxic, can cause heart and circulatory disturbances and can affect the ear and equilibrium functions. Penicillin can cause allergic reactions.

Precaution: Excessive or prolonged administration can lead to balance and hearing impairment.

Dose: Horses, cattle, sheep, goats: *by intramuscular injection*, 10 mg/kg daily

***Dogs, cats*:** by intramuscular injection, 25 mg/kg daily.

Withdrawal Period: Meat: 5 days Eggs: 3 days.

Proprietary Preperations:

Strepcin-G 0.5 *(Opsonin),* inj., 1 Lac IU + 200 mg + 1.5 Lac IU/ml, Tk 25/ml
SP-Vet LA (*ACME*), inj., 50 Lac IU + 10 gm + 75 Lac IU/50 ml,
SP-Vet (*ACME*), inj., 4 Lac IU + 20 Lac IU + .5 gm,
Streptopen (*Renata*), inj., 5 Lac IU + 15 Lac IU + 2.5 gm/vial, TK 93/vial
Streptocillin (*Techno*), inj., 5 Lac IU + 15 Lac IU + 2.5 gm/vial, Tk. 50/vial
Strepto-P (*ACI*), inj., 5 Lac IU + 15 Lac IU + 2.5 gm/vial, TK 83/vial

1.1.4 Macrolides

The macrolides include erythromycin, josamycin, spiramycin, tilmicosin, and tylosin, while clindamycin, pirlimycin and lincomycin belong to the related lincosamide group. They are usually bacteriostatic in action. All are basic compounds that are well absorbed following oral administration and inactivated by hepatic metabolism. Due to their basic nature they are concentrated by the 'ion-trap' in acidic fluids such as milk and prostatic fluid. Ion trapping also occurs within cells and macrolides, in particular, will attain high concentrations inside cells,

including macrophages which may target the drug to sites of infection. They can be effective against intracellular pathogens (for example *Mycobacteria* spp.).

Tylosin has good activity against *Mycoplasma* spp. and *Serpulina hyodysenteriae (Treponema hyodysenteriae)* and a number of Gram-positive aerobes, but little activity against Gram-negative organisms or obligate anaerobes.

Erythromycin is active against streptococci, *Staph. aureus* including penicillin-resistant strains, the more fastidious Gram-negative bacteria, and obligate anaerobes. It is likely to be the drug of choice for *Campylobacter* and also *Rhodococcus equi* in foals. Erythromycin has less activity than tylosin against *Mycoplasma* spp. or *Serpulina hyodysenteriae*. Vomiting is a common side-effect of erythromycin due to a gastric irritant effect. Fatal enterocolitis has been reported in horses following ingestion of erythromycin. In addition, this drug also inhibits the metabolism of other drugs by the liver and, in humans, has given rise to serious drug interactions. These interactions have not been studied in veterinary species but care should be taken when administering erythromycin with cyclosporin, oral anticoagulants, methylprednisolone, theophylline, and antihistamines such as terfenidine.

Azithromycin and **clarithromycin** are structural analogues of erythromycin produced for human medicine. They have longer half-lives and less frequent dosing is required. In addition, the gastro-intestinal side effects are less of a problem in humans and azithromycin does not inactivate the cytochrome P450 enzymes inhibited by erythromycin so the potential for serious drug interactions is much less. Both azithromycin and clarithromycin have greater activity than erythromycin against *Mycobacterium avium* complex (and can be used in treating atypical mycobacterial infections) and against *Toxoplasma gondii*. Azithromycin is also highly active against *Chlamydophila* and clarithromycin is active against *M. leprae*. Little work has been done on these drugs in domestic animals and many data in the literature are extrapolated from human studies. Azithromycin appears to have a long half-life of 35 hours in cats. Although azithromycin use will result in rapid resolution of clinical signs of chlamydophilial infection in cats, a recent study suggets that even prolonged and continuous dosing does not eliminate *Chlamydophila felis* infection and animals remain carriers.

Spiramycin is a macrolide which achieves very high tissue concentrations (in excess of those found in plasma) and penetrates well into milk, lacrimal fluids, respiratory secre-tions and other body fluids partly because of ion trapping of this weak base in fluids which are more acidic than plasma. The high tissue levels found are partly due to binding of the drug to tissue proteins, a feature which prolongs the resi-dence time of spiramycin within tissue compartments. Its spectrum of activity is similar to that of erythromycin. It has greater acid stability than erythromycin and good oral bioavailability in monogastric animals. There is some evidence of a synergistic action with metronidazole against obligate anaerobic bacteria. Spiramycin also has activity against *Toxoplasma gondii* and *Isospora* spp.

Tilmicosin is indicated for the treatment of pneumonia associated with *Pasteurella* spp. in cattle and sheep and *Actinobacillus pleuropneumoniae, Mycoplasma hyopneumoniae*, and *Pasteurella multocida* in pigs. It is also effective against ovine mastitis associated with *Staphylococcus aureus* and *Mycoplasma agalactiae*.

ERYTHROMYCIN[W]

Description: A macrolide antibiotic, produced from *Streptomyces erythreus*. It is a weak base that is available commercially in several salts and esters. Erythromycin base occurs as a bitter tasting, odorless or practically odorless, white to slight yellow, crystalline powder. Approximately 1 mg is soluble in 1 ml water; it is soluble in alcohol. The spectrum of activity of is limited primarily to gram-positive aerobic bacteria; it has little or no effect on gram-negative

bacteria. The spectrum of activity also includes mycoplasma. At sub-antimicrobial doses, erythromycin mimics the effects of motilin (cats, humans, rabbits) or 5-hydroxytryptophan3 (5-HT3) and stimulates migrating motility complexes and antegrade peristalsis. By inducing antral contractions, gastric emptying is enhanced. Erythromycin also increases lower esophageal pressure. Erythromycin's prokinetic mechanism of action in dogs is not completely understood, but probably is via activation of 5-HT3 receptors.

Mode of action: Erythromycin is usually a bacteriostatic agent, but in high concentrations or against highly susceptible organisms it may be bactericidal. Like other macrolides, it inhibits bacteria by binding to the 50S ribosome and inhibiting protein synthesis.

Indications: General: Soft tissues infections caused by gram-positive bacteria, skin and respiratory infections; Animal:Treatment of *Rhodococcus equi* infections in foals with rifampin. As a prokinetic agent to increase gastric emptying in dogs and cats. Also beneficial in treatment of reflux esophagitis; Poultry: Mycoplasmosis (C.R.D), CCRD, infectious coryza*, Staph. spp.* Laryngitis, tracheitis, bronchitis, secondary bacterial infections etc.

Contraindication: Orally should not be used in ruminants as severe diarrheas may result. As it may induce a toxic enterocolitis, erythromycin (and other macrolides) is contraindicated in rabbits, gerbils, guinea pigs, and hamsters. Many clinicians believe that it is contraindicated in adult horses. Only the gluceptate and lactobionate salts should be used intravenously.

Side effects: IM injections: Local reactions and pain at the injection site may occur. IV injections: Can readily cause thrombophlebitis. GI disturbances such as diarrhea, anorexia, and vomiting. Swine: Rectal edema and partial anal prolapse have been found. Allergic reactions can occur but are thought to be rare. Foal: May alter temperature homeostasis. Foals of 2-4 months old: Have been reported to develop hyperthermia with associated respiratory distress and tachypnea. Adult horse: May develop severe, sometimes fatal, diarrheas.

Precaution: Do not administer erythromycin solutions intended for intramuscular administration by intravenous injection. Do not combine erythromycin with other macrolide antibiotics.

Doses and administration: Cattle: Abscesses, pododermatitis: 2.2-8.8 mg/kg q24h IM, Pneumonia: 2.2-8.8 mg/kg q24h IM or 15 mg/kg q12h IM, Stimulate rumen motility: Calves 8.8 mg/kg IM; cows 10 mg/kg IM; Swine: 2.2-6.6 mg/kg IM once daily; Dog, cat: 10-20 mg/kg PO three times daily. Poultry: by addition to drinking water, 250 mg/Litre. Foals: by mouth, 25 mg/kg body weight 3 times daily.

Withdrawal Periods: Cattle: Meat- 14 days, Milk- 3 days; Sheep: Meat- 3 days; Swine: Meat- 7 days; Poultry: Meat- 3 days, Egg- 6 days

Proprietary Preperations:

CombinedProprietary Preperations: Erythromycin + Sulphadiazine + Trimethoprim, WSP, 18 gm + 15 gm + 3 gm/100 gm:

Eraprim Vet *(ACME),* WSP, 18 gm + 15 gm + 3 gm/100 gm, Tk. 351.06/100g,

Set-3 Vet *(Al-Madina),* WSP, 18 gm + 15 gm + 3 gm/100 gm, Tk. 362.45/100g, Tk. 1720.43/500g;

Erotid Vet *(Albion),* WSP, 18 gm + 15 gm + 3 gm/100 gm, Tk. 365.00/100g;

Streptonill Vet *(Bridge),* WSP, 18 gm + 15 gm + 3 gm/100 gm,

EST-Vet *(Eon),* WSP, 18 gm + 15 gm + 3 gm/100 gm,

Erotrim Plus *(Ethical),* WSP, 18 gm + 15 gm + 3 gm/100 gm,

Microgard *(Guardian),* WSP, 18 gm + 15 gm + 3 gm/100 gm, Tk. 45.13/10g, Tk. 363.09/100g;

Firmac Plus Vet *(Incepta),* WSP, Tk. 360.00/100g, Tk. 1600.00/500g;

Medmycin *(MedRx),* WSP, Tk. 75.80, Tk. 365.00/100g;

Erazine Vet *(Navana),* WSP, Tk. 45/10g; 75.00/20g; 385/100g;

Erocot *(Opsonin),* WSP, Tk. 45.30/10g, Tk. 422.85/100g;

S-Vet Plus *(Popular),* WSP, Tk. 45.00/10g, Tk. 420.00/100g,

Rampanid Plus *(Rampart-Power),* WSP, Tk. 446.00/100g;
Micronid Vet *(Renata),* WSP, 10g - Tk. 40.71, 100g - Tk, 362.49.
NEW CONID VET *(Newtec),* WSP, Tk. 45.75/10g, Tk. 362/100g; Tk. 1642/500g;
Turbonid Vet (Eskayef), WSP, 18gm+15gm+3gm/100gm, Tk.35/6gm, Tk.400/100gm, Tk.1900/500gm
Erisen Vet *(Square),* WSP, 18 gm + 15 gm + 3 gm/100 gm, Tk. 326.83/100g

SPIRAMYCIN[W]

Indications: Ruminants: Treatment and prevention of pulmonary infections, enteric infections, mastitis, metritis, omphalitis, omphalophlebitis (navel ill/joint ill), arthritis, interdigital abscess; Pig: Pulmonary infections, pig house cough, atopic rhinitis, infections caused by *Streptococcus spp*., erysipelas, arthritis, mastitis and prevention of neonatal infections in piglets, gastroenteritis

Contraindication: See under macrolids

Precaution: Do not overdose in goat

Doses: Adult Cattle: 30000 IU/kg, deep IM; Calf, sheep, goat, pig: 75000 IU/kg, deep IM

Proprietary Preperations:
Suanovil 20 *(AASCo.),* Inj., 6 lakh units/ml,
Spir *(Nutec),* Inj., 5.4 lakh units/ml,

TILMICOSIN[W]

Description: Tilmicosin is a semi-synthetic macrolide antibiotic; a basic, lipid-soluble compound consisting of a lactone ring to which is attached deoxy sugar. The commercial products are found as Tilmicosin phosphate. The spectrum of activity is limited primarily to gram-positive aerobic bacteria; *Mycoplasma*; and respiratory pathogens such as *Pasteurella multocida, Mannheimia haemolytica,* and *Histophilus somni*. Tilmicosin administered to calves (15 mg/kg SC) reduced expression of prostaglandin (PGE2) stimulated by bacteria. There also may be some anti-inflammatory effects such as reduced leukocyte release of inflammatory mediators in the lungs. There also may be reduced prostaglandin synthesis with tilmicosin administration in alveolar macrophages.

Mode of action: Tilmicosin inhibits bacterial protein synthesis by binding to 50_S ribosome.

Indications: Animal: Bovine or ovine respiratory diseases (BRD) caused by *Mannheimia (Pasturella) haemolytica*. Poultry: Pasteurellosis, mycoplasmosis, CRD, CCRD

Contraindication: Do not administer to any animals IV or death can result. Do not administer to goats. It is not recommended for small animals. Tilmicosin has been shown to be fatal in swine (when injected), non-human primates and potentially, in horses. Tilmicosin reaches high concentrations in milk for up to 42 days. Do not administer to lactating dairy cattle. Avoid direct contact with eyes. Accidental self-injection can be fatal in humans. Fatal cardiac reactions caused by injections have been reported in people. Accidental injection in people requires immediate treatment. Emergency treatment includes applying ice to injection site. Do not use in automatically powered syringes

Side effects: IM injections may cause a local tissue reaction resulting in trim loss. Edema is possible at SC injection site. Tilmicosin may be cardiotoxic in some animals. Injections to pigs have been fatal because of cardiotoxicity. The cardiac effects are increased heart rate and decreased contractility. Rabbit: Weakness, pallor, tachypnea and sudden death. May cause acute death if given IV. SC injections can cause local swelling and necrosis

Precaution: Accidental self-injection may be fatal in humans. In case of accidental self-injection seek urgent medical attention and show package leaflet to medical services.

Doses and administration: Cattle, sheep: by subcutaneous, 10 mg/kg, Pig: Pneumonia: 181-383 gm/ton of feed; Poultry: by addition to drinking water, 75 mg/Litre.

Withdrawal period: Cattle: Meat- 28 days, Milk- Nil. Poultry: Broiler- 12 days, Turkey- 19 days.

Proprietary Preperations:
Tilvet *(Al-Madina),* Oral Solution, 250 mg/ml, Tk. 800.00/100 ml;
Bentil Vet *(BRL),* Oral Solution, 250 mg/ml;
Qtill S Vet *(Eskayef),* Oral Solution, 250 mg/ml, 175 mg/10ml, Tk. 825/100 ml, Tk.3600/500ml, Tk.4670/1L
Gcotil Vet *(Gentry),* Oral Solution, 250 mg/ml,
Avitil Vet *(Incepta),* Oral Solution, 250 mg/ml, Tk. 750/100ml; Tk. 3500/500ml
Macrotyl Vet *(Medicon),* Oral Solution, 250 mg/ml, Tk. 750.00/100 ml;
Tilcon Vet *(Navana),* Oral Solution, 250 mg/ml, Tk. 3600/500 ml; Tk. 810/100 ml;
Tilmisin Vet *(Renata),* Oral Solution, 250 mg/ml, Tk. 825.00;
Tilcosin Vet *(Square),* Oral Solution, 250 mg/ml, Tk. 825/100 ml; Tk. 3600/500 ml;
Ticor (Vet) *(Techno),* Oral Solution, 250 mg/ml, Tk. 820/100 ml; Tk. 3600/500 ml;
Acmetil Vet *(ACME),* Oral Solution, 250 mg/ml, Tk. 825/100 ml; Tk. 3600/500 ml;
TMC Liquid (Vet) *(Vision),* Oral Solution, 250 mg/ml, Tk. 825/100 ml; Tk. 3600/500 ml;
Pulmotil AC (*Elanco*), Oral Solution, 250 mg/ml, Tk 6400/240 ml
Hytil *(Pharma & Firm),* Oral Solution ,100ml-870 tk, 500ml-3600tk
TilSol *(Shinil Pharma Ltd.),* Oral Solution, 100ml, 500ml, 1L,

TYLOSIN[W]

Description: A macrolide antibiotic related structurally to erythromycin. Tylosin is produced from *Streptomyces fradiae*. It occurs as an almost white to buff-colored powder. It is slightly soluble in water and soluble in alcohol. Tylosin is considered highly lipid soluble. The tartrate salt is soluble in water. The injectable form of the drug is in a 50% propylene glycol solution. Binding sites on the 50_S ribosome overlap with binding sites of chloramphenicol and the lincosamides (especially clindamycin) and combination therapy should be avoided. It may also have immunomodulatory effects on cell mediated immunity.

Mode of action: It is a bacteriostatic antibiotic by inhibiting bacterial protein synthesis. It binds to the 50_S ribosome to prevent translocation of amino acids to the growing peptide chain.

Indications: Cattle, sheep, and swine: Local and systemic infections caused by *Mycoplasma* and Gram (+) bacteria

Contraindication: Tylosin is contraindicated in hypersensitive patients. Most clinicians feel that tylosin is contraindicated in horses, as severe and sometimes fatal diarrheas may result from its use in that species. Sometimes not recommended for hamster. Ruminant: Don't use orally. It should not be used in poultry producing eggs for human consumption. Partial cross-resistance with erythromycin was found. Tylosin did not develop cross-resistance to tetracycline or furazolidone.

Side effects: Pain and local reactions at IM injection sites. Mild GI upset (anorexia and diarrhea). Ruminant: Orally: severe diarrheas, ruminal stasis, inappetance, foul smelling feces, and decreased milk production. IV administration in cattle has produced shock, dyspnea, and depression. Horse: Severe diarrheas if administered at any routes. Swine: Edema of rectal mucosa and mild anal protrusion with pruritus, erythema, and diarrhea. Tylosin and spiramycin have induced contact dermatitis in veterinarians. Poultry: Safe at recommended dose; diarrhea and urticaria may occur.

Precaution: Do not administer to rabbits, guinea pigs, chinchillas, hamsters, etc. or serious enteritis and clostridial enterotoxemia may occur.

Doses and administration: Cattle: by intramuscular, 10-20 mg/kg body weight daily. by additiona to milk or milk replacer, 1 g/calf twice daily. Sheep, goat: by intramuscular, 10 mg/kg, Poultry: by addition to drinking water, 0.5 g/Litre. Dog: by mouth, 40 mg/kg body weight daily in divided doses.

Withdrawal period: Cattle: Meat- 28 days, Milk- Nil. Poultry: Meat- Nil, Egg- Should not use in birds producing eggs for human consumption.

Proprietary Preperations:
Tylovet *(ACME),* WSP, 200 mg/g, Tk. 213.84/100g, Tk. 1934.81/1 kg;
Tylotar *(ACI),* WSP, Tk. 230 /100g, Tk. 1100 /500g;

Tylotrat-20 *(Al-Madina),* WSP, 200 mg/g, Tk. 206.26/100g,
Tylox-Al Vet *(Albion)* WSP, 200 mg/g,
Tylost Vet *(Biopharma),* WSP, 200 mg/g,
Tysinvet *(Bridge),* Inj., 200 mg/ml,
Tylochem *(Chemist),* Inj., 200 mg/ml, Tk. 330/100ml, Tk. 60/10 ml
Elosin-T *(Eon),* WSP, 200 mg/g, Tk. 1013.04 /500g, Tk. 213.44/100g;
Tylosef 20% *(Eskayef),* WSP, 200 mg/g, Tk.233.45/100gm, Tk.2121.05/1kg
Tylopol *(Ethical),* WSP, 200 mg/g,
Amp 20% *(Globe),* WSP, 200 mg/g, Tk. 200.00/100g,
Tyloguard *(Guardian),* WSP, 200 mg/g, Tk. 215.00/100g, Tk. 1900.00/kg;
Tylorest Vet *(Incepta),* WSP, 200 mg/g, Tk. 232.00/100g, Tk. 1065.00/500g Tk. 2040.00/Kg;
Mycosef Vet *(Kemiko),* WSP, 200 mg/g, Tk. 230.69/100g, Tk. 1103.00/500g, Tk. 2116.00/kg;
Tyret 20% *(Medicon),* WSP, 200 Mg/G,
Tylomed 20 *(Medrx),* WSP, 200 Mg/G, Tk. 1065.00/500g;
Tylos V 20% *(Navana),* WSP, 200 Mg/G, Tk. 205.50/100g,
Tylobac Vet *(Popular),* WSP, 200 Mg/G, Tk. 212.80/100g, Tk. 1882.08/500g;
Tyloram *(Rampart-Power),* WSP, 200 Mg/G, Tk. 226.00/100g, Tk. 962.00/500g, Tk. 2175.00/Kg;
Mycostop Powder *(Renata),* WSP, 200 Mg/G, Tk. 231.21/100g, Tk. 2051.02/Kg;
Tam Vet *(Square),* WSP, 200 Mg/G, Tk. 204.52/100g, Tk. 1012.04/500g
Tylosin-20 *(Techno),* WSP, 200 Mg/G, Tk. 350.00/100g.
Losin (Vet) *(Super Power),* WSP, 20 Gm/100 Gm,
Tylan Soluble (*Elanco*) WSP 100 Gm/100 Gm, Tk. 1777.10/100 Gm
F.T.D. Inj (*Pharma & Frim).* 50ml-434 Tk, Tk. 784/100ml

TYLVALOSIN[W]

Indication: Indicated For The Treatment Of Mycoplasmosis, Necrotic Enteritis, Infection Caused By *Ornithobacterium Rhinotracheale* Etc.

Contraindication: Contraindicated In Animals Hypersensitive To Tylvalosin.

Side Effects: Occasional Swelling At Injection Site.

Precaution: See Under Macrolides

Dose: Poultry: By Addition To Drinking Water, 125 Mg/Litre (20-25 Mg/Kg Body Weight) Daily For 3-4 Days.

Withdrawal Period: Poultry: Meat- 2 Days, Egg- Should Not Use In Birds Producing Eggs For Human Consumption.

Proprietary Preperations:
Tylvasin Vet (*ACME*), WSP, 62.5 Mg/100g; Tk…/Packet
Navatyl (Vet) *(Navana),* WSP, 62.5 Mg/100g; 40g Tk 650/Packet
Navatyl (Vet) *(Navana),* WSP, 62.5 Mg/100g; 100g Tk 1500/Packet
Valotil Vet *(Eskayef),* WSP, 62.5 Mg/100g; Tk.160/10gm Packet, Tk.1500/100gm Packet
Tylva-Vet *(Al-Madina),* WSP, 62.5 Mg/100g; Tk 350/50g Packet

1.1.5 Lincosemides

LINCOMYCIN[A]

Description: An antibiotic obtained from cultures of *Streptomyces lincolnensis*. Lincomycin is available commercially as the monohydrate hydrochloride. It occurs as a white to off-white, crystalline powder which is freely soluble in water and may have a faint odor with a pKa of 7.6. The commercially available injection has a pH of 3-5.5 and occurs as a clear to slightly yellow solution. Lincomycin may act as bacteriostatic or bactericidal agents, depending on the concentration of the drug at the site of infection and the susceptibility of the infective organism.

Mode of action: The lincosamides are believed to act by binding to the 50_S ribosomal subunit of susceptible bacteria, thereby inhibiting peptide bond formation.

Indications: Most aerobic gram-positive cocci are susceptible to the lincosamides (*Strep. faecalis* is not), including *Staphylococcus* and *Streptococci*. Other organisms that are generally susceptible include*: Corynebacterium diphtheriae, Nocardia asteroides, Erysepelothrix* and *Mycoplasma spp.* Anaerobic bacteria that may be susceptible to the lincomycin include: *Clostridium perfringens. C. tetani* (not *C. difficile*), *Bacteroides* (including many strains of *B. fragilis*),

Fusobacterium, Peptostreptococcus, Actinomyces, and *Peptococcus*.

Contraindication: Oral administration to ruminants and horses can cause severe enteritis. Do administer rapidly through IV route to avoid cardiac collapse. Because of its peripheral neuromuscular blocking effects, lincomycin should not be given with anesthetics and neuromuscular blocking agents.

Side effects: IM injections reportedly cause pain at the injection site. Rapid IV injection can cause hypotension and cardiopulmonary arrest. Serious and fatal diarrhea in horses, rabbits, and other herbivores. Cattle: Oral: At concentrations as low as 7.5 ppm in feed has resulted in inappetence, diarrhea, ketosis, and decreased milk production. Pig: Anal swelling, diarrhea, irritable behavior and skin reddening. Dog, cat: Oral use: Anorexia, vomiting, and diarrhea sometimes occurred.

Precaution: Do not administer orally to rodents, horses, ruminants, or rabbits.

Doses and administration: Cattle: by intramuscular, 10 mg/kg body weight twice daily for 5-7 days. Sheep/Goat: by intramuscular 5 mg/kg body weight daily for 3-5 days; Swine: by intramuscular 11 mg/kg IM daily for 3-7 days; or 250 mg/gallon water; Dog, cat: 15-25 mg/kg twice daily, PO, IM, IV; Poultry: by addition to drinking water, 250 mg/Litre.

Withdrawal Periods: Cattle: Meat- 7 days; Milk-4 days. Swine: Meat- 5 days. Chicken: Meat- 0 days.

Propeitary Preperation:

Acilin (Vet) *(ACI),* WSP, Tk 50 /20 gm, Tk. 210/100gm, Tk. 840/500gm,
Neucomycin-Vet *(Incepta),* WSP, 44 mg/gm, Tk. 210/100gm, Tk. 840/500gm,
Lincoren-40 Vet *(Renata)***,** WSP, 40 mg/gm, Tk. 960/500gm,

Lincomycin HCl+Spectinomycin HCl

Description: The combination of lincomycin and spectinomycin acts additive and in some cases synergistic. Spectinomycin acts bacteriostatic or bactericidal, depending on the dose, against mainly Gram-negative bacteria like Campylobacter, E. coli, and Salmonella spp. and against Mycoplasma. Lincomycin has a bacteriostatic or bactericidal action against mainly Gram-positive bacteria like Staphylococcus, Streptococcus and Treponema spp. and against Mycoplasma. Cross-resistance of lincomycin with macrolides can occur.

Indications: It is indicated for the treatment of diseases caused by micro-organisms susceptible to lincomycin and spectinomycin. Poultry : treatment of chronic respiratory diseases (CRD) caused by Mycoplasma infections as well as any infection due to E. coli bacteria sensitive to lincomycin and spectinomycin.

Withdrawal Period: Meat: Poultry: 5 days.

Proprietary Preperations:

Linospin *(Bridge),* inj., 50 mg + 100 mg/ml,
Linospec Vet *(ACME),* WSP, 22.2 gm + 44.4 gm/100 gm,

Lincomycin HCL+ Neomycin Sulfate

Description: Lincomycin Hydrochloride is a lincosamide antibiotic. It has a bacteriostatic effect mostly on gram-positive bacteria. Lincomycin is indicated for the control of necrotic enteritis caused by Clostridium perfringens susceptible to lincomycin.

Neomycin Sulfate is a broad-spectrum antibiotic of the aminoglycoside class. It is active against gram-positive and gram-negative bacteria like Escherichia coli, Salmonella, Campylobacter, Pasteurella, Staphylococci and Listeria spp.

Indications: Effective against a wide range of diseases of Poultry mainly caused by gram- negative & gram-positive bacteria. Such as –

Necrotic enteritis, Bacterial enteritis, Respiratory tract infections, Salmonellosis, Colibacillosis

Withdrawal Period: Meat: 2 days; Egg: 2 days.

Proprietary Preperations:

Necronil Vet (Eskayef), Oral Solution, 250mg + 140 mg/ml, Tk. 750/100ml, Tk. 3500/500 ml

1.1.6 Chloramphenicols

Chloramphenicol is a broad-spectrum bacteriostatic anti-bacterial. It is active against rickettsial and chlamydophilial infections, the majority of obligate anaerobes, most Gram-positive aerobes, and non-enteric aerobes including *Actinobacillus*, *Bordetella*, *Haemophilus*, *Pasteurella multocida*, and *Mannheimia haemolytica*. Enterobacteriaceae including *Escherichia* and *Salmonella* spp. are intrinsically susceptible but plasmid-mediated resistance is widespread. Chloramphenicol has activity against *Mycoplasma* and *Proteus* spp. but is unreliable. It is inactive against *Pseudomonas* spp.

In veterinary medicine, the use of chloramphenicol is restricted to non-food producing animals. Chloramphenicol should be used to treat individual animals rather than a group.

Chloramphenicol is a simple uncharged lipid soluble compound which readily crosses cellular barriers. Chloramphenicol diffuses throughout the body and reaches sites of infection inaccessible to many other antibacterial drugs including cerebrospinal fluid, brain, and internal structures of the eye. It is inactivated in the liver by conjugation and then excreted in urine and bile.

Drug metabolism is particularly rapid in horses and chloramphenicol is therefore of limited use in this species. Due to limited drug metabolism in the cat, chloramphenicol may accumulate giving rise to reversible bone-marrow suppression. Treatment should be restricted to one week in cats.

The bacteriostatic action of chloramphenicol may inhibit the bactericidal action of beta-lactam antibacterials and these drugs should not therefore be used concurrently. Chloramphenicol is an irreversible inhibitor of the cytochrome P450 enzymes involved in the metabolism of bar-biturates and will affect the metabolism of these drugs by dogs for up to 3 weeks following a single dose of 50 mg/kg of chloramphenicol.

Florfenicol, a fluorinated analogue of chloramphenicol, shares the general properties of the parent substance but is less liable to produce blood dyscrasias. It is a less satisfactory substrate for bacterial chloramphenicol acetyl-transferase and may be active against some strains resistant to chloramphenicol. Both florfenicol and thiamphenicol lack the nitrobenzene component of chloramphenicol that is thought to be responsible for the idiosyncratic reaction to chloramphenicol leading to fatal aplastic anaemia, occasionally seen in humans.

CHLORAMPHENICOL[A]

Indications: is a broad-spectrum bacteriostatic antibacterial. It is active against rickettsial and chlamydophilial infections, the majority of obligate anaerobes, most Gram-positive aerobes, and non-enteric aerobes including Actinobacillus, Bordetella, Haemophilus, Pasteurella multocida, and Mannheimia haemolytica. Enterobacteriaceae including Escherichia and Salmonella spp. are intrinsically susceptible but plasmid-mediated resistance is widespread. Chloramphenicol has activity against Mycoplasma and Proteus spp. but is unreliable. It is inactive against Pseudomonas spp.

Contraindications: Hepatic impairment.

Side effects: Bone marrow suppression, diarrhoea, vomiting.

Precaution: Administer with caution to cats, safety in pregnant or lactating animals and neonates has not been established.

Dose:

Dogs: by mouth or by slow intravenous injection, 50 mg/kg 1–2 times daily
Cats: by mouth or by slow intravenous injection, 25 mg/kg 1–2 times daily

Preparations:

FLORFENICOL[A]

Description: Florfenicol is a fluorinated analog of thiamphenicol. Florfenicol is a highly lipophilic antibiotic. It is available as

light yellow to straw-colored injectable solution. Florfenicol is bacteriostatic and broad spectrum and are effective against most anaerobic bacteria.

Mode of action: Florfenicol bind to the bacterial 50_S ribosome unit to inhibit peptide bond formation and protein synthesis.

Indications: Cattle: Treatment of bovine respiratory disease (BRD) associated with *Pasteurella haemolytica, P. multocida*, and *Haemophilus somnus*. Foot rot, acute interdigital necrobacillosis, infectious pododermatitis. Infectious bovine keratoconjunctivitis caused by *Moraxella bovis*; Pig: Treatment of swine respiratory disease (SRD) caused by *Actinobacillus pleuropneumoniae, Pasteurella multocida, Salmonella choleraesuis,* and *Streptococcus suis*; Poultry: Colibacillosis, pasteurellosis, salmonellosis, fowl cholera, CRD, infectious coryza, streptococcosis, Gram positive and gram-negative bacterial infections

Contraindication: Long-term use in animals may cause bone marrow suppression. Administration to horses is not recommended. At high doses, florfenicol may cause testicular degeneration.

Side effects: Cattle: Anorexia, decreased water consumption, or diarrhea; Horse: Diarrhea, colitis, and elevations in bilirubin. Inflammation at the injection site; Other species (mammals): Gastrointestinal effects, including severe diarrheas are potentially possible

Precaution: Do not administer more than 10 ml in a single site and adult bulls or boars intended for breeding purposes.

Doses and administration: Cattle: 20 mg/kg q48h SC or IM (in the neck); Sheep, goat: For respiratory disease complex in kids: 20 mg/kg a day (route not specified; assume IM) for 2 days; Pig: 15 mg/kg IM in the neck q48h; Dog: 20 mg/kg q6h IM or PO; Cat: 22 mg/kg q8h IM or PO

Withdrawal Periods: Cattle: Meat: 28 days (IM), 38 days (SC); Pig: Meat: 16 days (idw), 13 days (in feed)

Preparations:

Flor Super *(Advent),* Oral Solution, 20 gm/100 ml,
FC -Vet *(Al-Madina),* Oral Solution, 20 gm/100 ml,
Novoflor Vet *(Eskayef),* Oral Solution, 20 gm/100 ml, Tk 750/100ml bottle, Tk. 3150/500ml bottle
Geniflor Vet *(Gentry),* Oral Solution, 20 gm/100 ml,
ColiFlor Vet *(Incepta),* Oral Solution, 20 gm/100 ml, Tk 750/100ml bottle, Tk 3150/500ml bottle, Tk 6000/1L bottle
Florfen Vet *(Navana),* Oral Solution, 20 gm/100 ml, Tk. 750/100ml bottle
Florfen Vet *(Navana),* Oral Solution, 20 gm/100 ml, Tk. 3150/500ml bottle
Flor Vet *(Newtec),* Oral Solution, 20 gm/100 ml,
ASI-Florfenicol 10 *(Avon)*, Per os., 100ml bottle, 1L bottle,
F-Fenicol *(Theep)*, Per os., 100ml bottle,
Florstar *(Rafique)*, Per os., 100ml bottle,
Renaflor *(Renata),* Oral Solution, 20 gm/100 ml, Tk 750/100ml bottle, Tk. 3150/1L bottle
Amflor Vet *(ACME),* Oral Solution, 20 gm/100 ml, Tk 390/100ml bottle,
Flotec *(Pharma & Frim),* Oral Solution, Tk.1024/100ml, Tk. 4370/500ml
F.T.D. Inj *(Pharma & Frim).* Tk. 434/50ml, Tk. 784/100ml

1.1.7 Sulphonamides and Potentiated Sulphonamides

1.1.7.1 Sulphonamides

The sulphonamides form an extensive series of drugs that differ more in their physicochemical characteristics, and hence in mode of administration and pharmacokinetics, than they do in their antibacterial activity. They act by competing with tissue factors, notably *p*-aminobenzoic acid, and are therefore inactive in the presence of necrotic tissue. They are bacteriostatic to a range of Gram-positive and Gram-negative bacteria. They are active against aerobic Gram-positive cocci and some rods and many Gram-negative rods including Enterobacteriaceae. *Leptospira* and *Pseudomonas* spp. are resistant. Sulphonamides are also active against *Chlamydophila*, *Toxoplasma*, and coccidia.

The sodium salts are alkaline and hence irritant by intra-muscular injection and so are often given intravenously. However,

there are safety concerns over intravenous administration of sulphonamides. Sulphonamides are well absorbed following oral administration. They diffuse well into body tissues and are partly inactivated in the liver, mainly by acetylation. The acetylated derivatives are relatively insoluble in acidic urine and so may precipitate in the renal tubules of carnivores leading to crystalluria and renal failure. This problem may be reduced by increasing the urine volume or by increasing the urine pH.

Prolonged administration of certain sulphonamides may cause keratoconjunctivitis sicca (dry eye) in dogs, and sulfadiazine-containingProprietary Preperations may promote a reversible immune-mediated sterile polyarthritis in dogs. Sulphonamides may cause petechial haemorrhages in poultry as a result of vitamin K antagonism. Prolonged treatment with sulphonamides may lead to vitamin K deficiency causing agranulocytosis and haemolytic anaemia. Sulphonamides may inhibit thyroid hormone synthesis and, in some dogs can cause subclinical hypothyroidism with subnormal T_4 concentrations and high concentrations of TSH detected in plasma in these cases. This effect is reversible when the therapy is stopped. Concurrent administration of sulphonamides and sedatives or anaesthetics is contra-indicated in horses because severe cardiac arrhythmias and collapse may result. Intravenous administration of sulphonamides to cattle and horses can result in sudden collapse. A relatively rare but severe idiosyncratic reaction to sulphonamides reported to occur in dogs is acute hepatopathy. It is likely that this occurs due to increased formation of toxic metabolites (hydroxylamine, nitroso metabolites, or both) in some individual animals although work on the pathogenesis is ongoing.

SULFADIMIDINE [A]

(Sulphadimidine)

Description: Sulfadimidine is a derivative of p-aminobenzene sulfonic acid. It is odorless sticky, white or creamy-white crystalline powder. Generally, solutions are too alkaline for routine parenteral use. Slightly bitter taste, insoluble in water. Water solubility increases rapidly with increasing pH. Sensitive to light and may also be sensitive to heat. Oxygen and moisture may accelerate the effects of heat and light. The effect is bacteriostatic, although a bactericidal action is evident at the high concentrations.

Mode of action: Sulfadimidine is a structural analog of para-aminobenzoic acid (PABA) and competitively inhibit dihydropterate synthetase, an enzyme that facilitates PABA as a substrate for the synthesis of dihydrofolic acid. Dihydrofolate is a precursor for formation of tetrahydrofolate (folinic acid), an essential component of the coenzymes responsible for single carbon metabolism in cells. It results in blockade of several enzymes needed for the biogenesis of purine bases; for the transfer of desoxy-uridine to thymidine; and for the biosynthesis of methionine, glycine, and formylmethionyl-transfer-RNA. Protein synthesis, metabolic processes, and inhibition of growth and replication occur in organisms that cannot use preformed folate.

Indications: Bacterial pneumonia, foot rot, pododermatitis. Bacterial enteritis, coccidiosis, colibacillosis. Shipping fever, ephemeral fever, rinderpest. Calf diphtheria, calf scour, dysentery, joint ill, polyarthritis. Metritis, mastitis, strangles, actinobacillosis, toxoplasmosis. Pasteurellosis, streptococcal infection of horse and dog. Hemorrhagic septicemia and secondary bacterial infection due to influenza, contagious coryza, foot and mouth disease (FMD), distemper.

Contraindication: Sulfadimidine is contraindicated in hypersensitive patients. Prolonged treatment has been known to cause agranulocytosis, hemolytic anemia and avitaminosis K. It is contraindicated in patients with renal insufficiency or renal failure. Use cautiously in severely dehydrated patients

Side effects: Dehydrated patient: Crystlluria, renal tubular blockage,

hematuria; Hypersensitivity: Urticaria, angioedema, anaphylaxis, skin rashes, drug fever, polyarthritis, hemolytic anemia, and agranulocytosis; GIT upsets: Nausea, vomiting, diarrhea, dehydration, debility, inappetance; Prolong treatment: Bone marrow depression (aplastic anemia, granulocytopenia, thrombocytopenia), hepatitis and icterus, peripheral neuritis and myelin degeneration in the spinal cord and peripheral nerves, photosensitization, stomatitis, conjunctivitis, and keratitis sicca.

Precaution: Care in renal impairment; ensure adequate water intake during treatment; avoid prolonged administration

Doses and administration: Cattle: 220 mg/kg, PO, IV SID (initial dose; half for subsequent doses), 110 mg/kg, PO SID; 150 mg/kg, SC SID; Sheep, goat: 110 mg/kg, PO, SID; 215 mg/kg, SC, IV, SID; Swine: 110 mg/kg, PO, SID; 150 mg/kg, SC, SID; Dog, cat: 100 mg/ kg PO SID; then 50 mg/kg BID

Withdrawal Periods: Cattle, goat: 15 days (Meat), 3 days (Milk); Cattle: SR bolus: 8-18 days (Meat); Soluble powder: 10 days (Meat); Sheep, swine: 15 days (Meat)

Proprietary Preperations:

Salmid Inj. Vet *(Opsonin),* Inj., 33.3 gm/100 ml, 30ml vial, Tk. 120/Vial,
Diadin *(Renata)*, Inj., 33.3 gm/100 ml Tk. 120.21/Vial, 30ml vial Tk. 36.39/Vial,
Sulfasolect *(Acme)*, Inj., 33.3 gm/100 ml, 30ml vial, Tk. 115/Vial,
Dimi-Vet *(Square),* Inj., 100ml vial, Tk. 120/Vial,
Dimidin *(Techno),* Inj., 33.3 gm/100 ml, 100ml vial, Tk. 125/Vial,
Salidone Injection *(ACI)*, Inj., 25ml vial, Tk. 34.2 /Vial, 100ml vial, Tk. 120.46 /Vial,
Sulidimin Vet *(Eon),* Inj., 30ml vial,
Midingard *(Guardian),* Inj., 33.3 gm/100 ml, 30ml vial, Tk. 120/Vial,
Chemodine (Vet) *(Globe),* Inj., 33.3 gm/100 ml, 30ml vial, Tk. 115/Vial,
Bactidin *(Ethical),* Inj., 33.3 gm/100 ml, 30ml vial, Tk. 30/10ml Vial,
Sulmidine Bolus (Vet) *(Al-Medina),* Bolus, 5gm/blous, Tk. 8/bolus
Sulnid (Vet) *(Albion),* Bolus, 5gm/blous, Tk. 10/bolus
Bactidin Vet *(Ethical),* Bolus, 5gm/blous, Tk. 10/bolus
Chemodine (Vet) *(Globe),* Bolus, 5gm/blous, Tk. 10/bolus
Suldin (Vet) *(Kemiko),* Bolus, 5gm/blous,
Sulmin *(Medicon),* Bolus, 5gm/blous, Tk. 5/bolus,
Salmid *(Opsonin),* Bolus, 5gm/blous, Tk. 10/bolus,
Diadin Vet *(Renata),* Bolus, 5gm/blous, Tk. 9.68/bolus,
Sulfasol Vet *(ACME),* Bolus, 5gm/blous, Tk. 12/bolus,

SULPFANILAMIDE[A]

Description: See under Sulfadimidine

Mode of action: See under Sulfadimidine

Indications: Streptococcal septicaemia, equine pneumonia, strangles, joint-ill, metritis in mares, cows and ewes. Topical application: Dusting powder for wounds

Contraindication: Sulphanilamide is relatively non-toxic, but prolonged treatment has been known to cause agranulocytosis, haemolytic anaemia and avitaminosis-K. It occasionally causes crystalluria, particularly when urinary pH is low. Take particular care in the case of animals suffering from renal damage.

Side effects: Ruminants: Allergic rashes, diarrhea, dehydration, debility, loss of appetite, hypogalactia, digestive disturbances. Other species: Depression, vomiting, crystalluria, hemolytic anemia

Proprietary Preperations:

Sulphavet *(Acme)*, Powder, 10g packet,
Sumid-Vet *(Square)*, Powder, 10g Sachet, Tk.14/Sachet,
Medfanil Vet *(MedRx)*, Powder, 10g packet,
Nilamide *(Techno)*, Powder, 100g packet,

Sulfadiazine+ Sulfadimidine + Sulfapyridine

Indications: Pneumonia, hemorrhagic septicemia, calf diphtheria, secondary bacterial infection in case of FMD, navel ill, omphalitis, dehorning, castration, ovarian and uterine infections, urinary tract infection, metritis, arthritis, tonsillitis in dog, paratyphoid, distemper etc.

Contraindication: Sulfonamides are contraindicated in hypersensitive patients. Prolonged treatment has been known to cause agranulocytosis, hemolytic anemia and avitaminosis K. Contraindicated in

patients with renal insufficiency or renal failure. Use cautiously in severely dehydrated patients. Treatment should be stopped in case of severe hypersensitivity.

Side effects: Dehydrated patient: Crystlluria, renal tubular blockage, hematuria. Hypersensitivity: Urticaria, angioedema, anaphylaxis, skin rashes, drug fever, polyarthritis, hemolytic anemia, and agranulocytosis. GIT upsets: Nausea, vomiting, diarrhea, dehydration, debility, inappetance. Prolong treatment: Bone marrow depression (aplastic anemia, granulocytopenia, thrombocytopenia), hepatitis and icterus, peripheral neuritis and myelin degeneration in the spinal cord and peripheral nerves, photosensitization, stomatitis, conjunctivitis, and keratitis sicca.

Proprietary Preperations:
Sulpha 3 *(Renata)*, Per os., 5g bolus, Tk. 21/bolus,
Sulphadin *(Acme)*, Per os., 5g bolus,
Triplex-Vet *(Square)*, Per os., 5g bolus,
Trisulfa *(Elanco)*, Per os., 5g bolus,
Sulfon *(Opsonin)*, Per os., 5g bolus,
Sulfamed-3 Vet *(MedRx)*, Per os., 5g bolus,
Sulba Vet-3 *(Gentry)*, Per os., 5g bolus,
Kemidin *(Kemiko)*, Per os., 5g bolus,
Al-Sul *(Albion)*, Per os., 5g bolus,
3 Sulfa *(Popular)*, Per os., 5g bolus, Tk. 15.45/bolus,
3S Bolus *(Navana)*, Per os., 5g bolus,

1.1.7.2 Potentiated Sulphonamides

Sulphonamides may be combined with the dihydrofolate reductase inhibitors **baquiloprim**, **ormetoprim**, or **trimethoprim**. They inhibit the conversion of bacterial dihydrofolic acid to tetrahydrofolic acid which is necessary for the synthesis of certain amino acids, purines, and DNA synthesis. Potentiated sulphonamides block sequential stages in the synthesis of tetrahydrofolate and thus have a synergistic antibacterial action. This combination may be bactericidal and allows a smaller dose of sulphonamide to be used. The antibacterial spectrum of the combination is broad and includes a high proportion of anaerobic bacteria, *Nocardia*, *Chlamydophila*, and *Toxoplasma* spp. Plasmid mediated resistance to trimethoprim occurs. Side effects seen with sulphonamides also occur with potentiated sulphonamide administration. In human medicine, the therapeutic activity of the combination has been found to be fully accounted for by the trimethoprim and the recommendations for combined therapy are rather restricted. Trimethoprim is cleared much more rapidly in animals than humans. There are no veterinary products containing only baquiloprim or ormetoprim.

CompoundProprietary Preperations usually contain 5 parts sulphonamide and one-part trimethoprim, baquiloprim, or ormetoprim. The sulphonamides most commonly used in conjunction with trimethoprim are sulfadiazine (co-trimazine) and sulfadoxine, the latter acting for a longer period.

Trimethoprim, like the sulphonamides, diffuses well into body tissues and so the combination is the treatment of choice for disorders such as coliform meningitis. Unfortu-nately, in domesticated animals, trimethoprim is more rapidly inactivated than the sulphonamide component so that useful ratios are present in the body for a short time only. Trimethoprim is active against Gram-negative and Gram-positive bacteria. Trimethoprim is used alone in human medicine in the treatment of urinary tract, respiratory, and prostatic infections. The rapid clearance of trimethoprim from the plasma of domestic species makes its use as a sole agent less likely to be successful.

Baquiloprim is however more slowly inactivated and its prolonged half-life more closely matches the half-life of sulfadimidine in cattle and pigs or sulfadimethoxine in dogs and cats.

Ormetoprim has been less well studied in domestic animals. It appears to have similar pharmacokinetic properties to trimethoprim in those species in which it has been studied (horses and cattle) such that the drug is more rapidly cleared from the plasma than the sulphonamides with which it is combined.

Trimethoprim (and possibly baquiloprim) retain some slight activity on mammalian dihydrofolate reductase and so may predispose to a folate deficiency and

hence to a reduction in bone marrow function. Intravenous administration of potentiated sulphonamides may precipitate collapse in horses and cattle.

SULFADIAZINE with TRIMETHOPRIM[A]

Indications: Sulfadiazine/trimethoprim-sensitive infections. It is indicated for the treatment of pneumonia caused by bacteria sensitive to trimethoprim and sulfadimine like Pasteurella and Streptococcus spp; intestinal infections caused by bacteria sensitive to trimethoprim and sulfadimine like E. coli and Salmonella in Calves, lambs. It is also indicated for bacterial complications of CRD, airsacculitis, tracheitis, omphalitis, Salmonellosis, Colibacillosis and Streptococcosis in poultry.

Contraindications: Sulphonamide hypersensitivity; severe hepatic impairment; blood dyscrasias; horses with drug-induced cardiac arrhythmias; dogs with kerato-conjunctivitis sicca; oral administration to calves with a functional rumen. Do not use in layers producing eggs for human consumption. Do not administer to animals with an impaired liver or kidney function. Do not administer in case of decreased water intake. Do not administer to animals hypersensitive to sulfadimidine or trimethroprim. Do not administer to animals with an impaired function of hemopoietic organs.

Side effects: Occasional transient polyarthritis and kerato-conjunctivitis sicca in dogs, drowsiness in cats. Long-term treatment may result in damage to kidneys due to crystallization, digestion disturbances and diarrhoea, inhibition of the immune system, disturbances of the male fertility, peripheral neuritis or the development of haemorrhages. Allergic reactions may occur.

Precaution: Care in renal impairment; care with concurrent chloramphenicol, detomidine, halothane, miconazole, phe-nylbutazone, procaine hydrochloride, romifidine, thiopen-tal, warfarin; the drug may cause salivation in cats and coated tablets should be fed whole, should not be halved, crushed, or chipped; ensure sufficient water intake to avoid crystalluria; safety of feeding milk from treated animals to young not established. Do not combine with bactericidal agents like penicillins, coccidiostats or with local anaesthetics.

Dose: Dosages vary. For guidance. Expressed as trimethoprim + sulfadiazine

Horses, cattle: by mouth, 30 mg/kg daily (absorption may be better if food withheld for a few hours prior to treatment) by intramuscular or slow intravenous injection, 15–24 mg/ kg daily.

Sheep: by intramuscular or slow intravenous injection, 15– 24 mg/kg daily.

Dogs, cats: by mouth or by subcutaneous injection, 30 mg/ kg daily

Poultry: by addition to drinking water, 15 mg/kg body-weight daily by addition to feed, 300 g/tonne feed

WITHDRAWAL PERIOD: Meat: Calves, lambs, kids: 14 days, Poultry: 5 days.

Proprietary Preperations:

Trimosul (*Al-Madina*), Suspension, 40 gm + 8 gm/100 ml, Tk 166.01, Tk 810.00
Altrim (Vet) (*Albion*), Bolus, 1000 mg + 200 mg,
Biotrim (Oral) Vet (*Biopharma*), Suspension, 40 gm + 8 gm/100 ml,
Supertrim (*Ethical*), Powder, 40 % + 8 %,
Sulba-T (*Gentry*), Bolus, 1000 mg + 200 mg, Tk. 6.52/bol
Sulba-T Vet (*Gentry*), Suspension, 40 gm + 8 gm/100 ml, Tk182.54, Tk 822.61
Strimgard (*Guardian*), Suspension, 40 gm + 8 gm/100 ml, Tk 805.00
Ktrim-S Vet (*Kemiko*), Suspension, 40 gm + 8 gm/100 ml, Tk 802.40, Tk 1504.51.
Naafzin-3 (Vet) (*Naafco*), Suspension, 40 gm + 8 gm/100 ml, Tk
S Trim *(Navana*), Bolus, 1000 mg + 200 mg, Tk. 4.92/bol
Cidazine VET (*Opsonin),* Suspension, 40 gm + 8 gm/100 ml,
S-Vet (*Popular*), Suspension, 40 gm + 8 gm/100 ml,
Trimavet (*Rampart-Power*), Bolus, 1000 mg + 200 mg,
Trimavet (*Rampart-Power*), Suspension, 40 gm + 8 gm/100 ml, Tk.113.00, Tk 178.00
Renatrim Vet (*Renata*), Bolus, 1000 mg + 200 mg, Tk. 9.00/bol
Renatrim Vet (*Renata*), Suspension, 40 gm + 8 gm/100 ml, Tk. 190.00,

Sulprim Vet (*Square*), Suspension, 40 gm + 8 gm/100 ml, TK.182/100 ml
Autoprim (Vet) (*Super Power*), Suspension, 50 gm + 10 gm/100 ml, Tk. 140.00, Tk. 788.00
Sulfatrim (*Techno*), Powder, 40 % + 8 %, Tk. 139.52, Tk 1204.53, Tk. 15.05
Sulphatrim (*Techno*), Bolus, 1000 mg + 200 mg, Tk. 6.02/bol
Trim (*Techno),* Injection, 400 mg + 84.4 mg/ml,
Ativet (*ACME),* Suspension, 40 gm + 8 gm/100 ml,

SULFADOXINE with TRIMETHOPRIM[A]

Indications: Sulfadoxine/trimethoprim-sensitive infections.

Contraindications: Intraperitoneal administration; horses with cardiac arrhythmias; sulphonamide hypersensitivity; concurrent alpha$_2$-adrenoceptor stimulants

Side effects: Occasional transient swelling at site of injection; cardiac and respiratory shock in horses; anaphylactic or hypersensitivity reactions in horses; renal, hepatic, or haematopoietic system damage.

Precaution: Safety in pregnant animals has not been established; use with caution in animals with renal or hepatic impairment or blood dyscrasias; ensure adequate water supply available.

Dose: Expressed as sulfadoxine + trimethoprim

Horses: by intramuscular or slow intravenous (preferred) injection, 15 mg/kg

Cattle: by intramuscular (preferred) or intravenous injection, 15 mg/kg daily.

Proprietary Preperations:

SULFAMETHOXAZOLE with TRIMETHOPRIM[A]

Indications:
Sulfamethoxazole/trimethoprim-sensitive infections.

Contraindications: Sulphonamide hypersensitivity; severe hepatic impairment; blood dyscrasias.

Side effects. Occasionally erythema and petechiae of the skin, internal haemorrhage, haematuria, keratoconjunctivitis sicca

Precaution: Safety in pregnant animals has not been established; use with caution in animals with renal or hepatic impairment or blood dyscrasias; ensure adequate water supply available.

Dose: Expressed as sulfamethoxazole + trimethoprim

Dogs, cats: by mouth, 30 mg/kg daily.

Proprietary Preperations:
Albutrim Vet (*Albion)*, Bolus, 1000 mg + 200 mg, Tk. 2.15/Bolus
Remetrim (Vet) (*Bengal*), Bolus, 1000 mg + 200 mg, Tk.6.00/ Bolus
Cidatrim Vet (*Eon)*, Suspension,10 gm + 2 gm/100 ml, Tk. 24.04.
Trizin (*Ethical*), Bolus, 1000 mg + 200 mg,
Sat Vet (*FnF*), Bolus, 1000 mg + 200 mg,
Trivet (*Globe*), Suspension, 10 gm + 2 gm/100 ml, Tk. 30.00
Trivet (*Globe*), Bolus, 1000 mg + 200 mg, Tk. 3.25/ Bolus
Jasotrim (*Jayson*), Bolus,1000 mg + 200 mg, Tk. 2.39/ Bolus
Ketrim Vet (*Kemiko*), Suspension,10 gm + 2 gm/100 ml, Tk. 56.17, Tk 231.00, Tk 344.02.
Covet *(Medicon),* Bolus, 1000 mg + 200 mg, Tk. 2.50/ Bolus
Naftrizole Bolus (Vet) (*Naafco)*, 1000 mg + 200 mg, Tk. 3.38/ Bolus
Naftrizole (Vet) *(Naafco),* Suspension, 10 gm + 2 gm/100 ml, Tk. 230.00
S Trim (*Navana*), Suspension, 10 gm + 2 gm/100 ml, Tk. 180.00
S Trim (*Navana)*, Suspension, 10 gm + 2 gm/500 ml, Tk. 825.00
New Trivet (*Newtec),* Suspension, 10 gm + 2 gm/100 ml, Tk. 56.47
Cidacot *(Opsonin),* Suspension, 10 gm + 2 gm/100 ml, Tk. 34.15, Tk 231.69, Tk 377.55
Cidacot (*Opsonin*), Bolus, 1000 mg + 200 mg, Tk. 4.36/ Bolus
Cotrim Vet (*Square),* Bolus, 1000 mg + 200 mg, Tk. 4.36/ Bolus
Cotrim *(Square),* Suspension, 10 gm + 2 gm/100 ml, Tk.34.15/60 ml, Tk.231.69/500 ml
Politrim *(ACME),* Bolus, 1000 mg + 200 mg, Tk. 4.36/bol.
Politrim Vet (*ACME),* Injection, 20 gm + 4 gm/100 ml, Tk. 86.26, Tk 247.24
Sulphaprim Inj. *(Pharma & Firm),* 50ml-248.29 tk, 100ml-501 tk

SULFAQUINOXALINE with TRIMETHOPRIM[A]

Indications. Sulfadimidine/trimethoprim-sensitive infections; treatment of coccidiosis in chickens (see section 1.4)

Contra indications. Use in water-proportioner systems.

Dose. Expressed as sulfaquinoxaline + trimethoprim

Chickens, turkeys: bacterial infections, by addition to drinking water or feed, 30 mg/kg body-weight

Proprietary Preperations:

SULFACHLOROPYRIDAZINE SODIUM with TRIMETHOPRIM[A]

Indications.
Sulfachloropyridazine/trimethoprim-sensitive infections; treatment of bacterial infections in chickens (see section 1.4)

Contra indications. Use in water-proportioner systems.

Dose. Expressed as sulfachloropyridazine + trimethoprim

Chickens, turkeys: bacterial infections, by addition to drinking water or feed, 30 mg/kg body-weight

Proprietary Preperations:
Cosumix Plus (*Naafco*) SCP 10 gm & TMP 2 gm, 10 X100 gm, Tk. 195.00/100 gm

SULFACLOZINE SODIUM

Indications. Sulfaclozine-sensitive infections; treatment of coccidiosis in chickens (see section 1.4)

Contra indications. Use in water-proportioner systems.

Dose. Expressed as sulfaclozine sodium

Chickens, turkeys: bacterial infections, by addition to drinking water or feed, 30 mg/kg body-weight

Proprietary Preperations:

ESB_3 30% *(Naafco)* Sulphaclozine Sodium 30%, 10X100 gm, Tk. 260/100 gm

1.1.8 Nitrofurans

The nitrofurans, which include furazolidone and nitrofurantoin, are relatively broad-spectrum bactericidal drugs. They are *active against Salmonella spp., coliforms, Mycoplasma* spp., *Coccidia* spp., and some other protozoa. Resistance is by chromosomal mutation. Plasmid-mediated transmissible resistance is rare.

Furazolidone and nitrofurantoin prohibits in medicinal products for food producing species.

Nitrofurantoin is well absorbed following oral administration and rapidly excreted in the urine. Blood and tissue concentrations are too low for the treatment of systemic infection and it is mainly used for urinary tract infections in dogs and cats.

NITROFURANTOIN[A]

Indications: Urinary tract infections
Dose: *By mouth*.
Dogs, cats: 4 mg/kg 3 times daily

Proprietary Preperations:

1.1.9 Nitroimidazoles

The nitroimidazoles include dimetridazole and metronidazole, which are bactericidal to most obligate anaerobic bacteria. They have negligible activity against aerobic bacteria. They are active against *Serpulina hyodysenteriae (Treponema hyodysenteriae)* and a variety of protozoa. Acquired resistance among susceptible organisms is rare.

Metronidazole is well absorbed by mouth and penetrates tissues throughout the body including the brain and cerebrospinal fluid. It is administered for a variety of anaerobic infections including gingivitis and empyema. The action of metronidazole is restricted to obligate anaerobic organisms but infections are often mixed. Therefore, it may be necessary to concurrently administer a drug which is active against aerobic organisms. One such drug, whose spectrum of activity is complementary to metronidazole, is spiramycin which is effective against Gram-positive aerobes and appears to be synergistic with

metronidazole against the obligate anaerobes.

METRONIDAZOLE[A]

Indications: Infections caused by anaerobic bacteria; treatment of trichomoniosis (see section 1.4.3); giardiosis (see section 1.4.5); hepatic encephalopathy (see section 3.10)

Contraindications: Very small birds such as zebra finches; hypersensitivity

Precaution: Care in patients with renal or hepatic impairment; overdosage may cause reversible neurological depression, ataxia, hepatic impairment; operators should wear impervious gloves when handling the product.

Dose:

Horses: by mouth, 20 mg/kg twice daily by intramuscular or slow intravenous injection or intravenous infusion, 20 mg/kg daily

Dogs, cats: by mouth or by intravenous infusion, 20 mg/kg daily.

Proprietary Preperations:
Metronidazole BP 2000 mg Bolus
Acimetro-Vet *(ACI),* Bolus, Tk. 4.47/bolus
Adzyl *(Advent),* Bolus, 2gm,
Amovet *(Al-Madina),* Bolus, 2gm, Tk. 4.25/bolus
Al-Metro *(Albion),* Bolus, 2gm,
Remenid (Vet) *(Bengal Remedies),* Bolus, 2gm, Tk. 4.50/bolus
Trodavet *(Bridge Pharma),* Bolus, 2gm,
Metrodon *(Chemist),* Bolus, 2gm, Tk. 4.50/ bolus
Metoba Vet *(Gentry),* Bolus, 2gm, Tk. 4.50/bolus
Micovet *(Globe),* Bolus, 2gm, Tk. 4.20/bolus
Metrogard *(Guardian),* Bolus, 2gm, Tk. 4.40/bolus
Kemet Vet *(Kemiko),* Bolus, 2gm, Tk. 4.50/bolus
Medizol (Vet) *(Medicon),* Bolus, 2gm, Tk. 4.50/bolus
Protomed *(MedRx),* Bolus, 2gm, Tk. 4.45/bolus
Metronaf (Vet) *(Naafco),* Bolus, 2gm, Tk. 4.50/bolus
Medavet *(Navana),* Bolus, 2gm, Tk. 4.30/bolus
Medavet Powder *(Navana),* WSP, 30 gm/100 gm, Tk. 135/packet
New Metro Vet *(Newtec),* Bolus, 2gm, Tk. 4.30/bolus
Zonabac *(Opsonin),* Bolus, 2gm, Tk. 4.50/bolus
Metonid Vet *(Popular),* Bolus, 2gm, Tk. 4.50/bolus.
OneMetro Bolus (Vet) *(One Pharma),* Bolus, 2gm, Tk.
Renamet *(Renata),* Bolus, 2gm, Tk. 4.47/bolus.
DIS-Vet *(RN Pharmaceuticals),* Bolus, 2gm, Tk. 4.50/bolus.
Amodis Vet *(Square),* Bolus, 2gm, Tk. 6.84/bolus, WSP, 30 gm/100 gm, Tk 135/Sachet
Metrovet *(Techno),* Bolus, 2gm, Tk. 7.40/bolus.
Dirovet *(ACME),* Bolus, 2gm,
Dirovet *(ACME),* Powder, 30%,
Kemet Vet *(Kemiko),* Powder, 30%, Bolus, 2gm, Tk. 4.50/bolus.
Todix (Vet) *(Superpower),* Bolus, 2gm, Tk. 5.50/bolus.

1.1.10 Quinolones and Fluoroquinolones[W]

Oxolinic acid, pipemidic acid, and **nalidixic acid** are 4-quinolone antibacterial agents. They are active against Gram-negative bacteria. However Gram-positive bacteria, *Pseudomonas aeruginosa*, and obligate anaerobes are not susceptible.

Fluoroquinolone derivatives such as **difloxacin**, **danofloxacin**, **enrofloxacin, flumequine, ibafloxacin, marbofloxacin, orbifloxacin,** and **sarafloxacin** have a broader spectrum of activity than the parent compounds and are well distributed to tissues. They are bactericidal by inhibiting microbial DNA gyrase and are active against a wide range of Gram-negative bacteria, including *Pseudomonas aeruginosa* and *Klebsiella* spp., and also against some Gram-positive micro-organisms and *Mycoplasma* spp. They are not active against obligate anaerobes. Fluoroquinolones are not particularly effective against streptococcal and entero-rococcal infections. For this reason, they tend to spare the normal gut flora of animals under treatment and are therefore the treatment of choice for neutropenic patients undergoing cancer chemotherapy.

Fluoroquinolones operate by a concentration-dependent killing mechanism in Gram-positive organisms and the most successful dosing regimens are those which produce high peak plasma concentrations.

Fluoroquinolones may inhibit the growth of load-bearing articular cartilage and therefore should not be administered to growing dogs or cats. There is some

evidence to suggest that fluoroquinolones may pre-dispose to seizure activity in patients suffering from epilepsy. These drugs should therefore be used with caution in epileptic patients, particulary if combined with certain NSAIDs. At higher dose rates than currently recommended in the UK, enrofloxacin use has been associated with retinal blindness in cats. Fluoroqui-nolones have been shown to interfere with the metabolism of methylxanthines in dogs and caution should be exercised if combining these drugs.

There is concern about the increasing resistance of certain bacteria to fluoroquinolones. These include some zoonotic organisms such as *Salmonella* spp*., Campylobacter* spp. and *E. coli*. The resistance is often due to chromosomal mutations either in the Gyr A gene or in proteins in the bacterial cell membrane which allow the drug to enter the bacterial cell. Resistance within a population of bacteria becomes evident whenever antibacterial drugs are heavily used due to selection pressure. It is recommended to perform antimicrobial sensitivity tests before using fluroquinolones or to limit the use of this group of drugs to the treatment of intractable Gram-negative infections. Examples of such infections are those that are potentially life threatening or resistant infections where other antibacterial drugs do not penetrate well enough to the site of infection and are therefore not likely to be successful in treating the problem (for example, chronic prostatic infections in dogs or recurrent and resistant urinary tract infections).

CIPROFLOXACIN[W]

Description: A fluoroquinolone antibiotic, ciprofloxacin HCl occurs as a faintly yellowish to yellow, crystalline powder which is slightly soluble in water. Ciprofloxacin is related structurally to the enrofloxacin (enrofloxacin has an additional ethyl group on the piperazinyl ring. It is aconcentration dependent bactericidal agent, causes susceptible bacterial cell death within 20-30 minutes of exposure.

Mode of action: Its mechanism of action is not thoroughly understood, but it is believed to act by inhibiting bacterial DNA-gyrase (a type-II topoisomerase), thereby preventing DNA supercoiling and DNA synthesis.

Indications: Broad antimicrobial activity: Wide variety of infections effective against some gram-positive aerobes and many gram-negative bacilli and cocci, including most species and strains of *Pseudomonas aeruginosa*, *Klebsiella spp*., *E. coli*, Enterobacter, *Campylobacter, Shigella, Salmonella, Aeromonas, Haemophilus, Proteus, Yersinia, Serratia, Clostridium, Pasteurella*and *Vibrio* species. Some activity against mycoplasma and Chlamydophila. Animals: Skin and urinary tract infections, soft tissue infections, bone and joint infections, gastrointestinal tract infections, enterotoxaemia, ear infections, uterine infections, udder infections, pneumonia, chronic bacterial prostitis, keratitis, conjunctivitis, pink eye, anthrax, swine dysentery. Poultry: CRD/CCRD, mycoplasmosis, salmonelosis, colibacillosis, infectious coryza, fowl cholera. streptococcosis, staphylococcosis, necrotic enteritisetc.; viral diseases like gumboro, newcastle disease etc. for preventing secondary bacterial infections.

Contraindication: Should be considered contraindicated in small and medium breed dogs from 2-8 months of age, patients with severe renal or hepatic impairment may require dosage adjustments to prevent drug accumulation. Use cautiously in animals that may be prone to seizures. Ciprofloxacin is contraindicated in dehydrated patient. Patients should be well hydrated and should be instructed to drink fluids liberally. Because of the risk of crystalluria, it is recommended that the usual dosage of the drug should not be exceeded. Patients with a history of hypersensitivity to Ciprofloxacin or to other quinolones.

Side effects: GIT: Nausea, Vomiting, anorexia, diarrhea; Hypersensitivity reactions; CNS: Headhache, stimulation, dizziness, confusion, insomnia, seizure; Young animals: CNS toxicity and arthropathy; Horse: Severe enteritis and colic; Cartilage damage, crystalluria, hematuria; hepatotoxicity; Retinal degeneration in cat; Stevens-Johnson

Syndrome: Blistering, itching, loosening, peeling, or redness of skin; diarrhea

Precaution: Avoid or reduce dosage of these drugs in animals with severe renal failure. Avoid in young animals or in pregnant or breeding animals. Not recommended to administer ciprofloxacin to horses.

Doses and administration: General: 5-15mg/kg, PO, IVRuminant: 5 mg/kg, IVDogs:20-25 mg/kg q24h PO; 10-15 mg/kg q24h IV; Cats:20 mg/kg q24h, PO; 10 mg/kg q24h IV' For susceptible infections: 5-15 mg/kg PO q12h; Poultry:2-5 mg/kg, IV, q24h for 5 days; 5-20 mg/kg, PO q12h for 5 days

Cattle, Sheep, Goat, Buffalo: Intramuscular/Intravenous: 5-10 mg/kg body weight daily for 3-5 days. Oral: 7-13 mg/kg body weight twice daily for 3-5 days.

Poultry: 8 mg/kg body weight daily for 3-5 days.

Dogs: 25 mg/kg body weight daily for 3-5 days.

Cats: 10 mg/kg body weight twice daily for 3-5 days.

Withdrawal Periods: Livestock- Meat- 10 days, Milk- 5 days; Poultry: Meat- 5 days, Egg- Not known.

Proprietary Preperations:

Cipro-A Vet *(ACME)*, Sol., 100 mg/ml, Tk. 230.55/100ml, Tk. 1057.11 /500ml; Inj., 50 mg/ml, Tk. 35.11/10 ml, Tk. 93.63/30 ml, Tk. 266.80/100 ml; Bol., 1g/bolus, Tk. 20.07/bolus;
Acivet Cipro *(ACI),* oral powder Tk. 241.50/100 gm, Tk.45/20 gm, Tk.1100/500 gm, oral solution Tk.233.70 /100 ml, Tk.1057.13/500 ml, Bolus Tk.19.80/per tablet, injection Tk. 266/100 ml, Tk.35/10 ml.
Adcipcin *(Advent),* Sol., 100 mg/ml, Tk. 00.00/100 ml, Bol., 1 g/bolus,
Alcipro *(Al Modina),* Sol., 100 mg/ml, Tk. 233.71/100 ml, Bol., 750 mg/bolus,
Ciptec-Al 20% Vet *(Albion),* WSP, 200 mg/ml, Tk. 243.62/100 ml, Sol. 100 mg/ml, Tk. 00.00/100 ml, Bol., 1 g/bolus,
Remeflox C (Vet) *(BRL),* Inj., 50 mg/ml, Tk. 35.00/10 ml, Sol., 100 mg/ml, Tk. 225.00/100 ml, Tk. 1050.00/500 ml, Bol., 1 g/bolus, Tk. 20.00/bolus;
Cipcin Vet *(Biopharma),* Sol., 100 mg/ml, Tk. 00.00/100 ml; Bol., 1 g/bolus, Tk. 20.00/bolus;
Proxacin *(Bridge),* Inj. 50 mg/ml, Tk.00.00/100 ml, Sol., 100 mg/ml; Bolus, 1 g/bolus,
Orciflox Vet *(Chemist),* Sol., 100 mg/ml, Tk.225 /100 ml, Bol., 1 gm/bolus, Tk. 20 /bolus;
Ciproset *(Eon),* Sol, 100 mg/ml, Tk. 233.58 /100 ml, Tk. 1053.15/500 ml;
Ciproflox *(Eskayef),* Sol., 100 mg/ml, Tk. 232/100 ml, Tk.1053/500 ml; Tk.2086/1L
Efloxin Vet *(Ethical),* Bol., 1 g/bolus,
Cfcin Vet *(FnF),* Inj., 50 mg/ml, Tk. 00.00/10 ml; WSP, 100 mg/g; Sol., 100 mg/ml,
Polflox *(Gentry),* Sol., 100 mg/ml, Tk. 00.00, Bol., 750 mg/bolus, Tk. 00.00/bolus;
Kaprovet *(Globe),* Sol., 100 mg/ml, Tk. 260.00/100 ml, Tk. 1050.00/500 ml, Tk. 2075.00/1 L; Bol., 1 g/bolus, Tk. 20.00/bolus;
Ciprogard Vet *(Guardian),* Inj., 50 mg/ml, Tk.138.00, Tk, 260.00; Sol., 100 mg/ml, Tk. Tk. 231.69, Tk, 1057.17, Tk. 2094.27; Bol., 1 g/bolus, Tk. 20.06/bolus;
Beuflox-Vet *(Incepta),* Sol., 100 mg/ml, Tk. 233/100 ml, Tk.1000/500 ml, Tk. 1980/1L, Bol., 1 g/bolus, Tk. 20.00/bolus;
Procin Vet *(Kemiko),* Sol., 100 mg/ml, Tk. 230.69, Tk, 1003.00, Tk, 2006.01, Bol., 750 mg/bolus, Tk. 16.05/bolus;
MediproVet *(MedRx),* Sol., 100 mg/ml, Tk. 240.00, Bol., 1 g/bolus, Tk. 20.00/bolus;
Cipronaf Vet *(Naafco),* Sol., 100 mg/ml, Tk. 1000.00/500 ml;
C-Flo Vet *(Navana),* Sol., 100 mg/ml, Tk. 1053.15/500 ml, 233/100ml Bol., 1 g/bolus, Tk. 20.00/bolus;
C-Flo Vet *(Navana),* Inj., Tk. 266/100ml; Tk. 95/30ml
Ocimax 20 *(One Pharma),* WSP, 200 mg/g, Tk. 243.60/100g, Tk. 1208.60/500g, Tk. 2401.20/kg, Bol., 1 g/bolus, Tk. 20.00/bolus;
Cidaflox *(Opsonin),* Sol., 100 mg/ml, Tk. 231.57/100 ml, Tk. 1057.13/500 ml, Tk. 2094.13/1 L;
Maprocin Vet *(Orion),* Sol., 100 mg/ml, Tk. 230.69/100 ml;
Floxin *(Pharmadesh),* Sol., 100 mg/ml, Tk. 00.00, Bol., 750 mg/bolus, Tk. 00.00/bolus;
Civox Vet *(Popular)*, Inj., 50 mg/ml, Tk. 90.34/30 ml, Tk. 266.00/100 ml, Sol., 100 mg/ml, Tk. 230.87/100 ml, Tk. 1053.96/500 ml, Bol., 1 g/bolus, Tk. 20.08/bolus;
Renaflox Vet *(Renata),* WSP, 200 mg/g, Tk. 243.62/100g, Sol., 100 mg/ml, Tk. 250.00/100 ml;

Q-Vet *(RN Pharma),* Bol., 750 mg/bolus, Tk. 20.00/bolus;
Ciprocin-Vet *(Square),* Sol., 100 mg/ml, Tk. 230.69/100 ml, Tk. 1003.01/500 ml, Inj., 50 mg/ml, Tk. 35.35/10 ml, Tk. 145.90/50 ml, Bol., 1 g/bolus, Tk. 20/bolus;
Cipro SP 10% *(Superpower),* Sol., 100 mg/ml, Tk. 235.00/100 ml, Tk. 1138.00/500 ml;
Ciprosol-10 *(Techno),* Sol., 100 mg/ml, Tk. 229.86/100 ml, Tk. 1090/500 ml;
AdCflox (Vet) *(Adova),* bolus, 1g/bolus, Tk. 20/bolus, oral solution, 10 gm/100 ml, Tk. 233/bottle;
Cipryl Solution *(Shinil),* oral solution, 10 gm/100 ml, Tk. 230/bottle, bolus, 1g/bolus, Tk. 20/bolus.
CPL Bolus (Vet) *(Vision)*, 1g/bolus, Tk. 20/bolus, 10 gm/100 ml,
Cipryl Bolus *(Shinil Pharma Ltd.),* 5x4 Strip, Tk. 401.60/strip
Cipryl 20 WSP *(Shinil Pharma Ltd.),* Tk. 233/100gm

ENROFLOXACIN[W]

Description: Enrofloxacin is a fluoroquinolone antibiotic which occurs as a pale yellow, crystalline powder; is slightly soluble in water.

Mode of action: As a concentration dependent bactericidal agent it inhibits the activity of DNA-gyrase enzyme, leading to a reduction in super coiling and serious disruption of the spatial arrangement of DNA. As a result, bacterial life cycle is disrupted.

Indications: Broad spectrum activity against both gram positive and negative bacteria. Infections of respiratory tract, GI tract, urinary and reproductive organs. Mycoplasmosis, Fowl cholera (Pasteurellosis), fowl typhoid. Paratyphoid, *E. coli* infection (Colibacillosis), actinobacillosis. Salmonellosis, brucellosis, colisepticemia. Staphylococcal and streptococcal infection. Secondary infection due to mixed bacterial and viral infection etc.

Contraindication: Dogs under 12 to 18 months of age and cats under 8 weeks of age. Do not administer to animals hypersensitive to enrofloxacin. Do not administer to animals with an impaired liver or kidney function.

Side Effects: No side effect is reported at the recommended dose

Precaution: It should not be used for poultry resistant to any quinolone derivative because cross resistance may develop.

Doses and administration: Cattle: 2.5-5 mg/kg SC q24h for 3-5 days or 7.5-12.5 mg/kg SC once; Horse: 7.5 mg/kg PO or IV once daily; Camelids: 5 mg/kg SC or 10 mg/kg PO sid; Dog: For sepsis: 5-11 mg/kg PO, IV, IM, SC q12h; Cat: 5 mg/kg, PO daily; Poultry:10-20 mg/kg, idw, daily for 3-10 days

Cattle, Sheep, Goat: Intramuscular, Subcutaneous: 2.5-5 mg/kg body weight daily for 3-5 days.

Poultry: 10 mg/kg body weight daily for 3-10 days.

Dogs: Oral- 5-20 mg/kg body weight once-twice daily for 5 days; Subcutaneous- 2.5 mg/kg body weight once followed by oral administration.

Cats: 5 mg/kg body weight daily.

Withdrawal Periods: Meat: Cattle, calves, sheep, goats: 21 days. Milk: 4 days Poultry meat and eggs -9 days

Proprietary Preperations:
Enrovet *(ACME)*, Sol., 100 mg/ml, Tk. 201.35/100 ml;
G-Enro *(ACI)*, Sol., 100 mg/ml, Tk. 200.60/100 ml, Tk. 1814.44/1 L;
Alenrol Vet *(Al-Madina)*, Sol., 100 mg/ml, Tk. 150.95/100 ml;
Enromax 10% Vet *(Albion),* Sol., 100 mg/ml, Tk. 00.00;
Enrosol Vet *(BRL),* Sol., 100 mg/ml, Tk. 200.00/100 ml;
Enroflox (*Eskayef),* Sol., 100 mg/ml, Tk. 220.00/100 ml, Tk. 933/500 ml; Tk.1800/1L
Enroflox DS *(Eskayef),* Sol.,200mg/ml, Tk.390/100ml, Tk.1650/500ml
En Vet *(Globe),* Sol., 100 mg/ml, Tk. 180.00/100 ml;
Enoxin Vet *(Incepta),* Sol., 100 mg/ml, Tk. 242.00/100 ml, Tk. 930.00/500 ml; Tk. 1850.00/1L
Enron Vet *(Kemiko),* Sol., 100 mg/ml, Tk. 200.60/100 ml, Tk. 932.80/500 ml, Tk. 1805.41/L;
Enflomed 10 *(MedRx),* Sol., 100 mg/ml,
Enro-10 Vet *(Navana),* Sol., 100 mg/ml, Tk. 196.95/100 ml; Tk. 1821.30/1L
Enrexacin Vet *(Popular),* Sol., 100 mg/ml, Tk. 200.00/100 ml, Tk. 602.26/500 ml, Tk. 1800.00/L;

Enorsol *(Rampart-Power),* Sol., 100 mg/ml,
Enrocin Vet *(Renata),* Sol., 100 mg/ml, Tk. 241.13/100 ml, Tk. 1995.00/L;
Enflox *(Square),* Sol., 100 mg/ml, Tk. 192.10/100 ml, Tk. 1743.54/L;
Enrox-10 *(Techno),* Sol., 100 mg/ml, Tk. 220.00;
AdovaEnro (Vet) *(Adova),* Sol., 100 mg/ml, Tk. 220.00;
Enrosol (Vet) *(Bengal),* Sol., 100 mg/ml, Tk. 200.00.

LEVOFLOXACIN[w]

Description: Levofloxacin is the levo isomer of ofloxacin, another quinolone antimicrobial agent. Levofloxacin, a fluorinated carboxyquinolone which is used as hemihydrates, It is a light-yellowish-white to yellow-white crystal or crystalline powder.

Mode of action: Levofloxacin inhibits the replication of bacterial DNA by interfering with the action of DNA gyrase (topoisomerase II) during bacterial growth and reproduction. Binding of the quinolone to both the enzyme and the DNA to form a ternary complex inhibits the rejoining step and can cause cell death by inducing cleavage of the DNA.

Indications: CRD, CCRD, colibacillosis, salmonellosis. Infectious coryza, dermatitis, ascites, gout. Gram positive and gram-negative bacterial infections

Contraindication: See under fluroquinolones

Side effect: See under fluroquinolones

Precaution: See under fluroquinolones

Doses and administration:

For treatment: 20 mg/kg body weight for 3-5 days. Or as directed by the registered Veterinarian.

Withdrawal period: Meat: 4 days, Egg: 7 days, Milk: Not required.

Proprietary Preperations:
ACI-Levo Vet *(ACI),* WSP, Tk 70/ 20 gm, Tk.1410.04/ 500 mg;
LV-Vet *(Al-Madina),* WSP, 100 mg/g,
Lifcin Vet *(Biopharma),* WSP, 100 mg/g, Tk. 260.00/100g;
Lexavet *(Bridge),* Sol.,100 mg/ml,
Levomax Vet *(Eskayef),* Sol.,100 mg/ml, Tk. 260.00/100 ml, Tk. 1100.00/500 ml; Tk.70/20ml
Vetlevo *(FnF),* WSP, 100 mg/g,
Levoxin-Vet *(Incepta),* Sol.,100 mg/ml, Tk. 260.00/100 ml, Tk. 1100.00/500 ml, Tk. 2100/1L;
Lemed 10 *(MedRx),* WSP, 100 mg/g, Tk. 300.00/100g;
Levoquin VET *(Navana),* Sol., 100 mg/ml, Tk. 260.00/100 ml, Tk. 1100.00/500 ml;
Orlev-Vet *(Orion),* WSP, 100 mg/g, Tk. 300.00/100 g;
Levo Super *(Advent),* Oral Solution, 100 mg/ml, Tk. 000.00/100 ml;
LV-Vet Powder (*Al-Madina*), Oral Powder, 100 mg/g, Tk. 300.00/100 g;
Levo-Al 10% Vet *(Albion),* Oral Solution, 100 mg/g, Tk. 260.00/100g;
NEW LEVON VET *(Newtec),* Oral Solution, 100 mg/g, Tk. 260.00/100g;
Levogard *(Guardian),* Oral Solution, 100 mg/g, Tk. 255.00/100g;
Orlev-Vet *(Orion),* Oral Solution, 100 mg/g, Tk. 300.00/100g;
Levosol 10% *(Techno),* Oral Solution, 100 mg/g, Tk. 260.00/100ml;
Levovet *(ACME),* Oral Solution, 100 mg/g, Tk. 260.00/100g;

FLUMEQUINE[W]

Description: Flumequine is a fluoroquinolone synthetic chemotherapeutic antibiotic. It is white microcrystalline powder. It is Soluble in aqueous alkaline solutions and alcohol, insoluble in water.

Mode of action: Flumequine inhibits topoisomerases, which are needed for the transcription and replication of bacterial DNA. The inhibition of the topoisomerases results in strand breakage of the bacterial chromosome, supercoiling, and resealing. Therefore, DNA replication and transcription are inhibited.

Indications: Enteric infections in domestic species. *E. coli, Klebsiella spp., Enterobacter cloacae, Proteus spp., Salmonella spp., Neisseria meningitidis, Pasteurella multocida, Campylobacter spp., Shigella spp.,* and *Serratia*infections. Poultry: Colibacillosis, salmonellosis and pasteurellosis. Swine: Colibacillosis, diarrhoea and bacterial enteritis. Lambs: Colibacillosis, septicaemia and

pasteurellosis. Calves: Bronchopneumonia, diarrhea, bacterial enteritis, colibacillosis and salmonellosis. Control of neonatal disease, especially in piglets and calves.

Contraindication: Consider hypersensitive to patients. It is contraindicated to be used with nitrofurans, trimethoprims. Avoid concurrent administration of tetracyclines, chloramphenicol, macrolides and lincosamides. Medicated drinking water should be used within 24 hours ofProprietary Preperations

Side effects: Hypersensitivity reactions

Precaution: Do not administer in ruminants. Not to be given to layers producing eggs for human consumption. Animals with a seriously impaired hepatic and/or renal function. The simultaneous administration of flumequin with trimethoprim, sulphonamides, furazolidone, phenylbutazone, acetylsalicylic acid and hydrocortisone may accelerate the excretion of flumequin. Simultaneous administration with colistin sulphate decreases the bio-availability of orally administered flumequin.

Doses and administration: Poultry: 10-25 mg/kg, PO (idw), SID for 3-5 days; Calf: 10-20 mg/kg, PO (idw), SID for 5 days; Lamb: 12 mg/kg, PO (idw), SID for 4-6 days; Swine: Adult: 12 mg/kg, PO (idw), SID for 3-5 days' Piglet: 24-25 mg/kg, PO (idw), SID for 3-5 days

Withdrawal Periods: Meat- Calves, goats, sheep and swine: 8-14 days, Poultry: 3 days. Egg: Not known

Proprietary Preperations:

Flumivet *(ACI),* WSP, Tk. 241.72 /100g;
Adquine *(Advent),* Solution, 200 mg/ml, Tk. 00.00/100ml;
Benaquin *(BRL),* Solution, 200 mg/ml, Tk. 330.00/100ml;
Flumequine *(Eon),* solution, 200 mg/ml, Tk. 320.16/100ml;
Emiquin *(Ethical),* WSP, 100 mg/g, Tk. 00.00/100g;
Naaflu-Q Vet *(Naafco),* Solution, 200 mg/ml, Tk. 00.00/100ml;
Renaquine Vet *(Renata),* WSP, 100 mg/g, Tk. 131.86/100g;
Renaquine 20% Vet *(Renata),* Solution, 200 mg/ml, Tk. 332.5/100ml;
Flumil-10 *(Techno),* WSP, 100 mg/g, Tk. 662.00/500g;
Flumil-20 *(Techno),* solution, 200 mg/ml, Tk. 391.46/100ml;
Emiquin *(Ethical),* WSP, 100 mg/g,
New FloCol Vet *(Newtec),* WSP, 200 mg/gm,

MARBOFLOXACIN[W]

Description: Marbofloxacinis a synthetic fluoroquinolone antibiotic whichis soluble in water, but solubility decreases as pH increases. Marbofloxacin is a bactericidal agent which is concentration dependent. Cell death of susceptible bacteria occurs within 20-30 min of exposure.

Mode of action: Its mechanism of action is not thoroughly understood, but it is believed to act by inhibiting bacterial DNA-gyrase (a type-II topoisomerase), preventing DNA supercoiling and DNA synthesis,

Indications: Infections caused by gram-negative and gram-positive bacteria including including most species and strains of Pseudomonas aeruginosa, *Klebsiella spp., E. coli, Enterobacter, Campylobacter, Shigella, Salmonella, Aeromonas, Haemophilus, Proteus, Yersinia, Serratia*, and Vibrio species. Other organisms that are generally susceptible include *Brucella spp., Chlamydia trachomatis, Staphylococci* (including penicillinase producing and methicillin-resistant strains), *Mycoplasma,* and *Mycobacterium spp.* (not the etiologic agent for Johne's Disease)

Contraindication: Marbofloxacin is labeled as contraindicated in small and medium breed dogs up to 8 months of age, large breeds to 12 months old, and giant breeds to 18 months old. It is also labeled as contraindicated in cats under 12 months of age. Marbofloxacin can (rarely) cause CNS stimulation and should be used with caution in patients with seizure disorders. The FDA has prohibited the use of this drug in food-producing animals. Avoid use in young animals because of risk of cartilage injury. Use cautiously in animals that may be prone to seizures. Possible reduced drug activity in patients with low urinary pH.

Side effects: GI distress: Vomiting, anorexia, soft stools, diarrhea; Hypersensitivity reactions or crystalluria could potentially occur; Occasional transient inflammatory reaction at injection site.

Precaution: Safety in pregnant animals has not been established; caution in young animals and epileptics; overdosage may cause neurological symptoms; possible reduced drug activity in patients with low urinary pH; care with concurrent antacids, theophylline;

Doses and administration: Cattle: 1-2 mg/kg, PO; 2 mg/kg, SC, IM, IV for 3 days; Goat, sheep: 2 mg/kg, SC, IM q24h; Pig: 2 mg/kg, IM, q24h for 3-5 days; Horse: 2 mg/kg, PO, IV, SID; Dog, cat: 2.75-5.5 mg/kg, PO, q24h; 2 mg/kg, SC, IV; Birds: 10 mg/kg, PO, IM, IV q24h

Cattle: Intramuscular or Intravenous or Subcutaneous: 2 mg/kg body weight daily for upto 3 days. Oral: 1-2 mg/kg body weight daily for upto 3 days.

Poultry: 10 mg/kg body weight daily for 3-10 days.

Dogs, Cats: Oral- 2 mg/kg body weight once daily for 5 days; Intravenous or Subcutaneous - 2 mg/kg body weight.

Withdrawal Periods: Cattle- Meat- 4 days, Milk- 1 day; Poultry: Meat- 3 days, Egg: Should not use in bird producing eggs for human consumption.

Indications: Marbofloxacin-sensitive infections

Contraindications: Dogs less than 12 months of age or to 18 months of age for large breeds such as Great Danes or Mastiffs, cats less than 16 weeks of age.

Side effects: Occasional vomiting, loose faeces, modification of thirst, transient increase in activity in dogs and cats; occasional transient inflammatory reaction at injection site.

Dose:

Cattle: by mouth, 1–2 mg/kg daily for up to 3 days by subcutaneous, intramuscular, or intravenous injection, 2 mg/kg daily

Dogs, cats: by mouth, 2 mg/kg once daily by subcutaneous or intravenous injection, 2 mg/kg

Proprietary Preperations:

Marquin Vet (*Navana*), Bolus, 50 mg/bolus, Tk. 25.00/bolus.
Marbo Vet (*Eskayef*), Inj., 100 mg/ml, Tk.350/10ml, Tk.1000/30ml, Bolus, 50mg/bolus, Tk.25/Bolus, DS Bolus, 100mg/bolus, Tk.40/bolus
M-Flox Vet *(ACI),* Bolus, 50 mg/bolus, Tk. 25.00/bolus.
Marboflox *(Bridge),* Inj., 10g/100ml, Tk. 000, Bol., 50 mg/bolus, Tk. 00.00/bolus.
MARBOCHEM *(Chemist),* Inj., 100 mg/ml, Tk. 350/ 10 ml, Bol., 50 mg/bolus, Tk. 25.00/bolus.
Marvet Bolus *(Newtec),* Bolus, 50 mg/bolus, Tk. 00.00/bolus.
Marbac DS Vet *(Popular),* Bolus, 100 mg/bolus, Tk. 40.00/bolus.
Marbac Vet *(Popular),* Bolus, 50 mg/bolus, Tk. 25.00/bolus.
Simar (Vet) *(Shinil),* Inj., 100 mg/ml, Tk. 350.00, Bolus, 50 mg/bolus, Tk. 25.00. DS Bolus, 100 mg/bolus, Tk. 40.00.
Marbosol *(Techno),* Inj., 100 mg/ml, Tk. 350.00, Bolus, 50 mg/bolus, Tk. 25.00.
Arbocin Vet *(ACME),* Inj., 10g/100ml, Tk. 000.00, Bolus, 50 mg/bolus, Tk. 25.00. DS Bolus, 100 mg/bolus, Tk. 40.00.
Simar Inj. (*Shinil Pharma Ltd.)* 10ml-350tk
Maroxacin Vet (*Square*), Inj., 100 mg/ml, Tk. 350.00/10 ml, Tk. 1000.00/30 ml

DANOFLOXACIN

Description: 3rd generation fluoroquinolone with broad spectrum bactericidal antimicrobial activity towards gram positive, gram

negative bacteria and mycoplasma. It is dedicated for veterinary use

Mode of action: Bactericidal drug, actively killing bacteria by inhibiting bacterial DNA gyrase or the topoisomerase IV enzyme, therebyinhibiting DNA replication and transcription

Indications:

Poultry: All kind of digestive tract infections caused by gram positive, gram negative bacteria. All kind of respiratory tract infections caused by mycoplasma. Secondary bacterial infections of viral diseases.

Cattle: For the treatment of respiratory disease caused by Pasteurella haemolytica and *P. multocida* and the treatment of enteric infections caused by Escherichia coli and Salmonella spp. in cattle.

Withdrawal period:

Poultry: Meat: 5 days
Cattle: Meat: 5 days, Milk: 48 hours

Proprietary Preperations:
DFN Vet (*Eskayef*), Solutiuon, 50mg/ml, Tk. 160/20ml, Tk. 720/100 ml, Inj., 25mg/ml, Tk. 160/10 ml

NORFLOXACIN[W]

Description: Norfloxacin a synthetic fluoroquinolone antibiotic which is soluble in water, but solubility decreases as pH increases. As like Marbofloxacin it is a bactericidal agent which is concentration dependent. Cell death of susceptible bacteria occurs within 20-30 min of exposure.

Mode of action: Norfloxacin inhibits the replication of bacterial DNA by interfering with the action of DNA gyrase (topoisomerase II) during bacterial growth and reproduction. Binding of the quinolone to both the enzyme and the DNA to form a ternary complex inhibits the rejoining step and can cause cell death by inducing cleavage of the DNA.

Indications: Respiratory, urinary tract, skin, and soft tissue infections. Colibacillosis, salmonellosis, infectious coryza, fowl cholera. CRD, necrotic enteritis, streptococcosis, staphylococcosis. Viral diseases: Ranikhet, gumboro etc. (secondary bacterial infection).

Contraindication: Animals hypersensitive to norfloxacin. Administration to animals with a serious impaired hepatic and/or renal function.

Side Effects: See under ciprofloxacin

Precaution: See under ciprofloxacin

Dose and administration: Poultry: by addition to drinking water, 50 mg/L once daily for 5-6 days.

Withdrawal period: Poultry: Meat- 12 days, Egg: Not known.

Proprietary Preperations:
Norvet *(ACME),* Sol., 100 mg/ml, Tk. 106.72/100 ml, Tk. 436.31/500 ml;
Benaflox N Vet *(BRL),* Sol., 100 mg/ml, Tk. 105.00;
Nfloxin *(Ethical),* Sol., 10 mg/ml, Tk. 00.00;
Norbac Vet *(Kemiko),* Sol., 300 mg/ml, Tk. 00.00;
Floxavet *(Techno),* Sol., 300 mg/ml, Tk. 00.00;
Floxavet *(Techno),* Inj., 100 mg/ml, Tk. 00.00;
Menorox LC 30% *(Newtec),* Sol., 300 mg/ml, Tk. 00.00;
Noracin Vet 30% *(Bridge),* Sol., 300 mg/ml, Tk. 00.00;
Nor-Al 30% (Vet) *(Albion),* Sol., 300 mg/ml, Tk. 300.00;
Nor *Super* *(Advent),* Sol., 100 mg/ml, Tk. 106.72/100 ml;
AdNorflox (Vet) *(Adova),* Sol., 100 mg/ml, Tk. 105/100 ml.
Norfloxillin 200 Sol. *(Pharma & Firm)*, Tk. 430/100ml, Tk. 1702/500ml

PEFLOXACIN[W]

Description: Pefloxacin is a fluorinated quinolone antibacterial. It is an analogue of norfloxacin. Pefloxacin mesylate is a synthetic chemotherapeutic agent.

Mode of action: It is believed to act by inhibiting bacterial DNA-gyrase (a type-II topoisomerase), thereby preventing DNA supercoiling and DNA synthesis.

Indications: Effective in both gram-positive and gram-negative bacterial infections. Colisepticemia, CRD, pasteurellosis, infectious coryza, salmonellosis. Secondary bacterial infection in gumboro and newcastle disease

Contraindication: Do not use in laying hens

Precaution: Egg production may be reduced, if used in laying chicken.

Doses and administration: Poultry: 5-10 mg/kg BW, PO

Poultry: by addition to drinking water, 100 mg/L once daily for 3-5 days.

Withdrawal period: Poultry: Meat- 5 days, Egg: Should not use in bird producing eggs for human consumption.

Proprietary Preperations:

Peflox Vet *(ACME),* WSP, 100 mg/ml, Tk. 150.44/100g, Tk. 17.04/10g;

Pelocin (*Eon*), WSP, 100 mg/ml, Tk. 16.11/10g, Tk. 151.02/100g;
Pelocin (*Eon*), Sol., 100 mg/ml, Tk. 151.20/100 ml;
Pexacin (*Opsonin*), Sol., 100 mg/ml, Tk. 16.11/10g Tk, 151.02/100g;
Xplocin Vet (*Orion*), Sol., 100 mg/ml,
Pevox Vet (*Popular*), Sol., 100 mg/ml, Tk. 150.57/100 ml, Tk. 717.70/500 ml, Tk. 1396.25/L;
Poxa DM (Vet) (*Super power*), sol.,10gm/100ml,

1.1.11 Pleuromutilins

Tiamulin and **valnemulin** are antibiotics belonging to the pleuromutilin group, which act by the inhibition of the initiation

of protein synthesis at the level of the bacterial ribosome. They have a broad spectrum of action, which includes more fastidious Gram-negative organisms such as *Haemophilus*, *Bordetella*, *Pasteurella* spp., *Serpulina*, and *Actinobacillus* spp., and also a number of anaerobic organisms. administration of pleuromutilins and ionophore antibiotics may result in severe growth depression, ataxia, paralysis, or death.

TIAMULIN FUMARATE

Description: A semisynthetic diterpene-class antibiotic derived from pleuromulin. Tiamulin is available commercially as the hydrogen fumarate salt. It occurs as white to yellow, crystalline powder with a faint. It has a characteristic odor. Approximately 60 mg of the drug are soluble in 1 ml of water.

Mode of action: Tiamulin is usually a bacteriostatic antibiotic, but can be bactericidal in very high concentrations against susceptible organisms. The drug acts by binding to the 50_S ribosomal subunit, thereby inhibiting bacterial protein synthesis.

Indications: Infections caused by Mycoplasmas: *Mycoplasma hyopneumoniae, M. hyorhinis, M. hyosynoviae, Ureaplasma spp. M. gallisepticum, M. synoviae and M. meleagridis* infections; Gram-positive bacteria: *Staphylococcus spp., Streptococcus spp., Arcanobacterium pyogenes* infections; Gram-negative bacteria: *Pasteurella spp., Klebsiella pneumoniae, Actinobacillus (Haemophilus) spp., Flusobacterium necrophorum, Bacteroides spp., Campylobacter coli, Lawsonia intracellularis*

Contraindications: Not to be given at tiamulin 100 g/ton feed or 5 mg/kg body-weight within 7 days of administration of monensin, narasin, or salinomycin.

Side effects: Tiamulin is suitable for use in laying and breeding birds as it has been shown to have no adverse effects on egg production, fertility and hatchability in chickens. Pig: Dermatitis with erythema and pruritus.

Doses and administration: Poultry: 200 mg/kg body weight.

Withdrawal Periods: Poultry: Meat- 5 days, Egg- should not be used in chickens producing eggs for human consumption; Pig: Meat- 7 days.

Proprietary Preperations:
Mycogard Vet *(ACI),* WSP, Tk. 1100.00/100g;
Tiamulin-Al 45% Vet (*Albion*), WSP, 450 mg/g,
Benagard (Vet) (*BRL*), WSP, 450 mg/g,
Tiam Vet (*Chemist*), WSP, 450 mg/g,
Tialin S Vet (*SK+F*), WSP, 450 mg/g, Tk. 1103.06/100g;
Maxgard (*Gentry*), WSP, 450 mg/g, Tk. 225.67/10g, Tk. 977.93/100g;
Tiavet Vet (*Incepta*), WSP, 450 mg/g, Tk. 1050.00/100g;
Jasolin Vet (*Jayson*), WSP, 450 mg/g;
Denagard 45% (*Naafco*), WSP, 450 mg/g; Tk. 1250/100 gm,
Resmulin 45 Vet (*Navana*), WSP, 450 mg/g, Tk. 1200.00/100g.
Tiogen-45 (*Opsonin*), WSP, 450 mg/g, Tk. 892.02/100g,
Megagard Vet (*Popular*), WSP, 450 mg/g, Tk. 250.94/10g, Tk. 1104.15/100g;
Tiamulirin Vet (*Rampart-Power*), WSP, 450 mg/g, Tk. 253.00/10g, Tk. 1124.00/100g,
Renagard 45% Vet (*Renata*), WSP, 450 mg/g, Tk. 1205.83/100g;
Stiagen Vet (*Square*), WSP, 450 mg/g; Tk.1040.52/100 g
Tiamul 45% (*Techno*), WSP, 450 mg/g, Tk. 135/10g, Tk. 1104.15/100g;
Tiamuvet (*FnF*), WSP, 450 mg/g, Tk. 250/10g, Tk. 1100/100g;

1.1.12. Other Antibacterial Preperations

COLISTIN[R]

Description: Colistin is a cyclic polypeptide antibiotic and has a bactericidal action against selected Gram-negative bacteria. The first bacterial effect of colistin is a blockade of the cell division of bacteria, followed by a secondary progressive lysis. Susceptible bacteria are Aerobacter aerogenes, Escherichia coli, Salmonella spp., Shigella spp., Haemophilus spp., Pasteurella spp., Pseudomonas aeruginosa, Vibrio spp. and paracolon bacteria (MIC values < 5 mcg/ml). Some Pseudomonas species may be primary resistant. Colistin sulphate is hardly absorbed after oral administration (less than 1% of the administered dose) and therefore remains active only in the gastrointestinal tract.

Indications: Colistin is indicated for treatment of gastrointestinal infections in calves, lambs, kids and poultry, caused by bacteria susceptible to colistin, particularly Colibacillosis and Salmonellosis.

Contraindications: Do not administer to animals hypersensitive to polymycins. Do not use for treatment of infections caused by resistant micro-organisms. Do not administer to animal species not listed under the indications, especially with an active rumen and intestinal microbial flora.

Side effects: none.

Dose: For oral administration via drinking water.

Calves, lambs, kids: 1 – 2 g per 80 kg bodyweight, twice daily, during 5 – 7 days.

Poultry :100 g per 500 – 1,000 litres of drinking water during 5 days.

Medicated drinking water should be used within 24 hours.

Withdrawal Period: Meat: 2 days, Eggs: 5 days.

Proprietary Preperation:

1.2 ANTIFUNGAL DRUGS

Treatment of fungal infections may include either systemic or topical medication. Topical antifungal drugs are used for the treatment of fungal infections of the skin, ear, and eye.

Systemic antifungal drugs are discussed below.

Griseofulvin is the main systemic medication used although ketoconazole or itraconazole are recommended for refractory cases. Aspergillosis is caused by *Aspergillus fumigatus* infection and characterised by severe mucopurulent nasal discharge and epistaxis. Long-term systemic treatment such as ketoconazole has been used. Topical enilconazole by intrasinus administration is preferred. The frontal sinuses are trephined and irrigation tubes inserted. Enilconazole 10 mg/kg daily in 2 divided doses is diluted in sodium chloride 0.9% solution (to make up to 5 to 10 mL) and administered for 10 days. Yeast infections include candidiasis (moniliasis) caused by *Candida albicans* and cryptococcosis caused by *Cryptococcus neoformans*. These are treated using systemic medication such as ketoconazole, amphotericin B, or amphotericin B in combination with flucytosine.

Griseofulvin is deposited in keratin precursor cells and concentrated in the stratum corneum of skin, hair, and nails thus preventing fungal invasion of newly formed cells. Griseofulvin is metabolised in the liver. In dogs and cats, absorption of griseofulvin is enhanced by administration with a fatty meal. Manufacturers may recommend treatment for 7 days but usually treatment for 3 to 4 weeks is required and extended periods of up to 12 weeks are often necessary. In dogs and cats, the usual dose may not be effective and a dose of 40–50 mg/kg daily may be required. Griseofulvin may be teratogenic and therefore should not be administered to pregnant animals.

Ketoconazole, an imidazole compound, is active against fungi and yeasts and also against some Gram-positive bacteria. Ketoconazole is well absorbed by mouth and is the treatment of choice for systemic candidiasis. It is also used for refractory dermatophyte infections. Ketoconazole may interfere with the biosynthesis of steroid hormones and indeed may be used in the treatment of hyperadrenocorticism.

Administration of ketoconazole with food may reduce the nausea associated with the drug. Prolonged administration of ketoconazole may cause liver damage and the drug may be teratogenic. The related **itraconazole** may also be used in systemic candidiasis and is the drug of choice for refractory dermatophyte infections. Itraconazole appears to be much less hepatotoxic and associated with fewer side effects than ketoconazole. It has minimal effect on steroid hormone concentrations.

Fluconazole, like itraconazole, is a triazole antifungal agent that is orally active. It is sufficiently water soluble to be given by intravenous injection, following which it can attain therapeutic concentrations within the CSF; this can beuseful in treating cats with cryptococcal infections. It also attains therapeutic concentrations in urine. Its clearance from the body is dependent on renal excretion and the dose should be reduced in patients with renal impairment.

Nystatin is not absorbed from the gastro-intestinal tract and may be given orally for the treatment of gastro-intestinal candidiasis.

Amphotericin is active against yeasts and fungi. Amphotericin B causes renal damage and renal function should be monitored regularly during treatment.

Flucytosine is effective against systemic yeast infections but not against fungal infections. Resistance develops rapidly and therefore the use of flucytosine is restricted to combination therapy with amphotericin B. Flucytosine and amphotericin B are synergistic and may be given concurrently to delay the onset of resistance to flucytosine and for the treatment of systemic cryptococcosis. The dose of amphotericin B should be halved when used in combination with flucytosine. Flucytosine is distributed throughout the body and diffuses into the cerebrospinal

fluid and thus is indicated for intracranial yeast infections.

Sodium iodide is used for fungal infections although the precise mechanism of action is unknown. It aids in resolution of granulomatous lesions in actinobacillosis, actinomycosis, and other fungal infections.

Terbinafine is an orally active antifungal with good efficacy against dermatophytes and yeasts. It is an allylamine derivative, which inhibits squalene epoxide and is fungicidal. Like griseofulvin, it binds to keratinised tissues and persists in nail beds for prolonged periods after treatment has ceased. Unlike ketoconazole, it does not inhibit cytochrome P450 enzymes. The optimum dose for treatment of dermatophytosis in dogs and cats has not been established by scientific study.

Propietary Preperation:

Dermaphyl Vet (*Navana*), Bolus, 2.5 g/bolus, Tk. 75.00/Bolus.

1.3 ANTIPROTOZOAL DRUGS

1.3.1 Anticoccidials

Coccidiosis is of major economic importance in the poultry industry, but other animals including calves, lambs, goats, dogs, cats, game birds, and rabbits may also be affected by the disease. The principal enteric coccidian affecting animals are *Eimeria* or *Isospora* spp. The protozoa invade the gut where their development damages the intestinal mucosa causing diarrhoea. Intestinal damage may occur before diagnosis of coccidiosis is possible. Disease prevention involves good husbandry and the use of anticoccidials. Anticoccidials may suppress development of asexual stages, sexual stages, or both. Drugs may act at different stages of the protozoal life-cycle.

In the poultry industry, it is usual to employ anticoccidials to control the disease in broiler birds and replacement stock. In broilers, anticoccidials are administered continuously until just before slaughter. In replacement stock, pullets that are reared on litter but are housed in cages for the laying cycle are medicated continuously until commencement of egg laying. Anticoccidials may interfere with egg quality and production, and with fertility. Prophylactic medication is therefore discontinued from the commencement of egg laying and some anticoccidials may only be indicated for use in broilers. In pullet rearing, where the birds are to be raised on litter, the use of subtherapeutic doses of anticoccidials allows a degree of parasite development enabling the

birds to acquire immunity to reinfection. Continuous use of anticoccidials may lead to ineffective treatment due to drug resistance in the parasite populations. Various strategies are employed in the poultry industry to avoid this problem, such as shuttle programmes using different drugs in the starter and grower rations, and rotation of drugs after several crops of broilers. Immunological control in pullets can also be achieved through use of an attenuated vaccine. In lambs, calves, and rabbits, continuous anticoccidial medication is used during periods of increased risk and stress.

The **sulphonamides** were among the first anticoccidials and are active against first and second stage schizonts, being coccidiostatic at low doses and coccidiocidal at higher doses. Currently the most widely used compounds are the ionophore

antibiotics, **monensin**, **narasin**, **salinomycin**, **maduramicin**, **semduramicin** and **lasalocid**, which prevent the development of first generation schizonts. These compounds are extremely toxic to horses. Ionophores such as monensin, narasin, and salinomycin may cause severe growth retardation when administered with tiamulin. Ionophores allow birds to develop immunity to coccidial protozoa and are used in replacement stock to be housed on litter. **Clopidol** (meticlorpindol), **decoquinate**, and **methylbenzoquate** are 4-hydroxyquinolones that act on first generation schizonts. **Dinitolmide** and **nicarbazin** are dinitro compounds used to prevent coccidiosis. Dinitolmide affects first generation schizonts and nicarbazin affects second generation schizonts. **Robenidine** affects the late first generation and second stage schizonts. **Halofuginone** affects first and second generation schizonts. **Diclazuril** is active against various stages of the life cycle depending on the particular species of coccidia. **Amprolium** acts on first generation schizonts thereby preventing differentiation of merozoites. **Toltrazuril** is a symmetrical triazone compound and is active against all intracellular stages of coccidia. Treatment of coccidiosis in all species involves restoring body fluids, when practicable, and combating the causal organism with a suitable anticoccidial drug. ***Infections with Isospora spp***. may occasionally be responsible for disease in young dogs and cats. Clinical signs include diarrhoea, weight loss, reduced appetite, and dehydration. Treatment in dogs and cats with sulfadiazine with trimethoprim (co trimazine) at a dose of 15 to 30 mg/kg twice daily for 6 days (once daily in

animals weighing less than 4 kg) has been reported.

Neosporosis is caused by *Neospora caninum*. The main clinical signs of infection consist of abortion in cattle and progressive paralysis in dogs. Treatment in dogs has included clindamycinand sulfadiazine with trimethoprim (co-trimazine)

TOLTRAZURIL

Description: Toltrazuril is a triazinetrione derivative which is used for the prevention and treatment of Coccidiosis in poultry and turkeys. Light and electron microscope studies show that Toltrazuril is active against all intracellular stages of coccidia, including schizonts, micro and macrogamonts. It interferes with the division of the protozoal nucleus, the activity of the mitochondria and damages the wall forming bodies in the microgametes. That's why Toltrazuril shows coccidicidal rather than coccidiostatic action. Tottrazuril acts on all intracellular development stages, does not inhibit immunity development, no need follow up treatment, Toltrazuril activity depends on severity of infection, compatible with feed additives and feed medication and has no adverse effects on feed and water intake, weight gain and F.C.R.

Mode of Action: Toltrazuril acts both on the schizogony and the gametogony stages of the parasites. The electron microscopic studies show that all intracellular development stages of *Eimeria* are damaged. The changes occur only in the parasites and do not affect the tissue cells of the host animals. Toltrazuril interferes with the division of the protozoal nucleus, the activity of the mitochondria and damage the wall forming bodies in microgamentes. Toltrazuril produces severe vacuolization of protozoal endoplasmatic reticulum in all stages of intracellular development.

Indications: Tottrazuril is indicated for the treatment and prevention of coccidiosis in poultry (eg. E. tenella, E. necatrix, E. acervulina, E. maxima, E. brunette & E. mitis) and turkeys (eg. E. adenoides, E. meleagrimitis, E. maleagridis & E. gallopavonis).

Contraindications: Should not be administered in flocks with impaired hepatic and renal function. Should not be used in animals hypersensitive to active ingredients.

Side Effects: Toltrazuril is well tolerated at recommended dose. However, at high dosages, egg-drop in laying-hens, growth inhibition in broilers and polyneuritis may be reported.

Precautions: Should supply the medicated drinking water as the only source of drinking water. Alkaline solution; operators should wear suitable protective clothing.

Doses: Poultry: by addition to drinking water, 7 mg/kg daily for 2days.

Withdrawal Period: Meat-Chickens: 8 days, Turkeys: 21 days, Egg: Not required.

Propietary Preperation:

Xmeria Vet *(Eskayef),* Solution, 2.5%, Tk. 470/100ml, Tk. 1420/500ml
Coxitril Vet (*Square*), Solution, 2.5%, tk. 426.88/100ml;
Zuril vet (*Opsonin*), Solution, 2.5%, tk. 470/100ml
Anticoc Vet (*ACME*), Solution, 2.5%, tk. 456/100ml
Toltacox Vet (*Incepta*), Solution, 2.5%, tk. 470/100ml, Tk. 1600/500ml
Tolcox Vet (*Gentry*), Solution, 2.5%, tk. 470/100ml
Tolicox Vet *(Popular),* Solution, 2.5%, tk. 470/100ml
T-Zuril Vet (*Al-Madina*), Solution, 2.5%, tk. 2100/1000ml
AToltra (Vet) (*Adova*), Solution, 2.5%, tk. 445/100ml
Adzuril Liquid (*Advent*), Solution, 2.5%, tk. 445/100ml
Toltrazuril Solution (*Bridge*), Solution, 2.5%, tk. 445/100ml
Cox-Zero (*Eon*), Solution, 2.5%, tk. 467/100ml
Coxi-Vet (*Kemiko*), Suspension, 5 gm/100 ml, tk. 602/100ml
Medicoc-25 (Vet) (*Medicon*), Solution, 2.5%, tk. 460/100ml
Naaftoltra-Vet (*Naafco*), Solution, 2.5%, tk. 460/100ml
Coczul Vet (*Navana*), Solution, 2.5%, tk. 470/100ml
Protocare vet (*Chemist*), Solution, 2.5%, tk. 450/ 100 ml
Coccilock Vet (*Newtec*), Solution, 2.5%, tk. 470/100ml

Toltarex (Vet) (*Super Power*), Solution, 2.5%, tk. 470/100ml
Tolvion-Vet (*Vision*), Solution, 2.5%, tk. 450/100ml
Renazuril-Vet *(Renata)*, Solution, 2.5%, Tk. 470/100ml
Cocci-zione 25 Sol. *(Pharma & Firm),* Tk. 545/100ml, Tk. 2420/500ml

SULFACHLOROPYRAZINE

Description: Sulfachloropyrazine is an antibiotic belonging to the group of sulfonamides. Sulfachloropyrazine is a competitive antagonist of para-aminobenzoic acid, which is a precursor of folic acid in protozoa and bacteria. Folic acid is a coenzyme necessary for the synthesis of nucleic acid, so in the presence of Sulfachloropyrazine, sensitive bacteria and protozoa do not multiply.

Indications: It is indicated for the treatment of coccidiosis in poultry due to infection with Eimeri species, fowl typhoid due to infection with Salmonella gallinarum and fowl cholera due to infection with *Pasteurella multocida.*

Contraindications: Do not administer to animals with a severe impaired renal or liver function.

Side Effects: Temporary egg drop, wind eggs and hypersensitivity reactions may occur.

Precaution: Do not combine with antacids: this may decrease the oral bioavailability of the product when administered together.

Dose: For oral administration via feed or drinking water.

Poultry, turkeys:

Coccidiosis: 100 g per 100 litres of drinking water during 3 days.

Salmonellosis and Pasteurellosis: 100 g per 100 litres of drinking water during 5 days.

Medicated drinking water should be used within 24 hours. In case of coccidiosis in poultry: If no improvement is noted within 3 days, evaluate the symptoms to determine the presence of other diseases. Follow the instructions of your veterinarian or poultry pathologist.

Withdrawal Period: Meat: 7 days, Eggs: 3 days.

AMPROLIUM HCL

Description

AmproliumHClis a water-soluble powder that is administer orally for the prevention and treatment of coccidiosis in poultry and turkey. It is a broad spectrum coccidiostat drug acting against all types of *Eimeria sp.*

Indications: Highly effective for the prevention and treatment of all types of Coccidiosis in Poultry and Livestock.

Contraindications: Should not be administered with Thiamin (Vitamin B_1).

Mode of Action: As the structure of Amprolium powder resembles to that of Vitamin B_1, it acts as antagonist of Vitamin B_1. As a result, due to the lack of essential Vitamin B_1, protozoa cannot reproduce and ultimately destroyed.

Animal			Dose
Poultry	Prevention	In Water	30 gm / 100 L for 7 – 14 days
		In Feed	60 – 75 gm / 100 Kg for 7 – 14 days
	Treatment	Normal Case	60 gm / 100 L for 5 – 7 days
		Complex Case	120 gm / 100 L for 5 – 7 days
Calf, Sheep	Prevention		1 gm / 40 Kg body weight for 5 days
	Treatment		2 gm / 40 Kg body weight for 5 days

Withdrawal Period

Meat: 3 days

Egg: 0 day

Drug Interaction

Exogenously administered thiamine in high doses mayreverse or reduce the efficacy of amprolium.

Proprietary Preperations
Coccivex *(Haychem BD)*, Solution, 20%, tk. 745/2000ml
AMPO-VET(*Al-Madina*), 20% Powder,
Amolium 20% Vet (*Albion*), Powder, Tk.45/10gm and Tk 85/30gm
Amprol 20%(*Eskayef*), Powder, Tk. 235/100 gm, Tk. 1120 / 500 gm
Amprium Vet (*Square*), Powder, Tk.213.44/100 g
Rolium 20(*Super-Power*), Powder, Tk. Tk.287/100gm
Coccinil20(*Techno*), Powder, Tk.210/100gm
Adpoli (Vet) (*Adova*), 20% Powder, Tk.213/100gm
NEW AMPROTECT 20% VET (*Newtec*), Powder, Tk.213/100gm
Ampro-50 Vet (*ACI*), solution, 100 ml, TK 540,
Prolium 20 WSP *(Shinil Pharma Ltd.),* 100gm,

AMPROLIUM, ETHOPHABATE, SULFAQUINOZALINE, VIT K_3 & VIT C

Description: It is a water-soluble powder for oral administration that contains Amprolium, Ethophabate, Sulfaquinoxaline, Vitamin K_3 and Vitamin C for the prevention and treatment of Coccidiosis in Poultry.

Indications: This powder is an anticoccidial drug for the treatment and control of coccidiosis in poultry. This combination is developed to take the advantage of synergistic benefits of the three chemicals against mixed infection of *Eimeriaacervulina, Eimeriamiaxima, Eimerianecatrix, Eimeriatenella, Eimeria brunette* at relatively safe levels of each drug by itself.

Mode of Action: Amprolium is a competitive antagonist of Thiamine. It causes deficiency of Thiamine in protozoan body and stops protozoan metabolism. Sulfaquinoxaline is a competitive antagonist of PABA which stops metabolism of protozoa and other gram-positive and gram-negative bacteria. Amprolium&Sulfaquinoxaline acts synergistically. Ethophabate increases the spectrum of activity into two-fold and overcome resistance which may be developed by the combination of Amprolium&Sulfaquinoxaline. Vitamin K_3 prevents hemorrhage. Vitamin C acts as an antistress factor and synthesizes collagen to repair intestinal ulcer.

Dosage & Administration

For oral administration

Treatment: 1 gm / 2 liters of drinking water for 5 - 7 days.

Withdrawal Period

Meat: 7 days

Contraindications: Do not use in animals hypersensitive to Amprolium or Ethophabate or Sulfaquinoxaline.

Do not use Vitamin B_1 or Furazolidone with it.

Proprietary Preperations
Each gm powder contains

AmproliumHCl ---------- 100 mg
Ethophabate ---------- 5mg
Sulfaquinoxaline ---------- 60 mg
Vitamin K_3 ---------- 2 mg
Vitamin C ---------- 20 mg

Amprol EP (*Eskayef*), Powder, Tk. 30/6gm, Tk. 270/100gm, Tk. 1350/500gm
Coctreat EP (*Square*), Powder, Tk.257/100 gm,
Coctreat EP (Vet) (*Aristopharma*), Powder,
Coxpro (*Orion*), Powder,
Coccioff WSP (*ACME*), Powder, Tk.250/100gm
Olinevet Powder (*Adova*), Powder, Tk.250/100gm
Adprolim Plus (*Advent*), Powder, Tk.250/100gm
Amolium Plus (Vet) (*Albion*), Powder, Tk.972/1000gm
Remecox (Vet) (*Bengal*), Powder, Tk.1090/1000gm
Kamprovet (*Bridge*), Powder, Tk.1100/1000gm
Amprosul K (*FnF*), Powder,
Ampropol (*Gentry*), Powder, Tk.972/1000gm
Ampromed Vet (*MedRx*), Powder,
Cocciout-Naf Powder (Vet) (*Naafco*), Powder,
Novocox (*Super power*), Powder, Tk.2134/1000gm
Ampro-50 Vet (*ACI)*, Solution, 50 gm/100 ml,
Sl Coccine Stop *(Pharma & Firm),* Tk. 320/100gm

SULFACLOZINE SODIUM MONOHYDRATE

Mode of action: Sulfaclozine sodium monohydrate inhibits nucleic acid synthesis of bacteria and protozoa. As a result, the life cycle of bacteria and protozoa become prohibited.

Indications: Sulfaclozine sodium monohydrate is used for the following protozoal diseases of chicken, broiler and layer poultry, such as; Coccidiosis or Blood dysentery caused by *Eimeriaacervulina* (duodenum), *E. maxima* (small intestine), *E. necatrix* (small intestine), *E. brunetti* (large intestine) and *E. tenella* (caecum). Sulfaclozine sodium monohydrate is also very effective against Fowl cholera caused by *Pasteurellamultocida* and Fowl typhoid caused by *Salmonellagallinarum*.

Contraindications: Though tolerance of Sulfaclozine sodium monohydrate (enriched with Vitamin K_3) is excellent but because of sulphonamide therapy sometimes haemorrhagic syndrome &crystalluria may occur. In these cases, Vitamin K_3 should be used according to the prescription of a registered veterinarian.

Side effect: There is no side effect of Sulfaclozine sodium monohydrate if used in recommended dose. Sometimes, crystalluria may occur in long term usage.

Precautions: During period of treatment through water medication, the birds must not be allowed access to any other water sources. The medicated water should be freshly prepared every day. No change should be made in the birds feed during the treatment. In sick birds the water intake may decrease, and if possible, for all sick birds Sulfaclozine sodium monohydrate should be given proportionately in larger quantity separately. In high temperature water intake of poultry may increase; in such cases Sulfaclozine sodium monohydrate should be given proportionately in smaller quantity.

Dosage & Administration: Normal Case: 1.5-2.0 gm/ liter drinking Water for 3-5 days

Severe case: 2.5 gm/ liter drinking water for 3-5 days

Withdrawal Period

Meat: 14 days

Egg: 11 days

Proprietary Preperations:

Alcocci (*Al-Madina*), Powder, 30%, Tk.1750/kg
Sulcox (*Eon*), Powder, 30%,
Coxina (*Globe*), Powder, 30%, Tk.24/10g
Coxistop (*Guardian*), Powder, 30%,
Navacox (*Navana*), Powder, 30%, Tk.260/100g; Tk. 1200/500g
Esb PLUS (*Novartis*), Powder, 30%,
Clozivet (*Opsonin*), Powder, 30%,
Anticoccid (*Rampart-Power*), Powder, 30%, Tk.
Coxicure (*Renata*), Powder, 30%, Tk.199.5/100g
Coccidil (*Techno*), Powder, 30%, Tk.150/100g
Scz (*ACME*), Powder, 30%,
Albi-S 30% *(Albion),* Powder, 30%,
ESB$_3$ 30% Powder (*Naafco*), Powder, 30%, Tk.260/100g
COCCITEC VET (*Newtec*), Powder, 30%, Tk.200/100g

1.3.2 Drugs for Babesiosis

Infection caused by *Babesia* spp. occurs in a number of species. Transmission of the protozoa is by ticks and ectoparasitic control may assist in prevention of the disease. Bovine babesiosis (redwater fever) is characterised by fever and intravascular haemolysis. Organisms involved include *Bab. bigemina*, *Bab. bovis*, and *Bab. divergens*.

Ovine babesiosis has been reported throughout Europe. *Bab. motasi* and *Bab. ovis* are both capable of causing either acute or chronic disease with symptoms similar to those seen in cattle.

Equine babesiosis (*Theileria equi* and *Bab. caballi*) is an occasional cause of severe clinical disease and mortality. It is of importance to the international horse trade, requiring strict control.

Canine babesiosis (*Bab. canis*) is becoming increasingly widespread in the USA and Europe. The clinical signs range from lethargy, fever, and pale mucous membranes to icterus and haematuria in severe cases. Tick control is essential in infected areas and dogs travelling to these areas should be protected against ticks. A

vaccine against this disease is available in some countries.

Imidocarb is effective against *Babesia* spp. infection. It is a cholinesterase inhibitor. It appears to act directly on the parasite leading to an alteration in morphology. Imidocarb is excreted unchanged mainly in the urine. It is effective in preventing and treating bovine babesiosis without interfering with the development of immunity. Infections caused by *T. equi* infections in horses□□are usually refractive to treatment and therapy at higher doses is within the toxic dose range.

Diminazene and **amicarbalide** are aromatic diamidine derivatives related to pentamidine. Both have low therapeutic indices and overdosage results in clinicalsigns such as lethargy, incoordination, and seizures.

IMIDOCARB DIPROPIONATE

Description: Imidocarb Dipropionateis effective against Babesiaspp. infection. It is a cholinesterase inhibitor. It appears to act directly on the parasite leading to an alteration in morphology. Imidocarb is excreted unchanged mainly in the urine. It is effective in preventing and treating bovine babesiosis without interfering with the development of immunity.

Mode of Action: Imidocarb is thought to act by combining with nucleic acids of DNA in susceptible organisms, causing the DNA to unwind and denature. This damage to DNA is believed to inhibit cellular repair and replication. ImidocarbDipropionate exerts its action through two mechanisms i. Interference with the production and/or utilization of polyamines, ii. Prevention of entry of inositol into the erythrocyte containing the parasite.

Indications: Babesiosis in horses, cattle and dogs; Anaplasmosis in cattle.

Contra indications: Animals hypersensitive to ImidocarbDipropionate& having impaired lung, liver & kidney function. Not to work with compounds that may exhibit anti- cholinesterase activity; repeated doses in cattle.

Side effects: Restlessness, sweating, abdominal pain.

Precaution: Intravenous administration is totally prohibited.

Use in pregnant & lactation: The safety and effectiveness of Imidocarb have not been determined in breeding, lactating or pregnant animals.

Toxicity: The sign of acute toxicity is generally consistent with anticholinesterase activity of Imidocarbdipropionate and included lethargy, salivation, lacrimation, ataxia, tremors and convulsions.

Dosage and administration

Cattle

Babesiosis treatment: 1.2 mg/kg Body weight subcutaneously as a single dose,

Babesiosis prophylaxis: 3 mg/kg Body weight subcutaneously as a single dose,

Anaplasmosis treatment: 3 mg/kg Body weight subcutaneously as a single dose,

Horses

Babesiosis: 2– 3 mg/kg Body weight subcutaneously and Repeat after 24 hours

Dogs

Babesiosis treatment: 2 mg/kg Body weight as a single dose,

Babesiosis prophylaxis, 4 mg/kg Body weight as a single dose;

Withdrawal Period

Meat: 28 days

Milk: 3 days

ProprietaryProprietary Preperationss

Babecure (*Acme*), Injection, 120mg/ml, Tk. 40/2ml,
Ectorid (*Renata)*, Injection, 9.35 mg/ml, Tk. 260/10ml,
Babenil (*Techno*), Injection, 9.35 mg/ml, Tk. 250/10ml,
ImiCarb-Vet (*Incepta*), Injection, 9.35 mg/ml, Tk. 200/10ml,

LITHIUM ANTIMONY THIOMALATE

Description

Lithium antimony thiomalate is a trivalent organic antimonial. It is low toxic and is well tolerated both locally and systemically.

Indication: Tropical nasal granuloma (Schistosomiasis) in cattle. Papillomatosis in cattle, horses and dogs. Filariasis and Leishmaniasis in canines. Use in Pregnancy & Pregnancy: Safe in pregnant animal**.**

Dosage & administration:

Lithium Antimony Thiomalate should be administered by deep intramuscular route preferably at the gluteal muscles.

Nasal Granuloma: 15 ml to 20 ml on three occasions at weekly intervals.

Papillomatosis: 15 ml to 20 ml on 4-6 occasions on alternative days.

As warts necrose, they should be enucleated and suitably dressed.

Filariasis and Leishmaniasis in canines: 1 ml to 2.5 ml on 4-6 occasions on alternative days.

The dosage may be gradually increased.

ProprietaryProprietary Preperationss:
Anthiomat *(Techno Drug),* Injection, 6%, Tk. 608/50ml vial.

BUPARVAQUONE

Description: Buparvaquone is analogue of antimalarial hydroxy-naphtho-quinones. It has in vivo and in vitro antiprotozoal activity.

Indications: Buparvaquone is indicated for the treatment of theileriosis (Corridor disease, East Coast Fever, Tropical Theileriosis, etc.) in cattle caused by Theileriaannulata and T. orientalis (sergenti). It is active against both the schizont and piroplasm stages of Theileria species and may be used in the incubation period of the disease, or when clinical signs are apparent.

Contra indications: Theileriosis has severe depressant effects on the **immune** system. Therefore, it is recommended that any vaccinations be delayed until the animal has recovered.

Side effects: Localized, painless, edematous swelling may occasionally be seen at the injection site.

Precaution: Do not use subcutaneously or intravenously.

Dosage and Administration:

For intramuscular injection into the muscles of the neck only.

Cattle: 2.5 mg buparvaquone per kg Body weight.

A single injection is usually sufficient. In severe cases, a further treatment with Buparvaquone at the same dose may be required (normally within 2 – 3 days after the initial injection).

No more than 10 ml should be injected into a single site.

Withdrawal Period:
Meat: 42 days

Milk: 48 hours

ProprietaryProprietary Preperationss:
Albu-Vet (*Al Madina*), Injection, 50 mg/ml, Tk. 627/vial
Buparvet (*Bridge Pharma*), Injection, 50 mg/ml,
Bupaquone (*Eagle Vet*), Injection, 50 mg/ml,

1.4 WHO Access, Watch, Reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use, 2021

To assist in the development of tools for antibiotic stewardship at local, national and global levels and to reduce antimicrobial resistance, the Access, Watch, Reserve (AWaRe) classification of antibiotics was developed – where antibiotics are classified into different groups to emphasize the importance of their appropriate use. This classification is intended to be used as a tool for countries to better support antibiotic monitoring and stewardship activities. It is not intended as model for the inclusion of antibiotics on national essential medicine lists. Antibiotics classified under AWaRe and also included on the WHO Model Lists of Essential Medicines are indicated in the worksheets.

Antibiotic	Class	ATC code	Category	Listed on EML/EMLc 2021
Amikacin	Aminoglycosides	J01GB06	Access	Yes
Amoxicillin	Penicillins	J01CA04	Access	Yes
Amoxicillin/clavulanic-acid	Beta-lactam/beta-lactamase-inhibitor	J01CR02	Access	Yes
Ampicillin	Penicillins	J01CA01	Access	Yes
Ampicillin/sulbactam	Beta-lactam/beta-lactamase-inhibitor	J01CR01	Access	No
Arbekacin	Aminoglycosides	J01GB12	Watch	No
Aspoxicillin	Penicillins	J01CA19	Watch	No
Azidocillin	Penicillins	J01CE04	Access	No
Azithromycin	Macrolides	J01FA10	Watch	Yes
Azlocillin	Penicillins	J01CA09	Watch	No
Aztreonam	Monobactams	J01DF01	Reserve	No
Bacampicillin	Penicillins	J01CA06	Access	No
Bekanamycin	Aminoglycosides	J01GB13	Watch	No
Benzathine-benzylpenicillin	Penicillins	J01CE08	Access	Yes
Benzylpenicillin	Penicillins	J01CE01	Access	Yes
Biapenem	Carbapenems	J01DH05	Watch	No
Brodimoprim	Trimethoprim-derivatives	J01EA02	Access	No
Carbenicillin	Penicillins	J01CA03	Watch	No
Carindacillin	Penicillins	J01CA05	Watch	No
Carumonam	Monobactams	J01DF02	Reserve	No
Cefacetrile	First-generation-cephalosporins	J01DB10	Access	No
Cefaclor	Second-generation-cephalosporins	J01DC04	Watch	No
Cefadroxil	First-generation-cephalosporins	J01DB05	Access	No
Cefalexin	First-generation-cephalosporins	J01DB01	Access	Yes
Cefaloridine	First-generation-cephalosporins	J01DB02	Access	No
Cefalotin	First-generation-cephalosporins	J01DB03	Access	No
Cefamandole	Second-generation-cephalosporins	J01DC03	Watch	No
Cefapirin	First-generation-cephalosporins	J01DB08	Access	No
Cefatrizine	First-generation-cephalosporins	J01DB07	Access	No
Cefazedone	First-generation-cephalosporins	J01DB06	Access	No
Cefazolin	First-generation-cephalosporins	J01DB04	Access	Yes
Cefbuperazone	Second-generation-cephalosporins	J01DC13	Watch	No
Cefcapene-pivoxil	Third-generation-cephalosporins	J01DD17	Watch	No
Cefdinir	Third-generation-cephalosporins	J01DD15	Watch	No
Cefditoren-pivoxil	Third-generation-cephalosporins	J01DD16	Watch	No
Cefepime	Fourth-generation-cephalosporins	J01DE01	Watch	No

Antibiotic	Class	ATC code	Category	Listed on EML/EMLc 2021
Cefetamet-pivoxil	Third-generation-cephalosporins	J01DD10	Watch	No
Cefiderocol	Other-cephalosporins	J01DI04	Reserve	Yes
Cefixime	Third-generation-cephalosporins	J01DD08	Watch	Yes
Cefmenoxime	Third-generation-cephalosporins	J01DD05	Watch	No
Cefmetazole	Second-generation-cephalosporins	J01DC09	Watch	No
Cefminox	Second-generation-cephalosporins	J01DC12	Watch	No
Cefodizime	Third-generation-cephalosporins	J01DD09	Watch	No
Cefonicid	Second-generation-cephalosporins	J01DC06	Watch	No
Cefoperazone	Third-generation-cephalosporins	J01DD12	Watch	No
Ceforanide	Second-generation-cephalosporins	J01DC11	Watch	No
Cefoselis	Fourth-generation-cephalosporins	to be assigned	Watch	No
Cefotaxime	Third-generation-cephalosporins	J01DD01	Watch	Yes
Cefotetan	Second-generation-cephalosporins	J01DC05	Watch	No
Cefotiam	Second-generation-cephalosporins	J01DC07	Watch	No
Cefoxitin	Second-generation-cephalosporins	J01DC01	Watch	No
Cefozopran	Fourth-generation-cephalosporins	J01DE03	Watch	No
Cefpiramide	Third-generation-cephalosporins	J01DD11	Watch	No
Cefpirome	Fourth-generation-cephalosporins	J01DE02	Watch	No
Cefpodoxime-proxetil	Third-generation-cephalosporins	J01DD13	Watch	No
Cefprozil	Second-generation-cephalosporins	J01DC10	Watch	No
Cefradine	First-generation-cephalosporins	J01DB09	Access	No
Cefroxadine	First-generation-cephalosporins	J01DB11	Access	No
Cefsulodin	Third-generation-cephalosporins	J01DD03	Watch	No
Ceftaroline-fosamil	Fifth-generation cephalosporins	J01DI02	Reserve	No
Ceftazidime	Third-generation-cephalosporins	J01DD02	Watch	Yes
Ceftazidime/avibactam	Third-generation-cephalosporins	J01DD52	Reserve	Yes
Cefteram-pivoxil	Third-generation-cephalosporins	J01DD18	Watch	No
Ceftezole	First-generation-cephalosporins	J01DB12	Access	No
Ceftibuten	Third-generation-cephalosporins	J01DD14	Watch	No
Ceftizoxime	Third-generation-cephalosporins	J01DD07	Watch	No
Ceftobiprole-medocaril	Fifth-generation cephalosporins	J01DI01	Reserve	No
Ceftolozane/tazobactam	Fifth-generation cephalosporins	J01DI54	Reserve	No
Ceftriaxone	Third-generation-cephalosporins	J01DD04	Watch	Yes
Cefuroxime	Second-generation-cephalosporins	J01DC02	Watch	Yes
Chloramphenicol	Amphenicols	J01BA01	Access	Yes
Chlortetracycline	Tetracyclines	J01AA03	Watch	No
Cinoxacin	Quinolones	J01MB06	Watch	No
Ciprofloxacin	Fluoroquinolones	J01MA02	Watch	Yes
Clarithromycin	Macrolides	J01FA09	Watch	Yes
Clindamycin	Lincosamides	J01FF01	Access	Yes
Clofoctol	Phenol derivatives	J01XX03	Watch	No
Clometocillin	Penicillins	J01CE07	Access	No
Clomocycline	Tetracyclines	J01AA11	Watch	No
Cloxacillin	Penicillins	J01CF02	Access	Yes
Colistin_IV	Polymyxins	J01XB01	Reserve	Yes
Colistin_oral	Polymyxins	A07AA10	Reserve	No
Dalbavancin	Glycopeptides	J01XA04	Reserve	No

Antibiotic	Class	ATC code	Category	Listed on EML/EMLc 2021
Dalfopristin/quinupristin	Streptogramins	J01FG02	Reserve	No
Daptomycin	Lipopeptides	J01XX09	Reserve	No
Delafloxacin	Fluoroquinolones	J01MA23	Watch	No
Demeclocycline	Tetracyclines	J01AA01	Watch	No
Dibekacin	Aminoglycosides	J01GB09	Watch	No
Dicloxacillin	Penicillins	J01CF01	Access	No
Dirithromycin	Macrolides	J01FA13	Watch	No
Doripenem	Carbapenems	J01DH04	Watch	No
Doxycycline	Tetracyclines	J01AA02	Access	Yes
Enoxacin	Fluoroquinolones	J01MA04	Watch	No
Epicillin	Penicillins	J01CA07	Access	No
Eravacycline	Tetracyclines	J01AA13	Reserve	No
Ertapenem	Carbapenems	J01DH03	Watch	No
Erythromycin	Macrolides	J01FA01	Watch	No
Faropenem	Penems	J01DI03	Reserve	No
Fidaxomicin	Macrolides	A07AA12	Watch	No
Fleroxacin	Fluoroquinolones	J01MA08	Watch	No
Flomoxef	Second-generation-cephalosporins	J01DC14	Watch	No
Flucloxacillin	Penicillins	J01CF05	Access	No
Flumequine	Quinolones	J01MB07	Watch	No
Flurithromycin	Macrolides	J01FA14	Watch	No
Fosfomycin_IV	Phosphonics	J01XX01	Reserve	Yes
Fosfomycin_oral	Phosphonics	J01XX01	Watch	No
Furazidin	Nitrofuran derivatives	J01XE03	Access	No
Fusidic-acid	Steroid antibacterials	J01XC01	Watch	No
Garenoxacin	Fluoroquinolones	J01MA19	Watch	No
Gatifloxacin	Fluoroquinolones	J01MA16	Watch	No
Gemifloxacin	Fluoroquinolones	J01MA15	Watch	No
Gentamicin	Aminoglycosides	J01GB03	Access	Yes
Grepafloxacin	Fluoroquinolones	J01MA11	Watch	No
Hetacillin	Penicillins	J01CA18	Access	No
Iclaprim	Trimethoprim-derivatives	J01EA03	Reserve	No
Imipenem/cilastatin	Carbapenems	J01DH51	Watch	No
Imipenem/cilastatin/relebactam	Carbapenems	J01DH56	Reserve	No
Isepamicin	Aminoglycosides	J01GB11	Watch	No
Josamycin	Macrolides	J01FA07	Watch	No
Kanamycin_IV	Aminoglycosides	J01GB04	Watch	No
Kanamycin_oral	Aminoglycosides	A07AA08	Watch	No
Lascufloxacin	Fluoroquinolones	J01MA25	Watch	No
Latamoxef	Third-generation-cephalosporins	J01DD06	Watch	No
Lefamulin	Pleuromutilin	J01XX12	Reserve	No
Levofloxacin	Fluoroquinolones	J01MA12	Watch	No
Levonadifloxacin	Fluoroquinolones	J01MA24	Watch	No
Lincomycin	Lincosamides	J01FF02	Watch	No
Linezolid	Oxazolidinones	J01XX08	Reserve	Yes
Lomefloxacin	Fluoroquinolones	J01MA07	Watch	No
Loracarbef	Second-generation-cephalosporins	J01DC08	Watch	No

Antibiotic	Class	ATC code	Category	Listed on EML/EMLc 2021
Lymecycline	Tetracyclines	J01AA04	Watch	No
Mecillinam	Penicillins	J01CA11	Access	No
Meropenem	Carbapenems	J01DH02	Watch	Yes
Meropenem/vaborbactam	Carbapenems	J01DH52	Reserve	Yes
Metacycline	Tetracyclines	J01AA05	Watch	No
Metampicillin	Penicillins	J01CA14	Access	No
Meticillin	Penicillins	J01CF03	Access	No
Metronidazole_IV	Imidazoles	J01XD01	Access	Yes
Metronidazole_oral	Imidazoles	P01AB01	Access	Yes
Mezlocillin	Penicillins	J01CA10	Watch	No
Micronomicin	Aminoglycosides	to be assigned	Watch	No
Midecamycin	Macrolides	J01FA03	Watch	No
Minocycline_IV	Tetracyclines	J01AA08	Reserve	No
Minocycline_oral	Tetracyclines	J01AA08	Watch	No
Miocamycin	Macrolides	J01FA11	Watch	No
Moxifloxacin	Fluoroquinolones	J01MA14	Watch	No
Nafcillin	Penicillins	J01CF06	Access	No
Nemonoxacin	Quinolones	J01MB08	Watch	No
Neomycin_IV	Aminoglycosides	J01GB05	Watch	No
Neomycin_oral	Aminoglycosides	A07AA01	Watch	No
Netilmicin	Aminoglycosides	J01GB07	Watch	No
Nifurtoinol	Nitrofuran derivatives	J01XE02	Access	No
Nitrofurantoin	Nitrofuran-derivatives	J01XE01	Access	Yes
Norfloxacin	Fluoroquinolones	J01MA06	Watch	No
Ofloxacin	Fluoroquinolones	J01MA01	Watch	No
Oleandomycin	Macrolides	J01FA05	Watch	No
Omadacycline	Tetracyclines	J01AA15	Reserve	No
Oritavancin	Glycopeptides	J01XA05	Reserve	No
Ornidazole_IV	Imidazoles	J01XD03	Access	No
Ornidazole_oral	Imidazoles	P01AB03	Access	No
Oxacillin	Penicillins	J01CF04	Access	No
Oxolinic-acid	Quinolones	J01MB05	Watch	No
Oxytetracycline	Tetracyclines	J01AA06	Watch	No
Panipenem	Carbapenems	J01DH55	Watch	No
Pazufloxacin	Fluoroquinolones	J01MA18	Watch	No
Pefloxacin	Fluoroquinolones	J01MA03	Watch	No
Penamecillin	Penicillins	J01CE06	Access	No
Penimepicycline	Tetracyclines	J01AA10	Watch	No
Pheneticillin	Penicillins	J01CE05	Watch	No
Phenoxymethylpenicillin	Penicillins	J01CE02	Access	Yes
Pipemidic-acid	Quinolones	J01MB04	Watch	No
Piperacillin	Penicillins	J01CA12	Watch	No
Piperacillin/tazobactam	Beta-lactam/beta-lactamase-inhibitor_anti-pseudomonal	J01CR05	Watch	Yes
Piromidic-acid	Quinolones	J01MB03	Watch	No
Pivampicillin	Penicillins	J01CA02	Access	No
Pivmecillinam	Penicillins	J01CA08	Access	No

Antibiotic	Class	ATC code	Category	Listed on EML/EMLc 2021
Plazomicin	Aminoglycosides	J01GB14	Reserve	Yes
Polymyxin-B_IV	Polymyxins	J01XB02	Reserve	Yes
Polymyxin-B_oral	Polymyxins	A07AA05	Reserve	No
Pristinamycin	Streptogramins	J01FG01	Watch	No
Procaine-benzylpenicillin	Penicillins	J01CE09	Access	Yes
Propicillin	Penicillins	J01CE03	Access	No
Prulifloxacin	Fluoroquinolones	J01MA17	Watch	No
Ribostamycin	Aminoglycosides	J01GB10	Watch	No
Rifabutin	Rifamycins	J04AB04	Watch	No
Rifampicin	Rifamycins	J04AB02	Watch	No
Rifamycin_IV	Rifamycins	J04AB03	Watch	No
Rifamycin_oral	Rifamycins	A07AA13	Watch	No
Rifaximin	Rifamycins	A07AA11	Watch	No
Rokitamycin	Macrolides	J01FA12	Watch	No
Rolitetracycline	Tetracyclines	J01AA09	Watch	No
Rosoxacin	Quinolones	J01MB01	Watch	No
Roxithromycin	Macrolides	J01FA06	Watch	No
Rufloxacin	Fluoroquinolones	J01MA10	Watch	No
Sarecycline	Tetracyclines	J01AA14	Watch	No
Secnidazole	Imidazoles	P01AB07	Access	No
Sisomicin	Aminoglycosides	J01GB08	Watch	No
Sitafloxacin	Fluoroquinolones	J01MA21	Watch	No
Solithromycin	Macrolides	J01FA16	Watch	No
Sparfloxacin	Fluoroquinolones	J01MA09	Watch	No
Spectinomycin	Aminocyclitols	J01XX04	Access	Yes
Spiramycin	Macrolides	J01FA02	Watch	No
Streptoduocin	Aminoglycosides	J01GA02	Watch	No
Streptomycin_IV	Aminoglycosides	J01GA01	Watch	No
Streptomycin_oral	Aminoglycosides	A07AA04	Watch	No
Sulbactam	Beta-lactamase-inhibitors	J01CG01	Access	No
Sulbenicillin	Penicillins	J01CA16	Watch	No
Sulfadiazine	Sulfonamides	J01EC02	Access	No
Sulfadiazine/tetroxoprim	Sulfonamide-trimethoprim-combinations	J01EE06	Access	No
Sulfadiazine/trimethoprim	Sulfonamide-trimethoprim-combinations	J01EE02	Access	No
Sulfadimethoxine	Sulfonamides	J01ED01	Access	No
Sulfadimidine	Sulfonamides	J01EB03	Access	No
Sulfadimidine/trimethoprim	Sulfonamide-trimethoprim-combinations	J01EE05	Access	No
Sulfafurazole	Sulfonamides	J01EB05	Access	No
Sulfaisodimidine	Sulfonamides	J01EB01	Access	No
Sulfalene	Sulfonamides	J01ED02	Access	No
Sulfamazone	Sulfonamides	J01ED09	Access	No
Sulfamerazine	Sulfonamides	J01ED07	Access	No
Sulfamerazine/trimethoprim	Sulfonamide-trimethoprim-combinations	J01EE07	Access	No
Sulfamethizole	Sulfonamides	J01EB02	Access	No

Antibiotic	Class	ATC code	Category	Listed on EML/EMLc 2021
Sulfamethoxazole	Sulfonamides	J01EC01	Access	No
Sulfamethoxazole/trimethoprim	Sulfonamide-trimethoprim-combinations	J01EE01	Access	Yes
Sulfamethoxypyridazine	Sulfonamides	J01ED05	Access	No
Sulfametomidine	Sulfonamides	J01ED03	Access	No
Sulfametoxydiazine	Sulfonamides	J01ED04	Access	No
Sulfametrole/trimethoprim	Sulfonamide-trimethoprim-combinations	J01EE03	Access	No
Sulfamoxole	Sulfonamides	J01EC03	Access	No
Sulfamoxole/trimethoprim	Sulfonamide-trimethoprim-combinations	J01EE04	Access	No
Sulfanilamide	Sulfonamides	J01EB06	Access	No
Sulfaperin	Sulfonamides	J01ED06	Access	No
Sulfaphenazole	Sulfonamides	J01ED08	Access	No
Sulfapyridine	Sulfonamides	J01EB04	Access	No
Sulfathiazole	Sulfonamides	J01EB07	Access	No
Sulfathiourea	Sulfonamides	J01EB08	Access	No
Sultamicillin	Beta-lactam/beta-lactamase-inhibitor	J01CR04	Access	No
Talampicillin	Penicillins	J01CA15	Access	No
Tazobactam	Beta-lactamase-inhibitors	J01CG02	Watch	No
Tebipenem	Carbapenems	J01DH06	Watch	No
Tedizolid	Oxazolidinones	J01XX11	Reserve	No
Teicoplanin	Glycopeptides	J01XA02	Watch	No
Telavancin	Glycopeptides	J01XA03	Reserve	No
Telithromycin	Macrolides	J01FA15	Watch	No
Temafloxacin	Fluoroquinolones	J01MA05	Watch	No
Temocillin	Penicillins	J01CA17	Watch	No
Tetracycline	Tetracyclines	J01AA07	Access	No
Thiamphenicol	Amphenicols	J01BA02	Access	No
Ticarcillin	Penicillins	J01CA13	Watch	No
Tigecycline	Glycylcyclines	J01AA12	Reserve	No
Tinidazole_IV	Imidazoles	J01XD02	Access	No
Tinidazole_oral	Imidazoles	P01AB02	Access	No
Tobramycin	Aminoglycosides	J01GB01	Watch	No
Tosufloxacin	Fluoroquinolones	J01MA22	Watch	No
Trimethoprim	Trimethoprim-derivatives	J01EA01	Access	Yes
Troleandomycin	Macrolides	J01FA08	Watch	No
Trovafloxacin	Fluoroquinolones	J01MA13	Watch	No
Vancomycin_IV	Glycopeptides	J01XA01	Watch	Yes
Vancomycin_oral	Glycopeptides	A07AA09	Watch	Yes

1.5 Maximum Residue Limits (MRLs) of Common Veterinary Antibiotics in Food (Codex Alimentarius, 2014)

	Species	Tissue	MRL (μg/kg)
Amoxicillin	Cattle	Muscle	50
		Liver	50
		Kidney	50
		Fat	50
		Milk	4
	Sheep	Muscle	50
		Liver	50
		Kidney	50
		Fat	50
		Milk	4
	Finfish	Fillet	50
		Muscle	50
Ampicillin	Finfish	Fillet	50
		Muscle	50
	Finfish	Fillet	50
Benzylpenicillin/Procaine Benzylpenicillin	Cattle	Muscle	50
		Liver	50
		Kidney	50
		Milk (μg/l)	4
	Chicken	Muscle	50
		Liver	50
		Kidney	50
Ceftiofur	Cattle	Muscle	1000
		Liver	2000
		Kidney	6000
		Fat	2000
		Milk (μg/l)	100
Chlortetracycline/ Oxytetracycline/Tetracycline	Cattle	Muscle	200
		Liver	600
		Kidney	1200
		Milk (μg/l)	100
	Fish	Muscle	200
	Giant prawn (*Paeneus monodon*)	Muscle	200
	Poultry	Muscle	200
		Liver	600
		Kidney	1200
		Eggs	400
	Sheep	Muscle	200

	Species	Tissue	MRL (µg/kg)
		Liver	600
		Kidney	1200
		Milk (µg/l)	100
Dihydrostreptomycin / Streptomycin	Cattle	Muscle	600
		Liver	600
		Kidney	1000
		Fat	600
		Milk	200
	Chicken	Muscle	600
		Liver	600
		Kidney	1000
		Fat	600
	Sheep	Muscle	600
		Liver	600
		Kidney	1000
		Fat	600
		Milk	200
Erythromycin	Chicken	Muscle	100
		Liver	100
		Kidney	100
		Fat	100
		Eggs	50
	Turkey	Muscle	100
		Liver	100
		Kidney	100
		Fat	100
Flumequine	Cattle	Muscle	500
		Liver	500
		Kidney	3000
		Fat	1000
	Chicken	Muscle	500
		Liver	500
		Kidney	3000
		Fat	1000
	Sheep	Muscle	500
		Liver	500
		Kidney	3000
		Fat	1000
	Trout	Muscle	500
Gentamicin	Cattle	Muscle	100
		Liver	2000
		Kidney	5000

	Species	Tissue	MRL (µg/kg)
		Fat	100
		Milk	200
Lincomycin	Cattle	Milk	150
	Chicken	Muscle	200
		Liver	500
		Kidney	500
		Fat	100
Monensin	Cattle	Muscle	10
		Liver	100
		Kidney	10
		Fat	100
		Milk	2
	Sheep	Muscle	10
		Liver	20
		Kidney	10
		Fat	100
	Goats	Muscle	10
		Liver	20
		Kidney	10
		Fat	100
	Chicken	Muscle	10
		Liver	10
Narasin	Cattle	Muscle	15
		Liver	50
		Kidney	15
		Fat	50
	Chicken	Muscle	15
		Liver	50
		Kidney	15
		Fat	50
Neomycin	Cattle	Muscle	500
		Liver	500
		Kidney	10000
		Fat	500
		Milk	1500
	Chicken	Muscle	500
		Liver	500
		Kidney	10000
		Fat	500
		Eggs	500
	Duck	Muscle	500
		Liver	500

	Species	Tissue	MRL (µg/kg)
		Kidney	10000
		Fat	500
	Goat	Muscle	500
		Fat	500
	Sheep	Muscle	500
		Liver	500
		Kidney	10000
		Fat	500
	Turkey	Muscle	500
		Liver	500
		Kidney	10000
		Fat	500
Spectinomycin	Cattle	Muscle	500
		Liver	2000
		Kidney	5000
		Fat	2000
		Milk (µg/l)	200
	Chicken	Muscle	500
		Liver	2000
		Kidney	5000
		Fat	2000
		Eggs	2000
	Sheep	Muscle	500
		Liver	2000
		Kidney	5000
		Fat	2000
Spiramycin	Cattle	Muscle	200
		Liver	600
		Kidney	300
		Fat	300
		Milk (µg/l)	200
	Chicken	Muscle	200
		Liver	600
		Kidney	800
		Fat	300
Sulfadimidine	Cattle	Milk (µg/l)	25
		Muscle	100
		Liver	100
		Kidney	100
		Fat	100
Tilmicosin	Cattle	Muscle	100
		Liver	1000

	Species	Tissue	MRL (µg/kg)
		Kidney	300
		Fat	100
	Chicken	Muscle	150
		Liver	2400
		Kidney	600
		Skin/Fat	250
	Sheep	Muscle	100
		Liver	1000
		Kidney	300
		Fat	100
	Turkey	Muscle	100
		Kidney	1200
		Liver	1400
		Skin/Fat	250
Tylosin	Cattle	Muscle	100
		Liver	100
		Kidney	100
		Fat	100
		Milk	100
	Chicken	Muscle	100
		Liver	100
		Kidney	100
		Fat/Skin	100
		Eggs	300

Codex Alimentarius, 2014. Maximum residue limits (mrls) and risk management recommendations (rmrs) for residues of veterinary drugs in foods updated as at the 37th session of the codex alimentarius commission 22–22.

Chapter 2

2. ANTHELMINTICS

By definition, anthelmintics are drugs that reduce parasite burdens in the animals to a tolerable level; they kill the parasites (vermicide), inhibit their growth or paralyse them (vermifuge). They also reduce the build-up of infective worm larva on the pasture, or eggs in the environment. The "ideal" anthelmintic should have a broad spectrum of activity against mature and immature parasites (including hypo biotic larvae), be easy to administer to a large number of animals, have a wide margin of safety and be compatible with other compounds, not require long withholding periods because of residue(s), no unpleasant side effects and capable of economical integration and management system.

The era of modern anthelmintics started in the middle of the 20th century with the introduction of phenothiazine and piperazine, products that are considered to be the first generation of the broad-spectrum drugs. The 2nd generation of truly broad spectrum anthelmintics were released in the 1960s and included the benzimidazoles, the probenzimidazoles, the imidazothiazoles and the tetra-hydro-pyrimidines. Following the early success of the introduction of the benzimidazoles, extensive research programmes were initiated during which successful structural modification resulted in the production of a series of benzimidazoles. Most recently, a 3rd generation of broad spectrum anthelmintics, the macrocyclic lactones, emerged in the early nineteen eighties. In addition, other compounds with a narrower spectrum have also been available on the market. These include substituted salicylanilides, phenols and organophosphates. Thus, the pharmaceutical industry has, during the last 35 years, been able to produce a string of highly effective, broad and narrow spectrum anthelmintics, and veterinarians and livestock producers have used these extensively for parasite control either by drenching or injecting cattle, sheep and goats.

General Mode of Action of Anthelmintics:

i. Neuromuscular Blockers:

Some of the anthelmintics have action on the neuro muscular system. For example, piperazine acts in the similar fashion as the curare and causes paralysis of the worms, especially Ascaris. The paralysis of the worms is due to hyperpolarization of the muscle membranes.

ii. Cholinomimetics:

e.g. Levamisole, methyridine, morantel, pyrantel, bephenium, thenium etc. The above cited drugs affect neuromuscular system of worms acting like cholinomimetics. These agents possess functional groups similar to acetylcholine and bind to the receptors from which the acetylcholine binds. By doing so, it causes a continuous stimulatory effect. However, these are not inactivated by acetylcholine esterase.

iii. Inhibitors of Glucose Transport:

Some anthelmintic agents like dithiazanine which is given for canine whipworm, inhibits glucose uptake. Thus, by reducing glycogen content causes death of the worms

iv. Disruptors of Glycogen Metabolism:

Schistosomicidal drug (niridazole) reduces phosphorylase phosphatase activity and increases the breakdown of glycogen reserve in worms. The death of worms is due to starvation.

v. Inhibitors of Glycolysis:

e.g. Arsenicals (thiacetarsamide), antimonials, (potassium antimony tartarate), stibophen etc. are organic trivalent heavy metals and bind with sulfhydryl (-SH) group. By binding with -SH they change the tertiary structure of proteins and the active site of enzymes.

vi. Inhibitors of Mitochondrial Reactions:

Benzimidazoles and thiophanate work in this way. For muscle contraction in works,

high energy (ATP) is required which is provided after reduction of fumerate to succinate in mitochondria. The above drugs exert their action by inhibiting fumerate reductase which is required for conversion of fumerate to succinate.

vii. Un-Couplers Electron Transport:

Salicylanilides (clioxanide), niclosamide, oxyclozanide, rafoxanide, substituted phenols (bithionol, dinitrophenol, hexachlorophene, niclofolam, nitroxynil etc. are un-couplers of electron transport. These drugs interfere with electron transport associated with phosphorylation process which is an important biochemical process for generation of ATP. As ATP is an important source of chemical energy to parasites, the worms lack this energy and die.

Classification of Anthelmintics:

(i) Antinematodal
(ii) Anticestodal
(iii) Antitrematodal

2.1 ANTINEMATODAL DRUGS

Drugs that act against round worms are called antinematodals.

These drugs are classified as follow:

i. Simple Heterocyclic compounds e.g., Phenothiazine, piperazine etc.
ii. Benzimidazoles e.g., Mebendazole, thiabendazole, cambendazole, albendazole, fenbendazole etc.
iii. Imidazothiazoles e.g. Butamisole hydrochloride, levamisole etc.
iv. Tetrahydropyrimides e.g. Pyrantel and morantel.
v. Organophosphorus compounds e.g. Crufomate, haloxon, coumaphos, diclorvos, trichlorfon etc.
vi. Miscellaneous drugs e.g. Toluene, n-Butylchloride, tetrachloroethane, theniumclosylate, disophenol, phthalofyne, glycobiarsol, avermectins, hygromycin B.

Piperazine

Description: Piperazine is an organic compound that consists of a six-membered ring containing two nitrogenatoms at opposite positions in the ring. It is a drug of choice for ascarid and nodular worm infections of all species of domestic animals. It is moderately effective in pinworm infections. However, it does not have any effect for other parasites of gastrointestinal tract.

Mode of action: Piperazine powder inhibits neuromuscular transmission of worms, which leads to flaccid paralysis and ultimate death of the worms**.** In addition to the above action, it inhibits succinic acid production in worms. Due to narcotic and paralytic effects produced by piperazine, worms lose their ability to maintain then-position in gastrointestinal tract and are eliminated due to peristaltic movement.

Indication: Piperazine is an ideal anthelmintic against piperazine sensitive nematodes. It is active against all adult forms as well as against some larval stages of worms where it is found to be a drug of first choice.

Ruminants: Piperazine is active against nodular worms (oesophagostomum) and ascarid infection. It does not possess activity against abosomal and small intestinal nematodes.

Horses: It has excellent activity against ascarids. The activity against strongyles and pinworm is limited. Because it possesses less efficacy against pinworms, therefore, the treatment is repeated after 21 days. It does not possess activity against stomach worms (Habronema) and tapeworms of equine. Combination of carbon disulfide (Piperazine and thiabendazole) provides activity against gastrophilus bots or strongyles respectively.

Dogs and Cats: It is 100% effective in Ascaris infection. Efficacy increases after combining theniumclosylate and anti-tape worm drugs with piperazine. Piperazine is also effective against whipworm and tapeworms.

Chickens: It possess high efficacy for Ascaridia galli. The caecal worm (Heterakis gallinarum) is not susceptible.

Contraindication: Contraindicated in poultry with known hypersensitivity to

piperazine or in renal failure. Animals suffering from hepatic and renal disorder should not be treated.

Side effect: Ruminants may suffer from diarrhoea, abdominal pain & hepatitis problem.

Precaution: Drinking water should be stopped at least 12 hours before medicated water is administered.

Use in Pregnancy & Lactation: May be used during Pregnancy & lactation

Dosage & administration

Poultry: 0.2 gm per kg body weight.

Cattle, buffalo & Horse: 10-25 gm /100 kg body weight.

Goat & Lamb: 0.3-0.5 gm / kg body weight.

Dog & Cat: 0.10-0.15 gm / kg body weight.

Withdrawal Period

Meat: 2 days; Egg: 1 day; Milk: 1 day

Proprietary Preperations

Adrazin (*Advent)*, Pow. 100%, Tk.
Helmacid (*Al-Madina*) Pow. 36%, Tk.1450/kg
Piperin-WS (*Chemist)*, Pow. 100%, Tk. 170/100gm
Kriminash (*Eon*), Pow. 100%, Tk.84/10gm
Eskapar (*Eskayef*), Pow. 100%, Tk. 173.42/100gm
Therazin (*Ethical*), Pow. 100%,
Warmex 100 (*Ethical*), Pow. 100%,
Pc Vet (*Globe*), Pow. 100%, Tk. 100/100gm
Razinmax Vet (I*ncepta*), Pow. 100%, Tk.172/100g, Tk.527/500g,
Perazin Vet (*Jayson*), Pow. 100%, Tk. 117/100g
Anipar 100 (*Medicon),* Pow. 100%Tk.65/50g
Piperamed (*MedRx),* Pow. 100%, Tk. 160/100g
Vetapar (*Navana),* Pow. 100%, Tk. 174/100g; Tk. 727.20/500g
New Vipar (*Newtec)*, Pow. 100%, Tk.201/100g
P Vet (*Opsonin*), Pow. 100%,
Pimex Vet (*Popular*), Pow. 100%,
Abipar 100 (*Rampart)*, Pow. 100%, Tk.162/100g
Endopar Vet 100 (*Reliance*), Pow. 100%,
Rena Per Vet 100 (*Renata*), Pow. 100%,
Piper Vet (*Square*), Pow. 100%, Tk. 202.61/100g, Tk. 906.72/500g
Therazin WSP (*Super powder*), Pow. 100%, Tk. 205/100g
Pirazin 100 (*Techno*), Pow. 100%, Tk. 22/10g
Peravet WSP 100 (*ACME*), Pow. 100%, Tk.173/100g
Ascarzin Powder (*Shinil*), Pow. 100%, Tk. 29/20g

Benzimidazoles group

Thiabendazole, albendazole, cambendazole fenbendazole, mebendazole, oxfendazole, oxbendazole, parbendazole etc. are considered under Benz imidazole group of anthelmintics.

Albendazole

Description: Albendazole is a broad-spectrum dewormer which belongs to the group of benzimidazole-derivatives. It is active against gastrointestinal roundworms and tapeworms.

Mode of Action: Albendazole acts by binding to **tubulin,** a structural protein of **microtubules.** These microtubules are important organelles involved in the motility, the division and the secretion processes of cells in all living organisms. In the worms the blocking of microtubules impairs the uptake of glucose, which eventually empties the glycogen reserves and resulting the paralysis of worm and die or are expelled.

Indication: Albendazole is used for the treatment and control of immature & adult stages of parasites in cattle, buffaloes, sheep, goats, horses, cats and dogs etc. It is effective against Tapeworms, abomasal and intestinal nematodes, liver fluke and lungworms, ovicidal and antigiardial. It is also indicated for the treatment of cystic hydatid disease of the liver, lung, and peritoneum, caused by the larval form of the dog tapeworm, *Echinococcus granulosus*.

Contraindications: Do not administer in the first 3 months of pregnancy.

Side effects: Hypersensitivity reactions may be observed.

Precautions: Wash hands carefully after direct contact with medicine. Direct contact with the medicine should be avoided by pregnant women.

Dosage & administration:

Cattle, Buffaloes, Sheep/Goat: 7.5mg/kg for cattle; 5mg/ kg for sheep& Goat; 10 & 7.5mg/ kg for liver fluke treatment in cattle

and sheep respectively; 20mg/kg to treat giardial for 3 days.

Dog/Cat: 25-50mg/Kg Body weight for 3-5days.

Poultry: 10-20mg / kg body weight

Withdrawal period

Meat: 12 days

Egg: 7 days

Proprietary Preperations

Benazole (*ACME),* Bolus, 600mg, Tk.7.5/Bolus,
Adrizol (*Advent*), Bolus, 600mg,
Wormfree (*Al Madina*), Bolus, 600mg, Tk.7.30 /Bolus,
Bendol-Al (*Albion*), Bolus, 600mg,
Relaben (*Bengal*), Bolus, 600mg, Tk. 7.75 /Bolus,
Azole Vet (*Biopharma*), Bolus, 600mg, Tk. 7.25/Bolus,
Bre-Zol (*Bridge*), Bolus, 600mg, Tk. /Bolus,
Albencid (*Chemist*), Bolus, 600mg, Tk. 7.50/Bolus,
Alzol (*Ethical*), Bolus, 600mg,
Alben vet (*Eskayef*), Bolus, 600mg, Tk. 7.67/Bolus,
Alben vet (*Eskayef*), Suspension, 10%, Tk. 55/20ml, Tk. 280/100 ml, Tk. 1150/500 ml,
Alvet (*FnF*), Bolus, 600mg, Tk.6 /Bolus,
AlrexVet (*Gentry*), Bolus, 600mg, Tk.7.60/Bolus,
Almavet (*Globe*), Bolus, 600mg, Tk.7.50/Bolus,
Gulben Vet (*Gurdian*), Bolus, 600mg, Tk. 752 /Bolus,
Helmiban Vet (*Incepta*), Bolus, 600mg, Tk. 7.65/Bolus,
Helmiban DS-Vet (*Incepta*), Bolus, 1200mg, Tk. 12.50/Bolus,
Elmin (*Jayson)*, Bolus, 600mg, Tk. 7.0/Bolus,
Adze Vet (*Kemiko*), Bolus, 600mg, Tk. 7.52 /Bolus,
Adze Vet (Kemiko), Suspension, 10%, Tk. 250 /100ml,
Wormet Vet (*Medivet*), Bolus, 600mg, Tk. /Bolus,
Worm Kill (*Navana*), Bolus, 600mg, Tk. 7.72/Bolus,
New Dazole (*Newtech*), Bolus, 600mg, Tk. 7.36/Bolus,
Destroall Vet (*One pharma*), Bolus, 600mg, Tk. 8/Bolus,
Helvizol (*Opsonin*), Bolus, 600mg, Tk. 6 /Bolus,
Albentic Vet (*Popular*), Bolus, 600mg, Tk. 6 /Bolus,
Helmex Vet (*Renata*), Bolus, 600mg, Tk. 7.60/Bolus,
Almex Vet (*Square*), Bolus, 600mg, Tk. 7.67/Bolus,
SP-BEN (*Super power*), Bolus, 600mg,
SP-Ben DS (*Super power*), Bolus, 1200mg,
Aldazole (Techno), Bolus, 600mg, Tk. 7/Bolus,
Vionzole Bolus (*Vision*), Bolus, 600mg, Tk.7.50 /Bolus,
IPC Bolus (*Vision*), Bolus, 600mg, Tk. /Bolus,
Abandi Vet (*RN*), Bolus, 600mg, Tk.7.40 /Bolus,
Adminth Bolus (*Adova*), Bolus, 600mg, Tk. 7 /Bolus,
Adminth Suspension (Vet) (*Adova*), suspension, 10 gm/100 ml, Tk 230,
S-Zol Sol. (Shinil Pharma Tld.) 100ml, 500ml, 1L,

Fenbendazole

Description: Fenbendazole is a broad spectrum benzimidazole anthelmintic used against gastrointestinal parasites including: Giardia, Roundworms, hookworms, whipworms, the tapeworm genus Taenia (but not effective against *Dipylidiumcaninum*, a common dog tapeworm), pinworms, aelurostrongylus, paragonimiasis, strongyles and strongyloides and can be administered to sheep, cattle, horses, dogs & cats.

Mode of action: See Albendazole.

Indications: Fenbendazole is active against the following parasites. Round worm, Lung worm &Tape worm in Sheep, Goat, Calf, Cattle and Buffalo.Round worm in horse. Round worm & tape worm in dog, cat.

Contraindication: Fenbendazole should not be used within 14 days of liver fluke treatment and animal less than 3 month of age.

Side effect: Ruminants may suffer from diarrhoea, abdominal pain & hepatitis problem.

Precaution: Use in pregnant animal Fenbendazole is not toxic. However, risk benefit should be considered during administration in pregnant animal.

Dosage & administration

Sheep & goat: 5 mg/ kg body weight as a single dose.

Cattle & Horse:7.5 mg/ kg body weight as a single dose.

Dog & Cat:100 mg/ Kg body weight as a single dose.

Withdrawal Period

Meat: 14 days & Milk: 3 days

Proprietary Preperations
Fenzol Vet (*ACME*), Bolus. 250mg, Tk.5.75 /Bolus; Liquid, 20%, Tk. 140 /100ml,
Fenbendazole 250 (*Albion*), Bolus. 250mg, Tk. 5.75 /Bolus,
Refenda (*Bengal Remedies*), Bolus. 250mg, Tk. 6 /Bolus,
Fe-Vet (*Chemist*), Bolus. 250mg,
Fenzol (*Ethical*), Bolus. 250mg, Powder, 22.2%, 100gm,
Safvet (*FnF*), Bolus. 250mg, Tk. 6 /Bolus,
Fenben (*FnF*), Bolus. 250mg, Tk. 6 /Bolus,
Fenvet (*Globe*), Bolus. 250mg, Tk.4 /Bolus,
FenthelVet (*Square*), Suspension, 10%, 100ml,
Peraclear (*Techno*), Bolus. 250mg, Tk. 5.75 /Bolus; Powder, 22.2%, Tk.1003 /100gm,
Febenazol (Vet) (*Renata*), Bolus. 250mg, Tk. 5 /Bolus,
Binizol (Vet) (*Super Power*), Bolus. 250mg, Tk. 5.75 /Bolus,

Mebendazole

Description: Mebendazole is a medication used to treat a number of parasitic worm infestations. This includes ascariasis, pinworm disease, hookworm infections, guinea worm infections, hydatid disease, and giardia.

Mode of action: The mode of action of Mebendazole consists in binding to **tubulin,** a structural protein of **microtubules.** These microtubules are important organelles involved in the motility, the division and the secretion processes of cells in all living organisms. In the worms the blocking of microtubules perturbs the uptake of glucose, which eventually empties the glycogen reserves. This blocks the whole energy management mechanism of the worms that are paralyzed and die or are expelled.

Indication: Mebendazole is active against the following parasites. Common roundworms (ascariasis). Hookworms (ancylostomiasis, necatoriasis, uncinariasis). Pinworms (enterobiasis, oxyuriasis). Whipworms (trichuriasis) of Dogs & cats.

Contraindication: Mebendazole is contraindicated in individuals who have shown hypersensitivity to the drug

Side effect: Overdose may cause abdominal pain, diarrhea & Flatulence

Use in Pregnancy & Lactations: Embryotoxic and teratogenic effects found in pregnant animals

Dosage & administration: Cattle, Sheep/Goat: 15-20mg/ Kg body wight.

Dog & Cat: 20mg/ Kg body weight for 3 consecutive days.

The product can be administered pure, mixed in a small amount of feed, piece of meat or any other food that pleases the animal, or dissolved in liquid.

Withdrawal Period: None

Proprietary Preperations
Ebenda (*Ethical*), Bolus. 750mg,
Helmavet (*Globe*), Bolus. 750mg, Tk. 4.60 /Bolus
Mevet (*Pharmadesgh*), Bolus. 750mg,
Nemadex (*Super powder*), Bolus. 750mg, Tk. 6.50 /Bolus

Thiophanate

Description: Thiophanate is a veteran pro-benzimidazole. It is transformed into an anthelmintic benzimidazole in the stomach and the intestine of the host, shortly after ingestion. It is available mainly in the form of drenches for cattle, sheep, goats and pig but has been vastly abandoned for use in livestock or pets.

Mode of action: The molecular mode of action of all benzimidazoles consists in binding to**tubulin,** a structural protein of **microtubules.** These microtubules are important organelles involved in the motility, the division and the secretion processes of cells in all living organisms. In the worms the blocking of microtubules perturbs the uptake of glucose, which eventually empties the glycogen reserves. This blocks the whole energy management mechanism of the worms that are paralyzed and die or are expelled.

Contraindication: Not established

Side effect: Over dosages causes renal and hepatic dysfunction in sheep and cattle respectively.

Use in Pregnancy & Lactations: None

Indications: Thiophanate is effective against the most relevant gastrointestinal roundworms of ruminants and pigs (e.g. of the genus Bunostomum, Haemonchus, Ostertagia - Teladorsagia, Trichostrongylus, Cooperia, Nematodirus, Chabertia, Oesophagostomum, Trichuris, etc.), both as adults and larvae. Depending on the dose it is also effective against arrested larvae of certain species, and against some lungworms.

Dosage & administrations:

Cattle, Sheep & goat: 75 mg/ kg body weight

Withdrawal Period: None

Proprietary Preperations
Nemafax (*Rampart*), Bolus. 2gm/bolus, Tk. 6.5 /Bolus
Nemafax (*Rampart)*, Powder. 2gm/100g, Tk.11.2/10g
Thiofex (*Techno*), Bolus. 2g, Tk. 7.65/ Bolus

Oxibendazole

Description: Oxibendazole is a benzimidazole drug that is used to protect against roundworms, strongyles, threadworms, pinworms and lungworm infestations in horses and some domestic pets.

Mode of action: The mode of action of Mebendazole consists in binding to **microtubules.** These microtubules are important organelles involved in the motility, the division and the secretion processes of cells in all living organisms. Blocking of microtubules impedes the uptake of glucose, which eventually empties the glycogen reserves. This blocks the whole energy management mechanism of the worms that are paralyzed and die or are expelled.

Indications: Oxibendazole can be used for removal and control of largestrongyles (*Strongylusedentatus, S. equinus, S. vulgaris*); small strongyles (species of the genera*Cylicostephanus, Cylicocyclus, Cyathostomum, Triodontophorus, Cylicodontophorus,* and *Gyalocephalus*); large roundworms (*Parascarisequorum*); pinworms (*Oxyurisequi*), including various larval stages and threadworms (*Strongyloideswesteri*).

Contraindication: Simultaneous administration of oxibendazole with diethylcarbamazine (anthelmintic used sometimes against filariasis, e.g. against heartworms) in dogs can cause acute or chronic periportal hepatitis.

Side effect: Do not administer to weak equines or animals otherwise affected by colic, toxaemia or infections.

Use in Pregnancy & Lactations: Teratogenic effects may be found in pregnant animals

Dosage & administration:

Cattle, Sheep/Goat: 15mg/ Kg body weight

Withdrawal Period: Meat: 7 Days

Proprietary Preperations
Oxyben (*Ethical*), Bol. 2g,
Oxizole (*Techno*), Bol. 2g,
Oxyclozid (Vet) (*Albion*), Bol. 1g, Tk. 8.00 /Bol,
Oxyconide Bolus (Vet) (*Bridge*), Bol. 1g, Tk. 8.00 /Bol,
Tremacid (*Renata)*, Bol. 1g, Tk. 8.79/Bol,
Oxicide (Vet) (*Super power*), Bol. 1g, Tk. 8.75 /Bol,

Levamisole

Description: Levamisole is a synthetic imidazothiazole derivative that has been widely used in treatment of worm infestations in animals. As an anthelmintic, it probably works by targeting the nematode nicotinergic acetylcholine receptor. It also acts as immune-modulator.

Mode of action: Levamisole is an ideal broad spectrum anthelmintic for poultry, which acts against respiratory and intestinal worms. Levamisole causes lysis of worms by neuromuscular paralysis.

Indication: Levamisole is an ideal anthelmintic & acts against nematodes of stomach & intestine like *Ascaridiagalli*, *Heterakisgallinarum*, *Capillaria*sp. and respiratory roundworm like *Syngamus trachea.*

Contraindication: The drug is contraindicated in animals hypersensitive to active ingredient.

Precaution: Water supply should be stopped before 12 hours of supplying medicated water.

Side effect: In therapeutic doses, there is no undesirable side effects of Levamisole in chicken. Even egg production, fertility and hatchability are not adversely affected. Ruminants may suffer from coughing & salivation problem.

Uses in Pregnancy & Lactation: NO evidence of teratogenicity or embryotoxicity.

Dosage & administration:

Poultry: 80 mg / kg body weight.

Cattle/Sheep/Goat: 7.5 mg / kg body weight.

Dog: 10 mg / kg body weight.

Cat: 20-40mg/kg body weight.

Withdrawal Period: Meat 7 days; Milk: 4 days, Egg 0 day

Proprietary Preperations

Alvasol (*Al Madina*), bolus, 600mg/bol, 46 gm/100 gm, 30%, Tk.141/100g,
Al-Lev Vet (*Albion*), Bol. 600mg; Powder, 30%,
Anthemisol (*Eon*), Powder, 30%, 30 gm/100 gm, Tk 147/100g,
LH Vet (Vet) (*Alkad*), Powder, 30%,
Eskanex 30% (*Eskayef*), Powder, 30%, Tk.150/100g,
Emitrex (*Ethical*), Bolus. 600mg; Powder, 30%,
Wormnil Vet Powder (*FnF*), Powder, 30%,
Poliva (*Gentry*), Powder, 20%,
Levs (*Globe*), Powder, 30%,
Paranex (*Guardian*), Powder, 30%, Tk.150/100g,
Levavet (*Hope Pharma*), Powder, 60%,
Mitrax Vet (*Incepta*), Powder, 30%, Tk. 167/100g,
Keminex Vet (*Kemiko*), Powder, 30%,
Medmisol Bolus (*MedRx*), Bol. 600mg, Tk 23/bol,
Livasol WS (*Navana*), Powder, 46%, Tk 160/100g,
Poulnex *(Novartis),* Powder, 30%,
Ralnex 600 (*Novartis*), Bol. 600mg,
Lemivet (*Opsonin*), Powder 30%, tk 148/100g,
Vaminil Vet (*Popular*), Powder 30%; Bol. 600mg, Tk. 7.10/bol,
Nemacidol (*Rampart-Power*), Powder 46%,
Avinex Vet (*Renata)*, Powder 30%, Tk 200/100g,
Elcaris Vet *(Square),* Powder 30%, Tk. 200.00/100 gm,
Telover 30 (*Super Power),* Powder 30%, Tk 10/10g,
Nemasole (*Techno*), Powder 46%, Tk 200/100g,
Technomysol (*Techno*), Bol. 600mg, Tk. 5.75/bol,
Neotrax (*ACME*), Powder 60%; Bol. 600mg, Tk. 7/bol,
Leride Bolus (Vet) (*Vision*), Bol. 600mg, Tk. 6/bol,
ASCATEC 30% (*Newtec*), Powder 30%,
Advasol (*Adova*), Syrup, 1%, Tk 20; powder, 30, Tk 150/100gm,
Admisol Powder (*Advent*), Powder 30%,

Tetramisole

Description: Tetramisole is a racemic mixture of levamisole and its enantiomer dexamisole, which is a specific inhibitor of tissue non-specific alkaline phosphatase (TNAP). This drug is used in veterinary to treat of ascariasis and other worm infections.

Mode of action: Tetramisole is an anthelmintic for poultry, which acts against respiratory and intestinal worms. Tetramisole kills worm by neuromuscular paralysis.

Indication: Tetramisole is an ideal anthelmintic & acts against nematodes of stomach & intestine like *Ascaris*& Hookworm.

Contraindication: The drug is contraindicated in animals hypersensitive to active ingredient.

Precaution: Water supply should be stopped before 12 hours of supplying medicated water.

Side effect: In therapeutic doses, there is no undesirable side effect of Tetramisole in chicken. Even egg production, fertility and hatchability are not adversely affected.

Uses in Pregnancy & Lactation: Embryo toxicity is noticed in pregnant animal.

Dosage & administration: Poultry: 50-80 mg / kg body weight.

Cattle, sheep and goats: 10-15mg /kg body weight.

Withdrawal Period: Egg 7 days, Meat: 28days

Do not use in animals producing milk for human consumption

Proprietary Preperations

Etrazol (*Ethical*), Bol. 600mg,

Technomisol (*Techno*), Bol. 600mg, Tk. 115.40/box,

Morantel: Morantel is an anthelmintic drug used for the removal of parasitic worms in livestock. It affects the nervous system of worms given the drug is an inhibitor of acetylcholine esterase.

Mode of action: Morantelinterferes with parasitic acetylcholine receptors, causing paralysis.

Indication: Morantel is a narrow-spectrum anthelmintic effective against gastrointestinal roundworms but not against those in the lungs or elsewhere in the host's body. It is also effective against certain tapeworms as well.

Contraindication: The drug is contraindicated in animals hypersensitive to active ingredient.

Side effect: In therapeutic doses, there is no undesirable side effect of Morantel. But over dosages may causes Dyspnea, Diarrhoea, Convulsion etc.

Uses in Pregnancy & Lactation: May used in pregnant animals

Dosage & administration:

Cattle: Gastrointestinal roundworms, 7-15mg/kg body weight

Sheep/goat: Gastrointestinal roundworms, 6-12mg/kg body weight

Withdrawal Period: Meat 30 days

Proprietary Preperations

Morentel (*Ethical*), Bol. 446 mg,

Deminth Vet (*Renata*), Powder 100 %; Bol. 446mg, Tk. 13.65/bol

Pyrantelpamoate

Description: Pyrantelpamoate is most commonly used to treat hookworms and roundworms in dogs and cats. It is not effective against tapeworms, whipworms, or many other types of intestinal parasites.

Mode of action: Pyrantel works by making the worms unable to move (paralyzed) so that the body can remove them naturally in the stool.

Indication: For the removal of large roundworms (Toxocaracanis and Toxascarisleonina) and hookworms (*Ancylostomacaninum* and *Uncinariastenocephala*) in dogs and puppies. It may also be used to prevent re-infestation of *T. canis* in puppies and adult dogs and in lactating bitches after whelping.

Contraindication: Pyrantel is contraindicated in animals hypersensitive to active ingredient.

Side effect: Over dosages may cause headache, drowsiness & dizziness.

Uses in Pregnancy & Lactation: May used in pregnant animals

Dosage & administration: Cattle: Gastrointestinal roundworms, 6.5-13 mg/kg body weight

Sheep/goat: Gastrointestinal roundworms, 13-25 mg/kg body weight

Withdrawal Period: Meat 30 days

Proprietary Preperations

Prazitel Vet (*Square*), Bolus, Tk.12/bolus,

Macrolidendectocide

Ivermectin

Description: Ivermectin is a broad spectrum anthelmintics which cures parasitic infection (Ecto and Endo parasites) and helps to improve quality life. The recommended dose of ivermectin is 200mcg/kg body weight.

Mode of action: Ivermectin have strong affinity to glutamate gated chloride ion channel of nerves and causes hyper-polarization of the nerve or muscles cells and resulting paralysis and killing of parasites. Ivermectin is metabolized in the liver and its metabolites are excreted almost exclusively in the feces over an estimated 12 days with less than 1% of the administered dose excreted in the urine.

Indications & Usages: Ivermectin acts against gastrointestinal roundworms like *Oesophagostomumradiatum*; *Ostertagiaostertagi*; *Haemonchusplacei*; *Trichostrongylusaxei; Cooperiaoncophora*; *C. punctata*; *Bunostomumphlebotomum*, Lungworms **(***Dictyocaulus viviparous*), Cattle grubs like-*Hypodermabovis* & *Hypodermalineatum*, Sucking Lice-*Linognathusvituli; Haematopinuseurysternus; Solenopotescapillatus,* Mites (scabies)-*Psoroptesovis & Sarcoptesscabiei var. bovis.*

Contraindications: Animal with history of hypersensitivity is contraindicated to use of Ivermectin. Administration to collies and related breeds is not recommended.

Use in Pregnancy & Lactation: During pregnancy and lactation use of Ivermectin is safe.

Side effects: Animal may show unusual movement of the body immediately after injection of ivermectin and recovered within few minutes. At the site subcutaneous injectionswelling of the loose tissue occurs and recuperates without further treatment.

Dosage & administration: Ivermectin can be administered Sub-cutaneous (SC) route as follows:

Cattle/Buffalo/Sheep/Goat:200mcg/kg body weight

Dog:200 - 600mcg/kg body weight

Withdrawal period: Meat: 35 days

Proprietary Preperations

Navamectin Vet (*Navana*), Inj. 10 mg/ml, Tk. 60.18/5 ml
Acimec 1% Injection (*ACI*), Inj. Tk.216.46/ 25 ml, Tk.60.41/ 5 ml
I-Pour Vet (*Albion*), Pour on 1%,
Intermectin Vet (*Bengal Remedies*), Inj. 1%,
Ivertin (*Chemist*), Inj. 1%, Tk. 410/ 50 ml,
Ivermec (*Ethical*), Inj. 1% & Solution 1%,
I Ver (*Globe*), Inj. 1%,
Ivergard (*Guardian*), Inj. 1%,
Parakil Vet (*Incepta*), Inj. 1% Solution, Tk 120/10ml,
Kemectin Vet (*Kemiko*), Solution 1%,
Invet (*Popular*), Inj. 1%,
Remectin Vet (*Rephco*), Solution 1%,
Parasitin Vet (*Square*), Inj. 1%, Tk. 60.18/5 ml, Tk. 118.35/10 ml,
Vermic (*Techno*), Inj. 1% 5mL, 70.26 Tk/Vial, 10 mL, 125.47 Tk/Vial, 50 mL, 600 Tk./Vial,
A-Mectin (*ACME*), Inj. 1%,
Verkil Vet (Eskayef), Solution 1%, Tk. 60/15ml, Tk. 138/100ml, Tk. 660/500ml,
Vermishin Inj. *(Shinil Pharma),* Tk. 60/5ml
Vermishin Sol. *(Shinil Pharma),* Tk.107/100ml, Tk. 500/500ml,

(**Note:** Ivermectin + Triclabendazole:
Iverzol Vet (*Square*), Susp. 200 mg + 12 gm/100 ml)

Ivermectin + Clorsulon

Description: Ivermectin&Clorsulon is a broad spectrum anthelmintic which cures parasitic infection (Ecto and Endo parasites) and helps to improve quality life. The recommended dose of Ivermectin is generic 200mcg/kg body weight and clorsulon 2mg/kg body weight behind the shoulder at the rate of 1ml per 50 kg body weight sub-cutaneously (SC).

Mode of action: Ivermectin have strong affinity to glutamate gated chloride ion channel of nerves and causes hyper-polarization of the nerve or muscles cells and resulting paralysis and killing of parasites. Clorsulon is rapidly absorbed into the circulating blood. Erythrocytes with bound drug as well as plasma are ingested by *Fasciola.* Adult *Fasciola* are killed by clorsulon because of inhibition of enzymes in the glycolytic pathway, which is their primary source of energy. Ivermectin is metabolized in the liver and its metabolites are excreted almost exclusively in the feces over an estimated 12 days with less than 1% of the administered dose excreted in the urine.

Indications & Usages: Ivermectin & Clorsulon acts against gastrointestinal roundworms (adult and fourth stage larvae)

- *Oesophagostomumradiatum*
- *Ostertagiaostertagi*
- *Haemonchusplacei*
- *Trichostrongylusaxei,*
- *Cooperiaoncophora*
- *C. punctata*
- *C. pectinata*

- *Bunostomumphlebotomum*

Lungworms (adult and fourth stage larvae)

Dictyocaulus viviparous

Cattle grubs (Parasitic developmental stages)

- *Hypodermabovis*
- *Hypodermalineatum*

Sucking Lice

- *Linognathusvituli,*
- *Haematopinuseurysternus*
- *Solenopotescapillatus*

Mange mites (scabies)

- *Psoroptesovis*
- *Sarcoptesscabiei var. bovis.*

Liver Flukes

- Fasciola (adults only)

Contraindications: Animal with history of hypersensitivity is contraindicated to use of Ivermectin&Clorsulon.

Use in Pregnancy: During pregnancy and lactation use of Ivermectin and Clorsulon at recommended dose is safe.

Side effects: Animal may show unusual movement of the body immediately after injection of Ivermectin&Clorsulon injection and recovered within few minutes. At the site subcutaneous injectionswelling of the loose tissue occurs and recuperates without further treatment.

Dosage & administration: Ivermectin and Clorsuloncan be administered Sub-cutaneous (SC) route as follows:

Cattle/Buffalo/Sheep/Goat: 1ml/50kg body weight (200mcg/kg body weight and Clorsulon 2mg/kg body weight)

Withdrawal period: Meat: 49 days

Proprietary Preperations

Clormectin *(Bridge*), Inj. 500 mg + 50 mg/5 ml,
Ivertin Plus (*Chemist*), Inj. 500 mg + 50 mg/5 ml, Tk.142/ 10 ml, Tk. 325/ 30 ml,
A-Meetin Plus (*ACME*), Inj. 3 gm + 300 mg/30 ml, Tk 326/30ml,
Acimec Plus (Vet) (*ACI*), inj., Tk.255 /25 ml, Tk 75/5 ml,
Parakil Plus Vet (*Incepta*), inj., 500 mg + 50 mg/5 ml, Tk. 145/10ml, Tk. 325/30ml,
Iveclor (Vet) *(Renata),* inj., 500 mg + 50 mg/5 ml, Tk 75/5ml, Tk. 326/30ml,
Vermishin Pus (*Shinil*), inj., 500 mg + 50 mg/5 ml, Tk 75/5ml,
Vermic Plus (*Techno*), inj., 500 mg + 50 mg/5 ml, Tk 75/5ml, Tk 325/30 mL,
Clomisole (*Bridge*), inj., 75 mg + 100 mg/100 ml,

2.2 ANTI-CESTODAL

Niclosamide

Description: Niclosamide is a medication used to treat tapeworm infestations. This includes diphyllobothriasis, hymenolepiasis, and taeniasis. It is not effective against other worms such as pinworms or roundworms.

Mode of action: Niclosamide works by killing tapeworms on contact. Adult worms (but not ova) are rapidly killed, presumably due to uncoupling of oxidative phosphorylation or stimulation of ATPase activity. The killed worms are then passed in the stool or sometimes destroyed in the intestine. Niclosamide may work as a molluscicide by binding to and damaging DNA.

Indications & Usages: For the treatment of tapeworm and intestinal fluke infections: *Taeniasaginata* (Beef Tapeworm), *Taeniasolium* (Pork Tapeworm), *Diphyllobothriumlatum* (Fish Tapeworm), *Fasciolopsisbuski* (large intestinal fluke). Niclosamide is also used as a molluscicide in the control of schistosomiasis.

Contraindications: Animal with history of hypersensitivity is contraindicated to use of Niclosamide.

Use in Pregnancy & Lactation: Not established.

Side effects: In dogs and cats transient vomit and diarrhea have been reported

Dosage & administration:

Cattle: Tapeworm-50-70mg/kg body weight

Sheep & Goat: Tapeworm-50mg/kg body weight

Dog & Cat: Taenia-150mg/Kg body weight

Withdrawal period: None

Proprietary Preperations
Niclosam (*Chemist)*, Bol. 1gm
Niclovet *(FnF),* Bol. 1gm
Mensonil *(Super powder)*, Bol. 1 gm
(**Note:** Levamisole + Niclosamide)
Niclosam Plus (*Chemist),* bolus, 75 mg + 1 gm,
Niclovet PLUS *(FnF),* bolus, 75 mg + 1 gm,

Praziquantel & Pyrantel

Description: Praziquantel&Pyrantel is used to treat tapeworms in pets. Tapeworms are spread by ingesting a flea or louse that has in turn ingested a tapeworm egg. A flea preventative may also be prescribed in conjunction with administration of Praziquantel to prevent any future tapeworm infections.

Mode of action: Praziquantel works by causing severe spasms and paralysis of the worms' muscles. This paralysis is accompanied - and probably caused - by a rapid Ca 2+ influx inside the schistosome. Morphological alterations are another early effect of praziquantel. These morphological alterations are accompanied by an increased exposure of schistosome antigens at the parasite surface. The worms are then either completely destroyed in the intestine or passed in the stool.

Indications & Usages: Praziquantel is highly effective against adults of many parasitic tapeworms (e.g. Dipylidium, Taenia, Echinococcus, Mesocestoides, Moniezia, Avitellina, Stilesia, etc.) as well as against a few flukes (e.g. Eurytrema and Schistosoma). It is also effective against larvae and/or eggs of certain species.

Contraindications: Animal with history of hypersensitivity is contraindicated to use.

Use in Pregnancy & Lactation: Not established.

Side effects: Vomiting, Diarrhea or loose stool, Loss of appetite, Lethargy & Drooling in cats.

Dosage & administration:

Ruminants, horses, dogs, cats, and poultry: 5 mg/kg Orally &5.8 mg/kg S/C

40 mg/kg is also effective against *Schistosoma* infections in cattle (and people).

Withdrawal period: None

Proprietary Preperations
Prazitel Vet (*Square*), Bolus. 18.2mg+72.6mg,

2.3 ANTI-TREMATODAL

Triclabendazole

Description: Triclabendazole is a medication used to treat liver flukes, specifically fascioliasis and paragonimiasis. It is taken by mouth with typically one or two doses being required.

Mode of Action: The molecular mode of action of all benzimidazoles, including triclabendazole, consists in binding to tubulin, a structural protein of microtubules. These microtubules are important organelles involved in the motility, the division and the secretion processes of cells in all living organisms. In the worms the blocking of microtubules perturbs the uptake of glucose, which eventually empties the glycogen reserves. This blocks the whole energy management mechanism of the worms that are paralyzed and die or are expelled.

Indications: Triclabendazole is effective against trematode of cattle, buffalo, sheep & goat etc. Triclabendazole is used for the treatment of acute, sub-acute and chronic Fascioliasis (infestation of trematodes) caused by *Fasciola hepatica* & *F. gigantica*.
Contraindication: Triclabendazole is contraindicated in animals hypersensitive to active ingredients.

Side effect: Triclabendazole is well tolerated. At the recommended doses there is no side effect.

Uses in pregnancy & Lactation: There is no effect on pregnant animals if given in recommended dosage. It reveals no embryonic or teratogenic effect.

Dosage & administration: Cattle, buffalo, sheep & goat: 10-12mg/kg body weight orally.

Withdrawal period: Milk: 10 days; Meat: 28 days

Proprietary Preperations

Acinex vet (ACI), Bolus. 15.05/per tablet,
Flucide (*FnF*), Bolus. 900mg,
Claben (*Globe*), Bolus. 900mg,
Fasinex (*Novartis*), Bolus. 900mg, Tk. 20/ bolus,
Fasinasol *(Rampart*), Bolus. 900mg,
Fasinil (*Techno*), Bolus. 900mg, Tk. 9/Bolus,

Triclabendazole + Levamisole

Description: This is a combination of triclabendazole&levamisoleused to treat liver flukes and round worm of domestic animals.

Indications: This combination is a broad spectrum anthelmintic used against helminths in cattle, buffalo, sheep, goat etc. The drug is used for the treatment of acute, sub-acute and chronic fascioliasis due to early immature, immature and adult stages of *Fasciola hepatica* & *Fasciolagigantica*. It is also used against major parasites of ruminant such as Haemonchus and Ostertagia of the abomasum; Cooperia, Trichostrongylus and Bunostomum of the small intestine; Oesophagustomum, Trichuris of the large intestine &Dictyocaulus spp. of the lungs. It is also successful in treating eye worms (Thelazia) of cattle.

Contraindication: Contraindicated in animals hypersensitive to active ingredients.

Side effect: Well tolerated. At the recommended doses there is no side effect.

Uses in pregnancy & Lactation: In recommended dosage the drug has no adverse effect on pregnancy.

Dosage & administration: Cattle, buffalo, sheep & goat: Triclabendazole- 10-12mg/kg body weight.

Levamisole: 7.5mg /kg body weight

The combination is 19.5mg/Kg Body weight

Withdrawal period: Milk: 10 days; Meat: 28 days

Proprietary Preperations

An - Worm Vet (*Al-Madina*), Bol. 900mg+600mg, Tk 21/bol,
Levatrim Vet (*Bengal Remedies*), Bol. 900mg+600mg, Tk 22/bol,
Leva Plus (*Biopharma*), Bol. 900mg+600mg, Tk 21/bol,
L-Trivet (*Bridge*), Bol. 900mg+600mg, Tk 21/bol,
Triolev (*Chemist*), Bol. 900mg+600mg, Tk 22/bol,
Levaben Vet (*Eon*), Bol. 900mg+600mg,
Triben L (*Ethical*), Bol. 900mg+600mg,
Lezol (*FnF*), Bol. 900mg+600mg, Tk 24/bol,
Poliva-T Vet (*Gentry*), Bol. 900mg+600mg, Tk 20/bol,
Trisol (*Globe*), Bol. 900mg+600mg, Tk 20/bol,
Trical Vet (*Guardian*), Bol. 900mg+600mg, Tk 20/bol,
Duozol Vet (*Incepta*), Bol. 900mg+600mg, Tk 22/bol,
Kemidex Vet (*Kemiko*), Bol. 900mg+600mg, Tk 22.50/bol,
Solben (*Medicon*), Bol. 900mg+600mg, Tk 10/bol,
Navadex (*Navana*), Bol. 900mg+600mg, Tk 22/bol,
Endex (*Naafco*), Bol. 900mg+600mg, Tk 26/bo,
OT-Lev (*One Pharma*), Bol. 900mg+600mg,
Trimisol (*Opsonin*), Bol. 900mg+600mg, Tk 19.65/bol,
LT Zol (*Popular*), Bol. 900mg+600mg, Tk 22/bol,
Lendazole (*Rampart-Power*), Bol. 900mg+600mg, Tk 21.30/bol,
Renadex Vet (*Renata*), Bol. 900mg+600mg, Tk. 22.08/Bolus,
Bendasol Vet (*RN Pharma*), Bol. 900mg+600mg, Tk 22/bol,
Trilve Vet (*Square*), Bol. 900mg+600mg,
Sundex (*Super Power*), Bol. 900mg+600mg,
Moondex (*Super Power),* Bol. 150 mg + 225 mg, Tk 10/bol,
Levex *(Techno),* Bol. 600 mg + 900 mg, Tk 22/bol,
LT Vet (*ACME*), Bol. 600 mg + 900 mg, Tk 22/bol,
Levavion Bolus (*Vision*), Bolus, . 600 mg + 900 mg, Tk 24/bol,
V-Dx Bolus (Vet) (*Vision*), Bolus, . 600 mg + 900 mg, Tk 24/bol,
Shitril Bolus (Vet) (*Shinil*), Bolus, . 600 mg + 900 mg, Tk 25/bol,
New Dex Vet (*Newtec*), Bolus, . 600 mg + 900 mg, Tk 20/bol,
Endex Bolus *(Naafco),* Bolus, . 600 mg + 900 mg, Tk 25/bol,
Triclazol Bolus (Vet) (*Eskayef*), Bolus, . 600 mg + 900 mg,
Levaqure Bolus Vet (*Adova*), Bolus, 600 mg + 900 mg, Tk 25/bol; DS bolus, 750 mg + 1.2g, Tk 29/bol,

Antiworm Vet (*ACI*), bolus, Bolus, 600 mg + 900 mg, Tk. 24/per tablet,
Antiworm DS Vet (*ACI*), bolus, 1.2g + 1.8g, Tk 37.5/bol,
Doubledex Vet (*Eskayef*), Bolus, 1800 mg + 1200 mg, Tk 45/bol,
Doubledex ½ Vet (*Eskayef*), Bolus, 900 mg + 600 mg, Tk 25/bol,
Shitril Bol. *(Shinil Pharma Ltd.),* 900mg+600mg, 10x2 Strip, Tk. 500/strip,
(**Note:** Ivermectin + Triclabendazole)
Iverzol Vet (*Square*), suspension, 200 mg + 12 gm/100 ml, Tk 140,

Nitroxynil

Description: Nitroxinil is an anthelmintic, a veterinary medicine against parasitic worms in sheep and cattle. The substance is active against the liver fluke the *Fasciola sp.* and to a lesser extent against thread worms in the gastrointestinal tract. It is also effective at the recommended dose rate against adultand larval stages of *Haemonchuscontortus* in cattle & sheep and *Haemonchusplacei, Oesophagostomumradiatum* and *Bunostomumphlebotomum* in cattle.

Mode of Action: Nitroxinil is an **uncoupler of the oxidative phosphorylation** in the cell mitochondria, which disturbs the production of ATP, the cellular "fuel". This impairs the parasites motility and probably other processes as well.

Indications: Nitroxinil is highly effective against adult liver flukes and against late immature stages (> 6 weeks) in cattle. It is also effective against a few gastro-intestinal round worms (e.g. *Bunostomum*spp, *Haemonchus*spp, *Oesophagostomum*spp, and *Parafilariabovicola*) as well as against myiases caused by the sheep nasal bot fly (*Oestrusovis*).

In contrast with many other anthelmintic (e.g. imidazothiazoles, benzimidazoles, tetrahydropyrimidines), nitroxinil has a residual effect, i.e. it not only kills the parasites present in the host at the time of treatment, but protects against re-infestation for a period of time (up to several weeks) that depends on the dose and the specific parasite. Nitroxinil is not effective against rumen flukes (*Paramphistomum*spp), other roundworms such as lungworms (e.g. *Dictyocaulus*spp) or eyeworms (e.g. *Thelazia*spp), tapeworms and other external parasites.

Contraindication: Do not use in animal with known hypersensitivity to nitroxynil. Injection should not be mixed with any otherProprietary Preperations.

Side effect: No systemic ill-effects are to be expected when animals (including pregnant cows and ewes) are treated at normal dosage. It is four times safer than therapeutic dose. In case of any reaction or accidental over dosage, dextrose saline should be administrated intravenously. Keep the animal in a cool and dry place.

Uses in pregnancy & Lactation: Dairy cows should be treated at drying off (at least 30 days before calving), As **Nitroxynil** passed in milk, it is better avoiding it in lactating cows, and ewe in advanced pregnancy should be driven, handled and dosed carefully.

Dosage & Administration: Cattle, Buffalo, Goat & Sheep: 10 mg per kg of body weight, subcutaneously.

In case of acute fascioliasis (immature flukes), increase the dose to 13 mg per kg of body weight.

In case of massive infestation, repeat, if necessary after 3 weeks.

Withdrawal period: Meat: 30 days

Proprietary Preperations

Nitroxynil (*ACI*), Inj. Tk.65/10 ml, 133.28/25 ml
Nitroworm-Vet (*Al-Madina*), Inj. 34%, Tk 75.5/vial
Nitrofast Vet (*Albion*), Inj. 34%, Tk 73/vial
Bentronil Vet (*Bengal Remedies*), Inj. 34%, Tk 75.5/vial
Nitrovet (*Bridge*), Inj. 25% & Inj. 34%,
Nitronil (*Chemist*), Inj. 25%,
Nitronil 34% Vet (*Chemist*), Inj. 34%, Tk. 75/ 10 ml, Tk. 285/ 50ml
Niloxin Vet *(Eskayef),* Inj. 25%, Tk 75.25/vial
Nitril *(Ethical),* Inj. 25%, Tk 75.5/vial
Nitril 34% *(Ethical),* Inj. 25%,
NitroMax Vet (*One Pharm*), Inj. 34%, Tk 75/vial
N-Nil Vet (*Globe*), Inj. 34%,
Nixil (*Opsonin*), Inj. 25%, Tk 250/100ml
Navet (*Popular*), Inj. 25%, Tk 220/100ml
Nitronex Vet (*Renata*), Inj. 25% & Inj. 34%, Tk 214.01/30ml, Tk. 75/10ml

Oxynil (*Techno*), Inj. 25% & Inj. z34%, Tk 225/100ml, Tk 80/10ml, Tk 350/50 ml
Nitrox-A *(ACME),* Inj. 34%, Tk 202/100ml

Oxyclozanide

Description: Oxyclozanide is a salicylanilide anthelmintic. It is used in the treatment and control of fascioliasis in ruminant's mainly domestic animals such as cattle, sheep, and goats. It mainly acts by uncoupling of oxidative phosphorylation in flukes.

Mode of Action: The molecular mode of action of salicylanilide, including oxyclozanide, is not completely elucidated. They all are **uncouplers of the oxidative phosphorylation** in the cell mitochondria, which disturbs the production of ATP, the cellular "fuel". This seems to occur through suppression of the activity of succinate dehydrogenase and fumarate reductase, two enzymes involved in this process. This impairs the parasites motility and probably other processes as well.

Indications: Oxyclozanide is effective against adult liver flukes as well as against immature stages in the tissues (older than 10 weeks). Efficacy against rumen flukes (*Paramphistomum*spp) is limited. It has also a dose-dependent effect on larvae of cattle grubs (*Hypoderma*spp) and sheep nasal bot flies (*Oestrusovis*). It has no efficacy whatever against roundworms and heads or not-gravid segments of tapeworms. As most other salicylanilidesoxyclozanide has a certain residual effect, i.e. it not only kills the parasites present in the host at the time of treatment, but also protects against re-infestation for a period of time (up to several weeks) that depends on the dose and the specific parasite.

Dosage & Administration:

Cattle: Fasciola-10-15 mg/ kg of body weight; Paramphistomum-15 mg/kg of body weight; Moniezia-10 mg/ kg of body weight.

Sheep: Fasciola-10-15 mg/ kg of body weight; Paramphistomum-15mg/ kg of body weight.

Contraindication: Administration to animals with an impaired hepatic function. Concurrent administration of Pyrantel, Morantel or organo-phosphates.

Side effect: Overdosages can cause excitation, lacrimation, sweating, excessive salivation, coughing, hyperpnoea, vomiting, colic and spasms.

Uses in pregnancy & Lactation: Not established

Withdrawal period: Meat: 28 days & Milk: 4 days

Proprietary Preperations
Oxyconide Bolus Vet (*Bridge*), Bol. 1 gm, Tk 8/bol
Tremacid (*Renata*), Bol. 1gm, Tk. 8.79/Bolus
Oxyclozid (Vet) (*Albion*), Bol. 1gm, Tk 8/bol
Oxicide (Vet) (*Super power*), Bol. 1gm, Tk 8.75/bol

Oxyclozanide + Teramisole

Description: This combination is anthelmintic. It is used in the treatment and control of fascioliasis in ruminant's mainly domestic animals such as cattle, sheep, and goats. It mainly acts by uncoupling of oxidative phosphorylation in flukes.

Mode of Action: The molecular mode of action of salicylanilide, including oxyclozanide, is not completely elucidated. They all are uncouplers of the oxidative phosphorylation in the cell mitochondria, which disturbs the production of ATP, the cellular "fuel". This seems to occur through suppression of the activity of succinate dehydrogenase and fumarate reductase, two enzymes involved in this process. This impairs the parasites motility and probably other processes as well.

Indications: Oxyclozanideand Teramisole combination is indicated for the eradication of Paramphistomiasis (Rumen fluke) and also indicated for the *fasciolagigantica* (liver fluke), Round worm, lung worm etc.

Dosage & administration: 1 bolus / 100-150 kg body weight.

Contraindication: Administration to animals with an impaired hepatic function. Concurrent administration of Pyrantel, Morantel or organo-phosphates.

Side effect: Over dosages can cause excitation, lachrymation, sweating, excessive salivation, coughing, hyperpnoea, vomiting, colic and spasms.

Withdrawal period: Meat: 28 days & Milk: 4 days

Uses in pregnancy & Lactation: Not established

Proprietary Preperations

(Oxyclozanide + Tetramisole Hydrochloride; 1.4 gm + 2 gm)

Adminide (*Advent*), Bol. 3.4gm, TK.
Albinid Vet (*Albion),* Bol. 3.4gm, TK.20.25/bol
Tclovet Vet (*Bengal),* Bol. 3.4gm, TK.20.25/bol
O-Tvet *(Bridge),* Bol. 3.4gm,
Trox (*Chemist*), Bol. 3.4gm, Tk. 21/ bolus
Oxynid (*Ethical*), Bol. 3.4gm
Tozan Vet (*Square*), Bol. 3.4gm
Levanid (*ACME*), Bol. 3.4gm, TK.21/bol

Closantel

Description: Closantel is a synthetic anti parasitic agent which is highly effective against liver fluke, blood sucking nematodes and larval stages of some arthropods in Sheep, Goat and Cattle.

Mode of action: Closantel decouples the mitochondrial oxidative phosphorylation, which leads to the inhibition of ATP synthesis. That causes a significant change in the energy metabolism and as a consequence the death of the parasite.

Indications: Trematode- *Fasciola gigantic*&*Paramphistomumspp*

Nematode- *Haemonchusconcortus***,** *Haemonchusplacei***,** *Bunostomumphlebotomum***,** *Oesophagostomumradiatum***,** *Strongyloidespapillosus*&*Chabertiaovina*

Arthropod- Hypoderma*bovis* & *Oestrusovis*

Contraindications: Animal with history of hypersensitivity is contraindicated to use of Closantel and Levamisole.

Side effects: Hypersensitivity reaction may occur in animals but over dose can cause Blindness, anorexia, lack of coordination and general weakness.

Use in Pregnancy & Lactation: Do not use in animals at third trimester of pregnancy.

Dosage & administration

Cattle & Sheep: Closantel- 2.5 to 5 mg/kg body weight.

Levamisole: 7.5mg/kg body weight.

Withdrawal period: Meat: 28 days

Proprietary Preperations

Closantel & Levamisole Combination (75 mg + 100 mg/100 ml)
Clomisole *(Bridge),* Inj. 100ml,
Levasan *(Techno),* Inj. 100ml,

Chapter 3

3. ANALGESICS/ANTIPYRETICS

Analgesic drugs are used for the relief of pain. They have many indications, ranging from their use in first aid situations to the relief of severe visceral pain. Analgesics are also used routinely as part of the pre-operative medication and, combined with a sedative drug, provide analgesia for minor surgery. During recent years there has been a greater understanding and appreciation of pain perception in animals. Alongside this development there has been an increase in the number and variety of analgesic drugs available to the veterinary profession. There is now little excuse for any animal to suffer pain during and after veterinary procedures. Even routine surgery such as ovariohysterectomy results in a degree of post-operative pain that can be prevented by the use of appropriate analgesic drugs. The opioid analgesics are the most potent drugs for the control of pain. The NSAIDs also have analgesic activity. Although this property of NSAIDs is largely through their anti-inflammatory action, recent studies have shown that they also act at the spinal level. NSAIDs are widely used preoperatively.

Paracetamol

Description: The mechanism of action of paracetamol is not completely understood. Unlike NSAIDs such as aspirin, paracetamol does not appear to inhibit the function of any cyclooxygenase (COX) enzyme outside the central nervous system, and this appears to be the reason why it is not useful as an anti-inflammatory.It does appear to selectively inhibit COX activities in the brain, which may contribute to its ability to treat fever and pain. This activity does not appear to be direct inhibition by blocking an active site, but rather by reducing COX, which must be oxidized in order to function.

Paracetamol apparently might modulate the endogenous cannabinoid system in the brain through its metabolite, which appears to inhibit the reuptake of the endogenous cannabinoid/ vanilloid anandamide by neurons, making it more available to reduce pain.

Indication: Recovery from fever, pain (headache, earache, body ache, neuralgia, pain due to intestinal inflammation, rheumatoid fever, post vaccination pain, post-delivery pain, Post-operative pain) and tissue swollen resulting from trauma, injury, burn or any other infectious diseases of both Animal & Poultry.

Contraindication: Do not use paracetamol in cats as they lack glucuronyl transferase enzymes required to metabolize it and may therefore develop hepatotoxicity.

Side effects: Development of hepatotoxicity, Nephrotoxicity &Nausia.

Precautions: Treatment course should not exceed 5 days. Cautions with use in animals less than 6 weeks of age, or aged animals; avoid use in dehydrated, hypovolaemic, or hypotensive patients; avoid concurrent administration of potentially nephrotoxic drugs.

Doses & Administration:

Animal: 1 bolus / 130-140 kg body weight (15 mg/kg body weight), 3 times daily.
Poultry: 1 bolus should be mixed with 10 litre drinking water & administered 2 - 3 times daily.
Or as directed by the registered Veterinary physician.

Withdrawal periods: Should not be used in animals intended for human consumption.

ProprietaryProprietary Preperationss

Aspirin

(Acetylsalicylic acid)

Because of its potent anti-inflammatory effect, it may also be used in many inflammatory diseases e.g. rheumatic fever, Aspirin causes significant gastricirritation. Its use (in low dose) is now more and more restricted to its antiplatelet action. Dispersible aspirin tablets are adequate for most purposes as they act rapidly and are less irritant for the stomach.

Indications: Mild to moderate pain, pyrexia, inflammatory condition; used as an antiplatelet drug

Cautions: Asthma, peptic ulcer, gastric hyperacidity, renal and hepatic impairment, allergic conditions and pregnancy

Contra indications: Breast-feeding pet, milking animals are not to be given aspirin because it may cause Reye's syndrome; active peptic ulcer, haemophilia, known hypersensitivity to NSAIDs

Side effects: Gastric irritation, nausea, vomiting, gastro-intestinal bleeding, bronchospasm and precipitation of bronchial asthma, hypersensitivity

Dose: As ananalgesic antipyretic anti-inflammatory 300- 900 mg every 4-6 hours when necessary; maximum 4 g

Daily for pet animal, For antiplatelet activity, 75-300mg daily.

Proprietary Preperations

Acetylsalicylic Acid + Ascorbic Acid
Maxcool Powder (Vet) *(Bridge*), Oral Powder, 60 gm + 6.65 gm/100 gm,
Gspirin (*Guardian*), Oral Powder, 60 gm + 6.65 gm/100 gm, Tk. 45.13, Tk. 100.30, Tk 210.63, Tk 25.08
Renaspirin (*Renata*), Oral Powder, 60 gm + 6.65 gm, Tk.45/10g, Tk 385/100g
Acerbullin (*Super Power*), Oral Powder, 60 gm + 6.65 gm/100 gm, Tk. 1000.00, Tk. 1800.00
Salic Plus Powder (*Adova*), Oral Powder, 60 gm + 6.65 gm/100 gm, Tk. 40.00
SummerCool Powder (Vet) (*Al-Madina*), Oral Powder, 6.7 gm + 20 gm/100 gm,

Meloxicam

Description: Meloxicam is a non-steroidal anti-inflammatory drug (NSAID) of the oxicam family. It acts by inhibiting prostaglandin synthesis, thereby exerting anti-inflammatory, anti-exudative, analgesic and antipyretic properties. Meloxicam has anti-endotoxic properties too.

Indication: Inflammation, pain, fever, lameness, dehorning & castration. It is also used as supportive therapy in acute respiratory infection, diarrhea, acute mastitis etc.

ContraIndications: Previous sensitivity, Dehydration, Stomach/intestinal issues, Kidney disease, Liver disease, Bleeding disorders, Pregnant or lactating animals.

Side Effects: The most common side effects reported are related to gastrointestinal issues. Like, Decreased appetite, Vomiting, Diarrhea, Dark, tarry, or bloody stools. Itching, Increased thirst and urination, Pale or yellow gums, Elevated kidney and/or liver values, Lethargy, Incoordination, Behavior changes, Seizures

Precautions: Avoid use in pregnant or lactating animals, or those with existing kidney or liver disease. Use with caution in cats.

Dosage & administration:

Mel-Vet Injection

Cattle: 1 ml/10 kg body weight (0.5 mg/kg) SC/IV/IM as a single dose.

Dog: 1 ml/25 kg body weight (0.2 mg/kg) SC as a single dose.

Mel-Vet 2% Injection

Cattle: 1 ml/40 kg body weight (0.5 mg/kg) SC/IV/IM as a single dose.

Dog: 0.2 ml/20 kg body weight (0.2 mg/kg) SC as a single dose.

Mel-Vet Bolus

Cattle: 1 bolus/100 kg body weight (1 mg/kg) orally single dose.

Dog: 0.2 mg/kg body weight orally single dose for 1 day followed by 0.1 mg/kg from 2nd day.

Or as directed by the Veterinary Physician.

ProprietaryProprietary Preperationss:

Molaxivet Bolus (*Adova)*, Bolus 100 mg, Tk 0.0/bol,
M-Pain Vet *(ACI),* Bolus, 100 mg, Tk 6.01 Tk/bol,
M-Pain Vet *(ACI),* Injection, Tk 35.11 /10ml,
Mexicam Bolus (Vet) *(Al-Madina),* bol,100 mg, Tk. 6.00/bol,
Meloxicam Vet *(Albion)* Bol, 100 mg, Tk. 6.00/bol.,
MP vet Bolus *(Chemist),* bol. 100 mg,
Meximol (Vet) *(Ethical*), bol, 100 mg, Tk.000/bol,

Melgard (*Guardian),* bol, 100 mg, Tk.10.03/bol,
Kemel Vet *(Kemiko),* bol., 100 mg, Tk.6.02/bol,
Relpain Vet Bolus (*Navana*) bol, 100 mg, Tk 6.00/bol,
Relpain Vet *(Navana),* Injection, 200 mg/10 ml, Tk 85.00/vial,
Loxikam (*Opsonin*), bol, 100 mg, Tk 6.02/bol,
Loxikam (*Opsonin*), Injection, 50 mg/10 ml, Tk 35.11/5ml, Tk 95.29/10ml,
Camlox Vet (*Popular*), Injection, 50 mg/10 ml,
Camlox Vet (*Popular*), Injection, 150 mg/30 ml,
Camlox Vet Bolus (*Popular*), bol., 100 mg, Tk 6.00/bol**,**
Melocam (Vet) (*Renata)*, Injection, 50 mg/10 ml, Tk. 60/10ml,
Melocam (Vet) (*Renata*), Bolus, 100 mg, TK6.00/bol,
Meloshin (*Shinil)*, Injection,50 mg/10 ml, Tk35.00,
Jilocam (Vet) (*Super Power*), Bolus, 100 mg,
Melovet (*Techno),* Injection, 50 mg/10 ml, Tk 60.00/vial,
Melovet Bolus (Vet) (*Techno*), bol, 100 mg, Tk 6.00/bol,
Melovet 2% Inj (Vet) (*Techno*), Injection, 200 mg/10 ml, Tk85.00/vial,
Melovet 2% (*Techno*), Injection, 600 mg/30 ml, Tk. 250.00/vial,
Mel-Vet (*ACME),* Injection, 50 mg/10 ml, Tk. 45.00/vial,
Met-Vet (*ACME),* Bolus, 100 mg, Tk. 6.01/bol,
Mel-Vet 30 (*ACME*), Injection, 150 mg/30 ml, Tk. 95.29/vial,
Mel-Vet 2% *(ACME),* Injection, 200 mg/10 ml, Tk. 85.00/5ml, Tk. 250.00/10ml,
Mel-Vet 2% (*ACME*), Injection, Tk. 600 mg/30 ml,
(Note: Meloxicam + Paracetamol; 20 mg + 150 mg/ml**)**
Action-3 Vet *(Incepta),* inj., Tk.95.00/10 ml,
M P (Vet) *(Chemist),* inj., Tk. 100/ 10 ml**,**
Meximol Vet (*Ethical*), inj.,
Relpain Plus Vet (*Navana),* Bolus, 100 mg + 1500 mg/bol, Tk. 8/bol,
Loxikam Plus (*Opsonin)*, inj., Tk 95.2/10ml,
Meloshin Plus (*Shinil),* Inj., 200 mg + 1.5 gm/10 ml, Tk 95.2/10ml,
Meloshin Plus vet (*Shinil),* Bolus, 100 mg + 1500 mg/bol, Tk. 8/bol,
Mel-Vet Plus *(ACME),* Inj., 200 mg + 1.5 gm/10 ml, Tk 95.25/10ml; 100 mg + 1500 mg/bol, Tk. 8/bol,

Flunixin Meglumine

Description: Flunixin meglumine is a nonsteroidal anti-inflammatory drug (NSAID) and cyclooxygenase inhibitor. It is a potent analgesic, antipyretic, and anti-inflammatory. NSAIDs work by inhibiting the body's production of prostaglandins and other chemicals that stimulate the body's inflammatory response. Some of these actions may be dose-dependent. NSAIDs are quickly absorbed into the blood stream; pain relief and fever reduction usually start within one to two hours.

Indications: Flunixin is mainly used for colic pain, musculoskeletal pain, and ocular pain. It is also used as an antipyretic and to reduce the effects of endotoxemiamainly in horses.

ContraIndication: *Horse: There are no known contraindications to this drug when used as directed. Intra-arterial injection should be avoided. Horses inadvertently injected intra-arterially can show adverse reactions. Signs can be ataxia, incoordination, hyperventilation, hysteria, and muscle weakness. Signs are transient and disappear without antidotal medication within a few minutes. Do not use in horses showing hypersensitivity to flunixin meglumine.*

Cattle: *There are no known contraindications to this drug in cattle when used as directed. Do not use in animals showing hypersensitivity to flunixinmeglumine. Use judiciously when renal impairment or gastric ulceration are suspected.*

Side *Effects*: *The most-common side effects include GI ulceration, especially of the stomach and large colon. Rare side effects include kidney damage and bleeding disorders. Allergic reactions are rare but have been reported.*

Proprietary Preperations:

Fixin Vet (*ACI*), Inj, 500 mg/10 ml, Tk. 200.00/vial,
Fixin Vet (*ACI*), Inj, 1.25 gm/25 ml, TK 450.00/vial,
Flunixin (Vet) (*Bengal*), inj., 500 mg/10 ml, Tk. 100.00/10ml, Tk. 195.00/20ml, Tk. 500.00/50ml,
Pif R (Vet) (*Eskayef*), inj., 500 mg/10 ml, Tk. 200/10 ml, Tk. 500/30 ml,
Meglunix Vet (*Popular*), inj., 5 gm/100 ml, Tk. 200.00/vial, Tk 500.00/100ml,
Flumixine Vet (*Renata*), inj., 500 mg/10 ml, Tk. 200/10ml,
Flumixine-100 (Vet) (*Renata*), inj., 5 gm/100 ml,
Shiflu Inj (Vet) (*Shinil*), inj., 500 mg/10 ml, Tk. 200.00/vial,

FM (Vet) (*Techno*), inj., 500 mg/10 ml, Tk. 200.00/Vial,
Lega vet (*ACME*), Inj., 5 gm/100 ml, Tk. 1700.00/vial,
Lega Vet 1.5 G (*ACME*), Inj, 1.5 gm/30 ml, Tk. 500.00/vial,
Lega Vet 0.5 g (*ACME*), Inj., 500 mg/10 ml, Tk. 200.00/vial,

Tolfenamic Acid

Description: Tolfenamic acid is a non-steroidal anti-inflammatory of the fenamate family. It possesses anti-inflammatory, analgesic and antipyretic properties. The anti-inflammatory activity is mainly related to an inhibition of cyclo-oxygenase leading to a reduction of prostaglandin and thromboxanes synthesis, important inflammatory mediators. In the dog, Tolfenamic acid is rapidly absorbed. Tolfenamic acid is distributed in all organs with a high plasma concentration, digestive tract, liver, lungs and kidneys. However, the concentration in brain is weak. The molecule and its metabolites cross little the placental wall. Tolfenamic acid is eliminated mainly in unchanged form and in weak part in the form of non-active metabolites. In the dog renal insufficiency, elimination of Tolfenamic acid is not altered.

Indication: An ant-inflammatory, antipyretic & analgesic agent indicated. Cattle: As an aid in the acute inflammation associated with respiratory diseases and as an adjunct to the treatment of acute mastaitis.

Sidde effects: Diarrhea and vomiting may be encountered in rare cases during treatment. A temporary increase in thirst and/or in diuresis may ocur. In most of cases, these signs disappear spontaneously when treatment is stopped.

Precautions:

- Do not administer to animals which have a hypersensitiveness to this product.
- Do not use another NSAIDs simultaneously or within 24 hours.
- It is highly bound to plasma proteins & may compete with other highly bound drugs.
- Not more than 20ml inject; i/m
- Shake the product well before use it.
- Directions by registered Veterinarian.

Dosage & administration:

Cattle: Respiratory diseases; 1ml/20kg by i/m route (Additionally treated with same dosage at 48 hours interval according to symptom)

Mastaitis: 1ml/10kg; s/c route.

Withdrawal Period: Cattle:14 days; pigs: 14days.

Proprietary Preperations

Set 101 (*Incepta*), inj.,4 gm/100 ml l, Tk 102.00/vial,
F-Nil (Vet) (*ACI*), inj., 400 mg/10 ml, Tk.100/vial,
F-Nil (Vet) (*ACI*), Inj.,1 gm/25 ml, Tk.230/vial,
Fenacid Injection (Vet) (*Bridge*), inj., 4 gm/100 ml,
CHEMOFEN (*Chemist)*, inj., 4 gm/100 ml, Tk 100/ 10 ml vial, Tk. 284/ 30 ml vial
Fevenil (Vet) (*Renata*), inj., 4 gm/100 ml, Tk 102.00/10ml vial, Tk 284.00/100ml
Shifen Inj (Vet) *(Shinil),* inj., 400 mg/10 ml, Tk 102.00/10ml vial
Tofenac Vet *(Square)* , inj., 4 gm/100 ml, Tk 102.00/10ml vial, Tk. 284.00/30 ml vial
Tamic Vet (*ACME*), inj., 400 mg/10 ml,
Tamic Vet (*ACME*), inj., 1.2 gm/30 ml,
Tufnil Vet *(Eskayef)*, Inj, 400 mg/10 ml, Tk. 102.00/10 ml, Tk. 284.00/30 ml,

Ketoprofen

Description: ketoprofen Injection is a potent, non-narcotic, non-steroidal anti-inflammatory drug (NSAID) with analgesic, anti-pyretic and anti-inflammatory properties.

Indication: Arthritis, Musculoskeletal injuries, Fever, Acute clinical mastaitis, Pain, Mild to moderate colic.

Contraindications: Do not administer to horses, cattle or pigs that have previously shown a hypersensitivity to ketoprofen. Do not administer other non-steroidal anti-inflammatory drugs (NSAIDs) concurrently or within 24 hours of each other. Use is contraindicated in animals suffering from cardiac, hepatic or renal disease, where there is the possibility of gastro-intestinal ulceration or bleeding, where there is

evidence of a blood dyscrasia or hypersensitivity to the product.

Side Effects: Avoid use in any dehydrated, hypovolaemic or hypotensive animals as there is a potential risk of increased renal toxicity.

Precautions: Precautions for use in animals Avoid intra-arterial injection. Do not exceed the stated dose or duration of treatment. Special precautions to be taken by the person administering the medicinal product to the animals. In case of accidental self-injection seek medical advice. Wash hands after use. Avoid splashes on the skin and eyes. Irrigate thoroughly with water should this occur. If irritation persists, seek medical advice.

Dose: Horse: For use in musculoskeletal conditions, the recommended dosage is 2.2mg ketoprofen/kg i.e. 1ml of KETOFEN 10%/45kg bodyweight, administered by intravenous injection once daily for up to 3 to 5 days. For use in equine colic, the recommended dosage is 2.2mg/kg (1ml/45kg) bodyweight, given by intravenous injection for immediate effect. A second injection may be given if colic recurs.

Cattle: The recommended dose is 3mg ketoprofen/kg bodyweight, i.e. 1ml of KETOFEN 10%/33kg bodyweight, administered by intravenous or deep intramuscular injection once daily for up to 3 days.

Withdrawal periods:

Horses–1 day

Cattle–following intravenous administration: 1 day

– following intramuscular administration: 4 days

There is no withholding period necessary for the milk of treated cattle.

Proprietary Preperations:

Carprofen *(Eskayef),* Bolus, oral, 500 mg

Description: Carprofen is a non-narcotic, non-steroidal anti-inflammatory drug of the 2-arylpropionic acid group. It is used as anti-inflammatory, analgesic and antipyretic drug.

Indication: Carprofen is indicated for rapid relief of Pain, Inflammation & Fever in the following conditions: Bovine Respiratory Disease, Osteoarthritis, Mastitis, Metritis, Soft tissue surgical pain, Post-operative pain, Lameness.

Contraindications: Do not use in animals showing hypersensitivity to Carprofen.

Side Effects: There are relatively few side effects assorted with Carprofen. The most common side effects are diarrhea, vomiting & loss of appetite.

Precautions: none

Dose:

Cattle, Buffalo:

1 bolus/ 350 Kg body weight once daily

1/2 bolus/ 175 Kg body weight once daily, Or, 1.4 mg/Kg body weight once daily

Horse: 0.7 mg/Kg body weight once daily

Dogs: 2-4 mg/Kg body weight once daily

Birds: 2 mg/ Kg body weight once daily

Reptiles: 1-4 mg/ Kg body weight once daily, Or, as per direction of registered Veterinarian/Consultant.

Withdrawal periods: Milk – Zero (0) day; Meat – 21 days

Proprietary Preperations:

PK5 Vet *(Eskayef)*, Bolus, 100mg, Tk. 23/Bolus, 500mg, Tk. 90/Bolus

Chapter 4

4. CORTICOSTEROIDS

Corticosteroid**:** A class of steroids (aldosterone, cortisone & hydrocortisone) related to steroids naturally synthesized by the adrenal cortex. Includes both glucocorticoids (e.g. cortisol, prednisone) & mineralocorticoids (e.g. aldosterone) that have selectivities for different intracellular receptors affecting gene transcription.

Note: "*Corticosteroid*" & "*glucocorticoid*" are commonly used interchangeably as synonyms**,** although to be completely accurate, corticosteroids (by definition) also include mineralocorticoids.

Dexamethasone

Descriptions: Dexamethasone is a synthetic corticosteroid with approximately 25 times the anti-inflammatory potency of naturally occurring cortisol. ***Dexamethasone*** commonly is used in both small- and large-animal ***veterinary medicine***. It may be given by injection, inhalation, orally, or topically.www

Indications: Dogs and Cats- Anaphylactic reactions, spinal cord trauma, or shock, immune-mediated hemolytic anemia or thrombocytopenia; some cancers; allergic reactions such as asthma, hives, and itching; inflammatory diseases and some neurologic diseases, a variety of skin and eye problems. Horses-High doses in emergencies for anaphylactic reactions, spinal cord trauma, or shock. Chronic Obstructive Pulmonary Disease (COPD), hives, itching, inflammatory diseases including arthritis, and to manage and treat immune-mediated hemolytic anemia, and thrombocytopenia. It sometimes is used systemically as a "performance-enhancing" drug because corticosteroids decrease inflammation, possibly enhance glucose metabolism.

Contraindications: 1) Pregnancy and lactation unless the benefits outweigh the risks. 2) Except for emergency therapy, do not use in animals with chronic nephritis and hyper-corticalism (Cushing's Syndrome). Existence of congestive heart failure, diabetes, and osteoporosis are relative contraindications. Do not use in viral infections during the viremic stage

Side Effects: Immune suppression, GI Ulcer, Laminities in horse, abortion, teratogenic effect; weight loss, anorexia, polydipsia, and polyuria in dogs. Vomiting and diarrhea (occasionally bloody) in cats and dogs.

Precautions: Chronic or inappropriate use of corticosteroids including dexamethasone can cause life-threatening hormonal and metabolic changes. Animals that have received long-term therapy should be withdrawn slowly by tapering the dosage and prolonging the interval between doses. Corticosteroids should be avoided or used very carefully in young animals both because of immune suppression and the risk of GI ulcers.

Doses: Bovine: Dexamethasone: 5 - 20 mg intravenously or intramuscularly. Equine: Dexamethasone: 2.5 - 5 mg intravenously or intramuscularly.

Proprietary Preperations:

Dexason-Vet (*Albion*), Bolus, 10 mg, Tk 4.38/bol,
Remedex (Vet) (*Bengal*) Injection, 2 mg/ml, TK 290.00/vial,
Vetodex *(Opsonin)*, Bolus, 10 mg, Tk. 5.03/bol,
Vetodex *(Opsonin)*, Bolus,20 mg, Tk.8.06/bol,
Orbidex Vet *(Popular)*, Bolus, 10 mg,
Dexavet *(Techno)*, Inj., 2 mg/ml, Tk.150.57/10ml, Tk, 32.12/5ml,
Steron Vet *(ACME)*, Bolus, 10 mg, Tk 5.01/bol,
Steron Vet *(ACME)*, Inj, 60 mg/30 ml, Tk 85.00/vial,
Dexason *(Vet) (Albion)*, Inj., 2 mg/ml, Tk. 31.00/ml, Tk 84.00/10ml, Tk 280.00/100ml,
Dexaphos *(Chemist)*, Inj., 2 mg/ml, Tk. 35/ 10 ml, Tk. 176/ 50 ml,
Dexaroid Vet *(Eskayef)*, Inj., 2 mg/ml, Tk. 35.00/10 ml vial, Tk. 100.00/30 ml vial, Tk. 300.00/100 ml vial,
Methavet *(Ethical)*, Inj., 2 mg/ml,
Stedex Vet *(Navana)*, Inj., 2 mg/ml,
Vetodex *(Opsonin)*, Inj., 2 mg/ml, TK.32.22/vial,
Dexaren *(Vet) (Renata)*, inj., 2 mg/ml, Tk. 35.00/10ml, Tk 160.00/50ml, 10mg/Bolus, Tk.5/Bolus,
Dexavet Inj. *(Vet) (Techno)*, Inj., 2 mg/ml, Tk.150.57/50ml, Tk. 35/10ml
Steron Vet-10 *(ACME)*, Inj., 2 mg/ml, Tk. 32.10/vial,

Prednisolone

Description: Prednisolone is a synthetic corticosteroid with approximately four times the anti-inflammatory potency of hydrocortisone.

Indications: Dogs and Cats-Emergencies for anaphylactic reactions, spinal cord trauma, endotoxemic or septic shock. It also is used to manage and treat diseases of practically every organ system in the dog and cat, some autoimmune diseases, some reproductive disorders, some toxicosis, and some neoplastic conditions. Horses-emergencies for anaphylactic reactions, spinal-cord trauma or shock, allergic reactions such as Chronic Obstructive Pulmonary Disease, hives, itching, inflammatory diseases, immune-mediated hemolytic anemia and thrombocytopenia.

Contraindications: Same as Dexamethasone

Precautions: Same as Dexamethasone

Side Effects: Same as Dexamethasone

Doses: Dogs: 0.5-1.0 mg/kg. Cats: 1-2 mg/kg

Proprietary Preperations:

Prednivet *(Techno)*, inj., 7.5 mg/ml, Tk. 200.00/vial
P20 Vet (*Renata*), Inj. 10mg/ml, Tk. 150/10ml, Tk. 600/50ml

Chapter 5

5. ANTIHISTAMINICS

Antihistamines are antagonists of the histamine H1receptor and include chlorphenamine, diphenhydramine, promethazine and H2 receptor antagonists are ineffective. Antihistamines diminish or abolish the main actions of histamine in the body by competitive, reversible blockade of histamine receptor sites. Histamine is only one of many autacoids involved in hypersensitivity reactions and so antihistamines have limited use in the treatment of allergic disorders in animals. The effects of antihistamines may not be observed for 1 to 2 weeks and they are most effective for preventing rather than for rapidly reducing pruritus. Some authorities indicate initial use of glucocorticoids in conjunction with antihistamines. Glucocorticoid therapy is stopped when pruritus is eliminated; antihistamine treatment is continued. Systemic antihistamines may be used to control pruritus in allergic reactions such as urticaria and allergic skin problems including food allergies. It is generally accepted that about 10% to 15% of dogs are likely to respond to treatment with H1 receptor antagonists but there is considerable individual variation between dogs and it is not possible to predict which antihistamine will be effective in any particular dog. Orally administered antihistamines reported to be effective include chlorphenamine and diphenhydramine. In cats, efficacy has been reported with chlorphenamine. Antihistamines are frequently sedative. CombinationProprietary Preperations of antihistamines and corticosteroids are available in some countries.

Pheniramine Maleate

Description: Theraupetic group H-1 Blocker Alkylamine derivative. Each ml contains 10mg mg chlorpheniramine maleate, and each tablet contains 8mg chlorpheniramine maleate.

Indication/uses: Itching, eczema, dermatitis, insect bite, tail eczema in horses, inflammation of the hooves in cattle, anaphylactic shock, toxemia, pulmonary emphysema in cattle and horses, laminitis, & bloat in cattle.

Contraindications: Contraindicated in Pregnant animals due to its teratogenic effects.

Side effects: Sedation, CNS excitement, Gastrointestinal disturbances.

Precautions: Store in cool dark place. Do not freeze

Dosage and administration: I/M or I/V route. Repeat after 8 - 12 hours if necessary. Cattle: 30-50 mg Total dose. Dog: 0.4 -2 mg/kg B.W BID. injection is administered by IM & IV route. Onset of action is quick following IV administration and acts within 10-20 minutes after IM administration. The drug can be administered 2-3 times daily, depending on the severity of the disease. Cattle, Buffalo & Horse: 5-10 ml per day. Goat & Sheep: 0.5-1 ml per day. Or as directed by the registered veterinary physician.

Proprietary Preperations

Hista-Vet (*Advanced*), Inj.,22.75 mg/ml,
AD-Hista Vet (*Advent*), Inj., 22.75 mg/ml,
Alhista Vet (*Al-Madina),* Inj., 22.75 mg/ml, Tk. 15.05/ml, Tk 120.37/10ml,
Histanol (*Chemist),* Inj., 22.75 mg/ml, Tk. 16/ 10 ml, Tk. 105/ 100 ml,
Phenavet (*Eon),* Inj., 22.75 mg/ml,
Alerin Vet (*Eskayef*), Inj., 22.75 mg/ml, Tk. 15.00/10ml vial, Tk 40.00/30ml vial, Tk. 110.00/100 ml vial,
Phenvet (*FnF*), Inj., 22.75 mg/ml, TK100.00/vial,
Histagard (*Guardian*), Inj., 22.75 mg/ml, 15.05/ml, Tk 85.26/10ml,
Phenira (vet) (*Navana)*, Inj., 22.75 mg/ml, Tk..15.05/10ml; Tk. 119.35/100ml,
Niravet (*Opsonin*), Inj., 22.75 mg/ml, Tk. 9.60/ml, Tk. 45.56/5ml, Tk. 80.84/10ml,
Alarvet (*Popular*), Inj., 22.75 mg/ml, Tk. 80.30/vial,
Anthista Vet (*Square*) 22.75 mg/ml, Tk. 15/10 ml, Tk. 120/100 ml,
Asta (*ACME*), Inj., 22.75 mg/ml, Tk. 104.37/vial,

Promethazine Hydrochloride:

Description: A histamine H1 antagonist used in allergic reactions, hay fever,

rhinitis, urticaria, and asthma. It has also been used in veterinary applications. One of the most widely used of the classical antihistaminics, it generally causes less drowsiness and sedation than promethazine.

Indication: Eczema, dermatitis, urticaria, skin edema, insect bites, photodermatitis, rhinitis, tail eczema in horses, stomatitis, toxic hoof horns and inammation of the hooves of cattle, serum shock, paresis during pregnancy, puerperal toxemia, pulmonary edema in cattle, pulmonary emphysema in horses, toxic hypopepsia.

Side effects: Sedation, CNS excitement, Gastrointestinal disturbances.

Dose: Cattle, Horse, Sheep, Goat & Pig: 0.4-0.5 mg/kg body weight or 4-5 mL/100 kg body weight once daily for 3-5 days. Cats & Dog: 0.5 mg/kg body weight or 0.5mL/10 kg body weight every 24 hours for 3-5 days. The dosage should be adjusted individually. If possible, small doses are given because it has often been shown that anti-allergic drugs are effective in comparatively small doses. May be administered intramuscularly or intravenously.

Proprietary Preperations

Thazine Bolus Vet (*Adova*), Bolus, 150 mg, Tk. 3.34/bol,
Prozin Vet (*Advanced*), Bolus, 150 mg, Tk. 3.32/bol,
Adprozin (*Advent*), Bolus, 150 mg,
Promethazine (*Al-Madina*), Bolus, 150 mg, Tk 3.34/bol,
Prom-Al Vet (*Albion*), Bolus, 150 mg, Tk. 3.32/bol,
Promodin (*Chemist*), Inj., 50 mg/2 ml,
Promevet (*FnF*), Bolus, 150 mg,
Promevet (*FnF*), Inj., 50 mg/2 ml,
Promigen Vet (*Gentry*), Bolus, 150 mg, Tk. 3.30/bol,
Promin (*Globe*), Inj., 50 mg/2 ml,
Promin Bolus Vet *(Globe),* Bolus, 150 mg, Tk. 3.30/bol,
Promigard (*Guardian*), Bolus,150 mg, Tk. 3.25/bol,
Promazin (Vet) (*Kemiko*), Bolus, 150 mg, Tk. 3.31/bol,
Prozimed (*MedRx)*, Bolus, 150 mg, Tk. 3.33/bol,
Prometha vet (*Newtec*), Bolus, 150 mg,
Prohista (*Opsonin*), Bolus,150 mg,
Quickler Vet (*Popular*), Bolus,150 mg, Tk. 2.17/bol,
Dellergen (*Renata*), Injection, 500 mg/10 ml, 15.40/10ml,
Dellergen (*Renata*), Bolus, 150 mg, Tk. 3.32/bol,
Shillergen (*Shinil*), Bolus,150 mg, Tk. 3.34/bol,
SP-Zin (Vet) (*Super*), Bolus, 150 mg,
Flugan (*Techno)*, Inj., 50 mg/2 ml, Tk. 8.5/5 mL Vial, Tk.15/10 ml vial,

Diphenhydramine

Indications: It is indicated for allergy of diverse origins such as cutaneous allergies, urticarias (hives), angioneurotic edema, relief of coughing, laminitis, anaphylactic shock, allergic reactions to the medicaments, eczema, purities, photosensitization, insects, snack bites etc.

Contraindications: Urine retention, glaucoma, hyperthyroidism.

Side effects: CNS depression; drowsiness

Dosage and administration: For intramuscular or intravenous use only.

Cattle, Buffalo, Horse: 1.25-2.50 per 100 kg body weight.

Sheep, Goat: 1 ml per 40 kg body weight (0.5 mg/kg)

Dog: 0.25 ml per 5 kg body weight

Cat: 0.1 ml per 2 kg body weight

Or *as Directed by Veterinary Physician.*

Proprietary Preperations

Vetphen Bolus (Vet) (*Adova*), Bolus, 500 mg, Tk. 3.50/bol
Phenadryl-30 Vet (*ACME*), Inj., 600 mg/30 ml,
Phenadryl-10 Vet (*ACME)*, Inj., 200 mg/10 ml,

Chlorpheniramine Maleate

Indications: Pruritus in allergic skin disorders, premedication for drugs that may induce an anaphylactic reaction; mild sedation, compulsive scratching.

Contraindications: Contraindicated in Pregnant animals due to its teratogenic effects.

Side effects: Sedation, CNS excitement, Gastrointestinal disturbances.

Dose & Administration: I/M or I/V route. Repeat after 8 - 12 hours if necessary.

Cattle: 30-50 mg Total dose. Dog: 0.4 -2 mg/kg B.W BID.

Proprietary Preperations

CM-Vet (*Globe*), Inj., 10 mg/ml, Tk. 9.43/vila, Tk 87.00/Vial,
Histacin VET (*Jayson*), Inj.,10 mg/ml, Tk. 9.50/vial,
Histacin (*Jayson*), Inj., 10 mg/ml, Tk. 3.35/ml, Tk. 5.48/5ml,
Renacin Inj. Vet (*Renata*), Inj., 10 mg/ml, Tk, 9.47/10ml vial, Tk. 88/100vial,
Fenarvet (*Techno*), Inj., 10 mg/ml, Tk 20.00/vial 10 mL, Tk. 150/100 mL Vial,

Chapter 6

6. EXPECTORENTS

Expectorants increase the volume of secretions in the respiratory tract and therefore assist in removal by ciliary action and coughing. Mucolytic agents such as bromhexine and dembrexine reduce mucus viscosity in the tracheobronchial tree and are often prescribed for chronic bronchitis in dogs, bronchopneumonia in cattle, and chronic coughing in horses. The rationale for their use is that mucus of lower viscosity is more easily carried up the tracheobronchial tree by the mucociliary clearance mechanism and expectorated during coughing. Ambroxol is a metabolite of bromhexine and has similar actions. Acetylcysteine is a mucolytic agent that reduces the viscosity of secretions probably by the splitting of disulfide bonds in mucoproteins. It is also used to detoxify an intermediate paracetamol metabolite that is present in paracetamol over dosage. In small animal's inhalation of water vapor and chest physiotherapy are effective methods of mucus removal.

BROMHEXINE

(Bromhexine Hydrochloride)

Description: Bromhexine reduce mucus viscosity in the tracheobronchial tree and are often prescribed for chronic bronchitis in dogs, bronchopneumonia in cattle, and chronic coughing in horses. The rationale for their use is that mucus of lower viscosity is more easily carried up the tracheobronchial tree by the mucociliary clearance mechanism and expectorated during coughing.

Indications: Bromhexine Hydrochloride is indicated for the treatment of respiratory disorders associated with productive cough in livestock, Poultry, Dogs, Cats & Pigs as supportive therapy. These includes Pneumonia, Bronchopneumonia, Rhinitis & Cough in Cattle, Goat, Sheep, Dogs, Cats & Pigs. Chronic Respiratory Diseases (CRD), Infectious Bronchitis, Laryngotracheitis, Infectious Coryza, Influenza & Infectious sinusitis in Poultry.

Dose & administration: For oral administration only.

Bolus:

Cattle: 0.50 mg/ kg body weight (one bolus for 200 kg body weight) once daily for 5 days.

Horse: 0.20-0.40 mg/ kg body weight (one bolus for 250-500 kg body weight) once daily.

Dogs: 2 mg/ kg body weight (half bolus for 25 kg body weight) twice daily for 5 days.

Cats: 1 mg/ kg body weight once daily for 7 days.

WSP:

Poultry: 1g/ 4-5 liters of drinking water once daily for 5-7 days.

Cattle: 1g/ 20 kg body weight (0.50 mg/ kg body weight) once daily for 5 days.

Dogs: 2g/ 10 kg body weight (2 mg/ kg body weight) twice daily for 5 days.

Cats: 1g/ 10 kg body weight (1 mg/ kg body weight) once daily for 7 days.

Add to feed or drinking water immediately before administration. *Or, as directed by the Veterinary Physician.*

Withdrawal Periods. Cattle: slaughter 1 day, should not be used in cattle producing milk for human consumption.

Proprietary Preperations:

Cold Care Vet (*Eskayef*), Bolus, 100 mg, Tk.10.00/bolus
Responil Vet (*Newtec*), Powder,10 mg/gm,
Mucospel-Vet (*Square*), Powder,10 mg/g, Tk. 98.94/100 gm,
A-Cold Vet (*ACME*), Powder,10 mg/gm, Tk. 98.64/packet,
A-Cold Vet (*ACME),* Bolus, 100 mg,
A-Cold Vet (*ACME),* Oral Solution, 80 mg/100 ml,
Hexiren Tab. *(Renata),* Bolus, Tk. 10/Bolus,
Phenbrosol *(Shinil Pharma Ltd.),* Oral Solution 100ml, 500ml,
(Note: Bromhexine Hydrochloride + Doxycycline + Tylosin Tartrate; 2 gm + 20 gm + 10 gm/100 gm, WSP)

Tylo Doxi Plus (*Advanced*),
AL-TDOX PLUS (*Al-Madina*),
T Dox-B Vet (*MedRx*),
Phenbrox (Vet) (*Bengal*),
Polcough Vet (*Gentry*),
TD Cough (T*echno*), Tk. 230/100 mL, Tk. 1050/500 ml,

AyurvedicAnticough/Expectorent

Description: Herbal Extract & Vitamin.

Indication and uses: Used in cold, nasal discharge, coughing, sneezing & phlegm in lungs for poultry & livestock. It is also used for supportive therapy of infectious coryza, CRD, bronchitis, laryngitis etc in poultry & enhance immunity.

Precautions:

Dose and administration: *Livestock-*

- Large animals: 0.5 ml / kg body weight, twice daily until recovery.

- Small animals: 0.3 ml / kg body weight, twice daily until recovery.

Poultry-

Ingeneral 1 ml/liter of drinking water or

For 100 birds
- Chicks: 2 ml/day for 7 days
- Grower: 5 ml/day for 7 days
- Layer/Broiler Finisher: 7 ml/day for 7 days.

Withdrawal Periods:

Proprietary Preperations

Chapter 7

7. HORMONES

Hormones are certain kind of chemicals that are naturally present in the animal body. They are actually produced in a very small amount in the various hormone-producing organs, but their role is very significant in various body functions, including reproduction as well as the development and growth of various animal body parts.

Basically, hormones are very essential for the proper functioning of the various body organs of animals but imbalance of a single hormone can create a lot of problems. Injection of hormones is very important for the farmers as they help the animals for production. Injecting hormones in cattle is very common in the meat and dairy industry.

So, preventive ways should be taken in order to ensure an animal in a healthy state. Hence, the use of injection hormone should be inspected consistently to prevent from misusing it. Finally, we have to ensure the use of hormonalProprietary Preperations in animals only on the prescription of a registered veterinarian to avoid malpractice

Cloprostenol Sodium/ Prostaglandin (PGF2α)

Generic Name of the drug: Each ml injection contains 250 µg Cloprostenol as 263 µg Cloprostenol sodium.

Description: Cloprostenol sodium is a synthetic reproductive hormone which is analogue to prostaglandin & structurally related to prostaglandin F2α (PGF2α).

Mode of action: Cloprostenol rapidly absorbed through the intramuscular to the plasma and distributed throughout the body. Cloprostenol metabolized through circulation by the effects of enzyme15-hydroxyprostaglandin dehydrogenase and prostaglandin-13 reductase. Cloprostenol sodium causes rapid regression of functional corpora lutea with a resultant rapid decline in progesterone production. Luteolysis is usually followed by ovarian follicular development and a return to estrus with normal ovulation. The precise mechanism of Cloprostenol sodium induced luteolysis is uncertain but may relate to blood flow changes in the utero-ovarian vessels, inhibition of the normal ovarian response to circulating Gonadotropin or stimulations of catalytic enzymes. Cloprostenol sodium also has a direct stimulatory effect on uterine smooth muscle causing contraction and a relaxant effect on cervix.

Indications: Unobserved or undetected estrus. Pyometra or chronic endometritis. Expulsion of mummified fetus. Helps in Ovulation, luteolysis & contraction of uterine smooth muscle. Controlled breeding.

Contraindications: Since Cloprostenol results in an abortion rate of approximately 95% in cattle up to 4.5 months of gestation and causes some cattle in later pregnancy to abort, it should not be given to pregnant animal unless induced abortion is desired.

Side effect: Mild side effects may be detected in some cases. These include increased uneasiness, slight frothing and milk let-down.

Precaution: Do not use in pregnant animal when abortion or induced parturition is not the objective. It should not be administered as intravenous injection. It also should not be administered into a female horse which got the respiratory problem or acute/sub-acute gastrointestinal problems.

Dose: Cattle: intramuscular route 2ml/ animal (Cloprostenol 500 µg) single dose.

Mare: intramuscular route 0.5-1 ml (Cloprostenol 125-250 µg) per 400 kg BW, 2 ml (Cloprostenol 500 µg) more than 400 kg BW single dose. Or as directed by a registered veterinarian.

Withdrawal Period: Not required.

Proprietary Preperations

Ovuprost (*Renata*), Inj. 20 ml: Tk. 1442,
Prostenol (*Techno*), Inj. 250 mcg/ml, 2 ml: Tk. 100/2ml,

Remeprost (Vet) (*Bengal*), Inj., 250 mcg/ml, Tk 72.00/vial,
Estrotech (*Techno*), inj., 250 mcg/ml. Tk. 70/vial,

Oxytocin

Composition: Oxytocin 16.6 µg equivalent to 10 IU Oxytocin.

Description: Oxytocin is secreted from posterior pituitary gland. It is usually secreted at the later stage of pregnancy, during and a few days after parturition. Oxytocin promotes expulsion of fetus and increases the secretion of milk by stimulating uterine musculature and myoepithelial cells around the alveoli of the udder. After parturition it helps in the expulsion of placenta and involution of uterus.

Mode of Action: Oxytocin acts directly on the smooth musculature of the uterus to induce rhythmic contractions, although in some species the uterine cervix does not respond to Oxytocin. The responsiveness of the uterine musculature to Oxytocin varies greatly with the stage of the reproductive cycle. During the early phases of pregnancy, the uterus is relatively insensitive to the effects of Oxytocin, while in the late phases the sensitivity is markedly increased. Oxytocin also has been shown to exert milk ejecting effect, occasionally referred to as the galactogogic effect. The actual mechanism by which Oxytocin stimulates the release of milk from the mammary glands is not known with certainty, but Oxytocin acts on certain smooth muscle elements in the gland.

Indications: Uterine inertia. Inadequate labor. Delayed parturition. Retention of Placenta. Post-partum hemorrhage. Prolapse of the uterus. Incomplete milk letdown. Pyometra and insufficient involution of uterus in cattle, buffalo, sheep, goat, dog etc.

Contraindications: Do not use in dystocia due to abnormal presentation of the fetus until correction is accomplished.

Side effect: Vasodilatation, decreased blood pressure, hyperstimulation of uterus if used at high dose and sometimes anaphylactic reactions may occur.

Precautions: Adrenaline at physiological levels markedly reduce the effect of Oxytocin on the uterus or mammary gland. For this reason, the animal should not be frightened when complete Oxytocin effect is desired to cause either milk let-down or uterine contractions.

Dose and administration:

Mare & Cow: 4 – 6 ml (40-60 IU/Animal) single dose

Ewe & Goat: 1 – 2 ml (10-20 IU/Animal) single dose

Sow: 1 – 3 ml (10-30 IU/Animal) single dose

Bitch & Cat: 0.25 – 1 ml (2.5-10 IU/Animal) single dose

Administered by single dose subcutaneous or intramuscular injection and may be repeated if necessary. Oxytocin administered by slow intravenous injection at dose rates one-third of the above.

or as directed by a registered veterinarian.

Withdrawal Period: Not required.

Proprietary Preperations
Pitocin *(Chemist),* inj. 10 ml, Tk. 235,
Oxcin (*Techno*), Inj. 10 ml: Tk. 54,
Nuoxin Vet *(FnF),* inj., 100 IU/10 ml,
Rentocin (Vet) (*Renata*), Inj., 100 IU/10 ml, Tk. 200.00/10ml,
Oxcin 10 (*Techno*), inj.,100 IU/10 ml, Tk. 150.00/vial,
Otocin Inj. *(Shinil Pharma Ltd.)* 100 IU/10 ml, Tk. 198,

Gonadorelin

Generic Name of the drug: Synthetic Gonadorelin 100 µg as Gonadorelin hydrochloride.

Description: Gonadorelin is a sterile solution containing Gonadorelin as hydrochloride in an aqueous formulation. Gonadorelin is the gonadotropin-releasing hormone (GnRH) which is produced by the hypothalamus and cause the release of gonadotropin luteinizing hormone (LH) and follicle stimulation hormone (FHS) from the anterior pituitary.

Mode of action: Gonadorelin, a decapeptide identical to the endogenous Gonadotropin Releasing Hormone (GnRH), which controls the production and secretion of Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH) by the pituitary gland. Both LH and FSH have a direct effect on the ovary. FSH stimulates follicle development, while LH induces ovulation and luteinization. FSH and LH thereby stimulating the maturation of ovarian follicles, ovulation and development of the corpus luteum.

Indications: Estrous synchronization, Treatment of Anoestrus, Prevention of delayed ovulation, Improvement of postpartum fertility, Treatment of cystic ovaries, Repeat breeding

Contraindications: No contraindication in lactating cows during treatment.

Side effect: Vasodilatation, decreased blood pressure, hyperstimulation of uterus if used at high dose and sometimes anaphylactic reactions may occur.

Precautions: No adverse effects in lactating cows during treatment. Do not cause embryotoxic or teratogenic effects in pregnant animals. Gonadorelin acetate to normally cycling dairy cattle had no effect on hematology or blood chemistry. Preferably dispose of the product by use. Otherwise, dispose of product and packaging in an approved landfill or other approved facility.

Dose and administration: 2-4 ml (200-400 µg/animal) Single dose by intramuscular route.

or, as directed by a registered veterinarian.

Withdrawal Period: Not required.

Proprietary Preperations

Fertilon (*Techno drugs*), Inj. 100 mcg/ml, Tk. 300/5 ml,
Fertagyl (*Intervet*), Inj. 5 ml: Tk. 710,
Gonarelin (Vet) (*Bengal*), inj., 100 mcg/ml, Tk. 480.00/vial,
Gonavet *(Chemist),* inj., 100 mcg/ml, Tk. 270/5ml,
GND 100 Inj. (*Shinil Pharma Ltd.),* 100 mcg/ml, 10ml,

Gonadotropin

(Pregnant Mare Serum Gonadotropin)

Generic Name of the drug: Each vial contains Pregnant Mare Serum Gonadotropin (PMSG) as a white freeze-dried crystalline powder (1000 IU).

Description: PMSG is a complex glycoprotein obtained from the serum of pregnant mares. This 43–63 kda protein is capable of supplementing and being substituted for the follicle stimulating gonadotropin and interstitial cell-stimulating hormone of the anterior pituitary gland in both the male and female. Thus, PMSG stimulates the development of the ovarian follicle in the female.

Mode of action: Pregnant Mare Serum Gonadotropin (PMSG) is a complex glycoprotein obtained from the serum of pregnant mares. It has a stimulating influence on the gonads of both the female and male animal. Thus, Pregnant Mare Serum Gonadotropin (PMSG) stimulates the development of the ovarian follicle in the female and has spermatogenic activity in the male by its effect on the seminiferous tubules.

Indication: Induction and synchronization of ovulation in cow, heifers, sheep & goat. Super-ovulation (required for embryo transplantation) in cow. Increase of fertility rate.

Contraindication: PMSG use alone often causes cystic ovarian disease because of the unrestrained ovarian stimulation and due to the sugar molecules, which decrease the clearance of the hormone. PMSG is more likely to be used than other pituitary hormones due to the extended circulatory half-life.

Side effect: Mild side effects may be detected in some cases. These include increased uneasiness, slight frothing, and milk let-down.

Precautions: Dispose of small amounts of spilled material. Large spills must be dealt with separately by qualified disposal personnel. Avoid dispersal of spilled material to soil, waterways, drains and sewers.

Dose and administration: Anoestrus-Cow & Buffaloes 500-1000 IU by intramuscular route single dose. Superovulation (required for embryo transplantation) - Cow- 1500 to 3000 IU between 8-13 days of cycle.

By intramuscular route single dose. Or as directed by a registered veterinarian.

Withdrawal period: Not required.

Proprietary Preperations

Folligon (*Intervet*), Powder, 1000 IU vial with 5 ml solvent: Tk. 565,
Sergon (*Eon*), injection, 2 ml vial, Tk. 870,

Human Chorionic Gonadotropin
(HCG)

Generic Name of the drugs: Human Chorionic Gonadotropin (HCG) as a white freeze-dried crystalline powder (1500 IU).

Description: A freeze-driedProprietary Preperations of chorionic gonadotropin (human Chorionic Gonadotropin or HCG) for intramuscular administration after reconstitution. When reconstituted with the accompanying sterile diluents, each 10 ml vial contains 10,000 I.U. chorionic gonadotropin (equivalent to 10,000 USP Units chorionic gonadotropin) and 10 mg mannitol, with mono- and disodium phosphate to adjust the pH of the solution.

Mode of action: Human Chorionic gonadotropin has luteinizing hormone-like activity with little or no follicle stimulating or estrogenic activity. This hormone is used primarily to induce maturation and ovulation of a dominant follicle. Induction of ovulation with HCG is most effective when a mare is in estrus. Ovulation usually occurs 36 hours after administration of HCG (1500 to 2500 units, IV or IM). Efficacy at inducing a timed ovulation may be reduced if HCG is given repeatedly during the same breeding season.

Indication: Induction of ovulation in mares. Induction and synchronization of ovulation in sows. Optimization of fertility in cows and heifers (repeat breeders). Treatment of follicular cysts in cows and heifers.

Contraindication: Chorionic gonadotropin is a protein. In the unlikely event of an anaphylactic reaction, epinephrine should be administered. The administration of an antihistamine may also be indicated.

Side effect: Repeated administration of HCG has been documented to result in the formation of anti-HCG antibodies.

Precautions: Once reconstituted, should be used immediately. Unused solution should be disposed of properly and not stored for future use.

Dose and administration: Improvement of conception rate in cows & heifers: 1000-1500 IU SC/IM weekly for the first four weeks after service. Induction of ovulation (Mares): 1500-3000 IU, 24 hours before AI /mating. Repeat in 2-3 days if required. By intramuscular or intravenous route.

Withdrawal Period: Not required.

Proprietary Preperations

Chorulon (*Intervet*), Powder 1500 IU vial with 5 ml solvent: Tk. 585,

Chapter 8

8. ANESTHETICS

General Anesthetics

Sedatives and tranquilizers play an important role in day to day veterinary practice. The use of these medications as part of an anesthetic regimen has many advantages, including, but not limited to, calming the patient, facilitating intravenous catheterization, analgesia, reduced sympathetic responses to surgical stimulation, reduced anesthetic requirements, and promoting smooth induction and recovery. The distinction between a tranquilizer and sedative is often nebulous due to species and dosing differences. Phenothiazines are commonly used as sedatives, or in combinations as premedication prior to anesthesia. Aminobutyric acid (GABA) is the primary inhibitory neurotransmitter in the central nervous system (CNS). Frequently used in both large and small animal patients, α_2-adrenergic receptor agonists provide sedation, analgesia, and muscle relaxation. The ability to antagonize pharmacologically the cardiovascular, sedative, and analgesic actions of α_2-adrenergic receptor agonists is a major reason why this class of sedative analgesic drugs are used in veterinary practice.

Ketamine

Description: Ketamine is one of the most widely used anaesthetic medicines in veterinary practice worldwide, and is also used for the provision of analgesia in certain circumstances. Limitation to its availability would be a major loss to animal welfare.

Indication: As the sole anesthetic agent for diagnostic and surgical procedures that do not require skeletal muscle relaxation. Ketamine is best suited for short procedures and it can be used with additional doses, for longer procedures. For the induction of anesthesia prior to the administration of other general anesthetic agents. To supplement low-potency agents, such as nitrous oxide.

Contra-indication: Do not use ketamine as a sole agent in horse and donkey and in renal and hepatic failure. Hypertension, congestive cardiac failure, stroke.

Side effects: Hypertension, congestive cardiac failure and stroke.

Precautions: Store in cool dark place. Following withdrawal of the 1st dose, use the product within 3 months.

Dose and administration:

Cats: for minor surgery, suturing restraint; 11-22 mg/kg body weight I/M; Castration, catheterization: 22 - 33mg/kg I/M. General, abdominal, orthopaedic surgery and major density: 33 - 44mg/kg I/M. Ketamine &Xylaxine combination.

Cat: xylazine (1.1mg/kg) and atropine (0.3mg/kg) by I/M injection maybe used 20mins pior to ketamine at 22mg/kg.

Horse and Donkey: xylazine is administered by slow I/V at 1.1mg/kg. The horse should appear sedated by 2mins post injection and then ketamine at 2.2mg/kg I/V is administered (don't delay ketamine injection longer then 5mins after xylazine administration). Anesthesia will last for 10 - 30mins.

Dogs: xylazine at 1mg/kg I/M, immediately follow by ketamine at 15mg.kg I/M. Anesthesia will last for about 25mins.

Swine: 10 - 15mg/kg I/M with xylazine at 0.5 - 1mg/kg: I/M. Route.

Proprietary Preperations

Xylazine

Description: Xylazine's muscle-relaxant effect is based on inhibition of the intra-neural transmission of impulses in the central nervous system. The centrally acting muscle-relaxant effect causes relaxation of the skeletal musculature complementing sedation and analgesia. In Cervidae and other non-domestic hoofstock, the respiratory rate is reduced as in natural sleep. Following treatment with xylazine, the heart rate is decreased and a transient change in the conductivity of the cardiac muscle may occur, as

evidenced by a partial atrioventricular block. This resembles the atrioventricular block often observed in normal domestic horses. Although a partial A-V block may occasionally occur following intramuscular injection of xylazine, the incidence is less than when it is administered intravenously. Intravenous administration of xylazine causes a transient rise in blood pressure, followed by a slight decrease.

Indication: Sedation of a wide variety of domestic, wild or exotic species such as cattle, dogs, cats, horses, laboratory animals, zoo animals and deer.

Contraindication: Cardiovascular disease, Shock, acute or chronic cardiac insufficiency, severe respiratory depression, late pregnancy. Condition in dogs & cats where emesis is undesirable, E.g. obstruction of esophagus, torsion of stomach, hernia.

Side effects: obstruction of esophagus, torsion of stomach, hernia.

Precautions: In managing any unconscious or semiconscious ruminants to prevent inhalation pneumonia and bloat. Don't leave the animals under the influence of xylazine in the sun. In ruminants.

Dose and administration: By I/V or I/M route: Cattle: 0.25 - 1.5ml (5 - 30mg)/100kg I/M, 0.15 - 0.27ml/100kg body wt by slow I/V; Horse: 3 - 5ml/100kg slow I/V; Cat: 0.15/kg I/M; Dog: 0.05 - 0.15ml/kg I/M; Sheep: 0.05 - 0.1mg/kg; Pigs: 2 - 3mg/kg; Birds: 5 - 10mg/kg.

Proprietary Preperations

LOCAL ANAESTHETICS

Injectable anesthetics have a rapid onset of action and are commonly used as induction agents to effect rapid passage through the light planes of anesthesia during which the patient may struggle. These drugs are eliminated by metabolism and excretion and there is no way of increasing the rate of removal from the body to compensate for over dosage. Urinary pH may be altered to increase drug excretion but this is usually only employed for barbiturate poisoning. Most injectable anesthetics cause respiratory depression; periods of apnea commonly occur, but are not hazardous provided the patient is monitored closely and intermittent positive pressure ventilation (IPPV) can be provided if necessary. Other effects of injectable anesthetics include hypotension and tachycardia. There is inter-individual variation to a given dose. Therefore, the entire calculated dose should not be administered but the drug given until the required depth of anesthesia is achieved. This method of administration ensures an appropriate depth of anesthesia and avoids over dosage.

Lidocaine

Description: Lidocaine is a local anesthetic which decreases permeability of sodium ions, blocking induction and conduction of nerve impulses. Combination with epinephrine restricts systemic spread of lidocaine, vascular absorption and its duration of local anaesthetic effect.

Indications: This drug is indicated for production of local or regional anesthesia by infiltration techniques such as percutaneous injection, by peripheral nerve block techniques such as brachial plexus and intercostal and by central neural techniques such as lumbar and caudal epidural blocks, when the accepted procedures for these techniques as described in standard textbooks are observed.

Contraindication: Tachycardia, hypertension, cerebral arteriosclerosis, ischaemic heart disease, IV admin, anaesthetise digits or appendages, myasthenia gravis.

Side effects: Not to be used as intravenous injection during infiltration. To be used with care in animals with cardiac problems.

Dosage and Administration:

Obstetrical use**:** Large animals; 5 -10ml, Laprotomy use: 10 -15ml, S/C or epidural. Small animals: Obstetrical correction: 1-2ml epidural, Laprotomy:2.5 -5ml S/C.

Proprietary Preperations

Chapter 9

9. EUTHANASIA OF ANIMALS

Greek word 'Eu'= Good and 'Thanatos'= Death

Euthanasia is the humane killing of an animal.

According to OIE, Euthanasia is the act of killing by using a method that causes rapid and irreversible loss of consciousness with minimum pain and distress to the animal.

INDICATIONS:

- Terminal illness (e.g., Cancer, Rabies)
- Illness or accident that is not terminal but would cause suffering for the animal to live with or when the owner cannot afford the treatment expense
- Behavioral problems (e.g., Aggression)
- Loss of production and quality of life (e.g., Advanced age)
- Diseases that involve a significant threat to human health (e.g., Rabies)

METHODS OF EUTHANASIA:

a. Physical Method

Methods	Species
Captive bolt	Ruminants, Horses, Swine, Dogs, Cat
Cervical dislocation	Poultry, Mice, Rat
Decapitation	Rodents and small Rabbits
Electrocution	Dogs, Ruminants, Swine, Chicken

b. Chemical Methods

i. Using inhaled agents

Agents	Dose	Species
CO_2	10-30% volume/min	Small Rodents
CO	6-8%	Small Rodents
Inhaled anesthetics 1. Sevoflurane e.g., Sevoran, Techno Drug Ltd. 2. Isoflurane e.g., Flurane 100%, Techno Drug Ltd.	overdose	Dog, Cat

ii. Using injectable anesthetics

Injectable Agent	Dose	Species
Thiopental sodium e.g., Inj. Thiopen, ACI Ltd. Inj. Anestho, Incepta Pharmaceuticals Ltd.	High Dose	Horse, Dog, Cat
Saturated KCl	1-2 mmol/kg	Horse, Dog, Cat
Saturated $MgSO_4$		Horse, Dog, Cat, Rabbits

Confirmation of death:

- Heartbeat- not palpable or audible
- Cessation of respiration
- Absence of corneal reflex
- Extreme mydriasis

References:

1. Report of the AVMA Panel on Euthanasia (2000)
2. Reeves, Jeffrey (26 October 2018). "FAQ How do the medications work? and What are the medications used in euthanasia?". Paws at peace. Retrieved 27 February 2020.
3. "Euthanasia Guidelines". AAEP. 207. Archived from the original (PDF) on 26 June 2008. Retrieved 19 June 2008.
4. Conlee KM, Stephens ML, Rowan AN, King LA (April 2005). "Carbon dioxide for euthanasia: concerns regarding pain and distress, with special reference to mice and rats". Laboratory Animals. 39 (2):137–61.
5. Laboratory Animal Euthanasia". Australian National University. Archived from the original (DOC) on 19 August 2007. Retrieved 30 November 2007.
6. UK Veterinary Medicines Directorate Product Notes for 20% Pentobarbital solution.

Chapter 10

10. OPTHALMIC PREPERATIONS

Ciprofloxacin + Dexamethason

Description: Aural steroid & antibiotic combinedProprietary Preperations.

Dexamethasone is glucocorticoid. It has an anti-inflammatory and anti-allergic action. It is used topically in the treatment of inflammatory conditions of the anterior segment of the eye. It reduces prostaglandin synthesis by inhibiting the enzyme phospholipase A2. Also, Dexamethasone inhibits the chemotactic infiltration of neutrophils into the site of inflammation.
Ciprofloxacin has in vitro activity against a wide range of gram-negative and gram-positive organisms, possessing the greatest antibacterial activity of all quinolones. The bactericidal action of Ciprofloxacin results from interference with the enzyme DNA gyrase which is needed for the synthesis of bacterial DNA.

Indication: Eye: This combination eye drop is indicated for the treatment of steroid responsive inflammatory ocular conditions where bacterial infections or risk of bacterial infections co-exist. The use of a combination drug with an anti-infective component is indicated where the risk of infection is high or where is an expectation that potentially dangerous numbers of bacteria will be present in the eye. The combination can also be used for post-operative inflammation and any other ocular inflammation associated with infection.

Ear: It is indicated for the treatment of ear infections accompanied by inflammation such as otitis externa, otitis media and chronic suppurative otitis media etc. The combination can also be used for post-operative inflammation of ear.

Contraindications: Known hypersensitivity to any ingredient of the product. Herpes simplex and other viral conditions, mycosis, glaucoma, newborn babies, fungal diseases of ocular or auricular structures.

Side effect: Frequently reported adverse reactions are transient ocular burning or discomfort. Other reported reactions include stinging, redness, itching, photophobia, conjunctivitis/ keratitis, Periocular/ facial edema, foreign body sensation, blurred vision, tearing, dryness, and eye pain. Elevation of IOP with development of glaucoma, and delayed wound healing may rarely occur.

Precaution: Prolonged use may result in overgrowth of non-susceptible organisms including fungi; in ocular hypertension and/or glaucoma, with damage to the optic nerve, defects in visual acuity and fields of vision and posterior sub capsular cataract formation. Patients wearing contact lenses must not use the drops during the time the lenses are worn. Store in a cool and dry place, away from light. Keep out of reach of children. Shake well before each use.

Doses: For Eye: 1 drop to be instilled into conjunctival sac(s) every four to six hours. During the initial 24 to 48 hours, the dosage may be increased to 1 drop every two hours.

For Ear: Acute otitis media in pediatric patients with typanastomy tube: 4 drops instilled into the affected ear 2 times daily for 7 days.

Acute otitis externa: 4 drops instilled into the affected ear 2 times daily for 7 days.

Frequency should be decreased gradually or warranted in clinical signs. Care should be taken not to discontinue therapy prematurely.

Proprietary Preperations:

Chapter 11

11. TOPICALPROPRIETARY PREPERATIONS

Charmil Plus Gel

Description: Multiaction Skin Gel/Spray. Skin (body coat) in animal is the index to good health. Shining lustrous body coat free from lesions and roughness reflects disease free skin. Skin in animals is affected due to several reasons such as infections (parasitic, bacterial, fungal), allergens (natural as well as chemical), trauma and injury. Skin affections are manifested in the form of skin ulceration and lesions, inflammation, intense itching and irritation of affected area, oedamatous swellings and different types of wounds. These ailments, if not taken care of, produce secondary complications and besides skin, overall animal health is adversely affected.

Indications: Skin affections like mange, ringworm, dermatomycosis and other fungal infections. Eczema, foot lesions in F.M.D., various types of wounds including surgical wounds.

Precaution: For external use only.

Dose: Clean skin Wound and apply q12-24 h upto Recovery or as advised by veterinarian.

Proprietary Preperations:

Povidone Iodine 10%

Indication: Topical use: Any Injury, Humpsore, FMD etc.

Side Effect: may be Drying, Irrritating& staining to skin, hair, fabrics

Precausion: Avoid contact with Eye, Systemic Absorption may cause Renal & thyroid dysfunction.

Dose:

Cattle:

Hump sore, FMD:50ml/50ml water

Udder disinfection: 4 mL/liter water

Water disinfection: 6-8 mL/liter water

Poultry:

Poultry Farm, utensils, equipment's & footbath: 7 mL/liter water

Aqua:

Hatchery fry & eggs disinfection: 2-3 mL/100 liter water (10 min dip bath)

Brood fish disinfection: 3-5 mL/100 liter water (10 min dip bath)

Pond or Gher: 1-1.5 liter/ Acre for 3-4 ft. depth

Proprietary Preperations:

Povidon Vet (Eskayef), Solution, Tk.400/500 ml, Tk. 700/1L,

Sulphanilamide (Powder BP)

Description: Sulfanilamide (also spelled sulphanilamide) is a sulfonamide antibacterial. Chemically, it is an organic compound consisting of an aniline derivatized with a sulfonamide group. As a sulfonamide antibiotic, sulfanilamide functions by competitively inhibiting (that is, by acting as a substrate analogue) enzymatic reactions involving *para*-aminobenzoic acid (PABA). PABA is needed in enzymatic reactions that produce folic acid, which acts as a coenzyme in the synthesis of purines and pyrimidines. Mammals do not synthesize their own folic acid so are unaffected by PABA inhibitors, which selectively kill bacteria.

Indication: It is used to treat sulphanilamide-sensitive organisms, specially used as a dusting powder for wounds by topical application.

Contraindication: In therapeutic doses its relatively non-toxic, but prolonged treatment has been known to cause agranulocytosis, haemolytic anaemia and avitaminosis-K. Where prolonged treatment is undertaken, patients should be watched with care.

Sulphanilamide Powder occasionally causes crystalluria, particularly when urinary pH is low. Always ensure adequate water intake during treatment and take particular care in the case of animals suffering from renal damage.

Side Effect: Includes allergic rashes, diarrhoea, dehydration, debility, loss of appetite, hypogalactia, digestive disturbances in ruminants and in other species depression, nausea, vomiting, crystalluria, haemolytic anaemia.

Dose: For external use: Use externally as per requirement or prescribed by a registered veterinary doctor.

Proprietary Preperations:
Sulphanilamide Vet (*Albion*), powder, 100 %, Tk.18.00/packet,
Suni-Vet (*Eon*), powder, 100 %,
Sulid (*Globe*), powder, 100 %, Tk. 9.50 & Tk 65.00/packet,
Medfanil (*MedRx*), powder, 100 %, Tk. 9.70,
OnMide Powder (Vet) (*One Pharma*), powder, 100 %,
Sulpha (*Rampart-Power*), powder, 100 %,
Sumid Vet (*Square*) Powder, 100 %, Tk. 14/Sachet,
Nemide (*Super Power*), powder, 100 %, Tk.194.00 & Tk, 220.00/packet,
Nilamide *(Techno),* powder, 100 %, Tk. 11.04, Tk 53.20, Tk 266.00/packet,
Sulpha (*ACME*), powder, 100 %,
Embazin (*Rampart-Power*), powder, 25 gm/100 gm,

Sodium Carbonate/ Natri carbonus

Indication: FMD Cure is indicated for Foot and Mouth Disease (FMD).

Dose: Wash all wound of mouth and foot and other wound of infected animal for 2-3 times daily until recovery. Or, as per directed by the veterinary physician.

Proprietary Preperations:
FMD CUREVET (*Acme*) Solution 500ml,
FMD wash (solver) solution 100ml,500ml,
Khura Vet *(Advent),* Oral Solution, 4 gm/100 ml,
Chemist Sodicarb Vet (*Chemist),* Oral Solution, 4 gm/100 ml, Tk.100/ 500 ml,
Khuranil Solution (*Shinil),* Oral Solution, 4 gm/100 ml, Tk. 100.00,
FMD Cure Solution (*ACME),* Oral Solution, 4 gm/100 ml, 100.68,

Carboxypolymethylene + Hydroxy Ethyl Cellulose

Description:Hydroxyethyl cellulose is a polysaccharide derivative with gel thickening, emulsifying, bubble-forming, water-retaining and stabilizing properties. It is used as a key ingredient in many household cleaning products, lubricants and cosmetics due to its non-ionic and water-soluble nature. It is often used as an ingredient in ophthalmic pharmaceuticalProprietary Preperations such as artificial tear solutions and adjunct agent in topical drug formulations to facilitate the delivery of drugs with hydrophobic character.

Carboxypolymethylene is a term used for a series of polymers primarily made from acrylic acid. It is frequently used as gels in cosmetics and personal care products. It can be found in a wide variety of product types including skin, hair, nail, and makeup products, as well as dentifrices.

Indication: Used As lubricating Agent.

Proprietary Preperations:
E-L Gel Lubricating Gel (*Ethical)*, gel, 0.93 gm + 2.97 gm/100 gm,

Allopurinol

Allopurinol, a xanthine oxidase inhibitor, is a urate-lowering medication that is FDA approved for managing gout, preventing tumor lysis syndrome, and preventing recurrent calcium nephrolithiasis in patients with hyperuricosuria. Other non-FDA-approved indications include Lesch-Nyhan syndrome-associated hyperuricemia and the prevention of recurrent uric acid nephrolithiasis. It is important to note that asymptomatic hyperuricemia is not an indication of allopurinol or any urate-lowering therapy. This activity outlines the indications, mechanism, pharmacology, contraindications, and adverse events associated with allopurinol drug therapy.

Mode of Action: Allopurinol undergoes metabolism in the liver, where it transforms into its pharmacologically active metabolite, oxypurinol. The half-life of allopurinol is 1 to 2 hours, and oxypurinol is about 15 hours. Both allopurinol and oxypurinol are renally excreted. Allopurinol and oxypurinol both inhibit xanthine oxidase, an enzyme in the purine catabolism pathway that converts hypoxanthine to xanthine to uric acid.

Indication: prevention and treatment of high blood uric acid level and gout, prevents deposition of urate crystal in kidney, serous membranes of liver, heart, air sac and joints of poultry.

Dosage: In case of Poultry 10-20mg per Kg body Weight.

Precaution: Extra attention should be made towards ensuring that any birds taking this drug are always provided constant unrestricted access to a source of fresh, clean water. It is important because allopurinol can potentially be nephrotoxic to poultry if they get dehydrated.

Side Effects: Dehydration, diarrhoea, drowsiness

Contradiction:

- Aspirin: The therapeutic efficacy of Allopurinol can be decreased when used in combination with Aspirin.
- Amikacin: Amikacin may decrease the excretion rate of Allopurinol which could result in a higher serum level.
- Amoxicillin: The risk of a hypersensitivity reaction to Amoxicillin is increased when it is combined with Allopurinol.
- Ampicillin: The risk of a hypersensitivity reaction to Ampicillin is increased when it is combined with Allopurinol.

Proprietary Preperations:
Shinol *(Shinil),* 100gm, tk. 350/100gm

Chapter 12

12. VITAMINS

Vitamin B-Complex

Description: Containing vitamin B_1(thiamin), B_2(riboflavin), B_3 (niacinamide), B_6 (Pyridoxine), vitamin B_{12} (cyanocobalamin), calcium-D-pentothenate, innocitol, DL-Methionine

Indication: Ruminants: Inappetance, weakness, ataxia, paresis, anorexia, diarrhea followed by signs characteristic of polyuencephalomalacia including blindness, head pressing, convulsion, paralysis, opisthotonos, poor growth, loss of hair, skin lessions, lacrimation & salivation, scours, metabolic disorders.

Horse: Letargy, anorexia, weight loss, ataxia cardiac arrhythmias, muscle tremors & convulsions.

Dogs: Anorexia, emesis, depression, paraparesis, torticollis, circling, convulsions, signs of Black tongue, cheilosis, glossitis, gingivitis, bloody diarrhea and cardiomyopathy.

Contraindications: Injection should not be used in animals hypersensitive to active ingredient.

Side Effect: Injection has not common side effect for recommended dosage.

Doses: Injection Can be used intramuscularly. Large animal (cattle, Buffalo, Horse): Daily 5-10 ml, thrice in a weekly & Small Animal (Sheep, Goat, Dog, Cat,) Daily 1-2ml thrice in a weekly

Proprietary Preperations:

See vitamin B_{12}

Vitamin A D_3 E Injection

Description: Each ml injection contains Vitamin A 80,000 IU, Vitamin D_3 40,000 IU & Vitamin E 20 mg

Indication: Vit-ADE Injection is effective for breeding purpose of male &female animal. It also maintains epithelial tissue of the skin, it is particularly needed for calcium & phosphorous absorption that will maintain the growth of bone of animal. It is also effective to reduce tendency of different muscular diseases of animal.

Contra indications: Injection should not be used in animals hypersensitive to active ingredient.

Side Effect: There is no prominent side effect of this drug while used ion recommended dosage. Side effects have reported with specific vitamins but level substantially higher than those in the product.

Doses: For intramuscular Cattle, Buffalo, Horse: 5-10 ml; Calf: 2-5 ml; Sheep, Goat: 2-4 ml

Proprietary Preperations:

Adevit Vet (*Ethical*), inj., 80000 IU + 40000 IU + 20 mg/ml,
Acivit-ADE (Vet) (*ACI*), inj., 500000 IU + 75000 IU + 50 mg.Tk.964.89/100 ml, Tk.120.36/10 ml
Advit-ADE (*Advent*), Liquid, 1 Lac IU + 20000 IU + 20 mg/ml,
Advit AD3E (*Advent*), inj., 5 Lac IU + 75000 IU + 50 mg/ml,
Hyvit ADE Vet (*Al-Madina*), inj., 500000 IU + 75000 IU + 50 mg/100 ml, Tk. 120.06 Tk, 824.41,
Albivit AD3E (*Albion*), Liquid, 1 Lac IU + 20000 IU + 20 mg/ml, Tk. 170.00 Tk, 750.00,
Albivit AD3E (Vet) (*Albion*), inj., 500000 IU + 75000 IU + 50 mg/100 ml, Tk.45.00 Tk, 125.00 Tk, 380.00,
Remevit ADE (Vet) (*Bengal*), Liquid, 1 Lac IU + 20000 IU + 20 mg/ml, Tk. 285.00,
Remevit ADE (Vet) (*Bengal)*, inj., 500000 IU + 75000 IU + 50 mg/100 ml, Tk. 250.00,
EDA Vet Injection *(Bridge),* inj., 5 Lac IU + 75000 IU + 50 mg/ml,
Lipsol (*Chemist*), Liquid, 1 Lac IU + 20000 IU + 20 mg, Tk 160/100 ml, Tk. 550/500 ml,
AD3ESOL Vet (*Chemist*), inj., 5 Lac IU + 75000 IU + 50 mg/ml, Tk. 120.00 Tk/ 10 ml, Tk. 320/ 30 ml,
Adevit Vet (*Ethical*), Liquid, 62.5 mg + 20 mg + 20 mg,
Trivit ADE Vet (*FnF*), inj., 50 Lac IU + 7.5 Lac IU + 500 mg/10 ml,
Nasol AD3E Vet (*Gentry*), Liquid, 1 Lac IU + 20000 IU + 20 mg/ml,
Ade Vet (*Globe*), Inj., 3 Lac IU + 1 Lac IU + 50 mg, Tk. 46.00 Tk. 390.00,
Vitagard AD3E (*Guardian*), Inj., 500000 IU + 75000 IU + 50 mg/100 ml, Tk.120.37,

Kvit AD3E (Vet) (*Kemiko*), Liquid, 100 Lac IU + 20 Lac IU + 2 gm,
Medvit-ADE (*MedRx*), Liquid, 20 mg + 20000 IU + 1 Lac IU, Tk. 150.00, Tk 730.00, Tk 1300.00
Naafvit ADE (Vet) (*Naafco*), Liquid, 1000000 IU + 20000 IU + 20 IU/ml,
Vitade Vet (*Navana*), Liquid, 1000000 IU + 20000 IU + 20 IU/m,
Revit ADE (*Opsonin)*, Inj., 500000 IU + 75000 IU + 50 mg/100 ml,
Renasol AD3E Vet (*Renata*), 62.5 mg + 20 mg + 20 mg, Tk.170/100ml, Tk. 1500/1000ml,
Renasol AD3E (*Renata)*, Inj., 500000 IU + 75000 IU + 50 mg/100 ml, Tk.120/10ml, Tk 324/30ml,
Es-ADE (*Square*), Inj, 80000 IU+40000 IU+20 mg/ml, Tk.51.16/10 ml, Tk.402.20/100 ml,
Adesol FORTE (*Techno*), Inj., 3 Lac IU + 1 Lac IU + 50 mg, Tk. 120/10 ml, Tk. 530/50 ml,
Adesol PLUS (*Techno*) Inj., 5 Lac IU + 75000 IU + 50 mg/ml, Tk. 70.26, Tk. 120.45, Tk. 281.06, Tk. 572.15,
Adesol Oral Solution (*Techno*), Liquid,1 Lac IU + 20000 IU + 20 mg/ml, Tk. 115/60 ml, Tk.790/500 ml,
Vita Ade (*ACME),* Inj., 4.72 gm + 100 mg + 2 gm,
Vita Ade (*ACME),* Liquid,4 gm + 50 mg + 2 gm,
Vita-ADE Forte-100 (*ACME*), Inj., 500 Lac IU + 75 Lac IU + 5000 mg/100 ml, Tk. 827.48,
Vita-ADE Forte-30 Vet (*ACME*), Inj., 150 Lac IU + 22.5 Lac IU + 1500 mg/30 ml, Tk. 300.90,
Vita-ADE Forte-10 Vet (*ACME),* Inj., 50 Lac IU + 7.5 Lac IU + 500 mg/10 ml, Tk. 115.36,
B-Comp. Inj. *(Pharma & Firm),* Tk. 290/50ml, Tk. 490/100ml,

vitamin B_{12} (cyanocobalamin) and Butaphosphan Injection

Description: Injectable solution containing Butaphosphan and Cyanocobalamin (Vitamin B12), which helps to activate and optimize the metabolic function of animals.

Indication: Metabolic disorders caused by poor nutrition, inadequate management or disease condition. Developmental and nutritional disorder in young animals due to rearing disease in early life. Metaphylaxis of sterility and puerperal diseases and also as supportive Sterility treatment. Tetany and paresis as adjunct to Calcium and Magnesium therapy. As tonic in over-exertion and exhaustion and to increase muscle performance in healthy animals. In case of liver dysfunction due to fluke infestation and colibacillosis.

Contra indications: Injection should not be used in animals hypersensitive to active ingredient.

Side Effect: Injection should not be used in animals hypersensitive to active ingredient.

Doses: injection may be administered intravenously, intramuscularly or subcutaneously along with oral administration depending on animal condition and body weight.

Dose: Cattle, Buffaloes & Horse 10-25mL

Foal & Calf 5.0-12mL
Sheep & Goat 2.5-5.0mL
Dog 0.5-5.0mL
Cat 0.5-2.5mL
If necessary, treatment should be repeated daily.

Proprietary Preperations:
(cyanocobalamin and Butaphosphan)
Catopan VET (*Advanced*), In., 10 gm + 5 mg/100 ml, Tk. 50.34, Tk, 458.09,
Metaboost Vet (*Advent)*, In., 10 gm + 5 mg/100 ml,
Fatiso Vet *(Al-Madina*), In., 10 gm + 5 mg/100 ml, Tk. 50.15 Tk. 461.50,
Phosmin (Vet) *(Albion),* In.,10 gm + 5 mg/100 ml,
Butavet *(Chemist),* In., 10 gm + 5 mg/100 ml, Tk. 250/ 50 ml, Tk. 450/ 100 ml,
E-SolVet *(Eon),* In., 10 gm + 5 mg/100 ml,
Catasol *(FnF),* In., 10 gm + 5 mg/100 ml, Tk. 142.00, Tk. 450.00,
Cyanophos (*Guardian),* In., 10 gm + 5 mg/100 ml, Tk. 150.45, Tk. 451.36,
Metamax-Vet (*Incepta),* In., 10 gm + 5 mg/100 ml, Tk. 150.00/ 30ml, Tk. 465/ 100ml,
NAVASOL VET *(Navana),* In., 10 gm + 5 mg/100 ml, Tk.150.29/30ml; Tk.460/100ml,
Stresol VET (*Opsonin),* In., 10 gm + 5 mg/100 ml, Tk. 250.75, Tk 467.15,
Megasol Inj (Vet) (*Popular),* In., 10 gm + 5 mg/100 ml, Tk. 150.00, Tk 456.72, Tk. 50.19,
Catophos Vet (*Renata),* In., 10 gm + 5 mg/100 ml, Tk. 150.57/30ml, Tk. 465.75/100ml,
Buphos-Vet *(Square),* In., 10 gm + 5 mg/100 ml, Tk. 142.74/10 ml, Tk. 433.55/30 ml,
A Sol *(ACME),* In., 10 gm + 5 mg/100 ml, Tk. 458.09,
Qmeat BC Vet *(Eskayef)*, Powder, 10gm + 5 mg/100 gm, Tk. 60.00/30gm packet, Tk. 198.00/100 gm Sachet, Tk. 950.00/500 gm cont,
Qmeat BC Vet *(Eskayef)*, Inj., 10 gm + 5 mg/100 ml, Tk. 150.00/30 ml vial, Tk. 465.00/100 ml vial,

(Cyanocobalamin + Toldimfos Sodium)
Acitol B12 (*ACI),* Inj., Tk. 50.34/10ml, Tk. 377.55/100ml,
Remefos Plus (Vet) *(Bengal),* inj., 5 mg + 20 gm/100 ml, Tk. 172.00, Tk. 380.00,
Phosvet Inj. (Vet) *(Globe),* inj., 5 mg + 20 gm/100 ml, Tk. 148.00, Tk 380.00,
Megaphos Vet *(Popular),* inj., 5 mg + 20 gm/100 ml,
Vitaphos Vet *(Renata),* inj., 5 mg + 20 gm/100 ml, Tk. 172/30ml,
Tolphos Vet 10 ML *(ACME),* inj., 5 mg + 20 gm/100 ml,
Tolphos Vet 30 ml *(ACME),* inj., 1.5 gm + 6 gm/30 ml,
BPSOL *(Shinil Pharma Ltd),* Oral Solution, 100ml, 500ml,

Vitamin B_{12} (cyanocobalamin and Phosphorous Injection

Description: Injectable solution containing Toldimphos and Cyanocobalamin (Vitamin B12), which helps to activate and optimize the metabolic function of animals.

Indication: Is indicated for the Beef fattening, milk production, metabolic disorder, anorexia, infertility etc.

Contra indications: Injection should not be used in animals hypersensitive to active ingredient.

Side Effect: Injection should not be used in animals hypersensitive to active ingredient.

Doses: injection may be administered intravenously, intramuscularly or subcutaneously along Large animal: 25-50 ml. Small animal: 10-25 ml. If need than 2nd dose may be given after 24-48 hours.

Proprietary Preperations:
B 50 *(Square),* inj., 50ml, Tk…
(Vitamin C)
Acivit C (Vet) (*Advanced),* Powder,1 gm/gm,
Asvit-C Powder (Vet) *(Al-Madina),* Powder,1 gm/gm,
Vet-C (Vet) (*Alkad),* Powder,1 gm/gm,
Cecon WSP 500 (*ACME),* Cap.,500 mg, Tk.10.00,
CECON Sachet 1000 mg *(ACME),* Powder,1 gm/gm,

Vitamin, Minarals & Amino acidProprietary Preperations

Description: Dextrose, Calcium Chloride, Potassium Chloride, Magnesium Sulphate, Sodium Acetate, L-Histidine, L-Tryptophan, L-Cystine, L-Threonine, L-Isoleucine, L-Arginine, L-Phenylalanine, L-Valine, L-Lysine Hydrochloride, L-Leucine, Monosodium Glutamate, Riboflavin, D-Pantothenol, Pyridoxine Hydrochloride, Nicotinamide

Indication: It help in protein formation. It acts as building blocking agent for the development of meat production. It also use for the milk production. For use as a supplemental source of dextrose, electrolytes, vitamins and amino acids for all animals. Supporting therapy on the operation and after operation, convalescing, dehydration weakness, vomiting, diarrhea, imbalance of electrolytes, ketosis, anaphylaxis, acidosis and hypoproteinemia.

Contra indications: Injection should not be used in animals hypersensitive to active ingredient.

Doses: For Cattle, Buffalo, and Horse, Goat, Sheep, Dog & other animals: Normal dose: 1ml per 10 kg body weight. Beef fattening dose: 2-4 ml per 10 kg body weight. Milk increaser dose: 2-4 ml per 10 kg body weight inject intramuscular, intravenous or subcutaneous.

Proprietary Preperations:
Amino Plus *(Chemist)*, Injection, 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml,
Aminomax Vet *(Globe)*, inj., 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml, Tk. 150.00, Tk 290.00/vial
Aminogard *(Guardian)*, inj., 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml, Tk. 40.13, Tk. 275.83/vial

Prolivet *(Orion)*, inj., 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml, Tk 300.90/vial
Aminovit Plus (Vet) (*Popular*), inj., 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml, Tk. 150.57, Tk. 292.60, Tk 598.50, Tk. 1053.96/vial
Protinex Vet (*Eskayef*), inj., 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml, Tk. 150.00/50 ml, Tk. 295.00/100 ml
Renagest solution *(Renata),* Tk. 175/100ml, Tk. 625/500ml
Amilyte C Inj. (*Pharma & Firm),* (11 Amino Acids, 7 Minerals, 3 Electrolytes),50ml-300tk. 100ml-530 tk
Gainfast (Vet) (Incepta), inj., 2 mg + .1 mg + .525 mg + 50 mg + 1.425 mg + .02 mg + .02 mg + .525 mg + .6 mg + .525 mg + .35 mg + .35 mg + .175 mg + .525 mg + 2 mg + .08 mg + 3 mg + 2 mg + .1 mg + .05 mg + 7.5 mg + .1 mg/ml, Tk. 270, Tk. 1000/vial

Vitamin & Minarals Bolus

Description: Each bolus contains - Cobalt sulphate Ph.Gr. 51.546 mg Dried ferrous sulphate BP 100.000 mg Thiamine nitrate BP (Vit. B1) 25.000 mg Cyanocobalamin BP (Vit. B12) 20.000 mcg Choline bitartrate USP 9.100 mg.

Indication: Bolus is indicated as a supportive therapy of ruminant animal for simple indigestion, impaction etc. Ensures faster recovery of indigestion, anorexia, inappetence, impaction etc of ruminant animals and maintain normal affinity of taking food.

Contra indications: Thiamine hydrochloride is incompatible with oxidizing and reducing substances, iodides, carbonates. Destruction of thiamine hydrochloride in solution is accelerated by copper ions. Thiamine is incompatible with benzyl penicillin.

Doses: Cattle & buffaloes: Usually 2-3 bolus per day is adequate for 2-3 days. Sometimes animals of heavy weight may require a higher dosage of 04 bolus per day. Or as prescribed by the registered veterinary doctor.

Proprietary Preperations:

Rexon DS Vet (*Eskayef),* Bolus, 100mg + 200 mg + 50 mg + 40 mcg + 18.2 mg, Tk. 6.00/Bolus
Anorexon Tab./Anorexon DS Tab. *(Renata),* Tk. 3.00/Anorexon Tab., Tk. 5/Anorexon DS Tab.
Vitamix P *(ACME),* Oral Powder,
Eskavit *(Eskayef),* Oral Powder,
Eskavit Grower Premix *(Eskayef),* Oral Powder,
Eskavit Layer Premix *(Eskayef),* Oral Powder,
Rena Grower (*Renata),* Oral Powder,
Rena Breeder *(Renata),* Oral Powder,
Rena Broiler *(Renata),* Oral Powder,
Rena Layer *(Renata),* Oral Powder,
Acimix Supper-B (*Advanced),* Oral Powder,
Acimix Supper-BR (*Advanced*), Bolus,
Acimix Supper-GS *(Advanced),* Bolus,
Acimix Supper-L *(Advanced),* Bolus,
Eskavit *(Eskayef),* Oral Powder,
Multivet WS *(Globe),* Oral Powder,
Vitavet WS *(Medicon),* Oral Powder, Tk. 130.00 *(Sodium Selenate + Vitamin E)*
Sel-E Vet (*Advanced),* Oral Solution, 50 mg + 10 gm/100 ml,
ADSEL-E (*Advent),* Oral Solution, 50 mg + 10 gm/100 ml,
Hyvit ES Liquid (Vet) *(Al-Madina),* Oral Solution, 50 mg + 10 gm/100 ml,
Kvit-E-Sel Vet *(Kemiko),* Oral Solution, 50 mg + 10 gm/100 ml, Tk. 135.40, Tk 551.65, Tk. 952.86
Naafsele (Vet) *(Naafco),* Oral Solution, 50 mg + 10 gm/100 ml,
E-Sel Solution *(Square),* Oral Solution, 50 mg + 10 gm/100 ml, Tk. 153/100 ml, Tk. 720/500 ml, Tk. 1420/L,
E-Vet Plus-30 (*ACME*), inj.,0.5 mg + 50 mg/ml, Tk. 120.37,
OSE Vet *(Eskayef*), Oral Solution, 20 mg + 10 gm/100 ml, Tk. 60.00/20ml, Tk. 240.00/100ml, Tk. 1060.00/500 ml,
Rena Sel-E *(Renata),* Oral Solution, Selenium 0.6mg+Vita E 80mg/ml; Tk. 155/100ml, Tk. 1400/1000ml,
ShiSel E *(Shinil Pharma Ltd.)***,** Tk. 128/100ml, tk. 576/500ml**,**

Probiotic

Probiotics are live microorganisms that are intended to have health benefits when consumed or applied to the body. Probiotics may contain a variety of microorganisms. The most common are bacteria that belong to groups called

Lactobacillus and Bifidobacterium. Other bacteria may also be used as probiotics, and so may yeasts such as Saccharomyces boulardii. Different types of probiotics may have different effects. For example, if a specific kind of Lactobacillus helps prevent an illness, that doesn't necessarily mean that another kind of Lactobacillus or any of the Bifidobacterium probiotics would do the same thing.

Indication: They are used to improve digestion and restore normal flora. Probiotics alter the gut microbiota, reduce pathogen shedding and disease symptoms, increases gut immunity, and improve disease resistance and health. It increases food intake and improves average body growth. Increases enzyme secretion and digestion. It plays an effective role in increasing the immune system of fish.

Mode of Action: Basic probiotic mode of action includes (a) inhibition of pathogen adhesion; (b) production of antimicrobial components, i.e., bacteriocins and defensins; (c) competitive exclusion of pathogenic microorganisms; (d) enhancement of barrier function; (e) reduction of luminal pH; and (f) modulation of the immune system.

Side Effect: The most common side effects are a temporary increase in gas, bloating, constipation and thirst.

Dosage: Ruminants- 10% of the diet, Poultry-5% of the diet

Proprietary Preperations:

A-Max Xtra *(Shinil Pharma Ltd.),* Tk. 800/1kg, Tk. 15990/25kg

Biotop *(Shinil Pharma Ltd.),* Tk. 585/1kg, Tk. 8900/20kg

Speed Biotic *(Shinil Pharma Ltd),* Tk. 474/100gm

Sl Ruforte Bolus *(Shinil Pharma Ltd.),* Tk. 12/1 Bolus

Chapter 13

13. MINERALS

Calcium Gluconate

Descriptrion: Calcium gluconate is the calcium salt of gluconic acid, an intravenous medication used to treat conditions arising from calcium deficiencies such as hypocalcemic tetany, hypocalcemia related to hypoparathyrodism, and hypocalcemia due to rapid growth or pregnancy. Calcium gluconate is the antidote for magnesium sulfate toxicity. Calcium Gluconate is the gluconate salt of calcium. An element or mineral necessary for normal nerve, muscle, and cardiac function, calcium as the gluconate salt helps to maintain calcium balance and prevent bone loss when taken orally.

Indications: Hypocalcaemia, chronic calcium deficiency, rickets, osteomalacia, osteoporosis. In the treatment of lead poisoning (acute colic) and fluoride poisoning. Also given in gastrointestinal disorders such as tympany and acid indigestion.

Contra indications: S/C injection of calcium salts in dogs and cats may cause necrosis at the site and in cattle swelling may persist for several days.

Doses: Dog: (75 - 500mg) 5 to 7ml slow I/V daily

Cattle: (3 - 12g) 20 to 30ml I/V or S/C

Proprietary Preperations:

Calboric Vet (*Renata)*, Inj., Tk. 2075 mg/100 ml,

Calcium Gluconate + Dextrose + Magnesium Hypophosphite

Descriptrion: Calcium, magnesium, and vitamin D are all essential minerals for developing and maintaining healthy bones. If you are deficient, a supplement could reduce your risk for osteoporosis and fractures. Calcium and magnesium are components of strong bone, and your body needs vitamin D for absorbing and regulating calcium.

Indications: For milk fever and other calcium, glucose and magnesium deficiencies in cattle & sheep as grass tetany, transport tetany etc. For post operative exhaustion provides for rapid increase of body calcium and magnesium. It increases of energy and reduction of ketones.

Contra indications: It is contraindicated in animal hypersensitive to any of the active ingredients

Side effect: Nausea, vomiting, anorexia, abdominal pain, muscle weakness etc.

Precaution: Use according to the veterinarian's advice Avoid mixing with any other drugs Quick injection may cause cardiac failure, should inject slowly Before use, make it warm as much as the body temperature Stop treatment immediately if unexpected symptoms occur. for subcutaneous administration select loose skin at 2-3 sites of body.

Doses: Administer following doses slowly by intravenously, intramuscularly or subcutaneously

Before intra-venous injection it is desirable to warm the injectable solution to body temperature and should be administered very slowly., Cattle & Horse: 200-350 ml Calf, Goat & Sheep :25-50 ml Dog: 10-20 ml Or as directed by the registered veterinarian.

Proprietary Preperations:

Calcivit PLUS *(Advanced),* Inj., 4.2 gm + 20.8 gm + 22 gm + 5 gm/100 ml, Tk. 99.80,
MC-Vet (*Eon*), Inj., 4.2 gm + 20.8 gm + 22 gm + 5 gm/100 ml, TK.158.48,
Caldex Vet *(Popular),* Inj., 4.2 gm + 20.8 gm + 22 gm + 5 gm/100 ml, Tk.200.75,
Mifenil Vet (*Square*), Inj., 42 mg + 208 mg + 22 mg + 50 mg,
Cal-Vet (*ACME),* Inj., 14.375 gm + 70 gm + 22.5 gm/250 ml,
A-Cal Vet *(ACME),* Inj., 28.75 gm + 140 gm + 45 gm/500 ml,
Calplus Vet *(Al-Madina),* Inj., 208 mg + 200 mg + 50 mg/ml. Tk. 96.05
Camadex (Vet) *(Bengal),* Inj., 208 mg + 200 mg + 50 mg/ml, Tk. 73.00, Tk. 140.00,

CMPgard (*Guardian),* Inj., 208 mg + 200 mg + 50 mg/ml, Tk. 120.37,
OneCal-D Vet (*One Pharma),* Inj., 208 mg + 200 mg + 50 mg/ml,
Cal-D-Mag Vet (*Renata),* Inj., 208 mg + 200 mg + 50 mg/ml, Tk. 76.14, Tk. 158.00/200ml, Tk. 360.00/500ml,
Caldifos (*Techno),* Inj., 208 mg + 200 mg + 50 mg/ml, Tk. 80/100 ml, Tk.130/200 ml,
Decam (*ACME),* Inj., 208 mg + 200 mg + 50 mg/ml, Tk. 120.82,
Chem-Cal (*Chemist),* IV Infusion, 25 gm + 5 gm + 3 gm/100 ml, Tk.200/ 250 ml,
Caldex Vet Forte *(Popular),* IV Infusion, 25 gm + 5 gm + 3 gm/100 ml, Tk. 400.00,
Magical 28 Vet *(Eskayef),* IV infusion, 28gm + 9 gm + 5.75 gm/100 ml, Tk. 180.00/100 ml, Tk. 450.00/250 ml, Tk. 800.00/500 ml,

Zinc

(Zinc Sulphate Monohydrate)

Description: The importance of trace mineral is related to productivity & prevention of deficiency symptoms. As a trace mineral, zinc is a component of many enzymes such as carbonic anhydrase, alcohol dehydrogenase, alkaline phosphatase, DNA/RNA polymerase etc, which affects metabolism of carbohydrates, proteins, lipids and nucleic acid. Zinc is a component of thymosin, a hormone, which regulates cell mediated immunity. It also affects luteal function. Normal growth and repair are dependent on adequate zinc. Zinc is probably related intimately to the process of cell division. Physiological role of Zinc Zinc is essential for – ` Gene expression ` Cell division ` Growth ` Hormone production Metabolism ` Appetite control ` Immune function ` Maintaining structural integrity & health of the hoof and udder ` Wound healing and epithelium maintenance. Physiological role of Zinc: Zinc is essential for – ` Gene expression, Cell division, Growth ` Hormone production, Metabolism, Appetite control, Immune function, Maintaining structural integrity & health of the hoof and udder, Wound healing and epithelium maintenance.

Indication: *Livestock*-Zink is indicated for inappetance, diarrhoea, poor growth, alopecia, dermatitis, reduced testicular growth, swollen feet, wounds failed to heal properly, wool-eating, parakeratosis, hyperkeratosis, stiffness of the joint, malformed hoof, impaired reproduction, immunologic dysfunction, reduced production etc.

Poultry- It indicated for poor growth, reduced egg production and hatchability, diarrhoea, poor feathering, swollen/stiffness of joint, dry, thickened & fissured foot pad, hyperkeratosis etc.

Side effect: is relatively non-toxic. But feed may be unpalatable when zinc concentration is very high.

Precaution: Do not use calcium, copper & iron in conjunction with zinc. Store in a cool & dry place protected from light. Keep all medicines out of reach of children.

Dose: *Cattle, Buffalo*

Prevention: 1 bolus per 5 kg feed daily.
Treatment: 1 bolus per animal daily for 5-7 days.

Calf, Sheep, Goat

Prevention: 1 bolus per 5 kg feed daily.

Treatment: One-forth to one-half of bolus per animal daily for 5-7 days.

Poultry

Prevention: 1 bolus daily for 5-7 days.

Treatment: 1 bolus daily for 5-7 days.

Proprietary Preperations:
Zeenee (*Chemist*), Bolus, 200 mg. Tk. 6.25/ bolus,
Al Zinc-Vet (*Al-Madina*), Bolus, 200 mg,
F-Zinc Vet *(FnF*), Bolus, 200 mg,
Ziflu Vet (*Incepta*), 6 mg/100ml, Solution, Tk. 75.00/100 ml, Tk. 220.00/500 ml, Tk. 400.00/1L,
Shizinc Bolus (*Shinil*), Bolus, 200 mg, Tk.6.00/bol,
Shizinc Solution (*Shinil*), Tk. 42/100ml, Tk. 150/500ml, Tk. 275/1L-, Tk. 1175/5L
Zis-Vet (*ACME*), Bolus, 200 mg, Tk. 6.01/bol,
Zinvion Vet (*Vion*), 200 mg,
Zinc Liquid (Vet) (*Al-Madina*), Liquid, 2 gm/100 ml,
Rena Zinc *(Renata),* Tk. 50/100ml, Tk. 150/500ml, Tk 270 /1000ml,
Zinc Vet (*Navana*), Oral solution, 10 mg/5ml, Tk. 40/100ml, Tk. 135/500ml, Tk. 250/1L, Tk. 735/3L, Tk. 1200/5L,
Zinc Vet *(Navana),* Bolus, 200 mg/Bolus Tk. 6/bolus,

Hemopoietic Agents

Cobalt + Copper + Cyanocobalamin + Iron + Zinc

Descriptrion: Cobalt sulphate is a precursor of vitamin B12 synthesis and used in fortification of livestock. Dried Ferrous sulphate is required for the formation of R.B.C. Vitamin B12 help in activation of various enzymes.

Indications: acts as an appetizer & is required for relief from anorexia caused by various diseases in ruminants and animal starts eating quickly. In special disease or in infectious diseases it gives better results in addition to the specific diseases. itsused after the use of anthelmintics for round worms or liver flukes, the animals fortified rapidly.

Doses: should be given per adult cattle per day for consecutive 2-3 days orally. The dose may be increased in case of crossbreed cattle and buffaloes. Or prescribed by the registered veterinarian.

Proprietary Preperations:

Ferovet *(ACME),* Oral Solution, 10 mg + 20 mg + 10 mg + 50 mg + 20 mg/100 ml, Tk. 150.44,
Evm DB *(Globe),* Oral Powder, 6 mg + 800 mcg + 80 mg + 2.5 mg + 50 mg + 100 mcg + 10000 IU + 1000 IU + 10 mg + 45 mg,
Vitamix DB *(ACME),* Oral Powder, 6 mg + 800 mcg + 80 mg + 2.5 mg + 50 mg + 100 mcg + 10000 IU + 1000 IU + 10 mg + 45 mg,
TMB Vet *(Eskayef),* Bolus, 4 mg + 100 mg + 5 mg + 100 mg + 50 mg + 1 mg + 300 mg,
TMB Vet *(Eskayef),* Bolus, 4 mg + 100 mg + 5 mg + 100 mg + 50 mg + 1 mg + 300 mg,
Mintra Vet *(FnF),* Bolus, 4 mg + 100 mg + 5 mg + 100 mg + 50 mg + 1 mg + 300 mg,
VitaBoost *(Eon),* Inj., 7 mg + 2 mg + 1.2 mg + 200 mg + 150 mg + 1000 mg + 50 mg + 20 mg + 750 mg/10 ml,
Hemogard (*Guardian*), Inj., 7 mg + 2 mg + 1.2 mg + 200 mg + 150 mg + 1000 mg + 50 mg + 20 mg + 750 mg/10 ml, Tk. 30.10,
Hemovit Vet (*Renata*), Inj., 7 mg + 2 mg + 1.2 mg + 200 mg + 150 mg + 1000 mg + 50 mg + 20 mg + 750 mg/10 ml, Tk. 30.11, Tk. 72.52, Tk. 30.11/10ml,
V-Plex Vet Plus (*ACME*), Inj., 7 mg + 2 mg + 1.2 mg + 200 mg + 150 mg + 1000 mg + 50 mg + 20 mg + 750 mg/10 ml Tk. 30.20, Tk. 251.70,
SI Iron Solution Vet *(Shinil Pharma Ltd),* Tk. 58/100ml-, Tk. 230/500ml,

Copper Suplhate + Cobalt Sulphate + Manganese Sulfate + Zinc Sulfate + Potassium Iodide + Ferrous Sulfate + Sodium Selenite

Description: Essential Trace Mineral Bolus for cattle. These trace minerals help farmers to improve the trace element level of their herd over critical periods of the production cycle.

Indications: Improves reproductive performance, improves health and vigour of cows, buffaloes, breeding bulls and ruminants, plays vital role in reproduction and heamatopoiesis, helps to overcome anestrus and repeat breeding-in heifers, cows and buffaloes, helps to overcome poor libido and low sperm count in bulls, Recommended also for cases of anaemia and unthriftiness

Doses: Cattle and Buffaloes: 1 bolus/animal per day, Or, as directed by registered veterinarian/consultants.

Proprietary Preperations:

TMB Vet *(Eskayef),* Bolus, 100mg + 4mg + 50mg + 300mg + 5mg + 100mg + 1mg / Bolus, Tk. 22.00/Bolus,

Choline Bitartrate + Cobalt Sulfate + Cyanocobalamin + Ferrous Sulphate + Thiamine Mononitrate (B1)

Description: Deficiency sings

Cobalt: Progressive loss of appetite, weight loss, symptoms of anemia, weakness and pica are observed. Iron: Anemia, weakness, tachycardia, pallor. Anemia potentiates the incidence of enteric infection associated with *E. coli* & *Streptococcal pericarditis*.

Thiamine: The immediate effect of thiamine deficiency is reduction of appetite (anorexia). Thiamine deficiency hamper in carbohydrate and lipid metabolism, muscle weakness, peripheral & central neuropathy, gastrointestinal malfunction and may cause cardiac failure.

Vitamin B12: Anorexia, cessation of growth, loss of over all condition and muscular weakness.

Choline: Fatty liver syndrome, weakness and breathing problem.

Indication: Help to increase milk and/or meat in ruminants by fulfilling the deficiency of vitamins and minerals, increase hunger and appetite.

Doses: calf-1 bolus /Once in a week, Cow1-2 bolus/ days. oral administration. for 2-3 consecutive days. Dosage may be increased in case of cross-bred cattle and buffaloes. or as directed by the registered veterinarian.

Proprietary Preperations:

Albixon (Vet) (*Albion),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg,
Broxvet (*Bridge*), Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg,
Rumin Vet (*Gentry),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 2.34
Medfat (*MedRx),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 2.25
AnoFat Bolus (Vet) (*One),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg,
Faty Vet (*Popular),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 2.30
Mivit (*Chemist),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 3.25
Rexon DS Bolus Vet *(Eskayef),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 6.00/Bolus
Anotab *(Ethical),* 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg,
Amovet-Naf (Vet) (*Naafco),* Bolus, 9.1 mg + 50 mg + 2 mg + 100 mg + 25 mg,
Rumix *(Navana),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 3.00
Anorexon (*Renata),* Bolus, 9.1 mg + 50 mg + 2 mg + 100 mg + 25 mg, Tk. 3.00
Anorexon DS (*Renata),* Bolus, 18.2 mg + 100 mg + 4 mg + 200 mg + 50 mg, Tk. 5.00
Anora (*ACME),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 3.00
Antirox Vet *(Globe),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 2.30
Roxyvet (*Techno),* Bolus, 9.1 mg + 50 mg + 20 mcg + 100 mg + 25 mg, Tk. 3.5/bolus
Hozom (Vet) (*Advanced),* Bolus, 9.1 mg + 50 mg + .02 mg + 100 mg + 25 mg, Tk. 2.15
Hozom DS (Vet) *(Advanced),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 5.00,
Apetonic (*Advent),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg,
Hemorex (*Al-Madina),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 2.16,
Hemorex DS (*Al-Madina),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg,
Albixon-DS (Vet) (*Albion),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 3.25,
Feramin (Vet) (*Bengal),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 2.75,
Rumifat (*Eon*), Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 2.52,
Rexon DS Bolus Vet *(Eskayef),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 5.00,
Rumin-DS Vet *(Gentry),* 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg,
Bfat DS (*Guardian),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 3.51,
Anovet (Vet) (*Kemiko),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 2.31,
Fativet (*Medicon),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 1.50,
Medfat-DS Vet *(MedRx),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg,
Rumix DS (Vet) *(Navana),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 5.00,
Fatenin *(Opsonin),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 2.15,
Fatenin DS (*Opsonin),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 3.27,
Faty DS (*Popular),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 4.00,
Anorexon DS Vet (*Renata),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 5.00,
Shinora Bolus VET (*Shinil),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 2.75,
Aperex (Vet) (*Super Power),* Bolus, 9.1 mg + 50 mg + 20 mg + 100 mg + 25 mg, Tk. 3.83,
Roxyvet DS Bolus *(Techno),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 4.75/bolus,
Anora DS Vet *(ACME),* Bolus, 18.2 mg + 100 mg + 40 mcg + 200 mg + 50 mg, Tk. 5.00,

Iron dextran

Description: Iron dextran is an elemental iron supplement as an injection. It works by replenishing body iron stores in animals with iron deficiency.

Indications: For the treatment and prevention of iron deficiency anemia

Doses: Calf, Sheep, Goat**:** 4-8 ml /10 kg BW (1 week of age) Cattle, Horse,

Bualoes: 10 ml/100 kg BW Dog, Cat: 0.5-1 ml Intramuscular or subcutaneous injection

Proprietary Preperations:
Iron Dextran Vet (*Techno),* Inj.
Irondex (*Bridge),* Inj., 100 mcg + 100 mg/ml,
Bloodin Vet (*Chemist),* Inj., 20 gm/100 ml, Tk.72/ 10 ml,
Hempro Vet (*Square),* Inj., 20 gm/100 ml, Tk.75/10 ml,

Cyanocobalamin + Iron (Iii) Hydroxide Dextran Complex

Description: Cyanocobalamin is a man-made form of vitamin B12. Vitamin B12 is important for growth, cell reproduction, blood formation, and protein and tissue synthesis. Cyanocobalamin is used to treat vitamin B12 deficiency in people with pernicious anemia and other conditions

Indications: For the treatment and prevention of iron deficiency, anemia.

Contra indications: Do not use during Vitamin E deficiency.

Side effect: Pain and inflammation reactions, abscesses at the injection site, sudden death, intramuscular iron injections can lead to persistent colourization of the muscle tissue.

Doses: Intramuscular or subcutaneous injection

Calf, Sheep, Goat**:** 2-3ml every 48 Hours

Cattle, Horse, Bualoes: 5-8ml every 48 Hours

Dog, Cat: 0.5-1 ml every 48 Hours

Proprietary Preperations:
Hempro-Vet Plus *(Square),* inj., 20 mg + 20 gm/100 ml,

Iron dextran + Vitamin A + Vitamin E

Descriptrion: Function of Iron Dextran: Iron dextran is an elemental iron supplement as an injection. It works by replenishing body iron stores in animals with iron deficiency. Function of Vitamin A: Protect skin, promote immune systems, Increase resistance to infection. Function of Vitamin D_3: Metabolic regulation of Ca and P, promoting formation of frame, Promote the growth of calves. Function of Vitamin E: Promote luteinization, Prevention growth abnormality.

Indications: For the treatment and prevention of iron deficiency anemia for the treatment and prevention Vitamin A, D3 & E deficiency For Improve immunity against microorganisms & parasites for the treatment of nutritional infertility, calcium deciency & weakness Increase milk production to reduce stress after parasitic treatment

Doses: Sheep, Goat**:** 4-8 ml /10 kg BW (1 week of age)

Cattle, Horse, Bualoes: 10 ml/100 kg BW
Dog, Cat: 0.5-1 ml

Intramuscular or subcutaneous injection

Proprietary Preperations:
Embavit WS *(Rampart-Power),* Oral powder,
Vitamix *(ACME),* Oral powder,

Chapter 14

14. LIVER TONIC

Description: Liver Tonic comprises of liver boosting supplementary agents that prevent damages of liver. Liver Tonic contains mainly DL-Methionine, Choline Chloride, Inositol, Biotin, Vitamin B-2, defferant herbs etc.

Indications:

- Fatty Liver Syndrome
- Ascites
- After viral/Bacterial infections
- Liver damage by Toxins
- Liver damage by excessive use of antibiotics/chemotherapeutics
- Liver Worms
- Environmental stress
- Increase FCR in broiler
- Increase egg production & hatchability laying birds

Contra indications: Not known.

Side Effect: Not known.

Doses: Poultry: 1 – 2 ml solution per liter of drinking water for 5 – 7 days.

Cattle, Buffalo, Horse: 20 – 50 ml solution in drinking water per day for 5 – 7 days.

Sheep, Goats, and Calves: 5 – 10 ml solution in drinking water per day for5 – 7 days

Or, as directed by registered veterinarian/consultant.

Proprietary Preperations:

See Hemopoietic Agents

Chapter 15

15. MYCOTOXIN BINDER

Description: A mycotoxin binder is a substance that is added to animal feed in small quantities in order to trap mycotoxins, preventing them from entering the blood stream where they can cause serious harm to your animals. It contains synergistic combination of organic acids like Formic Acid, Ortho-Phosphoric Acid, Lactic Acid, Sorbic Acid, Fumaric Acid, Malic Acid, Citric Acid, Copper pentasulphate, Essential oil (Thymol), Yeast of saccharomyces cerevisiae & B-glucan and Mannan oligosaccharide etc. As a major component of yeast cell wall both Mannan-oligosaccharides (MOS) & β-glucan plays many important roles.

Indications:

- Prevent and treats the mycotoxin infestation in poultry
- Control gastro-intestinal pH
- Improves renal and hepatic function.
- Adsorbs mycotoxins

Contra indications: Not known.

Side Effect: Not known.

Doses: Poultry: Prevention: 0.5-1 ml / 5-10 L of drinking water for consecutive 3-5 days Treatment: 0.5-1 ml / 2.5-5 L of drinking water for consecutive 3-5 days

Small animals- 5-10ml day 2litter for 3-5 days.

Large animals- 50-60ml day 2litter for 3-5 days.

Proprietary Preperations:
Mycofix Plus *(Renata),*
Mycofix Select *(Renata),*
Mycofix Secure *(Renata),*

Chapter 16

16. LAXATIVES & PURGATIVE

Description: Laxatives are medicines that help resolve constipation or empty the bowel of fecal matter before procedures or surgery involving the lower bowel. There are several different types of laxative

Bulking Agents (Fiber): Fiber is the laxative most doctors recommend for normal and slow-transit constipation. Abdominal cramping, bloating, or gas can occur when abruptly increasing or changing your dietary fiber intake. Fiber is naturally available in fruits, vegetables, and whole grains (especially wheat bran). Fiber is also available over the counter in Benefiber, Citrucel, Equilactin, Fibercon, Fiber-Lax, and Metamucil.

Fiber works by increasing the water content and bulk of the stool, which helps to move it quickly through the colon. When taking fiber supplements, it's essential to drink enough water to minimize the possibility of flatulenceand a possible obstruction.

People who increase their fiber may abruptly suffer abdominal cramping, bloating, or gas. Gradually increase fiber intake. Also, fiber can reduce your body's absorption of some drugs, so always take your medications at least one hour before or two hours after consuming fiber.

Lubricant Laxatives: As the name implies, lubricant laxatives make stools slippery. The mineral oil within these products adds a slick layer to the intestine's walls and stops the stool from drying out. Though highly effective, lubricant laxatives are best used as a short-term cure for constipation. Over a longer period, mineral oil can absorb fat-soluble vitamins from the intestine, and decrease certain prescription drugs from being fully absorbed into the body. Do not take mineral oil at the same time as other medications or supplements

Emollient Laxatives (Stool Softeners): Commonly known as "stool softeners," emollient laxatives such as Colace (or generic Colace) contain docusate, a surfactant that helps to "wet" and soften the stool. Although it might take a week or longer for emollient laxatives to be effective, they are frequently used by those who are recovering from surgery, women who have just given birth, or individuals with hemorrhoids.

Osmotic and Hyperosmolar Laxatives: "The wetter the better," is the osmotic laxative's mission. These products include Fleet Phospho-Soda, Kristalose, Milk of Magnesia or MOM, and Miralax all hydrating agents that draw fluids into the intestine from the surrounding tissues. More water in the intestine results in softer stools that are easier to pass. It's imperative to drink a lot of water with osmotic and hyperosmolar laxatives, not only for the laxative to be effective, but to decrease the possibility of gas and cramps.

Indications: Laxatives are used to treat constipation, Indigestion, Corbohydrate engorgement, lactic acidosis, Impaction of catle, dog, cat etc. Clean out the colon before a colonoscopy or rectal surgery.

Contra indications: Hydroted & Dis functional/ Non-Functional Kidney. Pregnant & loctating cow/animals.

Side Effect: Some uncomfortness & Diarrhoea.

Doses:

Cow- 500ml/50 kg body wet, 2-3 times daily
Goot- 90ml/10 kg body wet, 2-3 times daily
Sheep- 125ml-375ml 2-3 times daily
Dog- 5-10ml 2-3 times daily
Cat- 2-6ml 2-3 times daily.

Withdrawal Period: Milk- 12 hrs. Meat – nil.

Proprietary Preperations:
(Liquid Paraffin + Magnesium Hydroxide)
Frelax *(Beximco),* Oral Emulsion, 25 ml + 6 gm/100 ml,
Lycogel Plus *(Desh),* Oral Emulsion, 25 ml + 6 gm/100 ml,
Momfin *(Kemiko),* Oral Emulsion, 25 ml + 6 gm/100 ml

Maglax Vet (MedRx), Oral Emulsion, 25 ml + 6 gm/100 ml,
(Magnesium Hydroxide Dried Gel+ Magnesium Hydroxide Paste)
MG VET *(Newtec),* Oral Suspension, 31.25 gm + 29.415 gm/500 ml, Tk. 25.00, Tk. 45.00, Tk. 95.00, Tk. 180.00,
Magvet *(ACME),* Oral Suspension, 31.25 gm + 29.415 gm/500 ml, Tk. 95.29,

Light maganesium oxide

Therapetic Group: Antacid/Laxitive

Indication/Use: Antacids in hyperacidity, gastritis, and intestinal indigestion, Laxatives in constipation; Used in mixture of universal antidote"; Dose/ administration; Large Animals: 150 - 200g orally; Dog: 1-2g.

Liquid paraffin

Dosage Form: Oral liquid

Therapeutic group: External and internal lubricant/laxatives

Indication: Externally used on the skin, for its & protecting effect, as a lubricant for diagnostic instruments such as probing & stomach tube. Internally as a laxative at the following doses

Dose: Dog: 4 - 30ml orally for 3 to 5 days; pig: 60 - 300ml orally for 3 to 5 days; Horse & cattle: 750ml orally for 3 to 5 days.

Magnesium Sulphate

Therapeutic group: Purgative

Indication: As an antiseptic at a concentration of 2 - 4%, At saturation as euthanizing agent; As purgative - used in constipation at rate of 150-200gm with water in cattle; As laxative at 0.5-1gm/kg body weight; As a general aesthetic agent with cholera hydrate. Mangnesium sulphate - 6% and chloral hydrate - 12%, when administered by I/V rout produces basal narcosis in large animals; Hot saturated solution for hot formentation in inflammation; a saturated solution of magnesium supgnesiumn sulphate may be applid and bandaged over infected wound.

Ammonium Bicarbonate + Nux Vomica + Sodium Bicarbonate + Gentian + Ginger

Description: Appetizer & digestion enhancer for ruminant

Indications: Digimax®powder is effective against various diseases like; ion imbalance, acidemia, gastric, dyspepsia, flatulence, colic, rheumatic diseases like arthritis, paralysis, sexual weakness & nervous weakness.

Contraindication: Not Known

Side Effects: Not known

Dosage & Administration: 20 gm (1 sachet) Digimax®powder per 1-2 liters of water should be given to the ruminants by stomach tube or other way for consecutive 2-3 days.

Cattle, buffalo & horses (100-500 kg body weight): 1-3 sachet of Digimax®powder (20 gm) twice daily.

Calf, goat & Ram (15-25 kg body weight): ¼ - ½ sachet of Digimax®powder (20 gm) twice daily, Or, as per direction of veterinary consultant

Proprietary Preperations:
Digimax Vet (*Eskayef*), Powder, 5 gm + 1.40 gm + 13 gm + 0.3 gm + 0.3 gm/Sachet, Tk. 165.50/ Sachet

Simethicone + Dill oil

Description: For all kinds of Bloat & tympany for ruminant

Indications: All kinds of Bloat & tympany; It is very rapid in action in cases of severe bloat

Contraindication: None

Side Effects: none

Dosage & Administration:

Cattle & Buffalo: 100 ml

Sheep, Goat: 20ml, Or, as per direction of registered Veterinarian/Consultant.

Proprietary Preperations:
Gasnil Vet (*Eskayef*), Oral Suspension, 10 mg + 5 mg/ml, Tk. 80.00/100 ml,

Chapter 17

17. IMMUNOMODULATOR

A substance that stimulates or suppresses the immune system and may help the body fight cancer, infection, or other diseases. Specific immunomodulating agents, such as monoclonal antibodies, cytokines, and vaccines, affect specific parts of the immune system.

Mode of action: Apart from modulation of the micro-environment and immune response, IMiDs also exert direct anti-proliferative effect on PC via inhibition of the cyclin-dependent kinase pathway, activation of Fas-mediated cell death, and downregulation of anti-apoptotic proteins. The compounds are an antioxidant nutrient, used to enhance growth and productive performance via modification and activation of gastrointestinal tract structure and function and to inhibit/prevent cancer initiations. Numerous studies performed on animal diets supplemented with phytogenic supplements/feed additives containing natural antioxidants such as carvacrol, thymol and others demonstrated its capability to improve performance indexes, feed utilization, immune functions and health of livestock as well as reducing the risks of different animal diseases like cancer and other diseases. Such properties could be due to its ability as antimicrobial, antioxidant, antifungal, immunomodulatory, anticancer and anti-inflammatory agents by preventing free radicals and hazardous compounds from interacting with cellular DNA and its ability to change the gut microflora, improving digestion coefficient and absorption of nutrient compounds.

Side Effects: These drugs can cause side effects such as drowsiness, fatigue, constipation, low blood cell counts, and neuropathy (painful nerve damage). There is also an increased risk of serious blood clots (that start in the leg and can travel to the lungs)

Contraindication: TPMT Deficiency, Drug Interactions, Fertility Uncertainties, Hypersensitivity and Pancreatitis, Reactive Hemophagocytic Syndrome, Malignancy, Infection Concerns.

Indication: To regulate immunity for the benefit of the animal and production efficiency Immunomodulators are used for many different types of illnesses and diseases. These include: inflammatory bowel disease (IBD), including ulcerative colitis and Crohn's disease, allergic conditions including allergies, asthma, and eczema infections.

Dosage form: For Grower Chick- 1ml/liter drinking water, For Broiler/Layer/Breeder- 1-2 ml/liter drinking water, For Calf/Sheep/Goat-20ml/day, For Dog- 5ml/liter

Proprietary Preperations:

SI Lysolex *(Shinil Pharma Ltd.),* Tk. 492/50gm, Tk. 880/100gm,

OreganoMix *(Shinil Pharma Ltd.),* Tk. 645/100ml,

Procalf *(Shinil Pharma Ltd.),* Tk. 169.00/200gm,

Chapter 18

18. VACCINES AND IMMUNOLOGICAL PREPERATIONS

Vaccines are Proprietary Preperations of specific for each agent, cross-protection can occur sometimes. Immunity in animals may be acquired by either passive or active means.

Passive immunity results from the transfer of maternal antibodies to offspring or the injection of antiserum to an animal of any age. *Antiserum* is serum usually obtained from immunized animals and contains antibodies to specific antigens.

An *antitoxin* is antiserum containing antibodies to a specific microbial toxin.

Domestic mammals acquire passive immunity by intestinal absorption of antibodies from colostrums ingested within the first few hours of life.

In poultry and other avian, maternal antibody is transferred to the yolk, from whence the developing chick absorbs it. The degree of protection conferred depends upon the amount and specificity of the antibodies transferred.

Passive immunity lasts only as long as antibodies remain reactive in the blood and mucosal surfaces, after which the animal loses immunity to that specific infection. Generally, passive immunity persists from 3 to 12 weeks in mammals, depending on the genetic similarity of donor and recipient, as well as the amount and quality of colostrums ingested by the neonate. Immunity persists for up to 3 weeks in poultry. If vaccines are given by parenteral administration during this period, they may be ineffective or induce only a short duration of immunity because of the interaction between maternally derived antibodies and the immunizing antigens.

Active immunity develops as a result of infection with a micro-organism, or by administration of a vaccine prepared from live or inactivated organisms, antigenic fractions, or from inactivated (detoxified) exotoxins produced by organisms.

TYPES OF VACCINES

There are several types of vaccines used in animals. The majority of the licensed veterinary vaccines currently in use are inactivated (killed) vaccines, live-attenuated vaccines, or toxoids. All these represent different strategies used to reduce the risk of illness while retaining the ability to induce a beneficial immune response.

Attenuated vaccine: Some vaccines contain live, but altered microorganisms. Many of these are active viruses cultivated under conditions that disable their virulent properties or use closely related but less dangerous organisms to produce a broad immune response.

Although most attenuated vaccines are viral, some are bacterial. Attenuated vaccines have some advantages and disadvantages. Attenuated, or live, weakened, vaccines typically provoke more durable immunological responses. But they may not be safe for use in immune compromised individuals. Anthrax spore vaccine is a attenuated bacterial vaccine used in cattle, buffaloes, sheep and goat for prevention of anthrax in these animals and attenuated PPR vaccine to prevent PPR in goat. Some of the live poultry vaccines are RaniVax Plus Vet Initial, RaniVax Plus Vet Booster, Lasovax Vet, GumboMed Plus Vet (Incepta Pharmaceuticals Ltd.), Bangla BCRDV, Bangla LaSota (FnF Pharmaceuticals Ltd.) etc.

Inactivated vaccine: Some vaccines contain inactivated but previously virulent microorganisms that have been destroyed with chemicals, heat, or radiation. Inactivated vaccines are mainly used 3-4 weeks old pullet before laying and laying hens, breeder types of chickens to maintain protective level of antibody titers. Examples of inactivated vaccines are trivalent FMD vaccine (Khuravax – (Incepta Vaccine Ltd.), Arriah, One Pharma Ltd (imported vaccine)., Bangla FMD, FnF Pharma) used in cattle, buffaloes, sheep and goat. Inactivated poultry vaccines are available from commercial importer and also from local manufactures (GuardFlu Vet, GuardFlu

Plus Vet, EDS Plus Vet; (Incepta Pharmaceuticals Ltd.), Gallimune H9+ND, Gumbopest: Square Pharmaceuticals Ltd.,), Bangla ND, Bangla ND+IBD, (FnF Pharmaceuticals Ltd.) etc.

- **Toxoid vaccine:** Toxoids are made from inactivated toxic compounds produced by microorganisms that, when activated, cause damage to cells. Examples of toxoid-based vaccines include tetanus and clostridium.
- **Subunit vaccines:** These vaccines contain short, specific proteins that are the same as the antigens of the target pathogen. A subunit vaccine uses a component to induce an immune response rather than introducing an inactivated or attenuated microorganism to an immune system.
- **Conjugate vaccine**: Certain bacteria have a polysaccharide outer coat, which is a weak antigen. The immune system has a more robust response by linking these outer coats to proteins (toxins), which are strong antigens.
- **Outer membrane vesicles (OMVs)**: OMVs are released spontaneously during growth by many groups of bacteria. They have the ability to naturally provoke an immune response in the body of a human or other animal and can be manipulated to produce potent vaccines. The best known OMVs vaccines are those developed for serotype B Meningococcal disease.
- **Heterologous vaccines**: These are also known as *"**Jennerian vaccines***". The heterologous vaccines contain pathogens from other animals that either do not cause disease or cause mild illness in the organism being treated. The classic example is Jenner's use of cowpox to protect against smallpox. A current example is using the vaccine made from *Mycobacterium bovis* to protect against tuberculosis in humans. Goat Pox Vaccine to protect Lumpy Skin Diseases (LSD).
- **Viral vector vaccines**: This vaccine uses a nonpathogenic virus to insert pathogen genes in the body to produce specific antigens, such as surface proteins, to stimulate an immune response. The new Epizootic Hemorrhagic Disease Virus (EHDV) vaccine uses this technology in combination with the subunit vaccine technology.

RNA vaccine: A mRNA vaccine is a novel type of vaccine composed of nucleic acid RNA, packaged within a unique delivery system like lipid nano particles.

How do vaccines work

Vaccines expose the animal to parts of pathogens, challenging the immune system to react to a possible pathogen invasion by creating memory cells for the antigens belonging to that specific pathogen which is called antibody. In the future, if the animal is exposed to the same pathogen, the immune system will quickly generate a response before the pathogen can cause disease.

Each antibody is usually specific for only one antigen. Because of this, the immune system keeps a supply of millions of different antibodies on hand to be prepared to overcome any foreign invader. For a naive animal (an animal that never was exposed to the pathogen), it may take 7 to 14 days after exposure to an infectious agent for the body to develop immunity to an antigen, which is plenty of time for some pathogens to wreak havoc on the body. On the other hand, it often takes only 48 hours to mount an immune response to the same antigen in a vaccinated animal.

Vaccination is only one tool to prevent disease and cannot be used as a stand alone practice alone to prevent disease or infection on the farm. Vaccination does not result in immediate immunity or resistance against diseases in all vaccinated animals. It takes time for the animal's immune system to react to the vaccine. Therefore, if an animal is vaccinated, it does not automatically mean that the animal cannot be infected or develop the disease. The degree of protection is directly dependent on the animal's health, how well the vaccine is matched to the pathogen, and how well the vaccine is administered to the animal. Vaccines come in many types, but all are

delicate organic products that need to be managed and administrated correctly to ensure their effectiveness.

Important factors to consider when using vaccines

- Use vaccines from a trusted source. Always use vaccines from a trusted veterinary supplier or directly from the company producing the vaccine in Bangladesh.
- Order an adequate amount of vaccine. Always add an extra 10 percent to your order to account for possible vaccine losses during animal handling. If possible, order bottles with fewer doses. Shelf life varies for each type of vaccine. Some vaccines have hours of efficacy after being mixed, some longer. However, it is not recommended to use an open vaccine bottle kept in the refrigerator after long periods. Again, fewer dose bottles help calculate what you need for that day.
- Correct storage conditions. Check instructions on how the vaccine should be stored. Most inactivated animal vaccines require refrigeration at 35 – 45 ˚F (2 – 8˚C). Make sure your storage refrigerator works properly, place a thermometer in a prominent place so you can check the temperature often. Refrigerators held in barns or open sheds can have temperature variations throughout the day, affecting the temperature. Never freeze inactivated vaccine, nor let it get too warm. Always avoid direct sunlight on your vaccine. Live attenuated lyophilized vaccine should be stored at -20˚C until use and after reconstitution vaccine should be kept in ice box during application.
- Expiration dates. Always check expiry dates, and start by using the oldest batch of vaccine first. Once opened, always label the bottle with the date, particularly if remain amount need to use store it for later use.
- Correct Proprietary Preperations and vaccine shelf life after mixing. Follow directions on the label/ leaflet supplied by the manufacturer/ supplier to ensure its effectiveness of vaccines. This is very important; some vaccines need to be reconstituted with sterile water or have special diluent supplied with vaccine that need to be mixed properly and gently with lyophilized antigen. Remember, vaccines are delicate microbial products product. Fluctuation of temperature or suddenly exposure to high temperature may affect the live shocks. Grabbing a cold vaccine bottle with warm hands can rapidly change the container's temperature and affect its efficacy.

Exposure to UV light. Do not expose vaccines to Ultraviolet light from the sun. Some vaccines can be rapidly deactivated if exposed to UV light.

Proper injection techniques. Always inject the vaccine according to the manufacturer's directions. In animals, most vaccines are injected either under the skin – subcutaneous (SQ), in the muscle – intramuscular (IM), wing wave, squirted in the nasal cavity – intranasal (IN), or directly in the blood stream – intravenous (IV). Using the correct technique and location according to the species is essential. Use the right needle size and avoid reusing the same needle on another animal if possible, to reduce the risk of some disease transmission. Darts can be used for intramuscular (IM) injections, even though it is not ideal. When using a dart, there are many variables that you need to consider. Common mistakes include missing, hitting the wrong spot, darting the same animal twice, or an incomplete discharge of the dose. If you are not sure if the animal received the full dose, a second full dose is recommended. There are some great guidelines regarding vaccine management and administration in the livestock industry presented by the Beef Quality Assurance (BQA) program. These best management practices for vaccines can also be applied to other species and aim for successful vaccination outcomes allied to food safety.

Good records. Always record dates, animal ID, and vaccine lot numbers. Keeping good records is critical to improving herd health over time and may

be critical for importing or exporting animals.

- Correct disposal of vaccine containers. Some vaccines have products that need special disposal, so you don't want to keep them on your farm. Read the instruction for proper disposal of used containers. Regulations can vary by state.
- Emergency information. In case of an accidental human injection or exposure to the vaccine, it is always important to have emergency numbers at hand for everyone working on the farm.

Storage and handling of vaccines.

Care must be taken to store and transport all vaccines and other immunological Proprietary Preperations under the conditions recommended by the manufacturer, otherwise theProprietary Preperations may become denatured and totally ineffective. Vaccines should be stored according to the manufacturer's recommendations. Refrigerated storage at 2°C to 8°C is usually necessary for inactivated vaccines and -20^0C for live attenuated vaccines. Unless otherwise specified, live vaccines must not be frozen and should be protected from light. Only sterile needles and syringes should be used for vaccination and injections should be given with aseptic precautions to avoid the possibility of abscess formation or the transmission of incidental infections. Animals should not be vaccinated through dirty, wet skin. The repeated use of single needles and syringes within herds and flocks is not recommended. Injectable vaccines should be stored and reconstituted as recommended by the manufacturer and liquidProprietary Preperations should always be adequately shaken before use to ensure uniformity of the material to be injected.

Companion & Large Animal Vaccines

Vaccines are products designed to trigger protective immune responses and prepare the immune system to fight future infections from disease-causing agents. Vaccines stimulate the immune system's production of antibodies that identify and destroy disease-causing organisms that enter the body. Vaccines provide immunity against one or several diseases that can lessen the severity or prevent certain diseases altogether. Animals receive vaccines for the same reason that humans do: to prevent diseases. Vaccinating animals reduces animal suffering, reduces the transmission of microorganisms in the animal population, and is often more affordable than paying for the treatment of sick animals. Pets receive vaccines for infectious diseases such as rabies, parvovirus, distemper, and hepatitis.

Livestock animals like Cattle, Buffalo, Sheep and Goat are vaccinated to protect against diseases like LSD, FMD, Anthrax, BQ, PPR, HS and Mastitis. Vaccinations keep individual animals, flocks and herds healthy and productiive.

1. Inactivated Trivalent Foot and Mouth Disease (FMD) Vaccine

Description: Foot-and-mouth disease is an infectious and sometimes fatal viral disease that affects cloven-hoofed animals, including domestic and wild bovids. The virus causes a high fever for between two and six days, followed by blisters inside the mouth and on the feet that may rupture and cause lameness. Prevalent seven (07) FMDV Types are O, A, Asia-1, C, SAT-1, SAT-2 and SAT-3 are prevalent in the world, out of these 07 FMDV types only 03 types- O, A and Asia -1 are prevalent in Bangladesh and South-east Asian countries. So, in Bangladesh inactivated trivalent FMD vaccine containing prevalent 03 FMD types O, A and Asia-1 are used for protection of FMD. In Bangladesh, FMDV type O is predominant and FMD causes huge economic loses in livestock sector. Like other viruses, the FMD virus continually evolves and mutates, thus one of the difficulties in vaccinating against it is the huge variation between, and even within, serotypes. There is no cross-protection between serotypes (a vaccine for one serotype will not protect against any others). This means FMD vaccines must be highly specific to the strain

involved. Vaccination only provides temporary immunity that lasts from months to years. There are seven strains of FMD virus and strains vary from region to region. World Organization for Animal Health (WOAH founded as OIE) recommended inactivated tissue culture FMD vaccine that has high immunogenicity and safety profile. It acts by stimulation of predominantly humoral immune response in the vaccinated animals. Potency of the vaccine varies from ≥3 PD_{50}/dose to ≥6 PD_{50}/dose, however, in FMD endemic countries like Bangladesh FMD vaccine of ≥3 PD_{50}/dose is preferable than ≥6 PD_{50}/dose to bring maximum animals under vaccination coverage and will be cost effective than ≥6 PD_{50}/dose. Protective immune response is induced within 14 days after vaccination and to ensure protection, animals need to be revaccinated after 4 month of first vaccination. For valuable animals like high yielding milking cows, bull used for semen collection, high valued fattening cattle should be given booster vaccine after 4 to 5 weeks of primary vaccination to ensure better protection.

Target Species: Cloven hoofed animal **(**Cattle, Buffalo, Sheep and Goat).

Indication: For active immunization of cloven-hoofed animals (Cattle, Buffalo, Sheep and Goat) against FMD (Foot and Mouth Disease).

Dosage and administration:

Cattle, Buffaloes & Calves: 2 ml by subcutaneous route.

Goat & Sheep: 1 ml by subcutaneous route or intramuscular routes as per manufacturer instructions.

Primary Vaccination:

Young animals from vaccinated dams: From 3-4 months of age.
Young animals from unvaccinated dams: From 1 months of age.

Booster: 4 to 5 weeks after primary vaccination.

Revaccination: Every 04 months in endemic areas. As FMD is endemic in Bangladesh, that's why revaccination needs after 4 months interval is recommended.

Precautions and Warnings

- Always vaccinate the healthy animals and keep the vaccinated animals comfortable by providing congenial temperature, feed, water and good ventilation.
- Part-used bottles of vaccine must be disposed at the end of the day.
- Keep out of the reach of children.

Side Effects: Swellings (up to 12 cm diameter in ruminants) at the injection site may occur in most animals after vaccination. They usually resolve over a four-week period after vaccination but may last longer in a small number of animals.

A slight increase in rectal temperature, of up to 1.2 °C for 4 days, may affect up to 1 in 10 animals following vaccination.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: The vaccine vial should be kept in cold temperature until used and each vial should be thoroughly shaken before use. If glass syringes are used, syringes and needles must be sterilized before use. It is advised to use sterile one time plastic syringe. The vaccine should be injected through an area of clean, dry skin with precautions taken against contamination, vaccination site should be cleaned with 70% ethanol before and after vaccination. FMD vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

Khuravax Vet *(Incepta Pharmaceuticals Ltd.)*;FMDV types -A, O & Asia-1, inactivated and adjuvanted. Inj. i//m or s/c, 10 ml & 20 ml
Aftovaxpur (*Merial,* imported by *Square Pharmaceuticals Ltd.*); FMDV types- A, O & Asia-1, inactivated and Adjuvanted. Inj. 20 ml, Tk. 2200,

Bangla FMD (*FnF*); Strain: A, O & Asia-1, Killed and Adjuvanted. Inj. 2 ml: Tk. 75, Inj. 6 ml: Tk. 150, Inj. 10 ml: Tk. 250, Inj. 20 ml: Tk. 500,
Khuravax Vet (*Incepta*); Strain: A, O & Asia-1, Killed and Adjuvanted. Inj. 10 ml**:** Tk. 400, Inj. 20 ml: Tk. 700,

2. Anthrax Vaccine

Description: Anthrax is an infectious bacterial disease of animals, caused by the spore-forming bacteria *Bacillus anthracis*. As it's a zoonotic disease it can affect humans and a wide range of animals. Cattle and sheep with anthrax generally die suddenly. Just prior to death, animals may show signs of high fever. Blood may be present around the nose, mouth and anus of carcasses. The Vaccine contains a suspension of living spores of uncapsulated avirulent strain (Sterne 34F2) of *Bacillus anthracis*.

Target Species: Cattle, Sheep and Goat.

Indication: For the active immunization of cattle, sheep and goat against anthrax.

Dosage and administration:

The bottle should be shaken well before each dose is withdrawn.

- Cattle: 1 ml by subcutaneous injection.
- Sheep and Goats: 0.5 ml by subcutaneous injection.
- Animals should first be vaccinated at 3 to 6 months of age and annually thereafter.
- In areas where animals are likely to be subjected to continued exposure to infection, vaccination every 6 months may be advisable.
- Under normal conditions, annual revaccination will usually suffice.

Precautions and Warnings

- Since the immune response to the anthrax component depends on multiplication of the living organisms after injection, the administration of antibacterial drugs should be avoided wherever possible from shortly before and until 2 weeks after vaccination.
- As with all vaccines occasional hypersensitivity reactions may occur. In such cases consult a veterinarian.
- The inoculation of animals late in pregnancy should be avoided unless there is a serious risk of disease.
- Dispose of any unused vaccine as well as all vaccine containers and vaccination equipment according to local waste disposal regulations.
- Although this vaccine has been extensively tested under a large variety of conditions, failure thereof may ensue as a result of a wide range of reasons. If this is suspected, seek veterinary advice and notify the registration holder.
- Keep out of the reach of children.

Side Effects: Usually no marked reaction follows vaccination although a transient swelling may appear at the site of inoculation and an animal may show a rise in body temperature for 1 or 2 days.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

3. Black Quarter Vaccine

Description: Blackleg, black quarter, quarter evil, or quarter ill is an infectious bacterial disease most commonly caused by Clostridium chauvoei, a Gram-positive bacterium. It is seen in livestock all over the world, usually affecting cattle, sheep, and goats. When infection begins, the animal may develop a fever, and the affected limb can feel hot to the touch. The limb usually swells significantly, and the animal can develop lameness on the affected leg. Crepitation (the sensation of air under the skin) can be noticed in many infections, as the area seems to crackle under pressure. The acute nature of the disease makes successful treatment

difficult, and the efficacy of the commonly used vaccine is disputed. This vaccine is a suspension of formalin-killed *Clostridium chauvoei* culture adjuvanted with Aluminium hydroxide gel.

Target Species: Cattle, Buffalo, Sheep and Goat.

Indication: For the active immunization of cattle against Black Quarter.

Dose and administration: Shake well to make uniform suspension.

Cattle and Buffalo: 2 ml by subcutaneous injection.

Sheep and Goats: 1 ml by subcutaneous injection.

The cattle should be vaccinated at least 15-20 days before the onset of seasonal outbreak. It requires about 14 days for the animal to develop full immunity. Immunity usually lasts for 4-6 months.

Booster vaccination is required every six month or just before the seasonal outbreak.

Precautions and Warnings:

- As with all vaccines occasional hypersensitivity reactions may occur. In such cases consult a veterinarian.
- The inoculation of animals late in pregnancy should be avoided unless there is a serious risk of disease.
- Dispose of any unused vaccine as well as all vaccine containers and vaccination equipment according to local waste disposal regulations.
- Keep out of the reach of children.

Side Effects: Usually no marked reaction follows vaccination although a transient swelling may appear at the site of inoculation and an animal may show a rise in body temperature for 1 or 2 days.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

4. Anthrax and Black Quarter Vaccine

Description: Anthrax is an infectious bacterial zoonotic disease of animals, caused by the spore-forming bacteria Bacillus anthracis and Black quarter is an infectious bacterial disease most commonly caused by Clostridium chauvoei, a Gram-positive bacterium. This vaccine contains a suspension of living spores of uncapsulated avirulent strain (Sterne 34F2) of Bacillus anthracis in alum-precipitated Clostridium chauvoei vaccine.

Target Species: Cattle, Sheep and Goat.

Indication: Combined black quarter-anthrax vaccine for the active immunization of cattle, sheep and goats against anthrax and black quarter (Quarter Evil).

Dosage and administration: The bottle should be shaken well before each dose is withdrawn.

- Cattle, sheep and goats: 2 ml by s/c inj.
- Animals should first be vaccinated at 6 months of age and annually thereafter. In areas where animals younger than 6 months of age become infected, earlier vaccination may be carried out but if calves, lambs or kids less than 3 months old are vaccinated a second dose should be given 6 weeks later to ensure an adequate immune response.
- In areas where animals are likely to be subjected to continued exposure to infection, vaccination every 6 months may be advisable.
- Under normal conditions, annual revaccination will usually suffice.

Precautions and Warnings:

- Since the immune response to the anthrax component depends on

multiplication of the living organisms after injection, the administration of antibacterial drugs should be avoided wherever possible from shortly before and until 2 weeks after vaccination.

- As with all vaccines occasional hypersensitivity reactions may occur. In such cases consult a veterinarian.
- Dispose of any unused vaccine as well as all vaccine containers and vaccination equipment according to local waste disposal regulations.
- Although this vaccine has been extensively tested under a large variety of conditions, failure thereof may ensue as a result of a wide range of reasons. If this is suspected, seek veterinary advice and notify the registration holder.
- Keep out of the reach of children.

Side Effects: Usually no marked reaction follows vaccination although a transient swelling may appear at the site of inoculation and an animal may show a rise in body temperature for 1 or 2 days.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: Careful vaccination technique is required to ensure correct delivery. A two-handed technique with pinching of the skin and injection under the fold is recommended (tenting method). Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

Provac AB (*Komipharm* imported by *Rafique Medicine*); Strain: live avirulent strain (Sterne 34F2) of *Bacillus anthracis* in killed alum precipitated *Clostridium chauvoei* vaccine, Inj. 20 ml: Tk. 560.

5. Hemorrhagic Septicemia (HS) Vaccine

Description: Hemorrhagic Septicemia (HS) Vaccine is used for prophylactic measures to control hemorrhagic septicemia disease caused by *Pasteurella multocida* infections in cattle, buffaloes, sheep and goats. HS vaccine contains formalin inactivated cultures of *Pasteurella multocida* (local strain). The inactivated cultures are further purified and concentrated before adjuvantation with oil and aluminium hydroxide gel.

Target Species: Cattle, Buffalo, Sheep and Goat.

Indication: For the active immunization of cattle, sheep, buffalo and goats against Hemorrhagic Septicemia.

Dosage and administration: The bottle should be shaken well before each dose is withdrawn.

Oil Adjuvanted

- Cattle and Buffalo (Above 2 years): 2 ml by subcutaneous injection.
- Cattle and Buffalo in enzootic area (Above 6 months): 1 ml by subcutaneous injection.
- Sheep and Goats: 1 ml by subcutaneous injection.

Alum Precipitated

- Cattle and Buffalo: 5 ml by intramuscular injection.
- Sheep and Goats: 2 ml by intramuscular injection.

Primary Vaccination: From 6 month of age and above.

Booster: 6 months after primary vaccination.

Revaccination: Annual.

Precautions and Warnings

- Immunize only healthy animals. Malnutrition, infestation with worms, administration of immunosuppressive agents such as corticosteroids or radiotherapy will interfere with the immune response to vaccine.
- Keep out of the reach of children.

Side Effects: Generally, there are no adverse reactions noticed. Occasionally a transient palpable swelling may occur at the site of injection, which will subside in

24-48 hours. Anaphylactic shock may occur in 1 percent animal.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

6. Mastitis Vaccine

Description: Mastitis is the persistent, inflammatory reaction of the udder tissue due to physical trauma or microorganisms infections. Mastitis, a potentially fatal mammary gland infection, is the most common disease in dairy cattle worldwide. It is also the most costly disease to the dairy industry. Milk from cows suffering from mastitis has an increased somatic cell count**.** The disease has public health significance. Prevention of Mastitis in cattle by vaccination is so much difficult because a large number of bacteria are associated with this disease. This vaccine contains anacultures of the most commonly found strains like *Streptococcus agalactiae, S. dysgalactiae, S. uberis, S. pyogenes, Staphilococcus aureus, Escherichia coli* (strains Bov-13, Bov-14, Bov-15, Suis-21 and J5) *and Arcanobacterium pyogenes*. Reinforced with immunity adjuvants.

Target Species: Cattle (Adult Cows).

Indication: Active immunization against clinical and subclinical mastitis of the cattle.

Dosage and administration: 5 ml by subcutaneous injection in neck or back region.

First vaccination: two injections with an interval between both applications of 15 days.

The minimum recommended age for the application of the products 20-22 months, 2 months before calving.

Heifer: administer 2 months before the first calve.

Cow: administer in any moment, independently of the physiologic status.

Re-vaccination: every 6 months.

Precautions and Warnings: Immunize only healthy animals. Malnutrition, infestation with worms, administration of immunosuppressive agents such as corticosteroids or radiotherapy will interfere with the immune response to vaccine. Keep out of the reach of children.

Side Effects: Generally, there are no adverse reactions noticed. Occasionally a transient palpable swelling may occur at the site of injection, which will subside in 24-48 hours.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

Mastivac (*Ovejero Laboratories* imported by *SK+F*), Strains (*Streptococcus agalactiae, S. dysgalactiae, S. uberis, S. pyogenes, Staphilococcus aureus, Escherichia coli* (strains Bov-13, Bov-14, Bov-15, Suis-21 and J5) *and Arcanobacterium pyogenes).* Killed and Adjuvanted. Inj. 20 ml (4 doses): Tk.1106, Inj. 100 ml (20 doses): Tk. 3111.

7. PPR Vaccine

Description: Peste des petits ruminants (PPR), also known as 'goat plague', is a viral disease of goats and sheep caused by a morbillivirus in the family of paramyxoviruses characterized by fever, sores in the mouth, diarrhea, pneumonia, and sometimes death. PPR vaccine contains live attenuated Peste des petits ruminants virus grown on Vero cell culture and freeze dried.

Target Species: Goat and Sheep.

Indication: For the prophylactic vaccination against Peste des petits ruminants (PPR) in sheep & goats.

Dosage and administration: 1 ml reconstituted vaccine. Subcutaneous injection at mid neck region is advocated through an area of clean dry skin with all precautions taken.

Suitable age for vaccination is 2-4 months.

Booster vaccination is required every six month or just before the seasonal outbreak.

Revaccination: Annually

The vaccine is presented as freeze-driedProprietary Preperations in vials. Vaccine diluent vials 100 ml are supplied for reconstituting freeze-dried material. Chill the diluent prior to reconstitution. Draw two/five ml sterile diluent from sterile diluent vial using sterile syringe and reconstitute with the freeze-dried vial. Shake well till the contents in the FD vials are completely dissolved. Draw the whole volume of reconstituted mixture using sterile syringe and inject back into the sterile diluent vial, shake gently to get virus suspension. Each ml of the reconstituted mixture contains one immunogenic dose against PPR. The whole contents of the reconstituted vaccine should be used immediately.

Precautions and Warnings

- Sheep & Goat should be dewormed prior to vaccination.
- Vaccination should be completed at least one month prior to monsoons.
- Vaccination should not be taken up in the areas of disease outbreak.
- Vaccination should be checked for cold chain before reconstitution & vaccination.
- Vaccination should be taken up only under the supervision of a registered veterinary practitioner.
- Keep reconstituted vaccine on ice.
- Use reconstituted vaccine immediately.
- Part use of vial and storing in deep freeze or refrigerator is not recommended.
- Fresh sterilized disposable needles are to be used for every sheep & goat to avoid cross contamination.
- A maximum of 10 withdrawals should be made from reconstituted vaccine.
- Vaccination of animals in advanced stage of pregnancy is not recommended.
- In rare cases hypersensitivity may occur, immediate treatment with antihistaminic is advocated.

Side Effects: Generally, no adverse reactions are noticed. A few of vaccinated animals might show pyrexia and transient drop in milk yield. Vaccination could precipitate pre-incubating diseases in rare cases.

Storage: The vaccine should be transported between 2 ^{0}C to 8 ^{0}C upon arrival should be stored at -20 ^{0}C. The diluent should be stored in a cool and dark place.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

8. Goat Pox Vaccine

Description: Goat pox is a contagious viral disease caused by *Goatpox virus*, a pox virus that affects goats and characterised by fever, salivation, nasal discharge, conjunctivitis and vesicles. The vaccine is a live attenuated vaccine. This vaccine is aProprietary Preperations derived from vero cell cultures infected with an attenuated local strain of goat pox virus freeze dried vaccine with 100 ml diluent.

Target Species: Goat

Indication: For the prophylactic vaccination against goat pox in goat.

Dosage and administration: 1 ml reconstituted vaccine. Subcutaneous injection at mid neck region is advocated through an area of clean dry skin with all precautions taken.

Suitable age for vaccination: 4 months to adult. It is advisable to vaccinate after kidding season or before onset of breeding season. Immunity is life long. The vaccine is presented as freeze-driedProprietary Preperations in vials. Vaccine diluent vials 100 ml are supplied

for reconstituting freeze-dried material. Chill the diluent prior to reconstitution. Mix the vial with chilled diluent properly. The whole contents of the reconstituted vaccine should be used immediately.

Precautions and Warnings:

- Vaccine should not recommend before 2 months of age.
- Vaccination should be checked for cold chain before reconstitution & vaccination.
- Use reconstituted vaccine immediately.
- Part use of vial and storing in deep freeze or refrigerator is not recommended.

Side Effects: Not recorded. In rare cases rise in temperature may be observed.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. The diluent should be stored in a cool and dark place.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

9. Rabies Vaccine

Description: Rabies is one of the major zoonotic diseases that cause inflammation of the brain in humans and other mammals. It's a viral disease caused by Lyssavirus. This vaccine is prepared by inactivating Rabies virus grown in VERO cell culture, with ß-propiolactone. It is available in liquid form adjuvanted with aluminium hydroxide gel.

Target Species: Cattle, Sheep, Goat, Dogs and Cats.

Indication: For active immunization of the target species against Rabies.

Dosage and administration:

Inactivated

Cattle and Sheep: 2 ml.

Dog and Cat: 1 ml.

Primary Vaccination: From 12 weeks of age.

Booster: 1 year after primary vaccination.

Revaccination: Every 3 years after booster vaccination.

Live Attenuated

After reconstituted with given diluent follow below vaccine schedule:

Species	Vaccine	Age	Dose	Route	Booster	Revaccination
Dog	LEP	>3 month	3 ml	IM		Every 1 year
Puppy	HEP	<3 month	1.5 ml	IM	**LEP vaccine after 1 month**	
Cat	HEP	>2 month	1.5 ml	IM		Every 1 year
Sheep & Goat	HEP	>3 month	1.5 ml	IM	1 month after	Every 1 year
Cattle	HEP	Adult	3 ml	IM	1 month after	Every 1 year
Calf	HEP	>3 month	1.5 ml	IM	1 month after	Every 1 year

Inactivated vaccine: By subcutaneous injection, preferably behind the shoulder blade.

Live attenuated vaccine: The vaccine is presented as freeze-driedProprietary Preperations in vials. Vaccine diluent vials 5ml are supplied for reconstituting freeze-dried material. Chill the diluent prior to reconstitution. Draw two ml sterile diluent from sterile diluent vial using sterile syringe and reconstitute with the freeze-dried vial. Shake well till the contents in the FD vials are completely dissolved. Draw the whole volume of reconstituted mixture using sterile syringe and inject back into the sterile diluent vial, shake gently to get virus suspension. The whole contents of the reconstituted vaccine should be used immediately. Inject the vaccine by intramuscular route only, preferably thigh muscle.

Precautions and Warnings

- Always vaccinate the healthy animals and keep the vaccinated animals comfortable by providing congenial temperature, feed, water and good ventilation.
- Part-used bottles of vaccine must be disposed at the end of the day.
- Don't inject live attenuated vaccine by subcutaneous route.
- Keep out of the reach of children.

Side Effects: Generally, there are no adverse reactions noticed. Occasionally a transient palpable swelling may occur at the site of injection, which will subside in 24-48 hours.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 8 ^{0}C. Antigenicity of the vaccine deteriorates if the temperature is allowed to rise above this range. Do not freeze the vaccine.

Special Note: Rabies vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

Rabisin (*Merial* imported by *Square Pharmaceutical Ltd.*), Killed and Adjuvanted. Inj. 1 ml: Tk. 790.

Rabies Killed Vac (*Komipharm* imported by *Rafique Medicine*), Killed and Adjuvanted. Inj. 2 ml: Tk. 200, Inj. 10 ml: Tk. 550.

CaniShot RV-K *(Manufactured by CAVAC imported by Pharma & Firm):* Strain-Pasteur, inactivated killed, 1ml/Dose- 305tk

10. Canine Distemper, Canine Contagious Hepatitis, Canine Parvovirus, Canine Parainfluenza and Leptospirosis vaccine

Description: These are the most common diseases of dog which affect different systems such as respiratory, gastrointestinal and nervous system. Vaccine for prevention of core diseases in dog elaborated with two fractions. Freeze dried fraction contains live Canine Distemper Virus (CDV) Lederle Strain, Canine Adenovirus type2 (CAV-2) Manhattan strain, Canine Parvovirus (CPV)-Cornell strain, Canine Parainfluenza virus (CPIV) Manhattan strain and liquid fraction contains inactivated *Leptospira interrogans sp..*

Target Species: Dog

Indication: Active immunization of dogs from 8 weeks of age from-

1. Prevent mortality and clinical signs of Canine Distemper, Canine Parvovirus disease and Infectious Canine Hepatitis.
2. Reduce infection and clinical signs of respiratory disease induced by CAV-2 and canine Parainfluenza Virus.
3. Prevent infection, mortality, clinical signs and lesions of *L. canicola* and *L. icterohaemorrhagiae*.

Dosage and administration: 1 ml.

First vaccination: 7-8 Weeks of age.

Booster: 12-16 weeks of age.

Re-vaccination: every 6 months.

After reconstitution of the freeze-dried fraction with liquid fraction, administer one dose of by Subcutaneous or Intramuscular route as per vaccination schedule.

Precautions and Warnings

- Use immediately after reconstitution.
- Keep out of the reach of children.

Side Effects: Generally, there are no adverse reactions noticed. Occasionally a transient palpable swelling may occur at the site of injection, which will subside in 24-48 hours.

Storage: The vaccine should be stored and transported between 2 ^{0}C to 6 ^{0}C. Protect from light. Do not freeze the vaccine.

Special Note: Vaccine is not recommended for the animals that are clinically sick or severely debilitated or under stress or strain.

Proprietary Preperations

Canigen DHa2PPi/L (*Virbac*); Strain: Freeze dried fraction contains live Canine Distemper Virus (CDV) Lederle Strain, Canine Adenovirus type2 (CAV-2)

Manhattan strain, Canine Parvovirus (CPV)-Cornell strain, Canine Parainfluenza virus (CPIV) Manhattan strain and liquid fraction contains inactivated *Leptospira interrogans sp.* Inj. 1 ml: Tk. 1200.

CaniShot DHPPL *(Manufactured by CAVAC imported by Pharma & Firm):* Strain- Freeze dried fraction contains live Canine Distemper Virus (CDV) Onder Stepoort Strain, Canine Adenovirus type2 (CAV-2) Manhattan strain, Canine Parvovirus (CPV)-LP780916- strain, Canine Parainfluenza virus (CPIV) D008 strain and liquid fraction contains inactivated *Leptospira interrogans sp,* Tk. 510/1Dose.

Poultry Bacterial Vaccine

1. Infectious Coryza Disease Vaccine

Description: Infections Coryza is usually acute and sometimes chronic, highly infectious disease of chickens, occasionally pheasants and guinea-fowl. Infectious Coryza is characterized by nasal discharge, sneezing, and swelling of the face under the eyes. Chickens of all ages are susceptible; however, the disease is usually less severe in immature birds. The incubation period is 1–3 days, and the disease duration is usually 2–3 weeks. It is caused by the bacterium *Haemophilus paragallinarum*. Most commonly used serotypes for killed vaccine production are *Haemophilus paragallinarum* serotypes *A*, *B* and *C*.

Target Species: Chickens, occasionally pheasants and guinea-fowl.

Indication: Indicated for the immunization of healthy birds against Infectious Coryza.

Dosage and Administration: Inject 0.5 ml/bird subcutaneously in the lower part of the back of the neck or by intramuscular route into the breast or thigh muscle at 5-10 weeks old breeder and pullets. A dose should be repeated a few weeks before the onset of lay.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 ^{o}C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. This vaccine contains oil-based adjuvant, so accidental injection into a human may cause severe pain and inflammation. Clean and disinfect the wound immediately, consult with a doctor and show him the leaflet.

Proprietary Preperations

Coryzavax Vet. *(Incepta Pharmaceuticals Ltd.)*, *Avibacterium paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 500 and 1000 doses.

Nobilis CORVAC (*MSD,* imported by *Bengal Overseas Ltd.*); *Avibacterium paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 1000 doses.

HAEMOVAX (*Merial,* imported by *Square.*); *Avibacterium paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 1000 doses.

CORIPRAVAC (*Hipra,* imported by *Nasco, Bangladesh*); *Haemophilus paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 1000 doses: Tk. 2400.

ITA CORYZA ABC Gel (*Laprovet,* imported by *Navana Animal Health*); *Avibacterium paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 1000 doses: Tk. 3900.

IZOVAC CORYZA3 (*Vaxxinova,* imported by *Renata Limited*); *Haemophilus paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 1000 doses: Tk. 3019.21.

Poulshot CORYZA (*CAVAC,* imported by *Pharma & Firm*); *Haemophilus paragallinarum* serotypes *A*,

B and *C*, Inactivated and Adjuvanted, Inj. 1000 doses. Tk-3237

Provac Coryza-3 (*Komipharm,* imported by *Rafique Medicine Bangladesh*); *Avibacterium paragallinarum* serotypes *A*, *B* and *C*, Inactivated and Adjuvanted, Inj. 1000 doses.

Poulvac Coryza ABC IC3 (*Zoetis, imported by Elanco Bnagladesh Limited*) Haemophilus paragallinarum serotypes A, B and C, Inactivated and Adjuvanted, Inj. 1000 doses

Avipro 101 Coryza Gold (*Elanco*) Haemophilus paragallinarum serotypes A, B and C, Inactivated and Adjuvanted, Inj. 1000 doses,

2. Fowl Cholera Disease Vaccine

Description: Fowl cholera is also called avian cholera, avian pasteurellosis, avian hemorrhagic septicemia. It is the most common pasteurellosis of poultry caused by *Pasteurella multocida*. In acute cases, a green diarrhea can be an early symptom. The most typical symptom, in chronic cases, is the swollen and cyanotic wattles and face. In acute cases, the most typical post-mortem lesion is the petechiae observed in the epicardial fatty tissue. The incubation period is usually 5-8 days and the morbidity and mortality may be up to 100%. Fowl cholera can be prevented by an effective killed vaccine. Fowl cholera vaccine (killed) is a Proprietary Preperations of one or more suitable strains of one or more serotypes of *Pasteurella multocida*.

Target Species: Chickens, turkeys, ducks and geese.

Indication: Indicated for the immunization of healthy birds against Fowl Cholera.

Dosage and administration: Inject 0.5 ml/bird subcutaneously in the lower part of the back of the neck at 7-10 weeks old poultry. A dose should be repeated at 3-4 weeks later and revaccinated at 6 months intervals.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- Before use allow the vaccine to reach at a temperature between 20 – 25^{o} C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8^{0} C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. This vaccine contains oil-based adjuvant, so accidental injection into a human may cause severe pain and inflammation. Clean and disinfect the wound immediately, consult with a doctor and show him the leaflet.

Proprietary Preperations

Avicolvax Vet *(Incepta Pharmaceuticals Ltd.); Pastuerella multocida Type A* serotypes 1, 3 and 4, Inactivated and Adjuvanted, Inj. 500 Doses: and 1000 doses.

MULTIMUNE K5 (*Ceva,* imported by *ACI Animal Health.*); *Pastuerella multocida* serotypes 1, 3 and 4 and 2 isolates of 3 x 4, Inactivated and Adjuvanted, Inj. 1000 doses.

Bangla Fowl Cholera (*FnF Pharmaceuticals Ltd.*); *Pastuerella multocida* serotypes 1, 3 and 4, Killed and Adjuvanted, Inj. 500 doses.

BIO-CHOLERA (*Merial,* imported by *Advance Animal Science Co. Ltd.*); *Pastuerella multocida* serotypes 1, 3 and 4, Inactivated and Adjuvanted, Inj. 1000 doses.

Avicolvax Vet *(Incepta); Pastuerella multocida Type A* serotypes 1, 3 and 4, Killed and Adjuvanted, Inj. 500 Doses: Tk.2670 and 1000 doses: Tk. 5219,

3. Coccidiosis Disease Vaccine

Description: Coccidiosis is a protozoal disease caused by *Eimeria sp.* mostly in chickens; some species can also have disease including turkeys, quail and pheasants. Nine species of Eimeria occur in the chicken and 6 are important. (*E. acervulina*, *E. maxima*, *E. brunetti*. *E. necatrix*, *E. mitis*, *E. tenella*). Coccidiosis

vaccine is a whitish suspension of live, freeze dried, trivalent and quadrivalent strains Vaccine.

Target Species: Poultry, specifically commercial breeder and layer chickens (1-10 days age)

Indications: For immunization of domestic poultry, specifically commercial breeder and layer chickens, against coccidiosis caused by *E. acervulina, E. maxima, E. tenella* and *E. necatrix*. Immunity develops 10 - 14 days after vaccination and remains active during the bird's whole life.

Dosage and administration:

Administration via spraying

Vaccinate day-old chick via spray method or via drinking water at 1-10 days of age (Refer to technical insert for vaccine suspensionProprietary Preperations).

Administration via spraying: Suitable for vaccination of one-day- old chickens in hatcheries. Shake the bottle well and dilute its content with the appropriate amount of water as indicated below. Then apply in coarse spray to chickens already placed in transport crates. Sprayed chickens must be kept in the crates at least for next 3 hours.

Dosage: For every 100 chickens, use 1ml (=100 doses) of Vaccine diluted in 19ml of water.

Administration via drinking water

Vaccine should be administered orally to chickens 1-10 days old. Shake the bottle well and dilute its contentwith the appropriate amount of drinking water as indicated below. Stop water supply for 2 hours before vaccination. The birds should then drink all the water containing Vaccine dry within next 2 hours.

Dosage: Vaccine dilution should be adjusted to chickens´ age and temperature in the poultry house. Use following formula to achieve optimal dosage: 1L of water for every 1,000 chickens and every day of their age. (i.e. 4 day of age, require 4L of water)

Precautions and Warnings:

- Chickens to be vaccinated must be healthy and raised under good management conditions.
- Do not use anticoccidial drugs or furazolidone in feed during the whole growing period.
- Discontinue the use of sulphonamides and amprolium for at least 2 days before and 7 days after the vaccination
- Dilute vaccine with cold drinking water only.
- Provide adequate number of drinkers so that all birds can receive the correct dose of the vaccine.
- Keep out of reach of children.

Side Effects: 1 - 2 weeks after vaccination a temporary impairment of feed conversion may be recorded.

Storage: Store in dry and dark place at +2 to +8 °C. Do not freeze.

Special Note: Avoid using theProprietary Preperations together with anticoccidials including sulphonamides. Dead animals sent for pathological and anatomical examination shall be accompanied with a document confirming that they were vaccinated against coccidiosis, to avoid any misdiagnosis.

Avoid using feed containing any anticoccidials for the whole life of the flock, and administration of sulphonamides between 2 days before and 14 days after the vaccination. TheProprietary Preperations can be used during egg laying period.

Proprietary Preperations

Livacox-Q (*Biopharm* imported by *Advance*); Strain: *Eimeria tenella, E. acervulina, E. maxima,* and*E. necatrix*. Live Attenuated Quadrivalent. Inj. 500 and 1000 dose.

Livacox-T (*Biopharm* imported by *Advance*); Strain: *Eimeria tenella, E. acervulina* and *E. maxima*. Live Attenuated Trivalent. Inj. 500 and 1000 dose.

4. Fowl Typhoid Disease Vaccine

Description: Fowl Typhoid is a bacterial disease caused by *Salmonella gallinarum.* In mature fowl, FT is manifested by decreased egg production, fertility, hatchability and anorexia, and increased mortality. Infection with Salmonella is one of the most common and important zoonoses but Fowl Typhoid is host adapted to avian species and considered to pose a minimal zoonotic risk. The vaccine is live freeze-dried and killed vaccine for the active immunization of healthy layers as an aid in the control of *Salmonella gallinarum* (fowl typhoid) and *Salmonella enteritidis*.

Target Species: Layer chickens

Indications: For the active immunization of healthy layers as an aid in the control of *Salmonella gallinarum* (fowl typhoid) and *Salmonella enteritidis*.

Dosage and administration:

Dose: 0.2 ml by subcutaneous route after reconstitutes the vaccine with diluent. For revaccination the vaccine may be administered via drinking water.

First vaccination: More than 6 weeks of age.

Second vaccination: 1 month after first vaccination.

Booster vaccination: 6 months after first vaccination.

Revaccination: In high risk situations revaccination at the interval of 12 weeks is recommended.

Precautions and Warnings:

- Initial vaccination should be carried out after 6 weeks of age
- Chickens to be vaccinated must be healthy and raised under good management conditions.
- Provide adequate number of drinkers so that all birds can receive the correct dose of the vaccine.
- The use of antibiotics or other substances with a systemic action should be avoided from 7 days before vaccination to 14 days after vaccination.
- Each vial should be used within 2 hours after reconstitution.
- Should a vaccinator accidentally inject himself or a bystander, a local reaction may occur. It is recommended that the advice of a doctor is sought.
- Keep out of reach of children.

Side Effects: Normally no side effects observed.

Storage: Store in the dark between 2 °C and 8 °C. Do not freeze.

Special Note: It is advisable to vaccinate all the susceptible fowls on the farm at the same time. If this is not feasible, strict separation of the vaccinated and the unvaccinated fowls should be done to prevent the spread of the vaccine organisms to the unvaccinated fowls. For the optimal development of immunity it is recommended that chickens are not introduced into an infected environment until 14 days after primary vaccination. However, experience in the field has shown that for Salmonella gallinarum, emergency vaccination at an early stage of infection may be effective.

Proprietary Preperations

NOBILIS SG 9R (*Intervet*); Strain: Live *Salmonella gallinarum* organisms strain 9R. Live freeze dried. Tablet 1000 doses.

LAYERMUNE SE (*CEVA imported by ACI),* Strain: *Salmonella enteritidis.* Killed and adjuvanted. Inj. 1000 Dose.

Avipro Salmonella Vac E (*Elanco*) Live, Salmonella Enteritidis, 2000 Dose.

Avipro Salmonella Duo (*Elanco*) Live, Salmonella Enteritidis and Salmonella Typhimurium, 2000 Dose.

5. Mycoplasma Disease Vaccine

Description: The most economically significant mycoplasma pathogen of poultry is *Mycoplasma gallisepticum*, and has a world-wide distribution. This disease affects chickens and turkeys worldwide, causing the most significant economic losses in large commercial operations. In most countries, control programmes for *M. gallisepticum* are

based on maintaining commercial breeding stock free of infection. In instances where control of *M. gallisepticum* infection is not feasible, *M. gallisepticum* vaccines, is being evaluated as an option. The vaccine is Live and inactivated against *Mycoplasma gallisepticum*.

Target Species: Chickens (Future layers)

Indications: Vaccination against infections caused by Mycoplasma gallisepticum in chickens

Dosage and administration:

Live Vaccine: 1 dose per bird from six weeks of age. To be fully effective, the vaccine must be administered by aerosol to healthy birds maintained in a proper environment under good management.

Killed vaccine: 0.5 ml per bird from 3 weeks of age by subcutaneous route in the lower part of the neck.

Precautions and Warnings:

- Do not vaccinate within 4 weeks of the onset of lay or to laying birds.
- Vaccinate healthy birds only.
- Before use allow the vaccine to reach room temperature (20-25˚C).
- Do not use other vaccine within 14 days.
- Provide adequate number of drinkers so that all birds can receive the correct dose of the vaccine.
- The use of antibiotics or other substances with a systemic action especially those with anti-mycoplasmal activity should be avoided from 7 days before vaccination to 14 days after vaccination.
- A minimum interval of two weeks must be allowed between the use of vaccine and other vaccine against disease of the respiratory tract (for example Newcastle Disease and Infectious Bronchitis)
- Do not mix with other vaccines.
- Keep out of the reach of children.

Side Effects: Normally no side effects observed.

Storage: Store in the dark between 2 °C and 8 °C. Do not freeze.

Special Note: It is advisable to vaccinate all the susceptible chickens on the farm at the same time. Should a vaccinator by accident inject himself or a bystander, a local reaction may occur in case oil emulsion inactivated vaccine. It is recommended that the advice of a doctor is sought, taking care to inform the doctor that the vaccine is an oil emulsion.

Proprietary Preperations

NOBILIS MG INAC (*Intervet*); Strain: Mycoplasma gallisepticum Strain 56 bacterial concentrate. Inactivated and adjuvanted. Inj. 1000 doses.

NOBILIS MG 6/85 (*Intervet*); Strain: Mycoplasma gallisepticum Strain 6/85. Live and freeze dried. Tab. 1000 doses.

Avipro MG F (*Elanco*), F Strain, Live, 1000 doses

Avipro 104 MG Bacterin (*Elanco*) Inactivated, 1000 doses

IZOVAC MG (VET) *(Vaxxinova, Renata Limited)*, Strain: Mycoplasma gallisepticum Strain S6 bacterial concentrate. Killed 1000 doses.

PoulShot MG/F *(CAVAC imported By Pharma & Firm),* Inactivated Strain: F810, Dose: 1000, Tk. 5290/1000dose

POULTRY VIRAL VACCINE

1. Newcastle Disease Vaccine

Description: Newcastle disease is one of the most important viral disease which causes devastating loss in both commercial and village chickens. Virulent ND causes high mortality of chickens. ND can be controlled by the use of vaccines. Usually two types of vaccines are used in field and commercial chickens: Attenuated live vaccines and killed vaccine. Live vaccines are prepared by low to moderate virulence virus and Inactivated/Killed vaccines are treated with chemicals, radiation or heat. There are many Newcastle disease vaccines suitable for use in scavenging and commercial chickens. Some vaccine strains of Newcastle disease virus are preferable for vaccine Proprietary Preperations. Such as:

1. Lentogenic strains: F, B1 and LaSota; ‘F’ strain is used in chickens age 5-7 days, ‘B1’ slight virulent than F strain.

LaSota strain is usually used as booster, vaccine in flocks vaccinated with 'F' or 'B1' strain.
2. Mesogenic strains: Mukteshwar, Komarov are usually used as booster dose, administered by injection.
3. Avirulent strains: V4, V4-HR are used for all age of chickens. They are heat resistant/thermostable strains.

Target Species: Healthy chickens that are maintained under good environmental condition.

Indication: Vaccination of poultry against Newcastle Disease.

Dosage and administration:

For live vaccine:
1. **Intraocular administration:** Reconstitute vaccine with diluent and shake it until all contents are dissolved.
   Administer one drop of vaccine on the bird's eye. Be sure the vaccine spreads over the eye before releasing the birds.
2. **Drinking water method:** Remove all medicants, sanitizers and disinfectants from the drinking water 3 days prior to vaccination.

Provide sufficient water so all chickens can drink at one time, Shut off others water supply from farm for proper use of vaccine mixed water of supplied matters.

Drinking water for vaccine delivery should contain 29/30 grams of non-fat dry milk per gallon of non-chlorinated, iron free water.

Distribute vaccine solution among water

Don't provide additional drinking water until all vaccine is consumed.

For Inactivated/Killed vaccine:

Subcutaneous method.

Birds should be primed with live vaccine (at least 4 wks prior to inactivated vaccine)
Vaccinate 4-6 wks of age of birds
Inject 0.5 ml per bird subcutaneously at neck region
Shake before use.

Precautions and Warnings

Live vaccine

- Newcastle Disease virus may cause a mild inflammation of the eye in humans which lasts for two or three days. Care should therefore be taken when handling the virus to avoid contact with the eyes.
- Satisfactory protection can be achieved only in healthy chicken. Always round the number of doses same or up (e.g. 1000 doses for 1000 chicken), do not stretch the doses.
- All the chicken in the flock must be vaccinated at the same time. Administer the vaccine during the coolest time of the day.
- Dispose off all opened vaccine vials remaining after vaccination. Do not refreeze the reconstituted vaccine.
- Improper storage or handling of the vaccine may result in loss of potency and efficacy.

Killed Vaccine

- Do not vaccinate within 42 days before slaughter.
- Do not use chemical disinfectants for sterilization
- Remove the vaccine from refrigerator at least 1 day before vaccination for better results
- Use entire contents of bottle when first opened
- Shake well before and during use
- Vaccinate only healthy birds
- For veterinary use only

Side Effects: The vaccine is generally well tolerated. But, rarely catarrhal respiratory symptoms may appear 4 to 6 days following vaccination but disappear within few days.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not

develop adequate immunity following vaccination.

Proprietary Preperations

Live Vaccines

AVI ND HB1 (*Laprovet,* imported by *Navana*); Strain: Newcastle Disease Virus Strain Hitchner B1, Live Freeze Dried. 500 doses: Tk. 159.99 & 1000 doses: Tk. 195.90.

AVI ND Lasota (*Laprovet,* imported by *Navana*); Strain: Newcastle Disease Virus Strain Lasota, Live Freeze Dried. 500 doses: Tk. 170.32 & 1000 doses: Tk. 221.76.

Avinew Neo *(Merial, imported by Square);* Strain: Newcastle Disease Virus Strain VG/GA-AVINEW, Live Freeze Dried. 1000 doses &.2000 doses.

Bangla ND LaSota (*FnF*); Strain: Lactogenic LaSota strain, Live Freeze Dried. 500 doses: Tk. 150.00 & 1000 doses: Tk. 200.00.

Cevac New L (*Cevac,* imported by *ACI);* Strain: LaSota lentogenic strain of Newcastle Disease virus, Live Freeze Dried, 500 doses & 1000 doses.

GallivacLaSota (*Merial,* imported by *Advance*); Strain: Newcastle Disease Virus Strain LaSota, Live Freeze Dried,1000 doses.

Himmvac ND LaSota Live Vaccine (*KBNP, INC imported by Tajarat*); Strain: Newcastle Disease Virus Strain Lasota, Live Freeze Dried. 1000 doses: Tk. 119.08.

Hipraviar Clone/79 (*Hipra,* imported by *Nasco*); Strain: Newcastle Disease Virus, Strain Clone, Live Freeze Dried, 1000 doses.

Hipraviar-S (*Hipra,* imported by *Nasco*); Strain: Live Newcastle Disease Virus Strain Lasota, Live Freeze Dried. 1000 doses.

Izovac B1 Hitchner Strain (*Vaxxinova,* imported by *Renata*); Strain: Newcastle Disease Virus Strain B1 Hitchner, Live Freeze Dried. 1000 doses: Tk. 154.00.

Izovac ND Lasota (*Vaxxinova,* imported by *Renata*); Strain: Newcastle Disease Virus Strain B1 Hitchner, Live Freeze Dried. 1000 doses: Tk 225.00.

Izovac Clone (*Vaxxinova*, imported by *Renata*); Attenuated NDV, Strain Clone:1000 doses; Tk. 340

Newcastle Disease Vaccine (*Zoetis,* imported by *Elanco*); Strain: B1 type LaSota starin, Live Freeze Dried. 1000 doses: Tk 438.00.

Nobilis ND Clone 30 (*MSD,* imported by *Bengal*); Strain: Live ND strain Clone 30, Live Freeze Dried. 1000 doses.

Lasovax Vet (*Incepta*); Newcastle Disease (LaSota Strain), live Freeze Dried. 500 Doses: Tk 150, 1000 Doses: Tk 210.

Poulshot LaSota (*Cavac* imported by *Pharma & Firm*); Strain: Newcastle Disease Virus, Strain LaSota, Live Freeze Dried. 1000 doses. Tk-305.00.Ranivax Plus vet Initial (*Incepta harmaceuticals Ltd.*). Live freez dried, 500 and 1000 doses.

Ranivx Plus Vet Booster (*Incepta pharmaceuticals Ltd.*). Live freez dried, 300, 500 and 1000 doses.

MuktaVax Vet Vaccine (*Incepta Pharmaceuticals Ltd.*), Live, 300, 500 and 1000 doses

Provac ND (*Komipharma,* imported by *Rafique Medicine*); Strain: Newcastle Disease Virus, Strain LaSota, Live Freeze Dried. 1000 doses.

Ornipest (*Bioveta,* imported by *Eon*); Strain: Newcastle Disease Virus strain Paramyxo virus, Live Freeze Dried, 500 doses: Tk. 117.00 & 1000 doses: Tk. 214.00.

Inactivated vaccines

Bangla ND Vac Killed (*FnF Pharmaceuticals Ltd.***)**; Strain: Viscerotropic velogenic strain, Inactivated. 500 doses: Tk. 1000.00 & 1000 doses: Tk. 2000.00.

Cevac New K (*Cevac,* imported by *ACI*); Strain: Newcastle Disease Virus, Strain LaSota, Inactivated. 500 and 1000 doses.

Himmvac ND Oil Vaccine (*KBNP,* imported by *Tajarat*); Strain: Newcastle Disease Virus strain (B1), Inactivated. 1000 doses: Tk. 2290.46.

Himmvac Dalguban N Plus Oil Vaccine (*KBNP,* imported by *Tajarat*); Strain: Newcastle Disease Virus strain KBNP-C4152R2L, Inactivated. 1000 doses: Tk. 3677.46.

Hipraviar BPL2 (*Hipra,* imported by *Nasco*); Strain: Newcastle Disease Virus Strain Lasota, Inactivated. 1000 doses.

ITA New (ND) (*Laprovet,* imported by *Navana*); Strain: LaSota, Inactivated. 1000 doses: Tk. 2040.65.

Izovac ND Vaccine (*Vaxxinova,* imported by *Renata*); Strain: Newcastle Disease Virus Strain LaSota, Inactivated. 1000 doses: Tk.2050.00.

Nobilis ND Broiler (*MSD,* imported by *Bengal*); Strain: Newcastle Disease Virus strain, Inactivated. 2000 doses.

Nobilis Newcavac (*MSD,* imported by *Bengal*); Strain: Newcastle Disease Virus strain, Inactivated. 2000 doses.

Avipro 105 ND Chicks (*Elanco*) Inactivated, B1 Type Lasota

Imopest (*Boehriner Ingelheim*, imported by *Square)* Strain: Ulster 2C Newcastle Disease Virus strain, Inactivated. 1000 doses. Tk. 2267.00

2. Infectious Bronchitis Disease Vaccine

Avian infectious bronchitis (IB) is caused by the gamma corona virus infectious bronchitis virus (IBV). The virus causes infections mainly in chickens and is a significant pathogen of commercial meat and egg type birds. IB is an acute, contagious disease characterized primarily by respiratory signs in growing chickens. In hens, decreased egg production and quality are often observed. Some strains of the virus are nephropathogenic and produce interstitial nephritis and mortality. Avian infectious bronchitis (IB) was first described in the United States of America (USA) in the 1930s as an acute respiratory disease mainly of young chickens. Morbidity is 100% in non-vaccinated flocks. Mortality varies according to the virus strain (up to 60% in non-vaccinated flocks). This disease is resistant in turkeys. Most commonly used strain in live vaccine is Massachusetts.

Target Species: Chickens.

Indication: Indicated for the immunization of healthy birds against Infectious Bronchitis Disease.

Dosage and administration: One dose per bird in each vaccination. The optimum time and method of administration depend largely upon the local situation. Therefore, the advice of a veterinarian should be sought. The vaccine is safe to use from 1 day of age onwards. As a guide: Broilers-Vaccination at day-old, by coarse spray or intranasal/intraocular or 10-15 days of broiler. Layers and breeders-Vaccination at day-old, by coarse spray or intranasal/intraocular. Revaccination at approximately 6 weeks of age by spray, intranasal/intraocular or drinking water administration.

Spray method: The vaccine should be dissolved in cool, clean water which is free of iron and chlorine. The vials should be opened under water. The spray apparatus should be free from sediments, corrosion and traces of disinfectants (preferably used for vaccination purpose only). The vaccine-medicated water should be sprayed evenly over the correct number of birds, at a distance of 30 to 40 cm, preferably when the birds are sitting together in dim light. For day-old chicks use 0.25 liter for 1000 birds and for older birds use 0.5 liter for 1000 birds and set the nozzle to produce a coarse spray.

Intranasal/ intraocular instillation: Dissolve the vaccine in physiological saline solution or respective company supplied diluent (usually 30 ml per 1000 doses) and administer by means of a standardized dropper. One drop should be applied from a height of a few centi-metres into one nostril or one eye. The handler should ensure that the bird inhales the nasal drop.

Drinking water: The vials should be opened under water. Use cool, clean water which is free of iron and chlorine. By adding 2gm skimmed milk powder per litre of water the virus retains its

Precautions and Warnings:

- Wash and disinfect hands and equipment after vaccinating.
- Vaccinate healthy birds only.
- Each vial should be used immediately after opening.
- Dispose of empty or part-used vials in accordance with local regulations.

Side Effects: The vaccine is generally well tolerated

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. Administration by coarse spray or the oculo/nasal route gives the best response. This should be the methods of choice, especially when vaccinating young birds.

Proprietary Preperations

AviPro IB H120 *(Zoetis,* imported by *Elanco);* Strain: IB Strain H120, Live Freeze Dried. 1000 doses.

GALLIVAC IB88 *(Merial,* imported by *Advance);* Strain: IB strain CR88121, Live Freeze Dried.1000 doses.

Himmvac IB Live Vaccine *(KBNP, INC* imported by *Tajarat)***;** Strain: IB Virus strain H-120, Live Freeze Dried. 1000 doses.

Nobilis IB Ma5 *(MSD,* imported by *Bengal)***;** Strain: IBV strain Ma5, Live Freeze Dried. 1000 doses & 2500 doses.

Nobilis IB 4/91*(MSD,* imported by *Bengal)*; Strain: IBV variant strain 4/91, Live Freeze Dried. 1000 doses & 2500 doses.

Cevac IBird (*Cevac*, imported by *ACI*); Strain: IB variant 1/96 strain, Live Freeze Dried.1000 doses.

Bioral H120 NeO *(Boehringer Ingelheim,* imported by *Square Phrmaceuticls Ltd.);* Strain: IB Strain H120, Live Freeze Dried. 2000 doses.

Ranivax Plus vet Initial (*Incepta harmaceuticals Ltd.*). Live freez dried, 300, 500 and 1000 doses.

Ranivx Plus vet Booster (*Incepta harmaceuticals Ltd.*). Live freez dried, 300, 500 and 1000 doses.

3. Infectious Bursal Disease (Gumboro) Vaccine

Description: Infectious bursal disease is a viral disease. Infectious bursal disease (IBD) is seen in domestic chickens worldwide. It is characterized by immunosuppression and mortality generally at 3 to 6 weeks of age and related secondary infections are typically seen. Severity of the immunosuppression depends on the virulence of the infecting virus and age of the host. Morbidity typically reaches 100%. Two serotypes of IBDV have been identified where antigenic variation can exist between strains. Vaccination is the only way to prevent IBD. Infectious Bursal Disease Vaccine found Inactivated and Live form in Intermediate & Intermediate Plus strain.

Target Species: Chicken

Indication: For the active immunization of healthy chickens and other poultry birds against Infectious Bursal Disease (Gumboro).

Dosage and administration:

Live Vaccine

One drop of vaccine should be administered by eye/oral/nasal instillation or drinking water at 10-14 days old poultry. A booster dose should be given after 7-10 dose of primary dose.

Killed Vaccine

Each bird 0.5 ml incase of inactivated vaccine subcutaneously (at the back of the neck)

Or as directed by the registered veterinarian.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 ^{0}C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

AVI IBD Inter (*Laprovet, Imported by Navana);* Strain: Avian Infectious Bursal disease virus strain LIBVD, Live Freeze Dried. 500 doses: Tk. 318.34 and 1000 doses: Tk 440.78.

AVI IBD Plus (*Laprovet, Imported by Navana);* Strain: Avian Infectious Bursal disease virus Winter field 2512 G-61 strain, Live Freeze Dried. 500 doses: Tk. 589.04 and 1000 doses: Tk 865.82.

Avipro IBD XTREME (*Elanco*); Strain: IBDV Winter field 2512 V 217 Strain, Live Freeze Dried. 1000 and 2000 doses.

AviPro PRECISE (*Elanco*); Strain: IBD intermediate virus LC75strain, Live Freeze Dried. 1,000 doses.

Bangla Gumboro (*FnFPharmaceuticals Ltd.)* Strain: Infectious Bursal Disease virus intermediate plus strain, Live Freeze Dried. 300, 500 and 1000 doses.

Bangla IBD Vac (*FnF Pharmaceuticals Ltd.*) Strain: Infectious Bursal Disease virus intermediate strain, Live Freeze Dried. 300, 500 and 1000 doses.

CEVAC GUMBO L (*Ceva,* imported by *ACI*); Strain: IBDV Strain, Live Freeze Dried. 500 & 1000 doses.

CEVAC IBD L (*Ceva, imported by ACI*); Strain: IBD Winter field 2512 G-61 Strain, Live Freeze Dried. 500 & 1000 doses.

CEVAC Transmune (*Ceva,* imported by *ACI*); Strain: IBD Winter field 2512 G-61 Strain, Inactivated. 5000 doses.

GumboMed Plus Vet (*Incepta*); Strain: Infectious Bursal Disease virus intermediate plus strain. Live Freeze Dried. 300 doses: Tk. 140.00, 500 doses: Tk. 260.00 and 1000 doses: Tk. 500.00.

GumboMed Vet (*Incepta*); Strain: Infectious Bursal Disease virus intermediate strain, Live Freeze Dried. 300 doses: Tk. 120.00, 500 doses: Tk. 210.00 and 1000 doses: Tk. 350.00.

Himmvac IBD *(KBNP, imported by Tajarat.*); Strain: IBD virus Lukert Strain BP, Live Freeze Dried. 1000 doses.

Hipragumboro CH/80 (*Hipra*, imported by *Nasco*); Strain: IBD virus strain CH/80, Live Freeze Dried. 1000 doses: Tk.500.00.

Hipragumboro GM97 (*Hipra*, imported by *Nasco*); Strain: IBD virus strain GM97, Live Freeze Dried. 500 doses: Tk. 475.00 & 1000 doses: Tk. 700.00.

Volvac IBD MLV (*Boehringer Ingelheim* imported by *Square*); Strain: Intermediate D-78 IBD Strain, Live Live Freeze Dried. 1000 and 5000 doses.

IBD-BLEN (*Merial*, imported by *Advance*); Strain: IBD Strain W 2512, Live Live Freeze Dried. 1000 and 2000 doses.

Izovac Gumboro-2 (*Vaxxinova*, Imported by *Renata*); Strain: Intermediate Gumboro Disease Virus, Live Freeze Dried. 1000 doses: Tk. 410.00.

Izovac Gumboro-3 (*Vaxxinova*, Imported by *Renata*); Strain: Intermediate plus Gumboro Disease Virus strain Winterfield 2512/90, Live Freeze Dried. 1000 doses Tk. 600.00.

Nobilis Gumboro 228 E (*MSD,* imported by *Bengal*); Strain: IBD Virus 228 E Strain, Live Freeze Dried. 1000 & 2500 doses.

NOBILIS GUMBORO D 78 (*MSD,* imported by *Bengal*); Strain: IBD Virus D 78 Strain, Live Freeze Dried. 1000 & 2500 doses.

NOBILIS GUMBORO INAC (*MSD,* imported by *Bengal*); Strain: IBD Virus D 78 Strain Inactivated, 1000 & 2500 doses.

Ornibur Intermediate (*Bioveta*, imported by *EON*); Strain: Bursitidis infectiosae avium intermediate strain, Live Freeze Dried. 500 doses: Tk. 195.00 & 1000 doses: Tk. 321.00.

Ornibur Intermediate Plus (*Bioveta*, imported by *EON*); Strain: Bursitidis infectiosae avium intermediate plus strain, Live Freeze Dried. 500 doses: Tk. 307.05 & 1000 doses: Tk. 515.85.

Poulshot Gumboro (*Cavac*, imported by *Pharma & Firm*); Strain: Gumboro intermediate strain, Live Freeze Dried. 1000 doses. Tk-535.00

Poulshot IBD Win+ (*Cavac*, imported by *Pharma & Firm*); Strain: Gumboro intermediate plus strain, Live Freeze Dried. 1000 doses. Tk-800.00,

Bursine 2 (*Zoetis, Imported by Elanco*) Bursine 2 strain, Intermediate Type, Live Freeze Dried, 1000 Doses,

Bursine Plus (*Zoetis, Imported by Elanco*) Bursine 2 strain, Intermediate Plus Type, Live Freeze Dried, 1000 Doses,

4. Fowl Pox Disease Vaccine

Description: Fowl Pox (FP) is a viral disease in chickens, turkeys, quail, canaries, pigeons, and many other species of birds. It is characterized by cutaneous lesions on the feather-less skin. The lesions vary according to the stage of development: papules, vesicles, pustules or crusts. The lesions are usually in the region of the head. The incubation period is 4-10 days. The disease is spread slowly and many weeks could pass between its emergence and severe outbreaks occurrence. Vaccination is the only way of prevention from Fowl Pox Disease. A suitable strain of Avian Fowl Pox Disease Virus is used for the production of live vaccine

Target Species: Chickens, turkeys, quail, canaries, pigeons, and many other species of birds.

Indication: Indicated for the immunization of healthy chickens and turkeys against Fowl Pox.

Dosage and administration:

Administer one dose (0.01 ml) reconstituted vaccine by wing-web method in chickens at 4-6 weeks of age or older and in turkeys at 8 weeks of age or older by thigh-stab application. Do not vaccinate 35 days prior to onset and during egg production.

Preparation of vaccine

- Remove the aluminum seal and rubber stopper from the vaccine vial and diluent vial.
- Use 5 ml and 10 ml diluent for 500 doses and 1000 doses vaccine respectively.
- Pour half of the diluent into vaccine vial. Insert the rubber stopper and shake gently and frequently until reconstituted.
- Pour reconstituted vaccine into diluent vial, add rubber stopper and shake well. This vaccine is now ready to use.

Wing-Web Method

Dip the supplied two-pronged needle applicator into the reconstituted vaccine. Pierce the web of the exposed wing with the charged applicator. Dip the applicator before each application. Avoid hitting blood vessels, bone and the wing muscle.

Thigh-Stab Application

Dip the supplied two-pronged needle applicator into the reconstituted vaccine and stab into the thigh muscle. Dip the applicator before each stab. Be careful not to pierce the tendons but go deep enough to break skin.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- All the chickens on the same shed should be vaccinated at the same time.
- Administer one dose vaccine per chicken.
- Reconstituted vaccine should be used within 2 hours.
- Use the entire vaccine when first opened.
- Do not mix with other vaccines.
- Disposal of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chickens that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. At about 7-10 days following vaccination, poultry should be examined for “takes” (swelling of the skin with scab formation at the point of vaccination). “Takes” generally disappear 2 weeks following vaccination. Checking post vaccination “takes” is the best method of checking immunity. Revaccinate the poultry that do not show “takes”.

Proprietary Preperations

AVI POX (*Laprovet,* imported by *Navana*); Strain: Fowl Pox Virus Cutter Strain, Live Freeze Dried, 1000 doses: Tk. 800.00.

Cevac FPL (*Ceva,* imported by *ACI*); Strain: Fowl Pox Virus Cutter Strain, Live Freeze Dried, 1000 doses.

Himmvac Fowl Pox Vaccine (*KBNP Inc.* imported by *Tajarat*); Strain: Fowl Pox Virus, Live Freeze Dried, 1000 doses: Tk. 268.87.

HIPRAPOX (*Hipra,* imported by *Nasco*); Strain: Fowl Pox Virus FPV-92 Strain, Live Freeze Dried, 1000 doses.

Poxine (*Zoetis,* imported by *Elanco*); Strain: Fowl Pox Virus, Live Freeze Dried, 1000 doses.

Henpox *(Incepta);* Live attenuated Fowl Pox Virus NLT 102.0 EID50 500 Doses: Tk.360, 1000 Doses: Tk. 675,

Diftosec (*Boehringer Ingelheim,* imported by *Square)* Strain: Fowl Pox Virus DCEP25, Live Freeze Dried, 1000 doses: Tk. 1120.00,

5. Marek’s Disease Vaccine

Description: Marek's disease is a Herpes virus infection of chickens, and rarely turkeys, seen worldwide. This disease is characterized by Paralysis of legs, wings and neck, loss of weight and grey iris or irregular pupil. Morbidity is 10-50% and mortality up to 100%. Vaccination is the only way of prevention. Marek's disease vaccine (live) is aProprietary Preperations of a suitable strain or strains of Marek's Disease Virus or Turkey Herpes Virus.

Target Species: Chickens

Indication: Indicated for the immunization of healthy chickens against Marek’s Disease.

Dosage and administration:

Dissolve the vaccine with 200 ml distilled water for 1000 doses and 100 ml distilled water for 500 doses. Inject 0.2 ml/bird subcutaneously in the lower part of the back of the neck or by intramuscular route into the breast or thigh muscle. Chicks are ideally vaccinated at day-old in the hatchery although chickens up to 3 weeks of age may be vaccinated. Vaccination is occasionally repeated at 2 to 4 weeks of age.

Precautions and Warnings

- Vaccinate healthy chickens only.
- All the chickens on the same shed should be vaccinated at the same time.
- Administer one dose vaccine per chicken.
- Reconstituted vaccine should be used within 2 hours.
- Use the entire vaccine when first opened.
- Do not mix with other vaccines.
- Disposal of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chickens that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

Cevac MD Rispens (*Ceva,* imported by *ACI*); Strain: MD Virus serotype 1 (Respens CVI 988), Live Freeze Dried, 2000 doses.

IZOVAC MAREK HVT (*Vaxxinova,* imported by *Renata*); Strain: Herpes Turkey Virus of Marek's Disease strain FC-126 (serotype 3), Live Freeze Dried, 1000 doses: Tk. 1400.00.

Nobilis Marek THV Lyo (*MSD,* imported by *Bengal*); Strain: MD strain P8-THV-1, Live Freeze Dried, 1000 doses.

Rispens Frozen (*Merial,* imported by *Advance.*); Strain: MD Virus serotype 1(Respens CVI 988) strain, Live Freeze Dried, 1000 doses.

MD Vac CFL (*Zoetis, imported by Elanco*) Turkey Herpes Virus 126 FC, Freeze Dried Live Vaccine, 1000 Dose

6. Egg Drop Syndrome (EDS) Vaccine

Description: Egg drop syndrome (EDS) is caused by a viral infection in laying hens. It is characterized by production of soft-shelled and shell-less eggs in apparently healthy birds, and leads to a sudden drop (10-40%) in recorded egg production or a failure to achieve a normal peak in production. It can be difficult to identify the early stages of the disease as hens will eat the shell-less eggs, and the only evidence that may remain is the membranes, which is a sign that is easy to miss. In flocks where some birds have acquired immunity due to the spread of the virus, a failure to reach expected production targets is observed. Inactivated vaccine is used for the immunization of chickens against Egg Drop Syndrome '76.

Target Species: Layer chicken

Indication: Indicated for the immunization of healthy birds against Egg drop syndrome.

Dosage and administration:

Each bird: 0.5 ml. intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck.

Precautions and Warnings:

- Vaccinate healthy birds only.
- EDS should be given to birds not less than 4 weeks before the expected onset of lay.
- Before use allow the vaccine to reach room temperature (20-25˚C).
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire contents when first opened.
- Do not mix with other vaccines.
- Should a vaccinator by accident inject himself or a bystander, a local reaction may occur. It is recommended that the advice of a doctor is sought, taking

care to inform the doctor that the vaccine is an oil emulsion.

Side Effects: The vaccine is generally well tolerated

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

EDS Plus (*Incepta Pharmceuticals* Ltd.) inactivated; EDS-76 virus (AV127), ND-Lasota & IBV (M 41 strain) 500 and 1000 doses,

Nobilis EDS (*MSD,* imported by *Bengal*); Strain: EDS'76 virus strain BC14, Inactivated water-in-oil emulsion, 1000 doses.

PoulShot BNE *(CAVAC imported By Pharma & Firm),* Killed Vaccine, 1000 Dose, TK- 6720,

7. Duck Plague Disease Vaccine

Description: Duck Plague/Duck Viral Enteritis is a worldwide viral disease caused by *Anatid alphaherpesvirus-1* that causes acute disease with high mortality rate in flocks of ducks, geese and swans. It is spread both vertically and horizontally through contaminated water and direct contact. Migratory water fowls are a major factor in the spread of this disease as they are carrier of this disease. The disease frequently occurs every year in Bangladesh in epidemic form and spread rapidly among the duck population at the duck raising areas.

Target Species: Duck and Geese

Indication: Indicated for the immunization of healthy duck and geese against Duck Plague disease.

Doses and administration:

Inject reconstituted vaccine (with distilled water) @0.5 ml per duck by subcutaneous or intramuscular route.

Initial vaccination: Ducklings originated from vaccinated parents might be vaccinated at day 21 or 28 (3-4 weeks of age) due to presence of maternal antibody. Progeny from non-vaccinated parents vaccinate at day 14-21 days.

Booster dose at 7-8 weeks of age

Revaccination: every 4-5 monthly.

Precautions and Warnings:

- Vaccinate healthy ducks only.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: At a temperature of 2-8 °C in the dark place

Special Note: This vaccine is not recommended for the ducklings that are clinically sick or under conditions of severe stress. Sick or weak ducklings will not develop adequate immunity following vaccination.

Proprietary Preperations

Bangla Duck Plague Vac (*FnF*); Live Freeze Dried, 100 doses & 300 doses.

Vaxxiuk (*Boehringer Ingelheim*, imported by *Square*); Strain: Duck Plague Virus, Tansen Strain, Live Freeze Dried, 500 Doses.

8. Avian Influenza (Bird Flu) Disease Vaccine

Description: Avian influenza known informally as avian flu or bird flu is a variety of influenza caused by viruses adapted to birds. The type with the greatest risk is highly pathogenic avian influenza (HPAI). Bird flu is similar to swine flu, dog flu, horse flu and human flu as an illness caused by strains of influenza viruses that have adapted to a specific host. Out of the three types of influenza viruses (A, B, and C), influenza A virus is a zoonotic infection with a natural reservoir almost entirely in birds. Avian influenza is most often spread by

contact between infected and healthy birds though can also be spread indirectly through contaminated equipment. The highly pathogenic influenza A virus subtype H5N1 is an emerging avian influenza virus that is causing global concern as a potential pandemic threat. It is often referred to simply as "bird flu" or "avian influenza", even though it is only one of many subtypes. Avian Influenza is an inactivated double adjuvanted vaccine that develops immunity against Avian Influenza (H5N1) in chickens, ducks and geese within 14-21 days after vaccination.

Target Species: Chickens, Ducks and Geese.

Indication: This Vaccine is used for the vaccination of chickens, ducks and geese to protect against Avian Influenza (H5N1).

Doses and administration:

Inject @0.5 ml by subcutaneous (especially in neck region) or intramuscular route (especially in breast muscle) carefully.

Breeder and Layer:

First Dose: 7-10 days.

Booster Dose: Within 3-4 weeks after first vaccination.

Third Dose: 3-4 weeks before laying period.

Revaccination: Every 4-6 months interval.

Commercial Broiler:

First Dose: 7-10 days.

Commercial Duck and Geese:

First Dose: 7-10 day.

Booster Dose: Within 3-4 weeks after first vaccination.

Precautions and Warnings:

- Shake the bottle before use
- Vaccinate healthy chickens only.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: At a temperature of 2-8 °C in the dark place, do not Freeze.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

Bangla Bird Flu Vac (*FnF*); Strain: Avian Influenza Virus Sub type H5 N1, MSD-3, Inactivated, 250 ml & 500 ml.

Vaxxon AviFlu (Vaxxinova, imported by Renata); Strain: Avian Influenza Virus Sub type H9 N1; 1000 doses; Tk. 4200.00,

GuardFlu Plus *(Incepta);* Inactivated/Killed Avian Influenza (H9N2) & Newcastle Disease (Lasota Strain), 250 ml 500 Doses: Tk. 2800.00, & 500 ml 1000 Doses: Tk. 5500.00,

GuardFlu *(Incepta);* Inactivated/Killed Avian Influenza (H9N2), 250 ml 500 Doses: Tk. 2700.00 & 500 ml 1000 Doses: Tk. 5250.00,

9. Low pathogenic Avian Influenza (H9N2) vaccine

Description: H9N2 is the most common subtype of influenza viruses in Chinese chickens and thus causes great economic loss for the poultry industry, even under the long-term vaccination programs. Avian influenza viruses are belonging to the Orthomyxoviridae family and are placed in the genus Influenza Virus Type A. Influenza A viruses are classified into subtypes based on two surface proteins, the hemagglutinin (HA) and neuraminidase (NA). For example, a virus that has HA 9 protein and NA 2 protein is designated as subtype H9N2. AI virus strains are usually classified into two categories according to the severity of the disease in poultry. Low pathogenic (LPAI) strains, which typically cause few or no clinical signs in poultry, and may go

undetected due to the lack of symptoms in some species of birds such as Avian Influenza Virus Type A (subtype H9N2). H9N2 virus causes constant low morbidity and mortality, resulting huge economic loses In layer farms.

Indications:
For active immunization of healthy chickens against Low Pathogenic Avian Infuenza (AI) H9N2

Dosage and Administration:
1st dose: 7-14 days of age
2nd dose: 6-10 weeks of age
3rd dose: 14-15 weeks of age (3-4 weeks before lay).
In emergency cases vaccine can be given in laying poultry.

Dose, route and age of the vaccine varies with manufacturers.
Inject 0.25 ml upto 2 weeks of age and 0.5 ml more than 2 weeks of age per bird intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck. Or as directed by registered veterinarian.

Side Effects: The vaccine is generally well tolerated at recommended dose.

Precautions:

Vaccinate healthy chickens only.
- Use sterile Injection during vaccination.
- Do not mix with other vaccines.
- Opened bottles should be used within 24 hours.
- Do not store partially used containers for future use.
- In case of Accidental self-vaccination consult with doctors.
- Dispose unused vaccine after vaccination.

Contraindications: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Withdrawal Period: Not required

Storage: Protect from light, store at +2 to +8 degree Centigrade and do not freeze. Keep out of the reach of children.

Proprietary Preperations
Guard Flu Vet vaccine *(Incepta Pharmaceuticals Ltd.)* 500 and 1000 does
Guard Flu Vet Plus vaccine *(Incepta Pharmaceuticals Ltd.)* 500 and 1000 doses
Bnagla Avianza Vac H9 *(FnF Pharmaceuticals Ltd.)*, 500 doses

10. Chicken Anemia Virus Vaccine

Description: Chicken anemia virus, or CAV, is currently a member of the anelloviridae family which is found worldwide. The virus only affects chickens causes bone marrow atrophy, anemia, and severe immunosuppression. Clinical signs of CAV infection are predominantly found in young chicks due to vertical transmission from the breeder hens whose maternal antibodies have not yet formed following exposure. The disease/virus has many names including chicken anemia, blue wing disease, anemia dermatitis syndrome, chicken/avian infectious anemia, hemorrhagic aplastic anemia syndrome, infectious chicken anemia, chicken infectious anemia virus and chicken anemia agent. The vaccine against Chicken Anemia Virus is live attenuated vaccine.

Target Species: Chickens

Indication: Vaccination of chickens against chicken anemia from 6 weeks of age onwards until 6 weeks prior to the onset of lay.

Doses and administration: 0.2 ml per bird.

For intramuscular or subcutaneous injection: Reconstitute the vaccine in diluent, using 200 ml per 1000 doses.

Administer 0.2 ml of the vaccine by intramuscular or subcutaneous injection.

For the wing web method: Reconstitute the vaccine in diluent, using 13 ml per 1000 doses.

Dip the double needle into the vaccine solution so that both grooves are filled, before vaccinating each bird. Insert the needle through the wing web from beneath.

Precautions and Warnings:

- The vaccine must not be used in the laying period.
- Wash and disinfect hands and equipment after vaccinating.
- Vaccinate healthy chickens only.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- The vaccine should be used within 4 hours of reconstitution.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: At a temperature of 2-8 °C in the dark place, do not Freeze.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

AVIPRO Thymovac (*Elanco***)**; Strain: CAV Cux-1 strain, Live Freeze Dried, 1000 doses.
CEVAC CIRCOMUNE (*Ceva* imported by *ACI*); Strain: Del Ros Strain, Live Freeze Dried, 1000 doses.
NOBILIS CAV P4 (*MSD* imported by *Bengal*); Strain: CAV virus. Live Freeze Dried, 1000 doses.

11. Pigeon pox vaccine

Description: Pigeon pox is caused by a poxvirus and is characterized by lesions of the mouth and eyes. Master seed is isolated from local strain of indigenous pigeon breed and attenuated by chicken Embryo Passage.

Target species: Pigeon and chicken.

Indications: Vaccination against pigeon pox.

Dose and administration:

Wing web method—0.015 ml per pigeon (pierced twice by bi-furked needle)

Intramuscular route—0.2 ml per pigeon

Vaccination is recommended between 3 to 7 days birds.

0.4 ml lyophilized vaccine have to be diluted with 3ml of distilled water

Precautions and Warnings:

- Vaccinate healthy chickens only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 °C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are

clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations:

12. Avian Encephalomyelitis Disease Vaccine

Description: Avian encephalomyelitis is a viral disease of the central nervous system of chickens, pheasants, turkeys, and quail. This disease is characterized by nervous signs, ataxia and sitting on hocks, imbalance, paralysis and Tremor of head, neck and wings. It has a worldwide distribution. Morbidity is 5-60% depending on the immune status of the majority of parents and mortality high. Vaccination is the only way of prevention. Avian Encephalomyelitis Disease Vaccine is a live vaccine containing Avian Encephalomyelitis virus. This vaccine is supplied as a freeze-driedProprietary Preperations.

Target Species: Chickens and turkeys

Indication: Indicated for the immunization of healthy future layer, breeding stock and turkeys Avian Encephalomyelitis.

Dosage and administration:

Administer one dose reconstituted vaccine by drinking water in chickens at 8-16 weeks of age and in turkeys at 18-26 weeks of age. Do not vaccinate the birds at least 1 month prior to onset and during egg production.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- All the chickens on the same shed should be vaccinated at the same time.
- Administer one dose vaccine per chicken.
- Reconstituted vaccine should be used within 2 hours.
- Use the entire vaccine when first opened.
- Do not mix with other vaccines.
- Disposal of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chickens that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. Only to be used when the birds are raised in a floor system.

Proprietary Preperations

GALLIVAC AE (*Boehringer Ingelheim, imported by Square*); Strain: AE virus strain, Live Freeze dried, 1000 doses.

Nobilis AE 1143 (*MSD,* imported by *Bengal*); Strain: AE virus strain Galnek, Live Freeze dried, 1000 doses.

13. REO Virus Vaccine

Description: The most frequent reovirus-associated disease in poultry is viral arthritis. Clinically it is manifested by lameness and swellings affecting primarily tars-metatarsal joints and the feet. Many infected birds are in a good condition, but some could be lethargic and exhausted. The mortality is very low. The infections affect predominantly meat type poultry. REO virus vaccine found in Live and killed both forms.

Target Species: Chicken

Indication: For the active immunization of healthy chickens and other poultry birds against REO virus Infection.

Dosage and Administration

Live Vaccine

Inject 0.2 ml/bird by intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck at 7 days of age. Revaccinate 5-7 weeks of age and again at 9-11 weeks.

Inactivated vaccine

Inject 0.5 ml/bird by intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck at 16-18 weeks age.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 ^{o}C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: The vaccine can be given on day 1 and does not interfere with the efficacy of Mareks vaccine. This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. Inactivated vaccine contains oil-based adjuvant, so accidental injection into a human may cause severe pain and inflammation. Clean and disinfect the wound immediately, consult with a doctor and show him the leaflet.

Proprietary Preperations

Gallivac REO (*Boehringer Ingelheim, imported by Square*) Strain: Mild REO virus strain 1133, Live Freeze Dried, inj. 1000 doses.

Nobilis REO 1133 (*MSD*, Imported by *Bengal*) Strain: Mild REO virus strain 1133, Live Freeze Dried, inj. 1000 doses.

Nobilis REO INAC (*MSD*, Imported by *Bengal*) Strain: REO virus strain 1733 & 2408. Inactivated water in oil emulsion inj, 500 ml (1000 doses).

TRI REO (*Zoetis*, Imported by *Elanco*) Strain: REO virus strain 1133, 2408 & 3005, Inactivated inj. 1000 doses (500 ml).

Avipro 106 Reo (*Elanco*) Strain: REO virus strain S1133, 1733, Inactivated Inj, 1000 Dose (500 ml)

14. Newcastle Disease and Infectious Bronchitis Vaccine

Description: This vaccine is used against Newcastle Disease & Infectious Bronchitis. Newcastle Disease & Avian Infectious Bronchitis Vaccine is a combined live vaccine. Most commonly used live vaccine strains are combination of live attenuated NDV F strain and IBV Massachusetts strain of IB, live attenuated NDV clone strain and Massachusetts strain of IBV, live attenuated NDV LaSota strain and IBV Massachusetts strain of IB and live attenuated NDV C2strain and IBV B48 strain of IB. The commonly used inactivated strain are Infectious Bronchitis Virus (Massachusetts type) and Newcastle Disease Virus.

Target Species: Chickens.

Indication: Indicated for the immunization of healthy birds against Newcastle disease & Infectious Bronchitis disease.

Dosage and administration:

Vaccination Schedule:

- The timing of primary vaccination depends on the level of maternally derived antibody (MDA) in offspring.

The best schedule may be determined by serological testing of the birds to detect the time at which MDA has fallen to a low level. Vaccination should be delayed until MDA in most of the flock has waned or reduced sufficiently.

- Water soluble antibiotic/electrolyte can be given in the water 4 days prior to and 5 days after the vaccination to reduce stress.
- Newcastle Disease (F strain) & Avian Infectious Bronchitis (Massachusetts strain) Vaccine should be administered at 3 – 7 days old Broilers/Layers/ Breeders as a Primary dose.
- Newcastle Disease (Lasota strain) & Avian Infectious Bronchitis (Massachusetts strain) Vaccine should be administered at 17-21 days old Broilers/Layers/Breeders as a Booster dose.

Dose:

- One dose per bird

Method of Administration:

Reconstitution of Vaccine

- Keep the diluent supplied with vaccine in the refrigerator (2-8°C) overnight. Diluent has to be chilled before use.
- Remove the seal & rubber stopper from the vaccine vial. Fix the connector (supplied with vaccine) on the mouth of the vaccine vial and carefully keep it in invert position on the mouth of diluent bottle.
- Reconstitute the vaccine by gently inverting the vaccine vial and diluent bottle several times.
- A clear solution will be seen.
- Vaccine should be utilized within 2 hours of reconstitution.

Administration

There are two methods through which this vaccine can be given.

- Eye drop/Nasal instillation Method
- Drinking Water Method

Note - For younger birds of age 0 to 7 days old Eye drop/Nasal instillation Method is preferred.

I. Eye drop/Nasal instillation Method

- Shake well the reconstituted vaccine frequently and keep it on ice during entire vaccination period.
- Vaccinate chicks by intraocular/ intranasal route, one drop per bird.
- Hold the chick with one eye/nostril turned up. Instill one drop of vaccine in one eye/nostril by dropper. Hold the chick till blink of eye to absorb the vaccine.
- In nasal instillation method the vaccine droplet is inhaled by the chick on momentary pressing of the beak.

II. Drinking Water Method

- The vaccine vial content is mixed in a small quantity of water mixed with skimmed milk and subsequently this is mixed in a total quantity of water in which the skimmed milk is mixed. Skimmed milk act as a stabilizer.
- Skimmed milk usage

- All containers used should be clean and free from any traces of detergent or disinfectant. Use clean cold water, in which chlorine or metals can neither be tasted nor smelt. Chlorine at levels as low as 1 ppm is known to have a detrimental effect on vaccine virus stability, therefore the use of skimmed milk is recommended to prolong the life of the virus.
- Only skimmed milk should be used, as the fat in whole milk may block the automatic drinking systems as well as reduce vaccine virus efficacy.
- Powder skimmed milk may be added to the water at the rate of 20 grams per 10 litres of water.

- Skimmed milk powder should be dissolved in the water and formation of lumps should be avoided.

- After mixing well, the solution should be allowed to stand for 15–30 minutes before adding the vaccine.
- Provide ample of water space so that all birds can drink vaccine-treated water comfortably.
- Withhold drinking water for at least two hours to allow birds to get thirsty before giving the vaccine.
- In drinking water method waterier space should be adequate so that more than 70% chick gets access to water at one time.
- Always make sure that there is food available when vaccinating. Birds will not drink if they have no food to eat.
- Turn the lights down low when the water is turned off.
- **For bell drinkers,** go around the house emptying and cleaning the drinkers during the half-hour lights low period. Mix up the vaccine according to the recommendations, and towards the end of the half-hour water withholding period, go around all the drinkers filling each with water containing vaccine. Leave the house and turn the light up. The increased light intensity will stimulate the birds to look for water and food. Therefore, it is important that food is available or the birds will not be interested in drinking. In some cases, it helps to run food tracks at the time the light intensity is increased.
- **For nipple lines** a substantial volume of residual water may remain in the lines after the half-hour water withholding/dark period. It is advisable to drain the lines and prime with vaccine loaded water before allowing the birds to have access to the drinker lines. Mix up the vaccine and apply to the header tank(s). Calculate the volume of water that is left in the tank below the outlet valve and make sure you add extra vaccine to this volume of water. For example, if 10 litres remain below the outlet pipe and you are using 10 litres/1000 birds to vaccinate, add one extra vial of vaccine when mixing up vaccine for that tank. The use of this extra vaccine is important.
- Ensure that all medicated water is consumed within 1–2 hours. Turn on mains water when all the vaccine water has been consumed.

Amount of water needed for vaccination

- This depends principally upon the age of the birds. Mixing the vaccine in an adequate amount of water is essential in gaining uniform and desired immune response. If too much water is used, birds do not consume their portion of the vaccine within the allotted time, yielding weak and inconsistent titres. If too little water is used more dominant birds or the ones nearest the drinker system over-consume leading to uneven uptake and non-uniform immune response among birds in the same house.
- Provide water 18-25 litres for Layers and broilers of 2-3 weeks of age.

Precautions and Warnings

- Consult Poultry experts Veterinarian regarding vaccination schedule and use of vaccine.
- Vaccination should always be conducted during cool hours.
- Examine diluent bottle before mixing for any abnormal change such as odor, turbidity or foreign body. If so, do not use such bottle of diluent.
- Use the sterile diluent supplied with the vaccine only. This has been tested for its stability in the laboratory for virus for which it is prepared.
- Pre-chill the diluent before mixing with vaccine vial.

- Do not mix the diluent and the vaccine till all the otherProprietary Preperations are ready.
- Keep reconstituted vaccine in ice bath during the entire vaccination period.
- Always vaccinate the healthy birds and keep the vaccinated birds comfortable by providing adequate temperature, feed, water and good ventilation.
- Burn and destroy the used container with the leftover vaccine.
- Do not use unsterile vaccination equipment. Chemical disinfectants should not be used for sterilization of vaccination equipment.
- Use the vaccine immediately after reconstitution. Do not refreeze the reconstituted vaccine.
- Do not vaccinate 21 days before slaughter.
- All susceptible birds on the same premises should be vaccinated at the same time.
- Do not dilute the vaccine or otherwise stretch the dosage of the vaccine.
- Newcastle virus occasionally causes conjunctivitis in humans. Avoid any contact of the vaccine with eyes.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

AVI ND Lasota + IB (*Laprovet* imported by *Navana*), Strain: NDV strain 'Lasota' + IB strain Massachusetts type-B48 strain, Live Freeze-Dried Vaccine, 1000 doses: Tk. 359.15.

Cevac BI L (*Cevac,* imported by *ACI*); Strain: Hitchner B1 of NDV & Massachusetts strain of IBV, Live Freeze Dried, 500 doses & 1000 doses.

Himmvac IB-ND Combined Live Vaccine (*KBNP, INC* imported by *Tajarat*); Strain: IB virus (H-120) strain & ND virus B1 strain, Live Freeze Dried, 1000 doses.

NOBILIS IB+ND (*MSD,* imported by *Bengal*); Strain: Massachusetts (strain M41) of IB and NDV strain, Live Freeze Dried, 1000 doses.

NOBILIS MA 5+CLONE 30 (*MSD,* imported by *Bengal*); Strain: Massachusetts (strain Ma5) of IB and Clone 30 of ND, Live Freeze Dried, 1000 doses.

RaniVax Plus Initial (*Incepta*); Strain: NDV F strain and IBV Massachusetts strain, Live Freeze Dried, 300 doses: Tk. 95.00, 500 doses: Tk. 180.00 & 1000 doses: Tk. 350.00.

RaniVax Plus Booster (*Incepta*); Strain: NDV LaSota strain and IBV Massachusetts strain, Live Freeze Dried, 300 doses: Tk. 100.00, 500 doses: Tk. 200.00 & 1000 doses: Tk. 360.00.

Newcastle Bronchitis (*Zoetis, Imported by Elanco*) B1 type Lasota and Massachusetts 41 strain, Live Freeze Dried, 1000 Dose, BDT 596.00

PoulShot B1+IB *(CAVAC Imported by Pharma & Firm),* Live Attenueted Vaccine, 1000Dose, Tk. 485.00

PoulShot Lasota + IB *(CAVAC Imported by Pharma & Firm),* Live Attenueted Vaccine, 1000 Dose, Tk- 475.00.

15. Newcastle Disease and Infectious Bursal Disease Vaccine

Description: Inactivated combined Vaccine against Newcastle Disease (Ranikhet Disease) and Infectious Bursal Disease (Gumboro Disease) in Chickens.

Target Species: Broiler, Layer and Breeder.

Indication: This Vaccine is used for the vaccination of broiler, layer and breeding birds to protect against Newcastle Disease and Infectious Bursal Disease.

Doses and administration:

For Broiler/layer/Breeder/Sonali/Cock bird: Inject 0.5 ml subcutaneously (at the back

of the neck) or intramuscularly (thigh or breast muscle) at 6-14 days of age. For Breeder Birds: Second vaccination @ 0.5ml per birds at 16-18 weeks of age, Then Revaccination: every 4 monthly to maintain a high and consistent level of antibody in birds and their offspring throughout the production period.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: At a temperature of 2-8 °C in the dark place

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. Should a vaccinator by accident inject himself or a bystander, a local reaction may occur. It is recommended that the advice of a doctor is sought, taking care to inform the doctor that the vaccine is an oil emulsion.

Proprietary Preperations

Bangla ND+IBD Vac (*FnF*); Strain: Viscerotropic velogenic strain of NDV and BMB 15/07 strain of IBDV, Inactivated and oil emulsified combined Vaccine, 500 & 1000 doses.

CEVAC ND IBD K (*CEVA* imported by *ACI*); Inactivated and oil emulsified combined Vaccine, 1000 doses.

ITA ND + IBD (*Laprovet* imported by *Navana*), Strain: NDV strain 'Lasota' + IBDV strain 'GP', Inactivated and oil emulsified combined Vaccine, 1000 doses: Tk. 4097.63.

IZOVAC ND-IBD (*Vaxxinova* imported by *Renata*) Strain: ND Virus and IBD Winterfield, Inactivated and oil emulsified combined Vaccine, 500 doses (250 ml) & 1000 doses (500 ml). Tk. 5300.00

Nobilis G+ND (*MSD* imported by *Bengal*); Inactivated and oil emulsified combined Vaccine, 1000 doses.

RaniGum-Vet *(Incepta);* Inactivated/Killed Gumboro (Intermediate Plus) & Newcastle Disease (Lasota Strain), 1000 Doses: Tk. 5700

16. Infectious Bursal Disease (Gumboro) + Newcastle Disease (ND) + Infectious Bronchitis (IB) Vaccine

Description: It is an inactivated combined vaccine for the immunization of chickens against Infectious Bursal Disease (Gumboro), Newcastle Disease (ND) & Infectious Bronchitis (IB).

Target Species: Breeders.

Indication: The vaccine is recommended for breeding stock as a booster vaccination to protect against Newcastle Disease, of Infectious Bronchitis, and to induce high maternal antibody levels against Infectious Bursal Disease in their offspring.

Dosage and administration:

Inject 0.5ml/bird intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck at 2-4 weeks before the expected onset of lay.

Precautions and Warnings

- Vaccinate healthy breeders only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 ^{o}C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the breeder that are clinically sick or under conditions of severe stress. Sick or weak breeders will not develop adequate immunity following vaccination. This vaccine contains oil-based adjuvant, so accidental injection into a human may cause severe pain and inflammation. Clean and disinfect the wound immediately, consult with a doctor and show him the leaflet.

Proprietary Preperations

BRONIPRA ND/IBD (*Hipra*, Imported by *Nasco*) Strain: IB virus, ND virus and IBD virus. Inactivated and Oil adjuvanted injection 500 ml (1000 Doses).

Nobilis IB multi + G + ND (*MSD,* imported by *Bengal*); Strain: IB strain M 41, D 274, Gumboro strain D78, ND Clone 30, Inactivated water in oil emulsion injection, 500 ml (1000 Doses).

PoulShot ING Plus *(CAVAc imported by Pharma & Firm),* Killed Combine Vaccine, 1000 Dose, Tk-7200.00

17. Infectious Bursal Disease (Gumboro) + Newcastle Disease (ND) + Egg drop syndrome (EDS) Vaccine

Description: It is an inactivated combined vaccine for the immunization of chickens against Infectious Bursal Disease (Gumboro), Newcastle Disease (ND) & Egg drop syndrome (EDS)

Target Species: Breeders

Indication: The vaccine is recommended for breeding stock as a booster vaccination to protect against Newcastle Disease, Infectious Bursal Disease (Gumboro) and to induce high maternal antibody levels against Egg drop syndrome in their offspring.

Dosage and administration:

Inject 0.5ml/bird intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck at 2-4 weeks before the expected onset of lay.

Precautions and Warnings:

- Vaccinate healthy Breeders only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 ^{o}C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the breeder that are clinically sick or under conditions of severe stress. Sick or weak breeders will not develop adequate immunity following vaccination. This vaccine contains oil-based adjuvant, so accidental injection into a human may cause severe pain and inflammation. Clean and disinfect the wound immediately, consult with a doctor and show him the leaflet.

Proprietary Preperations

ITA ND + IB + EDS (*Laprovet* imported by *Navana*); Strain: NDV strain 'Lasota' + IBV strain 'M/41'+ EDS strain 'B8/78'. Inactivated and adjuvanted, 1000 doses: Tk. 6530.00.

Nobilis G + ND + EDS (*MSD,* Imported by *Bengal*); Strain: Gumboro strain D78, ND Clone 30 and EDS'76 Virus strain BC14, Inactivated water in oil emulsion injection, 500 ml (1000 Doses).

IZOVAC ND-EDS-IB *(Vaxxinova imported by Renata)*, Strain: Inactivated ND Virus 50+Inactivated ED76 Virus+Inactivated IB Virus (1000 doses) Tk. 5700.

EDS Plus *(Incepta);* Inactivated/Killed Newcastle Disease (Lasota Strain), Infectious Bronchitis (M 41) & Egg Drop Syndrome (AV 127), 500 dose: Tk. 3500, 1000 dose: Tk. 6500.

VOLVAC ND+IB+EDS KV (*Boehringer Ingelheim* imported by *Square*); Strain: NDV strain 'Lasota' + IBV strain 'M/41'+ EDS strain '127'. Inactivated and adjuvanted, 1000 doses: Tk. 7400.00.

GALLIMUNE 302 (*Boehringer Ingelheim* imported by *Square*); Strain: Newcastle disease virus, Ulster 2 C Strain, Inactivated Infectious Bronchitis virus Masschusetts 41, Strain, Inactivated Egg Drop Syndrome virus (EDS'76) V127 Strain. Inactivated and adjuvanted, 1000 doses:

18. Infectious Bursal Disease (Gumboro) + Newcastle Disease (ND)+ Infectious Bronchitis (IB)+ Reo Vaccine

Description: It is an inactivated combined vaccine for the immunization of chickens against Infectious Bursal Disease (Gumboro), Newcastle Disease (ND), Infectious Bronchitis (IB) & Reo virus.

Target Species: Breeders

Indication: The vaccine is recommended for breeding stock as a booster vaccination to protect against Newcastle Disease, Infectious Bursal Disease (Gumboro), Infectious Bronchitis (IB) and to induce high maternal antibody levels against Reo virus in their offspring.

Dosage and administration: Inject 0.5ml/bird intramuscularly in the thigh or breast muscle or subcutaneously in the lower part of the neck at 2-4 weeks before the expected onset of lay.

Precautions and Warnings:

- Vaccinate healthy Breeders only.
- Before use allow the vaccine to reach at a temperature between 20 – 25 ^{o}C.
- Shake the bottle well before use.
- Use sterile injection equipment.
- Use the entire vaccine when first opened.
- Opened vial should be used within 3 hours.
- Do not mix with other vaccines.
- Dispose of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the breeder that are clinically sick or under conditions of severe stress. Sick or weak breeders will not develop adequate immunity following vaccination. This vaccine contains oil-based adjuvant, so accidental injection into a human may cause severe pain and inflammation. Clean and disinfect the wound immediately, consult with a doctor and show him the leaflet.

Proprietary Preperations

Gallimune 403 (*Boehringer Ingelheim, imported by Square);* Strain: IBD winterfield 2512, ND virus strain ulster 2C Strain, IB Virus M41, Avian Reo virus strain Olson WVU 2597, Inactivated water in oil emulsion injection, 500 ml (1000 Doses).

Provac 4 (*Zoetis*, imported by *Elanco*) Inactivated Bursine 2 (IBD), Massachusetts 41 (IB), Mesogenic kimber strain (ND) & REO virus strain 1733 & 2408, Inactivated and adjuvanted, inj, 1000 doses.

Repromune (*Biomune,* Imported by *Univet)* Strain: IBD Standard Sero 1 Lukert strain, ND virus B1 type Lasota Strain, IB Virus Massachuessetes, Avian Reo virus strain S1133 & 2408, Inactivated water in oil emulsion inj.1000 doses.

Avipro 431 ND IB BD3 Reo (*Elanco*) Strain: ND - B1 type Lasota, IBD: Baxendale, Maryland, Delware A & E, IB- Massachusetts type Dg, Reo- S 1133 & 1733, Inactivated, 1000 dose.

19. Fowl Pox + Avian Encephalomyelitis Disease Vaccine

Description: Fowl Pox (FP) + Avian Encephalomyelitis (AE) Disease Vaccine is a combined live vaccine containing Fowl Pox virus and Avian Encephalomyelitis virus. This vaccine is supplied as a freeze-driedProprietary Preperations.

Target Species: Chickens and turkeys.

Indication: Indicated for the immunization of healthy layer replacement pullets, breeder replacement pullets and turkeys against Fowl Pox and AE.

Dosage and administration: Administer one dose reconstituted vaccine by wing-web method in chickens at 8 weeks of age or older and in turkeys at 16 weeks of age or older by thigh-stab application. Do not vaccinate the birds at least 4 weeks prior to onset and during egg production.

Wing-Web Method

Insert the applicator into the webbed portion of the wing avoiding feathers, muscle, bone and blood vessels (0.01 ml dose/bird).

Thigh-Stab Application

Dip the applicator into the reconstituted vaccine and stab into the thigh muscle. Dip the applicator before each stab. Be careful not to pierce the tendons but go deep enough to break skin.

Precautions and Warnings:

- Vaccinate healthy chickens only.
- All the chickens on the same shed should be vaccinated at the same time.
- Administer one dose vaccine per chicken.
- Reconstituted vaccine should be used within 2 hours.
- Use the entire vaccine when first opened.
- Do not mix with other vaccines.
- Disposal of all opened vaccine vials remaining after vaccination.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chickens that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination. At about 7-10 days following vaccination, poultry should be examined for "takes" (swelling of the skin with scab formation at the point of vaccination). "Takes" generally disappear 2 weeks following vaccination. Checking post vaccination "takes" is the best method of checking immunity. Revaccinate the poultry that do not show "takes".

Proprietary Preperations

Cevac Poximune AEL (*Ceva,* imported by *ACI*); Strain: AE virus strain + Fowl Pox virus strain, Live Freeze Dried, 1000 doses.

GALLIVAC AE + FP (*Boehringer Ingelheim, imported by Square*); Strain: AE virus strain + Fowl Pox virus strain, Live Freeze Dried, 1000 doses.

Nobilis AE + Pox (*MSD,* imported by *Bengal*); Strain: AE virus strain Galnek + Fowl Pox virus strain Gibbs, Live Freeze Dried, 1000 doses.

20. Infectious Coryza + Salmonella + Newcastle Disease + Infectious Bronchitis + Egg Drop Syndrome Vaccine

Description: This vaccine is used against Infectious Coryza, Salmonella, Newcastle Disease, Infectious bronchitis and Egg drop syndrome. The commonly used strains are *Avibacterium paragallinarum* serotypes A, B and C, and *Salmonella enteritidis* strain, LaSota strain of Newcastle: isease, Massachusetts strain of Infectious Bronchitis and B8/78 strain of Egg drop syndrome.

Target Species: Chickens.

Indication: Indicated for the immunization of healthy birds against Infectious Coryza, Salmonella, Newcastle Disease, Infectious bronchitis and Egg drop syndrome.

Dosage and administration: Breeder & Layer pullet 16-18 weeks of age 0.5 ml subcutaneously or intramuscularly.

Precautions and Warnings: Vaccine should not be used with other vaccines or other antibiotics.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

Cevac Corymune 7K (*Cevac, imported by ACI*), Strain: Avibacterium paragallinarum
Serotypes A, B and C, and Salmonella enteritidis strain, LaSota strain of Newcastle Disease, Massachusetts strain of Infectious Bronchitis and B8/78 strain of Egg drop syndrome, Inactivated and adjuvanted 1000 doses.

21. Infectious Coryza + Newcastle Disease + Infectious Bronchitis + Egg Drop Syndrome Vaccine

Description: This vaccine is used against Infectious Coryza, Newcastle Disease, Infectious bronchitis and Egg drop syndrome. The commonly used strains are *Avibacterium paragallinarum* serotypes A, B and C, and, LaSota strain of Newcastle: disease, Massachusetts strain of Infectious Bronchitis and 127 strain of Egg drop syndrome.

Target Species: Chickens.

Indication: Indicated for the immunization of healthy birds against Infectious Coryza, Newcastle Disease, Infectious bronchitis and Egg drop syndrome.

Dosage and administration: Breeder & Layer pullet 16-18 weeks of age 0.5 ml subcutaneously or intramuscularly.

Precautions and Warnings: Vaccine should not be used with other vaccines or other antibiotics.

Side Effects: This vaccine is generally well tolerated.

Storage: Protect from light, store at 2-8 ^{0}C and do not freeze. Keep out of the reach of children.

Special Note: This vaccine is not recommended for the chicks that are clinically sick or under conditions of severe stress. Sick or weak chickens will not develop adequate immunity following vaccination.

Proprietary Preperations

VOLVAC AC Plus+ND+IB+EDS (*Boehringer Ingelheim*, imported by *Square*), Strain: *Avibacterium paragallinarum, serotype A, B & C with two subtype of B serotype (B+, B++), Newcastle Disease LaSota strain, Infectious Bronchitis, M-41 strain, Egg Drop Syndrome, 127 strain*., Inactivated and adjuvanted 1000 doses.

Chapter 19

19. VACCINATION SCHEDULE

Animal Vaccines Available in Bangladesh[4,5]

Poultry Vaccines:

i. Newcastle Disease Vaccine (Live & Killed)
ii. Infectious Bursal Disease Vaccine (Live & Killed)
iii. Fowl Pox Vaccine (Live)
iv. Fowl Cholera Vaccine (Killed)
v. Egg Drop Syndrome Vaccine (Killed)
vi. Marek's Vaccine (Live)
vii. Infectious Bronchitis (Live & Killed)
viii. Avian Encephalomyelitis (Live)
ix. Infectious Coryza (Killed)
x. Fowl Typhoid (Killed)
xi. Duck Plague (Live)
xii. Salmonella (Killed)
xiii. Mycoplasma (Killed)
xiv. Baby-chick Ranikhet Disease (BCRDV live)
xv. Pigeon Pox Vaccine (live)
xvi. Avain Influenza (AI, Killed)

Large and Small Animal Vaccines [4,5]

i. Foot and Mouth Disease (FMD), killed vaccine
ii. Anthrax (Live)
iii. Hemorrhagic Septicemia (Killed)
iv. Peste des petits ruminants (PPR), Live vaccine
v. Black Quarter (Killed)
vi. Rabies (Live/Killed)
vii. Mastitis (Killed)
viii. Goat Pox Vaccine (Live)
ix. Lumpy Skin Disease

Imported Vaccines Available in Bangladesh[4]

i. Newcastle Disease Vaccine (Live & Killed)
ii. Infectious Bursal Disease Vaccine (Live & Killed)
iii. Fowl Pox Vaccine (Live)
iv. Fowl Cholera Vaccine (Killed)
v. Egg Drop Syndrome Vaccine (Killed)
vi. Marek's Vaccine (Live)
vii. Infectious Bronchitis (Live & Killed)
viii. Avian Encephalomyelitis (Live)
ix. Infectious Coryza (Killed)
x. Salmonella (Killed)
xi. Mycoplasma (Killed)
xii. Avian Influenza (AI, Killed)
xiii. Foot and Mouth Disease (FMD, Killed)
xiv. Rabies (Killed)
xv. Mastitis (Killed)

Table 1: Vaccination Schedule for Large animals.

Name of Vaccine	Initial Dose	Booster Dose	Dose	Preservation
Foot & Mouth Disease (FMD)	- 1 Month[1] (if mother non vaccinated) -1.5 month[3] - 4 months[1] (if mother non vaccinated) - 1st Booster Dose after 21 Days[1,2]	-4 Monthly (if regularly vaccination done)[1] -6 Monthly (if vaccination done schedule wise)[1,2,3]	-6 ml adult cow, Buffalo -3 ml in calf, -2ml in Goat, Sheep[1]	2-8° F [1,2]
Anthrax	6 Month[1,3]	Yearly[1,2,3]	Cattle, Buffalo, Horse - 1ml, SC. Sheep, Goat – 0.5ml, SC [2]	2-8° F [1,2]
Black Quarter (BQ)	6 Month[1,2,3] 2nd dose 4weeks later	Yearly[1,2,3]	Cattle, Buffalo - 5ml, SC. Sheep, Goat -2ml, SC [2]	2-8° F [1,2]
Hemorrhagic Septicemia (HS)	6 Month	6 Monthly[1]	2ml, SC-Large Animal 1ml, SC- Small Animal (Oil Adjuvant) 5ml, IM-Large Animal 2ml. IM-Small Animal (Alum Precipitated)1,2	2-8° F [1,2]
Peste Des Petets Ruminants (PPR)	2-4month, 6month[2] 2-3 month[3]	Yearly[2] 3yearly[3]	1ml, SC[2]	-20°F , 1year -205 – 0°F, 6 months 2-8°F, 1 month[1,2]
Goat Pox	4th Month[3]	Yearly[3]	1ml, SC	-20° F, 1year 2-8° F, 1month[1,2]

Table 2: Vaccination Schedule for Commercial Broiler in Bangladesh [2,6]

Name of Disease	Day	Route	Comments
Marek's disease	1 day	SC	Usually given in hatchery
Newcastle disease, Infectious bronchitis	1 day or 4-7th day	Drinking Water or Coarse spray, Eye Drop, Nasal Drop.	
	14–21 days		
Infectious bursal disease	7th Day, 14–21 days		

Table 3: Vaccination Schedule for Commercial Layer in Bangladesh [2,6,7]

Age (Day)	Disease name	Vaccine Name	Route/Procedure
1	Marek's	Marek's	SC (Usually given in Hatchery)
2	Gumborro	Gumborro Vaccine (Live)	Eye Drop
3-5	Ranikhet	BCRDV	Eye Drop
7	Infectious Bronchitis	IBDV	Eye Drop
10-14	Gumborro	Gumborro Vaccine (Live)	Eye Drop
14	Avian Influenza	Avian Influenza Vaccine (H5N1/H9N2)	SC
21-24	Ranikhet	BCRDV	Eye Drop
24-28	Gumborro	Gumborro Vaccine (Live)	Eye Drop
28	Avian Influenza	Avian Influenza Vaccine (H5N1/H9N2)	SC
30	Infectious Bronchitis	IBDV	Eye Drop
35	Chicken Pox	Foul Pox Vaccine	SC
60	Ranikhet	RDV	SC
70	Infectious Bronchitis	IBDV	Eye Drop
80-85	Cholera	Foul Cholera Vaccine	SC/IM
90-95	Infectiuos Coryza	ICV	SC/IM
110-115	Cholera	Foul Cholera Vaccine	SC/IM
120	Avian Influenza	Avian Influenza Vaccine (H5N1/H9N2)	SC
130-135	Infectious Bronchitis, Ranikhet, Egg Drop Syndrome	IB, RD, EDS Combined Vaccine	SC/IM
30-60 days intervals	Ranikhet	Live (Lasota/MA5 Clone)	Drinking water

Table 4: Proposed Vaccination Schedule for Layer Breeder:[6, 9]

Age (Day)	Name of the vaccine	Vaccine Type	Method of Vaccination
0	HVT AIV (AI + Mareks)	Killed	SC
0	MD Rispens	Killed	SC
1-4	Infectious Bronchitis (IB) & New Castle (ND)	Live	ED / Spray / Nose /Drinking water
4-5	Coccidiosis Vaccine	Live	Drinking water
7-10	Infectious Bursal Disease/Gumboro (IBD) + New Castle (ND)	Killed	SC/ IM
10-14	IBD	Live	ED / Spray / Nose /Drinking water
17-19	Infectious Bronchitis (IB)	Live	ED / Spray / Nose /Drinking water
17-21	IBD	Live	ED / Spray / Nose /Drinking water
21-28	ND	Live	ED / Spray / Nose /Drinking water
35	AI (H9N2)	Killed	SC
40	Salmonella	Killed	SC
42	Infectious Laryngo Tracheitis (ILT)	Live	ED
48	Chicken Infectious Anemia (CAV)	Live	W, IM

Age (Day)	Name of the vaccine	Vaccine Type	Method of Vaccination
49	H5N1	Killed	SC/ IM
55	Fowl Pox	Killed	WW (Wing web method)
58	ND (Live)	Live	ED
58	ND (Killed)	Killed	SC/ IM
60	Mycoplasma	Killed	SC
65	Fowl Cholera	Killed	SC
70	Coryza	Killed	SC
70	Avian Encephalitis, Pox	Killed	WW
75	AI (H9N2)	Killed	SC
80	Salmonella	Killed	SC
84	ILT	Live	ED
90	CAV	Live	DW
91	IB+ND+EDS	Killed	IM, SC
95	IB+ND	Live	ED, DW
98	Mycoplasma	Killed	SC
105	TRT	Killed	SC
106	Coryza	Killed	SC
110	Fowl Cholera	Killed	SC
112	IB+ND+IBD	Killed	SC
118	H5N1	Killed	SC
120	H9N2	Killed	SC
245-480	H5N1+H9N2	Killed	SC
315-385	IB+ND+IBD	Killed	SC

- IB+ND (Live) advisable every 30-60 days & H5N1, H9N2 advisable every 8-12 weeks intervals after 40 weeks.
- Subcutaneous injection-SC in the lower part of neck, intramuscularly (IM) in the thigh or breast muscle ED (1 Drop in 1 eye).

Table 5: Proposed Vaccination for Broiler Breeder

Age (Day)	Name of the vaccine	Vaccine Type	Method of Vaccination
0	HVT AIV (AI + Mareks)	Killed	SC
0	MD Rispens	Killed	SC
1-4	Infectious Bronchitis (IB) & New Castle (ND)	Live	ED / Spray / Nose /Drinking water
4-5	Coccidiosis Vaccine	Live	Drinking water
7-10	Infectious Bursal Disease/ Gumboro (IBD) + New Castle (ND)	Killed	SC/ IM
10-14	IBD	Live	ED / Spray / Nose /Drinking water
11	Reo Virus Vaccine	live	SC
17-19	Infectious Bronchitis (IB)	Live	ED / Spray / Nose /Drinking water
17-21	IBD	Live	ED / Spray / Nose /Drinking water
21-28	ND	Live	ED / Spray / Nose /Drinking water
35	AI (H9N2)	Killed	SC
40	Salmonella	Killed	SC
42	Infectious Laryngo Tracheitis (ILT)	Live	ED
48	Chicken Infectious Anemia (CAV)	Live	W, IM
49	H5N1	Killed	SC/ IM
55	Fowl Pox	Killed	WW (Wing web method)

Age (Day)	Name of the vaccine	Vaccine Type	Method of Vaccination
58	ND (Live)	Live	ED
58	ND (Killed)	Killed	SC/ IM
60	Mycoplasma	Killed	SC
60	Reo	Killed	SC
65	Fowl Cholera	Killed	SC
70	Coryza	Killed	SC
70	Avian Encephalitis, Pox	Killed	WW
75	AI (H9N2)	Killed	SC
80	Salmonella	Killed	SC
84	ILT	Live	ED
90	CAV	Live	DW
91	IB+ND+EDS	Killed	IM, SC
95	IB+ND	Live	ED, DW
98	Mycoplasma	Killed	SC
105	TRT	Killed	SC
106	Coryza	Killed	SC
110	Fowl Cholera	Killed	SC
112	IB+ND+IBD	Killed	SC
118	H5N1	Killed	SC
120	H9N2	Killed	SC
143	ND+IB+IBD+Reo	Killed	IM
245-480	H5N1+H9N2	Killed	SC
315-385	IB+ND+IBD	Killed	SC

Note: This is an example of a vaccination program. Individual programs are highly variable and reflect local conditions, disease prevalence, serological tests, outbreaks, investigations, zone & severity of challenge, and individual preferences and specially depend on local requirements & veterinarian's opinions.

Table 6: Type of Vaccination for Pet [11,12, 14]

Type/ Species	Core Vaccination	Noncore vaccination
Dog	Rabies & DHPP: Distemper, Adenovirus (Hepatitis) Para influenza, Parvo virus	Influenza, Corona virus, Leptospira, Bordetella, Lyme Disease
Cat	Rabies, Herpes, Calicivirus, Penleukopenia	FIV (Feline Immunodeficiency Virus) FeLV (Feline Leukemia Virus)

Table 7: Rabies Vaccination Program Prophylaxis (Pre-exposure) [10]

Species	Age at Primary Vaccination	Revaccination
Dog & Cat	After 3 months of age	1 year
Cattle, Horse, Sheep & Goat	After 6 months of age	1 year
Ferret	After 3 months of age	1 year
1ml by subcutaneous or intramuscular injection (according to manufacturer guideline. Shake well before use.		
Post-Bite treatment (Post-exposure Prophylaxis)		
Dose number	Timing	Route
1st	Day 0 (as soon as possible following bite/exposure)	1ml by subcutaneous or intramuscular injection.
2nd	Day 3	
3rd	Day 7	
4th	Day 14	
5th	Day 28	

Table 8: Rabies suspected bite Management[15]

Category	Type of contact	Recommended treatment
I	Touching or feeding of animals Licks on intact skin	Wash the site with soap and water only
II	Minor scratches or abrasions without bleeding	Wound management Anti-Rabies vaccine (ARV) as soon as possible on 1st visit
III	Single or multiple transdermal bites or scratches with active bleeding Licks or broken skin, contamination of mucous membrane with saliva (i.e. licks) Exposure to bats	Wound management Administer Anti-Rabies vaccine immediately Administer Rabies immunoglobulin (RIG) and Prophylactic antibiotics if required Anti-tetanus vaccination if required

Table 9: Dog Vaccination Schedule[14]

Age	Core Vaccinations	Optional Vaccinations
6-8 weeks	Distemper, Parvovirus **(Recombitek C4)**	Bordetella
10-12 Weeks	DHPP (Vaccines for distemper, adenovirus [hepatitis], parainfluenza and parvovirus) **(Recombitek C4)**	Influenza, Leptospirosis, Bordetella, Lyme disease as recommended by veterinarian
16-18 Weeks	DHPP, Rabies **(Recombitek C4 and Rabisin)**	Influenza, Leptospirosis, Bordetella, Lyme disease
12-16 Months	DHPP, Rabies **(Recombitek C4 and Rabisin)**	Coronavirus, Leptospirosis, Bordetella, Lyme disease

Every 1-2 years	DHPP ((**Recombitek C4)**	Influenza, Coronavirus, Leptospirosis, Bordetella, Lyme disease
Every 1-3 years	Rabies ((**Rabisin)**	none

Table 10: Cat Vaccination Schedule [11,12,14]

Age	Core Vaccinations	Noncore Vaccinations
6-8 weeks	F3 Vaccine (Herpes, Calicivirus & Panleuopenia) (1st shot) **(Purevax Feline 4)**	FIV (Feline Immunodeficiency Virus) FeLV (Feline Leukemia Virus)
10-12 Weeks	F3 Vaccine (Herpes, Calicivirus & Panleuopenia) (2nd shot) **(Purevax Feline 4)**	FIV FeLV *Chlamydophila felis* Bordetella
14-16 weeks	F3 Vaccine (Herpes, Calicivirus & Panleuopenia) (3rd shot) **(Purevax Feline 4)**	FIV FeLV FIP (Feline Infectious Peritonitis) *Chlamydophila felis* Bordetella
Annually	F3 Vaccine (Booster) **(Purevax Feline 4)**	FIV (Booster) FeLV (Booster) FIP (Booster) *Chlamydophila felis* (Booster) Bordetella (Booster)

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Chapter 20

20. DISINFECTANT AND ANTISEPTICS

Any substance or process that is used primarily on non-living objects to kill germs, such as viruses, bacteria, and other microorganisms that can cause infection and disease. Most disinfectants are harsh chemicals but sometimes heat or radiation.

Mode of Action: The exact mechanism of action of a disinfectant is not easy to elucidate. But most of the case, the actions of disinfectants on the external membrane, cytoplasmic membrane and energy metabolism of cells; these actions include rupture of the membrane, loss of permeability and coagulation of the cytoplasm.

Side Effects of Disinfectants:

- Eye and skin irritation – Direct exposure to the eyes may result in irritation and redness.
- Likewise, prolonged or frequent exposure to disinfectants can cause skin conditions like
- chronic drying of the skin and dermatitis for those with sensitive skin.
- Liver damage – Some disinfectants contain ethanolamine, which functions as a pH adjuster
- to keep the disinfectant stable. When exposed in large doses, this chemical can harm the
- kidneys and cause liver disease.
- Respiratory conditions – Inhaling small particles of disinfectants meant for cleaning surfaces
- can cause coughing and may impair respiratory functions.
- Central nervous system effects – Overexposure or excessive inhalation of disinfectant sprays
- can cause headaches and dizziness. Moreover, the ingestion of disinfectant spray solution
- may cause nausea and vomiting.
- Cardiac reaction – Some disinfectants contain butane, a highly flammable compound which
- helps the product spray out of the canister. If a person accidentally consumes or inhales too
- much of the product, it may result in serious cardiac effects.
- Asthma – Frequent exposure to bleach can cause breathing difficulties for individuals who already
- have asthma. Bleach is an asthma, and research shows that people who are exposed to bleach
- regularly can develop asthma over time.

Contraindication:

The following conditions are contraindicated with this drug.

- glucose-6-phosphate dehydrogenase (G6PD) deficiency
- methemoglobinemia, a type of blood disorder
- a type of slowed heart rhythm disorder called heart block
- decreased lung function
- liver problems
- seizures
- a condition where the body is unable to maintain adequate blood flow called shock
- large open wound
- anaemia from pyruvate kinase and G6PD deficiencies
- sepsis

Precaution:

The below are general recommendations for precautions applicable to commonly used disinfectants:

- Keep all chemical disinfectants in correctly labelled containers.
- Do not mix chemical disinfectants together or with other cleaning products.
- Avoid splashes and spills by handling chemical disinfectants with care.
- Do not breathe vapour/gas or spray; prepare and use chemical disinfectants in well-ventilated areas.

- Only use water at room temperature for dilutions (unless specified otherwise in users' instructions).
- Do not eat, drink, or smoke when using chemical disinfectants.
- Wear personal protective equipment (protective clothing, gloves and goggles) if available
- when handling chemical disinfectants.
- Store chemical disinfectants out of reach of children and in a cool and dry place, protected
- from heat and sunlight.
- Wash your hands thoroughly with soap and water after handling chemical disinfectants
- Do not use environmental/surface chemical disinfectants for personal hygiene (hand disinfection or bathing).

Dosage Form: Sodium Dichloroisocyanurate 3.3gm-

For purification of water- 5gm in 250-500 liters of water.

For sterilization of instrument- 5gm in 5 liters of water

Proprietary Preperations:
Sl Chlor T Tab *(Shinil Pharma Ltd.),* 500gm- 1

Chapter 21

21. DRUG INTERACTIONS

One of the factors that can alter the response to drugs is the concurrent administration of other drugs. Two or more drugs given at the same time may exert their effects independently or may interact. The interaction may be either potentiation, synergism or additive effect or may be antagonism of one drug by another, or occasionally some other effects. There are several mechanisms by which drugs may interact, but most can be categorized as pharmacodynamic, pharmacokinetic (absorption, distribution, metabolism, excretion) or combined toxicity.

Pharmacodynamic interactions occur between drugs which have similar or antagonistic pharmacological effects or side effects. The two drugs may or may not interact on the same recptor to produce additive or synergistic effects. Conversely, drugs with opposing pharmacologic effects may reduce the response to one or both drugs. Pharmacodynamic interactions are usually predicatable from knowledge on pharmacology of the interacting drugs. They occur in a greater or lesser extent in most patients who receive the interacting drugs.

On the other hand, pharmacokinetic interactions occur when one drug alters the ADME (absorption, distribution, metabolism or excretion) of another, thus increasing or reducing the amount of drug available to produce its pharmacological effects. Reduction in the total amount of drug absorbed may result in infective therapy. Induction of the hepatic microsomal enzymes system by one drug can gradually increase the rate of metabolism of another, resulting in lower plasma concentrations and a reduced effect. Conversely, inhibition of metabolism of one drug results in higher plasma concentrations and an increased effect with potential risk of toxicity. Drugs which share active transport mechanisms for elimination can delay excretion, resulting in toxicity of some drugs.

The combined use of two or more drugs, each of which has toxic effects on the same organ, can greatly increase the likelihood of organ damage.

Drug interactions are studied extensively in Clinical Pharmacy. Clinical Pharmacists of the developed countries deal with the case of drug interactions. But in Bangladesh, the importance of drug interaction is not yet fully appreciated. Although most drug interactions are harmless, many of those, which are potentially harmful, occur in a small proportion of patients. Moreover, the severity of an interaction varies from one patient to another. Patients at increased risk from drug interactions include the elderly and those with impaired renal or liver function.

Drugs with a small therapeutic ratio (e.g. digoxin) and those which require careful control of dosage (e.g. anticoagulants, antihypertensives and antidiabetics) are most often involved in the drug interactions. Most of the potentially hazardous drug interactions are listed in the following chart. The combined administration of the drug listed in the chart should be avoided or only undertaken with caution and appropriate monitoring and under supervision by clinicians as well as pharmacists.

List of drug interactions:

The following is an alphabetical list of drugs and their interactions. To avoid excessive cross-referencing each drug or group is listed twice: in the alphabetical list and also against the drug or group with which it interacts. It is to be mentioned that in this compilation, an asterisk mark (*) has been placed against interactions that are potentially hazardous and where combined administration of the drugs involved should be avoided (or undertaken with caution and appropriate monitoring).

Abacavir

Use of alcohol with abacavir may result in decreased elimination of abacavir and consequent increases in exposure. Abacavir increases the systemic clearance

of oral methadone and patients should be monitored for signs of withdrawal symptoms. The dose of methadone may need to be increased in some patients.

ACE inhibitors and Angiotensin-II antagonists

Alcohol: enhanced hypotensive effect.

Allopurinol: increased risk of toxicity with Captopril, especially in renal impairment.

- *Anesthetics:* enhanced hypotensive effect.
- *Analgesics:* antagonism of hypotensive effect and increased risk of renal impairment with NSAIDs; hyperkalaemia with Ketorolac and possibly other NSAIDs.

Antacids: absorption of Captopril, Enalapril, Fosinopril and possibly other ACE inhibitors reduced.
Anti-arrhythmics: Procainamide increases risk of toxicity with Captopril, especially in renal impairment.
Anticoagulant: increased risk of hyperkalaemia with Heparin.
Antidepressants: possibly enhanced hypotensive effect.
Antidiabetics: hypoglycemic effect possibly enhanced.
Other Antihypertensives: enhanced hypotensive effect.
Antipsychotics: enhanced hypotension effect.
An*xiolytics and Hypnotics:* enhanced hypotensive effect.
Beta-blockers: enhanced hypotensive effect.
Calcium-channel blockers: enhanced hypotensive effect.

- *Cardiac Glycosides:* plasma concentration of Digoxin possibly increased by Captopril.
- *Ciclosporin:* increased risk of hyperkalaemia.
- *Corticosteroids:* antagonism of hypotensive effect.
  Cytotoxics: Azathioprine increases risk of leucopoenia with Captopril.
- *Diuretics:* enhanced hypotensive effect (can be extreme); risk of severe hyperkalaemia with Potassium-sparing diuretics.
  Dopaminergics: Levodopa enhances hypotensive effect.
  Epoetin beta: antagonism of hypotensive effect: increased risk of hyperkalaemia.
- *Lithium:* ACE inhibitors and possibly Angiotensin-II antagonists reduce excretion of Lithium (increased plasma-lithium concentration).
- *Muscle Relaxants:* Tizanidine enhance hypotensive effect.
  Nitrates: enhance hypotensive effect.
- *Oestrogens and Progestogens:* Oestrogens and combined oral contraceptives antagonize hypotensive effect.
- *Potassium Salts:* increased risk of hyperkalaemia.
  Uricosurics: Probenecid reduces excretion of Captopril.

Aciclovir

Note: Interactions do not apply to topicalProprietary Preperations.
Mycophenolate Mofetil: higher plasma concentrations of Aciclovir and of Mycophenolate Mofetil on concomitant administration.
Uricosurics: Probenecid reduces Aciclovir execration (increased plasma concentrations).
Adenosine Possibility of interaction with drugs tending to impair myocardial conduction:

- Anaesthetics, Local: increased myocardial depression when anti-arrhythmics given with bupivacaine, levobupivacaine, prilocaine or ropivacaine.
- Anti-arrhythmics: increased myocardial depression when anti-arrhythmics given with other antiarrhythmics.
- Antipsychotics: increased risk of ventricular arrhythmias when anti-arrhythmics that prolong the QT interval given with antipsychotics that prolong the QT interval.
- Beta-blockers: increased myocardial depression when anti-arrhythmics given with beta-blockers.
- Dipyridamole: effect of adenosine enhanced and extended by dipyridamole (important risk of toxicity).

- Nicotine: effects of adenosine possibly enhanced by nicotine.
- Theophylline: anti-arrhythmic effect of adenosine antagonised by theophylline.

Aliskiren

- ACE Inhibitors: avoid concomitant use of aliskiren with ACE inhibitors.
- Analgesics: hypotensive effect of aliskiren possibly antagonised by NSAIDs.
- Angiotensin-II Receptor Antagonists: avoid concomitant use of aliskiren with angiotensin-II receptor antagonists; plasma concentration of aliskiren possibly reduced by irbesartan.
- Antibacterials: plasma concentration of Aliskiren reduced by rifampicin.
- Anticoagulants: increased risk of hyperkalaemia when aliskiren given with heparins.
- Antifungals: plasma concentration of Aliskiren increased by itraconazole-avoid concomitant use.
- Calcium-channel Blockers: plasma concentration of aliskiren increased by verapamil.
- Ciclosporin: plasma concentration of Aliskiren increased by ciclosporin.
- Diuretics: aliskiren reduces plasma concentration of furosemide; increased risk of hyperkalaemia when aliskiren given with potassium-sparing diuretics and aldosterone antagonists.
- Potassium Salts: increased risk of Hyperkalaemia when aliskiren given with potassium salts.

Alcohol

- *ACE Inhibitors and Angiotensin-II Antagonists:* enhanced hypotensive effect.
- *Analgesics:* sedative and hypotensive effect of opioid analgesics enhanced.
- *Antibacterials:* Disulfiram-like reaction with Metronidazole, and possibly Tinidazole.
- *Anticoagulants:* see Warfarin.
- *Antidepressants:* sedative effect of Tricyclics (and related) enhanced; Tyramine (contained in some alcoholic and dealcoholised beverages) interacts with MAOIs (hypertensive crisis) - but if no Tyramine, enhanced hypotensive effect; effects of alcohol possibly enhanced by SSRIs.

Antidiabetics: enhanced hypoglycemic effect; flushing with chlorpropamide (in susceptible subjects); increased risk of lactic acidosis with Metformin.
Antiepileptics: CNS side effects of Carbamazepine possibly enhanced.
Antihistamines: enhanced sedative effect.
Antihypertensives: enhanced hypotensive effect.
Antimuscarinics: sedative effect of Hyoscine enhanced.
Antipsychotics: enhanced sedative effect.
Anxiolytics and Hypnotics: enhanced sedative effect.
Barbiturates: enhanced sedative effect.
Beta-blockers: enhanced hypotensive effect.
Calcium-channel Blockers: enhanced hypotensive effect; plasma-alcohol concentration possibly increased by Verapamil.
Cytotoxics: disulfiram-like reaction with procarbazine.
Muscle Relaxants: Tizanidine enhanced sedative effect.
Nitrates: enhanced hypotensive effect.
Retinoids: Etretinate formed form Acitretin in presence of alcohol.

Albendazole

- Anthelmintics: The plasma concentration of albendazole sulfoxide has been increased by praziquantel.
- Antiepileptics: Phenytoin, carbamazepine, andphenobarbital appear to induce the oxidative metabolism ofalbendazole via the cytochrome P450 isoenzyme CYP3A by roughly the same extent, resulting in significantly reduced concentrations of albendazolesulfoxide.
- Corticosteroids: lasma concentrations of the active metabolite of albendazole (albendazole sulfoxide) were reported to be raised by about 50% in a study in 8 patients receivingdexamethasone.
- Gastrointestinal drugs: Concentrations of albendazole sulfoxide have been found to be raised in bile and hydatid cyst fluid when albendazole was given withcimetidine, which may increase

efficacy in the treatment of echinococcosis.

Allopurinol

ACE Inhibitors and Angiotensin-II Antagonists: increased risk of toxicity with Captopril, especially in renal impairment.
Antibacterials: increased risk of rash with concomitant ampicillin and amoxicillin.
Anticoagulants: effects of Warfarin possibly enhanced.
Ciclosporin: plasma-ciclosporin concentration possibly increased (risk of nephrotoxicity).

- *Cytotoxics:* effects of Azathioprine and Mercaptopurine enhanced with increased toxicity (reduce dose when given with Allopurinol).

Theophylline: plasma-theophylline concentration possibly increased

Alpha-Blockers

ACE Inhibitors and Angiotensin-II Antagonists: enhanced hypotensive effect.

- *Anaesthetics:* enhanced hypotensive effect.
- *Analgesics:* NSAIDs antagonize hypotensive effect.
- *Antidepressants:* enhanced hypotensive effect.
- *Other Antihypertensives:* additive hypotensive effect.
- *Antipsychotics:* enhanced hypotensive effect.
- *Anxiolytics and Hypnotics:* enhanced hypotensive and sedative effect.
- *Beta-blockers:* enhanced hypotensive effect; increased risk of first-dose hypotensive effect of past-synaptic alpha-blockers such as Prazosin.
- *Calcium-channel Blockers:* enhanced hypotensive effect; increased risk of first-dose hypotensive effect of post-synaptic alpha-blockers such as Prazosin. *Corticosteroids;* antagonism of hypotensive effect of post-synaptic alpha-blockers such as Prazosin.
- *Diuretics:* enhanced hypotensive effect; increased risk of first-dose hypotensive effect of post-synaptic alpha-blockers such as Prazosin.

Dopaminergics: Levodopa enhances hypotensive effect.
Muscle Relaxants: Tizanidine enhance hypotensive effect.
Nitrates: enhanced hypotensive effect.
Oestrogens and Progestogens: Oestrogens and combined oral contraceptive antagonize hypotensive effect.

Ambrisentan

- *Antibacterials: plasma concentration of ambrisentan possibly increased by rifampicin*
- *Ciclosporin: plasma concentration of ambrisentan increased by closporin*

Aminoglycosides

Analgesics: Indomethacin possibly increases plasma concentration of Gentamicin and Amikacin in neonates.

Other Antibacterials: increased risk of ototoxicity and nephrotoxicity with Vancomycin; Neomycin reduces absorption of Phenoxymethyl Penicillin.

- *Anticoagulants:* see Phenindione and Warfarin.
- *Antidiabeti7cs:* Neomycin possibly enhances hypoglycemic effect of Acarbose and increases severity of gastro-intestinal effects.
- *Antifungals:* increased risk of nephrotoxicity with Amphotericin.
- *Botulinum Toxin:* neuromuscular block enhanced (risk of toxicity).
- *Ciclosporin:* increased risk of nephrotoxicity.
  Cardiac Glycosides: Neomycin reduces absorption of Digoxin.
- *Cytotoxics:* increased risk of nephrotoxicity and possibly of ototoxicity with Cisplatin.
- *Diuretics:* increased risk of ototoxicity with loop diuretics.
- *Muscle Relaxants:* effect of non-depolarizing muscle relaxants enhanced.
- *Parasympathomimetics:* antagonism of effect of Neostigmine and Pyridostigmine.

Amiodarone

Note: Amiodarone has a long half-life; there is a potential for drug interactions to occur for several weeks (or even months) after treatment with it has been stopped.

- O*ther Anti-arrhythmics:* additive effect with Disopyramide, Flecainide, Procainamide, and Quinidine (increased risk of ventricular arrhythmias - avoid concomitant use); increased plasma concentration of Flecainide, Procainamide and Quinidine; increased myocardial depression with any anti-arrhythmic.
- *Antibacterials:* increased risk of ventricular arrhythmias with Erythromycin (parenteral) Co-trimoxazole and moxifloxacin (avoid concomitant use).
- *Anticoagulants:* metabolism of Warfarin inhibited (enhanced anticoagulant effect).
- *Antidepressants:* increased risk of ventricular arrhythmias with Tricyclics (avoid concomitant use).
- *Antiepileptics:* metabolism of Phenytoin inhibited (increased plasma concentration).
- *Antimalarials:* increased risk of ventricular arrhythmias with Chloroquine, Hydroxychloroquine, Mefloquine and Quinine (avoid concomitant use); manufacturer of artemether with lumefantrine advises avoid concomitant use (risk of ventricular arrhythmias)
- *Antipsychotics:* increased risk of ventricular arrhythmias with Phenothiazines and Haloperiodol (avoid concomitant use).
- *Beta-blockers:* increased risk of bradycardia, AV block, and myocardial depression (avoid concomitant use).
- *Calcium-channel Blockers:* Diltiazem and Verapamil increase risk of bradycardia, AV block, and myocardial depression.
- *Cardiac Glycosides:* increased plasma concentration of Digoxin (halve Digoxin maintenance dose).

Ciclosporin: plasma concentration of Ciclosporin possibly increased.

Diuretics: cardiac toxicity increased if hypokalaemia occurs with Acetazolamide, loop diuretics, and Thiazides.

Lithium: increased risk of hypothyroidism.

Ulcer-healing Drugs: Cimetidine increases plasma concentrations of Amiodarone.

Anabolic Steroids

- *Anticoagulants:* anticoagulant effect of Warfarin enhanced.
  Antidiabetics: hypoglycaemic effect possibly enhanced.

Anaesthetics, General

- *ACE Inhibitors and Angiotensin-II antagonist:* enhanced hypotensive effect.
  Antibacterials: possible potentiation of Isoniazid hepatotoxicity; effect of Thiopental enhanced by Sulphonamides; hypersensitivity-like reactions can occur with concomitant intravenous Vancomycin.
  Antidepressants: risk of arrhythmias and hypotension increased with Tricyclics: MAOIs.
- *Antihypertensives:* enhanced hypotensive effect.
- *Antipsychotics:* enhanced hypotensive effect.
  Anxiolytics and Hypnotics: enhanced sedative effect.
- *Beta-blockers:* enhanced hypotensive effect.
- Calcium-channel Blockers: enhanced hypotensive effect and AV delay with Verapamil; hypotensive effect of Dihydropyridines enhanced by Isoflurane.
- *Dopaminergics:* risk of arrhythmias if volatile liquid anaesthetics such as Halothane given with Levodopa.
  Oxytocin: oxytocic effect possibly reduced by volatile anaesthetics (also enhanced hypotensive effect and risk of arrhythmias).
- *Sympathomimetics:* risk of arrhythmias if adrenaline or Isoprenaline given with volatile liquid anaesthetics such as Halothane.

  Theophylline: increased risk of arrhythmias with halothane.

Antacids

ACE Inhibitors: reduced absorption of captopril, enalapril, fosinopril and possibly other ACE inhibitors.
Analgesics: excretion Aspirin increased in alkaline urine.
Anti-arrhythmics: excretion of Quinidine reduced in alkaline urine (may occasionally increase plasma concentration).
Antibacterials: reduced absorption of Azithromycin, Cefaclor, Cefpodoxime, Ciprofloxacin, Isoniazid, Levofloxacin, Moxifloxacin, Nitrofurantoin, Norfloxacin, Ofloxacin, Rifampicin and most Tetracyclines.
Antiepileptics: reduced absorption of Gabapentin and Phenytoin.
Antifungals: reduced absorption of Itraconazole and Ketoconazole.
Antihistamines: reduced absorption of Fexofenadine
Antiplatelet Drugs: Dipyridamole patient information leaflet advises avoidance of antacids.
Antimalarials: reduce absorption of Chloroquine and Hydroxychloroquine; Magnesium trisilicate reduces absorption of Proguanil.
Antipsychotics: reduced absorption of Phenothiazines and of Sulpiride
Antivirals: reduced absorption of Zalcitabine.
Bisphosphonates: reduced absorption.
Cardiac Glycosides: possibly reduced absorption of Digoxin.
Iron: Magnesium trisilicate reduces absorption of oral iron.
Lithium: sodium bicarbonate increases excretion (reduced plasma-lithium concentration).
Penicillamine: reduced absorption.
Ulcer-healing Drugs: possibly reduced absorption of Lansoprazole.

Anthranol

- Minoxidil: Absorption of minoxidil may be increased by the concurrent use of topical dithranol.

Antidepressants, SSRIs

Alcohol: effects possibly enhanced.

- *Analgesics:* risk of CNS toxicity increased with Tramadol; increased risk of bleeding with aspirin and NSAIDs.
- *Anticoagulants:* effect of Warfarin possibly enhanced.
- O*ther Antidepressant:* CNS effects of SSRIs increased by MAOIs (risk of serious toxicity), plasma concentration of some Tricyclics increased; agitation and nausea with Tryptophan; Fluoxetine increases plasma concentration of Nefazodone.
- *Antiepileptics:* antagonism (convulsive threshold lowered); plasma concentration of Carbamazepine lowered by Fluoxetine; plasma concentration of Phenytoin increased by Fluoxetine; Phenytoin and possibly other antiepileptics reduce plasma concentration of Paroxetine.
- *Antimalarials*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use.
- *Antipsychotics:* plasma concentration of Clozapine increased by Fluoxetine, Paroxetine and Sertraline; plasma concentration of Haloperidol increased by Fluoxetine; plasma concentration of Thioridazine increased by Paroxetine (risk of ventricular arrhythmias – avoid concomitant use); plasma concentration of Risperidone increased by Fluoxetine.
- *Antivirals:* plasma concentration possibly increased by Ritonavir.
- *Dopaminergics:* hypertension and CNS excitation with Fluoxetine, Paroxetine or Sertraline and Selegiline (Selegiline should not be started until 5 weeks after discontinuation of Fluoxetine for 2 weeks after stopping Selegiline).
- *Lithium:* increased risk of CNS effects (lithium toxicity reported).
- *Opioid Analgesics:* Tramadol possibly increases risk of convulsions.
- *Theophylline:* plasma-theophylline concentration increased (concomitant use should usually be avoided, but where not possible halve Theophylline dose and monitor plasma-theophylline concentration).

Antidepressants, Tricyclic

- *Alcohol:* enhanced sedative effect.
- Anaesthetics: risk of arrhythmias and hypotension increased.
- *Analgesics:* risk of CNS toxicity increased with Tramadol; possibly increased sedation with opioid analgesics.
- *Anti-arrhythmics:* increased risk of ventricular arrhythmias with drugs that prolong QT interval, including Amiodarone (avoid concomitant use), Disopyramide, Procainamide and Quinidine.
  Antibacterials: increased risk of ventricular arrhythmias with moxifloxacin (avoid concomitant use); plasma concentrations of some tricyclics reduced by Rifampicin (reduced antidepressant effect).
- *other Antidepressants:* CNS excitation and hypertension with MAOIs; Tricyclic or related antidepressant should not be started until 2 weeks after stopping MAOI; conversely, MAOI should not be started until at least 1 week after Tricyclic or related antidepressant has been stopped; plasma concentrations of some Tricyclics increased by SSRIs.
- *Antiepileptics:* antagonism (convulsive threshold lowered); plasma concentration of some Tricyclics reduced (reduced antidepressant effect).
- *Antihypertensives:* in general, hypotensive effect enhanced, but antagonism of effect of adrenergic neurone blockers and of Clonidine (and increased risk of hypertension on Clonidine withdrawal).
  Antimuscarinics: increased antimuscarinic side effects.
- *Antipsychotics:* increased risks of ventricular arrhythmias- avoid concomitant use with Pimozide; increased plasma concentrations of Tricyclic antidepressants and increased antimuscarinic side effects with Phenothiazines.
  Anxiolytics and Hypnotics: enhanced sedative effect.
- *Barbiturates:* see under Antiepileptics, above.
  Calcium-channel Blockers: Diltiazem and Verapamil increase plasma concentration Imipramine and possibly other Tricyclics.
  Diuretics: increased risk of postural hypotension.
- *Dopaminergics:* CNS toxicity reported with Selegiline.
  Muscle Relaxant: enhanced muscle relaxant effect.
  Nitrates: reduced effect of sublingual nitrates (owing to dry mouth).
  Oestrogens and Progestogens: oral contraceptives antagonize antidepressant effect (but side effects may be increased due to increased plasma concentrations of Tricyclics).
- *Sympathomimetics:* hypertension and arrhythmias with adrenaline (but local anaesthetics with adrenaline appear to be safe); hypertension with Noradrenaline.
  Ulcer-healing Drugs: plasma concentrations of Amitriptyline, and probably other Tricyclics increased by Cimetidine (inhibition of metabolism).

Antidiabetics

Note: Includes Acarbose; Insulin; Metformin; Nateglinide; Repaglinide, Sulphonylureas.

ACE Inhibitors: possibly enhance hypoglycemic effect.

Alcohol: enhanced hypoglycemic effect; flushing with Chlorpropamide (in susceptible subjects); risk of lactic acidosis with Metformin.

Anabolic Steroids: possibly enhance hypoglycemic effect.

- *Analgesics:* possibly NSAIDs enhance effect of Sulphonylureas.
- *Antibacterials:* Chloramphenicol, Co-trimoxazole, and Sulphonamides enhance effect of Sulphonylureas; Ciprofloxacin possibly enhances effect of Glibenclamide; Neomycin possibly enhances hypoglycemic effect of Acarbose and increases severity of gastrointestinal effects; Clarithromycin enchances effect of repaglinide; Rifampicin reduces effect of Chlorpropamide, Tolbutamide and

possibly other Sulphonylureas (accelerate metabolism); Rifampicin reduces plasma concentration of Repaglinide.

Anticoagulants: possibly enhanced hypoglycemic effects of Sulphonylureas and changes to anticoagulant effects of Warfarin and other Coumarins.

Antidepressants: MAOIs enhance hypoglycemic effect of Insulin, Metformin, Sulphonylureas and possibly other antidiabetics.

Antifungals: Fluconazole and Miconazole increase plasma concentrations of Sulphonylureas- avoid concomitant use Miconazole with Gliclazide or Glipizide.

Antihistamines: depressed thrombocyte count with concomitant use of Biguanides and Ketotifen.

Antihypertensives: hypoglycemic effect antagonized by Diazoxide.

Antipsychotics: Phenothiazines possibly antagonize hypoglycemic effect of Sulphonylureas.

Beta-blockers: enhanced hypoglycemic effect and masking of warning signs of hypoglycemia such as tremor.

Calcium-channel Blockers: Nifedipine may occasionally impair glucose tolerance

Corticosteroids: antagonism of hypoglycemic effect.

Diuretics: hypoglycemic effect antagonized by loop and Thaizide diuretics; Chlorpropamide increases risk of hyponatraemia with Thiazides in combination with potassium-sparing diuretics.

Hormone Antagonists: manufacturer advises metabolism of oral Antidiabetics possibly accelerated by Aminoglutethimide.

Lipid-regulating drugs: Fibrates may improve glucose tolerance and have an additive effect; increased risk of severe hypoglycaemia with Repaglinide and Gemfibrozil (avoid concomitant use)

Lithium: may occasionally impair glucose tolerance.

Oestrogens and Progestogens: oral contraceptives antagonize hypoglycemic effect.

Orlistat: manufacturer advises avoid concomitant use with Acarbose or Metformin.

Pancreatin: hypoglycemic effect of Acarbose reduced by Pancreatin.

Testosterone: hypoglycemic effect possibly enhanced.

Ulcer-healing Drugs: Cimetidine inhibits renal excretions of Metformin (increased plasma Metformin concentration); Cimetidine enhances hypoglycemic effect of Sulphonylureas.

Antifungals, Imidazole and Triazole

Note: Imidazole antifungals include Clotrimazole, Ketoconazole and Miconazole; Triazoles include Fluconazole and Itraconazole. In general, interactions relate to multiple-dose treatment.

Analgesics: metabolism of Alfentanil inhibited by Ketoconazole (risk of prolonged or delayed respiratory depression); plasma concentration of Celecoxib increased by Fluconazole (halve Celecoxib dose).

Antacids: Antacids reduce absorption of Itraconazole and Ketoconazole.

- *Antibacterials:* Rifampicin accelerates metabolism of Fluconazole, Itraconazole and Ketoconazole (reduced plasma concentrations); plasma concentration of Rifampicin may be reduced by Ketoconazole; plasma concentration of Rifabutin increased by Fluconazole and possibly other Triazoles (risk of uveitis-reduce Rifabutin dose); plasma concentration of Ketoconazole may be reduced by Isoniazid.
- *Anticoagulants:* effect of Warfarin enhanced by Fluconazole, Itraconazole, Ketoconazole, and

Miconazole (note: oral gel and vaginal formulations absorbed).

- *Antidiabetics:* plasma concentrations of Sulphonylureas increased by Fluconazole and Miconazole; Fluconazole, Itraconazole, and Ketoconazole possibly increase plasma concentration Repaglinide (manufacturer advises avoid concomitant use); avoid concomitant use of Miconazole with Glipizide.
- *Antiepileptics:* effect of Phenytoin enhanced by Fluconazole and Miconazole; plasma concentrations of Itraconazole and Ketoconazole reduced by Phenytoin.
  Other Antifungals: Imidazoles and Triazoles possibly antagonize effect of Amphotericin.
- *Antihistamines:* manufacturer advises possibility of increased plasma-loratadine concentration with Ketoconazole; metabolism of Mizolastine inhibited by Ketoconazole and possibly other Imidazoles (avoid concomitant use).
  Antimuscarinics: reduced absorption of Ketoconazole.
- *Antipsychotics:* risk of ventricular arrhythmias if Imidazoles or Traizoles given with Pimozide (avoid concomitant use).
- *Anxiolytics and Hypnotics:* plasma concentration of Midazolam increases by Itraconazole, Ketoconazole, and possibly Fluconazole (prolonged sedative effect).
- *Calcium-channel Blockers:* Itraconazole inhibits metabolism of dihydropyridines (increased plasma concentration).
- *Cardiac Glycosides:* plasma concentration of Digoxin increased by Itraconazole.
- *Ciclosporin:* metabolism inhibited by Itraconazole, Ketoconazole and possibly Fluconazole and Miconazole (increased plasma-Ciclosporin concentration).
  Corticosteroids: Ketoconazole inhibits metabolism of Methylprednisolone and possibly other Corticosteroids; Itraconazole possibly inhibits metabolism of Methylprednisolone.
  Cytotoxics: Itraconazole may inhibit metabolism of Vincristine (increased risk of neurotoxicity); in vitro studies suggest possible interaction between Ketoconazole
  Diuretics: plasma concentration of Fluconazole increased by Hydrochlorothiazide
- *Lipid-regulating Drugs:* Itraconazole, Ketoconazole, and possibly other Imidazoles and Triazoles increase risk of myopathy with Simvastatin - avoid concomitant use of Itraconazole, Ketoconazole with Simvastatin, Itraconazole and possibly other Imidazole and Triazoles may increase risk of myopathy with Atorvastatin; Itraconazole increases plasma concentration of Cervistatin.
  Oestrogens and Progestogens: anecdotal reports of contraceptive failure with Fluconazole, Itraconazole, Ketoconazole and possibly others.
- *Theophylline:* plasma-theophylline concentration possibly increased by Fluconazole and possibly Ketoconazole.
  Ulcer-healing Drugs: histamine H_2-antagonists reduce absorption of Itraconazole and Ketoconazole; proton-pump inhibitors reduce absorption of Ketoconazole and possibly Itraconazole; Sucralfate reduces absorption of Ketoconazole.

Antihistamines

Note: Sedative interactions apply to a lesser extent to the non-sedating antihistamines, and they do not appear to potentiate the effects of alcohol. Interactions do not generally apply to antihistamines used for topical action (including inhalation).

Alcohol: enhanced sedative effect.

- *Anti-arrhythmics:* increased risk of ventricular arrhythmias with Mizolastine (avoid concomitant use with Amiodarone, Disopyramide, Procainamide and Quinidine).
- *Antibacterials:* manufacturer advises possibility of increased plasma-loratadine concentration with Erythromycin.

Antidepressants: MAOIs and Tricyclics increase antimuscarinic and sedative effects.

- *Antidiabetics:* depressed thrombocyte count with concomitant use of Biguanides and Ketotifen.
- *Antifungals:* manufacturer advises possibility of increased plasma-loratadine concentration with Ketoconazole (avoid concomitant use).
  Antimuscarinics: increased antimuscarinic side effects.
  Antivirals: plasma concentration of non-sedating antihistamines possibly increased by Ritonavir.
  Anxiolytics and Hypnotics: enhanced sedative effect.
- *Beta-blockers:* Sotalol increases risk of ventricular arrhythmias with Mizolastine.
  Betahistine: antagonism (theoretical).
  Ulcer-healing Drugs: manufacturer advises possibility of increased plasma-loratadine concentration with Cimetidine.

Antimuscarinics

Note: Many drugs have antimuscarinic effects; concomitant use of two or more such drugs can increase side effects such as dry mouth, urine retention, and constipation; concomitant use can also lead to confusion in the elderly; interactions do not generally apply to antimuscarinics used by inhalation.

Alcohol: sedative effect of Hyoscine enhanced.

Analgesics: increased antimuscarinic effects.

Anti-arrhythmics: increased antimuscarinic effects with Disopyramide; Atropine delays absorption of Mexiletine.

Antidepressants: increased antimuscarinic side effects with Tricyclics and MAOIs.

Antidepressants: increased antimuscarinic side effects with Tricyclics and MAOIs.

Antifungals: reduced absorption of Ketoconazole.

Antihistamines: increased antimuscarinic side effects of Phenothiazines (but reduced plasma concentrations).
Antipsychotics: increased antimuscarinic side effects of Phenothiazines (but reduced plasma concentrations); increased side effects of Clozapine.

Dopaminergics: increased antimuscarinic side effects with Amantadine; absorption of Levodopa possibly reduced.

Metoclopramide and Domperidone: antimuscarinics antagonize gastro-intestinal effects.

Nitrates: reduced effect of sublingual nitrates (failure to dissolve under tongue owing to dry mouth).

Parasympathomimetics: antagonism of effect.

Antipsychotics

Note: Increased risk of toxicity with myelosuppressive drugs- Clozapine in particular

should not be used concurrently with drugs associated with a substantial potential for

causing agranulocytosis, such as Carbamazepine, Co-trimoxazole, Chloramphenicol,

Sulphonamides, Pyrazolone analgesics such as Azapropazone, Penicillamine or

Cytotoxics also avoid Clozapine with long-acting depot antipsychotics (have

myelosuppressive potential).

ACE Inhibitors and Angiotensin-II antagonist: severe postural hypotension with Chlorpromazine and possibly other Phenothiazines.

Alcohol: enhanced sedative effect.

- *Anaesthetics:* enhanced hypotensive effect.
- *Analgesics:* enhanced sedative and hypotensive effect with opioid analgesics; severe drowsiness possible if Indomethacin given with Haloperidol; risk of ventricular arrhythmias if Levacetylmethadol given with Chlorpromazine, Haloperidol,

Pimozide or Thioridazine (avoid concomitant use).
Antacids and Adsorbents: reduced absorption of Phenothiazines with antacids and possibly with Kaolin.

- *Anti-arrhythmics:* increased risk of ventricular arrhythmias with drugs that prolong QT interval – avoid concomitant use of Pimozide or Thioridazine with Amiodarone, Disopyramide, Procainamide or Quinidine (also avoid Haloperidol with Amiodarone).
- *Antibacterials:* risk of arrhythmias if Clarithromycin and possibly Erythromycin given with Pimozide (avoid concomitant use); Erythromycin possibly increases plasma concentration Clozapine (possible increased risk of convulsions); Rifampicin accelerates metabolism of Haloperidol (reduced plasma-Haloperidol concentration).
- *Antidepressants:* increased risk of arrhythmias with Tricyclic antidepressants-avoid concomitant use of Pimozide with Tricyclics; increased plasma concentrations and increased antimuscarinic effects notably on administration of Tricyclics with Phenothiazines; Fluoxetine possibly increase plasma concentration of Clozapine; Fluoxetine increases plasma concentration of Haloperidol; Clozapine possibly enhances central effects of MAOIs.
Antidiabetics: hypoglycemic effect of Sulphonylureas possibly antagonized by Phenothiazines.
- *Antiepileptics:* antagonism (convulsive threshold lowered); Carbamazepine accelerates metabolism of Clozapine and Haloperidol (reduced plasma concentrations); Phenytoin accelerates metabolism of Clozapine
- *Antifungals:* risk of ventricular arrhythmias if Imidazoles or Triazoles given with Pimozide (avoid concomitant use).
Antihypertensives: enhanced hypotensive effect; increased risk of extrapyramidal effects on administration Methyldopa.
- *Antimalarials:* avoid concomitant use of Pimozide with Mefloquine and Quinine.
Antimuscarinics: antimuscarinic side effects of Phenothiazines increased (but reduced plasma concentrations).
- *Antivirals:* Protease inhibitors possibly increase plasma concentration of Pimozide (risk of ventricular arrhythmias- avoid concomitant use); Ritonavir increases plasma concentration of Clozapine (risk of toxicity – avoid concomitant use); Ritonavir possibly increases plasma concentration of other antipsychotics.
- *Anxiolytics and Hypnotics:* enhanced sedative effect; Diazepam increases plasma concentration of Zotepine; Buspirone increases plasma concentration of Haloperidol.
- *Beta-blockers:* Phenothiazines increase risk of ventricular arrhythmias with Sotalol; concomitant administration of Propranolol and Chlorpromazine may increase plasma concentration of both drugs.
Calcium-channel Blockers: enhanced hypotensive effect.
- *Desferrioxamine:* manufacturer advises avoid Prochlorperazine (also Levomepromazine on theoretical grounds).
- *Diuretics:* hypokalaemia increased risk of ventricular arrhythmias with Pimozide (avoid concomitant use).
Dopaminergics: antagonism of hypoprolactinaemic and ant antiparkinsonian effects of Bromocriptine; antagonism of effect of Apomorphine, Levodopa and Pergolide.

Lithium: increased risk of extrapyramidal effects and possibility of neurotoxicity with Clozapine, Haloperidol and Phenothiazines.

Metoclopramide and Domperidone: increased risk of extrapyramidal effects with Metoclopramide.

Sympathomimetics: antagonize pressor action.

Ulcer-healing Drugs: Cimetidine may enhance effects of Chlorpromazine, Clozapine, and possibly other antipsychotics.

Anxiolytics and Hypnotics

Alcohol: enhanced sedative effect.

Anaesthetics: enhanced sedative effect.

Analgesics: opioid analgesics enhance sedative effect.

- *Antibacterials:* erythromycin inhibits metabolism of Midazolam (increased plasma-Midazolam concentration, with profound sedation) and Zopiclone; Isoniazid inhibits metabolism of Diazepam; Rifampicin increased metabolism of diazepam and possibly other Benzodiazepines.

  Anticoagulants: Chloral Hydrate may transiently enhance anticoagulant effect of Warfarin.

  Antidepressants: enhanced sedative effect; manufacturer contra-indicates Buspirone with MAOIs.

  Antiepileptics: metabolism of Clonazepam accelerated (reduced effect); plasma-Phenytoin concentrations increased or decreased by Diazepam and possibly other Benzodiazepines.

- *Antifungals:* Itraconazole, Ketoconazole, and possibly Fluconazole increase plasma concentration of Midazolam (prolonged sedative effect)

  Antihistamines: enhanced sedative effect.

  Antihypertensives: enhanced hypotensive effect; enhanced sedative effect with alpha-blockers.
  Antipsychotics: enhanced sedative effects; Diazepam increases plasma concentration of Zotepine.

  Calcium-channel Blockers: Diltiazem and Verapamil inhibit metabolism of Midazolam (increased plasma-midazolam concentration, with increased sedation)

  Disulfiram: metabolism of Benzodiazepines inhibited, with enhanced sedative effect.

  Dopaminergics: Benzodiazepines occasionally antagonize effect of Levodopa.

  Muscle Relaxants: Tizanidine enhance sedative effect.

  Ulcer-healing Drugs: Cimetidine inhibits metabolism of Benzodiazepines and Chlormethiazole and Zaleplon (increased plasma concentrations); Omeprazole inhibits metabolism of Diazepam (increased plasma concentration).

Apremilast:

- YP3A4 Inducers (Moderate): May decrease the serum concentration of CYP3A4 Substrates (High risk with Inducers). Monitor therapy
- CYP3A4 Inducers (Strong): May decrease the serum concentration of Apremilast. Avoid combination
- Dabrafenib: May decrease the serum concentration of CYP3A4 Substrates (High risk with Inducers). Management: Seek alternatives to the CYP3A4 substrate when possible. If concomitant therapy cannot be avoided, monitor clinical effects of the substrate closely (particularly therapeutic effects). Consider therapy modification
- Deferasirox: May decrease the serum concentration of CYP3A4 Substrates (High risk with Inducers). Monitor therapy
- Pitolisant: May decrease the serum concentration of CYP3A4 Substrates (High
- risk with Inducers). Management: Combined use of pitolisant with a CYP3A4 substrate that has a narrow therapeutic index should be avoided. Other CYP3A4 substrates should be monitored more closely when used with pitolisant. Consider therapy modification
- Riociguat: Apremilast may enhance the hypotensive effect of Riociguat. Management: Riociguat is contraindicated with nonselective phosphodiesterase (PDE) inhibitors and PDE type 5 inhibitors. Other types of PDE inhibitors are not

contraindicated, but caution is advised and patients should be monitored for hypotension. Monitor therapy
- Sarilumab: May decrease the serum concentration of CYP3A4 Substrates (High risk with Inducers). Monitor therapy
- Siltuximab: May decrease the serum concentration of CYP3A4 Substrates (High risk with Inducers). Monitor therapy
- Tocilizumab: May decrease the serum concentration of CYP3A4 Substrates (High risk with Inducers). Monitor therapy

Aripiprazole

- May reduce plasma levels w/ CYP3A4 inducers (e.g. carbamazepine).
- May increase plasma levels w/ CYP3A4 inhibitors (e.g. clarithromycin, ketoconazole) or CYP2D6 inhibitors (e.g. fluoxetine, quinidine).
- Concurrent admin w/ anticholinergic agents may disrupt body temp regulation. Additive effects w/ hypotensive agents.
- Increased sedative and orthostatic hypotensive effects w/ lorazepam and other benzodiazepines.
- Overlapping adverse reactions (e.g. sedation) w/ CNS agents.

Armodafinil

- Reduced plasma levels w/ potent CYP inducers (e.g. carbamazepine, phenobarbital).
- May reduce the effectiveness of steroidal contraceptives. May reduce ciclosporin blood levels.
- May decrease clearance of phenytoin, warfarin, diazepam, propranolol, omeprazole

Artemether with Lumefantrine

Note: Grapefruit juice possibly inhibits metabolism Artemether and Lumefantrine (manufacturer advises avoid)

- *Antiarrhythmics*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use with Amiodarone, Disopyramide, Procainamide and Quinidine (risk of ventricular arrhythmias)
- *Antibacterials*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use with Macrolides and Quinolones.
- *Antidepressants*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use.
- *Antifungals*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use with imidazoles and triazoles
- *Other Antimalarials*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use.
- *Antipsychotics*: manufacturer of Artemether with Lumefantrine advises avoid concomitant use.
- Beta-blockers: manufacturer of Artemether with Lumefantrine advises avoid concomitant use with metoprolol.

Artesunate as of artemisinin

Use of artemisinin derivatives with drugs that prolong the QT interval should be avoided if possible; caution is advised when artemisinin derivatives are given with other antimalarials that have this propensity. Artemisinin has been reported to be a potent inhibitor of the cytochrome P450 isoenzyme CYP1A2, and might interact with drugs metabolised via this enzyme (such as theophylline). In contrast it is said to be an inducer of CYP2A6, although the clinical implications of this are unclear.

Aspirin

- *Other Analgesics:* avoid concomitant administration of other NSAIDs (increased side effects).
  Antacids and Adsorbents: excretion of aspirin increased in alkaline urine; Kaolin possibly reduces absorption.
- *Anticoagulants:* increased risk of bleeding due to Antiplatelet effect.
  Antiepileptics: enhancement of effect of Phenytoin and Valproate.
  Corticosteroids: increased risk of gastro-intestinal bleeding and ulceration; Corticosteroids reduce plasma-salicylate concentration.

- *Cytotoxics:* reduced excretion of Methotrexate (increased toxicity).
  Diuretics: antagonism of diuretic effect of Spironolactone; reduced excretion of Acetazolamide (risk of toxicity).
  Leukotriene Antagonists: Aspirin increases plasma concentration Zafirlukast.
  Metoclopramide and Domperidone: Metoclopramide enhances effect of Aspirin (increased rate of absorption).

  Uricosurics: effect of Probenecid and Sulphinpyrazone reduced.

Azathioprine

- *Allopurinol:* enhancement of effect with increased toxicity (reduce dose of Azathioprine when given with Allopurinol).
- *Antibacterials:* manufacturer reports interaction with Rifampicin (transplants possibly rejected).

Aztreonam

Caution is recommended in patients receiving aztreonam and oral anticoagulants because of the possibility of increased prothrombin time.

Barbiturates

Anti-arrhythmics: metabolism of Disopyramide and Quinidine increased (reduced plasma concentrations).
Antibacterials: metabolism of Chloramphenicol, Doxycycline, and Metronidazole accelerated (reduced effect); Sulphonamides enhance effect of Thiopental

- *Anticoagulants:* metabolism of Warfarin accelerated (reduced anticoagulant effect).
- *Antidepressants:* antagonism of anticonvulsant effect (convulsive threshold lowered); metabolism of Mianserin and some Tricyclics accelerated (reduced plasma concentrations).
- *Antiepileptics:* concomitant administration Phenobarbital with other antiepileptics may enhance toxicity without a corresponding increase in antiepileptics effect; moreover, interactions can complicate monitoring of treatment; interactions include enhanced effects, increased sedation, and reductions in plasma concentrations.
  Antifungals: Phenobarbital reduces absorption of Griseofulvin (reduced effect).
- *Antipsychotics:* antagonism of anticonvulsant effect (convulsive threshold lowered); Phenobarbital accelerates metabolism of Haloperidol (reduced plasma concentration).
- *Antivirals:* plasma concentration of Saquinavir possibly reduced.
- *Calcium-channel Blockers:* effect of Felodipine and probably Nifedipine and other Dihydropyridines, Diltiazem, and Verapamil reduced.
  Cardiac Glycosides: metabolism of Digitoxin only accelerated (reduced effect).
- *Ciclosporin:* metabolism of Ciclosporin accelerated (reduced effect).
- *Corticosteroids:* metabolism of Corticosteroids accelerated (reduced effect).
- *Folic Acid and Folinic Acid:* plasma concentration of Phenobarbital possibly reduced by Folic acid and Folinic acid.
  Leukotriene Antagonists: plasma concentration of Montelukast reduced by Phenobarbital.
- *Oestrogens and Progestogens:* metabolism of oral contraceptives accelerated (reduced contraceptive effect).
  Theophylline: metabolism of Theophylline accelerated (reduced effect).
  Thyroxine: metabolism of Thyroxine accelerated (may increase Thyroxine requirements in hypothyroidism).

  Vitamins: vitamin D requirements possibly increased.

Beta-Blockers

Note: Since systemic absorption may follow topical application of beta-blockers to the eye the possibility of interactions, in particular, with drugs such as Verapamil should be borne in mind.

ACE Inhibitors: enhanced hypotensive effect.

Alcohol: enhanced hypotensive effect.

- *Anaesthetics:* enhanced hypotensive effect; increased risk of Bupivacaine toxicity with Propranolol.
  Analgesics: NSAIDs antagonize hypotensive effect.
- *Anti-arrhythmics:* increased risk of myocardial depression and bradycardia; with Amiodarone increased risk of bradycardia and AV block; increased risk of Lignocaine toxicity with Propranolol; Propafenone increases plasma concentration of Metoprolol and Propranolol; risk of ventricular arrhythmias associated with Sotalol increased by Amiodarone, Disopyramide, Procainamide, and Quinidine (avoid concomitant use).
- *Antibacterials:* increased risk of arrhythmias with Sotalol and Fluroquinolones (avoid concomitant use); Rifampicin accelerates metabolism of Propranolol (significantly reduced plasma concentration).
- *Antidepressants:* risk of ventricular arrhythmias associated with Sotalol increased by Tricyclics.
  Antidiabetics: enhanced hypoglycemic effect and masking of warning signs of hypoglycemia such as tremor.
- *Antihypertensives:* enhanced hypotensive effect; increased risk of withdrawal hypertension with Clonidine (withdraw beta-blocker several days before slowly withdrawing Clonidine); increased risk of first-dose hypotensive effect with post-synaptic alpha-blockers such as Prazosin.
- *Antimalarials:* risk of ventricular arrhythmias associated with Sotalol increased by Phenothiazines; concomitant administration of Propranolol and Chlorpromazine may increase plasma concentration of both drugs.
  Anxiolytics and Hypnotics: enhanced hypotensive effect.
- *Calcium-channel Blockers:* increased risk of bradycardia and AV block with Diltiazem; severe hypotension and heart failure occasionally with Nifedipine and possibly other Dihydropyridines; asystole, severe hypotension, and heart failure with Verapamil.
  Cardiac Glycosides: increased AV block and bradycardia.
  Corticosteroids: antagonism of hypotensive effect.
  Diuretics: enhanced hypotensive effect; risk of ventricular arrhythmias associated with Sotalol increased by hypocalcaemia.
  Ergotamine: increased peripheral vasoconstriction.
  Muscle Relaxants: Propranolol enhances effect; possible enhanced hypotensive effect and bradycardia with Tizanidine.
  Oestrogens and Progestogens: oestrogens and combined oral contraceptives antagonize hypotensive effect.
  Parasympathomimetics: risk of arrhythmias possibly increased by Pilocarpine; Propranolol antagonizes effect of Neostigmine and Pyridostigmine.
- *Sympathomimetics:* severe hypertension with Adrenaline and Noradrenaline and possibly with Dobutamine (especially with non-selective beta-blockers).
  Theophylline: beta-blockers should be avoided on pharmacological grounds (bronchospasm).
  Thyroxine: metabolism of Propranolol accelerated (reduced effect).
  Ulcer-healing Drugs: plasma concentrations of Labetalol, Metoprolol and Propranolol increased by Cimetidine; hypotensive effect antagonized by Carbenoxolone.

Betahistine

Antihistamines: antagonism (theoretical).

Bile Acids

Antacids: may reduce absorption of bile acids.

- *Clofibrate group:* Clofibrate increases elimination of cholesterol in bile.
- *Oestrogens and Progestogens:* oestrogens increase elimination of cholesterol in bile.

Bisphosphonates
Analgesics: bioavailability of Tiludronic acid increased by Indomethacin.

Antacids: reduced absorption.

Antibacterials: increased risk of hypocalcaemia with Aminoglycosides.

Calcium salts: reduced absorption.

Iron: reduced absorption.

Bivalirudin May increase risk of bleeding when used with thrombolytics, oral anticoagulants or drugs that affect platelet function.

Bortezomib Bortezomib is a substrate of cytochrome P450 enzyme 3A4, 2C19 and 1A2.

CYP3A4 Inhibitors: Co-administration of ketoconazole, a strong CYP3A4 inhibitor, increased the exposure of bortezomib by 35% in 12 patients. Monitor patients for signs of bortezomib toxicity and consider a bortezomib dose reduction if bortezomib must be given in combination with strong CYP3A4 inhibitors (e.g. ketoconazole, ritonavir).

CYP2C19 Inhibitors: Co-administration of omeprazole, a strong inhibitor of CYP2C19, had no effect on the exposure of bortezomib in 17 patients.

CYP3A4 Inducers: Co-administration of rifampin, a strong CYP3A4 inducer, is expected to decrease the exposure of bortezomib by at least 45%. Because the drug interaction study (n=6) was not designed to exert the maximum effect of rifampin on bortezomib PK, decreases greater than 45% may occur.

Efficacy may be reduced when bortezomib is used in combination with strong CYP3A4 inducers; therefore, concomitant use of strong CYP3A4 inducers is not recommended in patients receiving bortezomib.

St. John's Wort (*Hypericum perforatum*) may decrease bortezomib exposure unpredictably and should be avoided.

Dexamethasone: Co-administration of dexamethasone, a weak CYP3A4 inducer, had no effect on the exposure of bortezomib in 7 patients.

Melphalan-Prednisone: Co-administration of melphalan-prednisone increased the exposure of bortezomib by 17% in 21 patients. However, this increase is unlikely to be clinically relevant.

Bosentan

- Antibacterials: plasma concentration of bosentan reduced by rifampicin
- Antidiabetics: increased risk of hepatotoxicity when bosentan given with glibenclamide
- Antifungals: plasma concentration of bosentan possibly increased by fluconazole; plasma concentration of bosentan possibly increased by itraconazole
- Antivirals: bosentan possibly reduces plasma concentration of indinavir; plasma concentration of bosentan increased by lopinavir ritonavir (consider reducing of bosentan); bosentan possibly reduces plasma concentration of telaprevir, also concentration of bosentan possibly increased; avoidance of bosentan advised by manufacturer of tipranavir
- Ciclosporin: plasma concentration of bosentan increased by ciclosporin (also plasma concentration of iclosporin reduced
- Cytotoxics: bosentan possibly reduces plasma concentration of bosutinib
- Lipid-regulating Drugs: bosentan reduces plasma concentration of simvastatin
- Oestrogens: bosentan possibly causes contraceptive failure of hormonal contraceptives containing oestrogens (alternative contraception recommended)
- Progestogens: bosentan possibly causes Contraceptive failure of hormonal contraceptives containing progestogens (alternative contraception recommended)
- Sildenafil: bosentan reduces plasma concentration of sildenafil
- Tadalafil: bosentan reduces plasma concentration of tadalafil

Bromfenac

Abciximab: Bromfenac may increase the anticoagulant activities of Abciximab.

Acebutolol: Bromfenac may decrease the antihypertensive activities of Acebutolol.

Aceclofenac: The risk or severity of adverse effects can be increased when Bromfenac is combined with Aceclofenac.

Acemetacin: The risk or severity of adverse effects can be increased when Bromfenac is combined with Acemetacin.

Acenocoumarol: Bromfenac may increase the anticoagulant activities of Acenocoumarol.

Acetylsalicylic acid: The risk or severity of adverse effects can be increased when Bromfenac is combined with Acetylsalicylic acid.

Bromocriptine

Alcohol: reduced tolerance to Bromocriptine.

Antibacterials: Erythromycin and possibly other Macrolides increase plasma concentration (increased risk of toxicity).

Antipsychotics: antagonism of hypoprolactinaemic and antiparkinsonian effects.

Metoclopramide and Domperidone: antagonize hypoprolactinaemic effect.

- *Sympathomimetics:* increased risk of toxicity with Bromocriptine and Phenylproponolamine.

Calcium Salts

Antibacterials: reduced absorption of Ciprofloxacin and Tetracyclines.

Cardiac Glycosides: large intravenous doses of calcium can precipitate arrhythmias.

Diuretics: increased risk of hypocalcaemia with Thiazides.

Calcium-Channel Blockers

Note: Grapefruit juice increases plasma concentration of dihydropyridine calcium-channel blockers (except Amlodipine) and Verapamil; Dihydropyridine calcium-channel blockers include Amlodipine, Felodipine, Lacidipine, Nifedipine and Nimodipine.

ACE Inhibitors: enhanced hypotensive effect.

- *Anaesthetics:* Verapamil increases hypotensive effect of general anaesthetics and risk of AV delay; Isoflurane enhances hypotensive effect of Dihydropyridines
- *Anti-arrhythmics:* Amiodarone-induced risk of bradycardia, AV block, and myocardial depression increased by Diltiazem and Verapamil; plasma-concentration of Quinidine reduced by Nifedipine; increased risk of myocardial depression and asystole if Verapamil given with Disopyramide; with Verapamil raised plasma concentration Quinidine (extreme hypotension may occur).
- *Antibacterials:* Erythromycin possibly inhibits metabolism of Felodipine (increased plasma concentration); Rifampicin increases metabolism of Diltiazem, Nifedipine, Verapamil and possibly Nisoldipine (plasma concentrations significantly reduced). *Antidepressants:* Diltiazem and Verapamil increase plasma concentration of Imipramine and possibly other Tricyclics. *Antidiabetics:* Nifedipine may occasionally impair glucose tolerance.
- *Antiepileptics:* effect of Carbamazepine enhanced by Diltiazem and Verapamil; Diltiazem and Nifedipine increase plasma concentration of Phenytoin; effect of Felodipine and probably Nifedipine and other Dihydropyridines reduced by Carbamazepine, Phenobarbitone, Phenytoin; effect of Diltiazem and Verapamil reduced by Phenobarbital and Phenytoin.
- *Antifungals:* Itraconazole inhibits metabolism of Felodipine (increased plasma concentration).
- *Antihypertensives:* enhanced hypotensive effect, increased risk of first-dose hypotensive effect of post-

synaptic alpha-blockers such as Prazosin
Antimalarials: possible increased risk of bradycardia with some calcium-channel blockers and Mefloquine.
Antipsychotics: enhanced hypotensive effect.
Anxiolytics and Hypnotics: Diltiazem and Verapamil inhibit metabolism of Midazolam (increased plasma-midazolam concentration, with increased sedation)

- *Barbiturates:* see under Antiepileptics, above.
- *Beta-blockers:* increased risk of bradycardia and AV block with Diltiazem; occasionally severe hypotension and heart failure with Nifedipine and possibly other dihydropyridines; asystole, severe hypotension, and heart failure with Verapamil.
- *Other Calcium-channel Blockers:* clearance of Nifedipine reduced by Diltiazem (increased plasma Nifedipine concentration).
- *Cardiac Glycosides:* plasma concentration of Digoxin increased by Diltiazem, Verapamil and possibly Nifedipine; increased AV block and bradycardia with Verapamil.
- *Ciclosporin:* plasma-ciclosporin concentrations increased by Diltiazem and Verapamil; possibly increases plasma concentration of Nifedipine.
Diuretics: enhanced hypotensive effect.
Lithium: neurotoxicity may occur without increased plasma-lithium concentrations in patients given Diltiazem and Verapamil.
Muscle Relaxants: Nifedipine and Verapamil enhance effect of non-depolarizing muscle relaxants, hypotension, myocardial depression, and hyperkalaemia with Verapamil and intravenous Dantrolene; risk of arrhythmias with Diltiazem and intravenous Dantrolene; enhanced hypotensive effect with Tizanidine.
- *Theophylline:* Diltiazem, Verapamil and possibly other calcium-channel blockers enhance effect (increased plasma-theophylline concentration).
Ulcer-healing Drugs: Cimetidine inhibits metabolism of some calcium-channel blockers (increased plasma concentration).

Capreomycin care should be taken when capreomycin is used with other drugs that have neuromuscular blocking activity. It should not be given with other drugs that are ototoxic or nephrotoxic.

Carbamazepine

- *Analgesics:* Dextropropoxyphene enhances effect of Carbamazepine; effect of Methadone and Tramadol decreased by Carbamazepine.
- *Antibacterials:* metabolism of Doxycycline accelerated (reduced effect); plasma-Carbamazepine concentration increased by Clarithromycin, Erythromycin and Isoniazid (also Isoniazid hepatotoxicity possibly increased).
- *Anticoagulants:* metabolism of Warfarin accelerated (reduced anticoagulant effect).
- *Antidepressants:* antagonism of anticonvulsant effect (convulsive threshold lowered); plasma concentration of Carbamazepine increased by Fluoxetine; metabolism of Mianserin and Tricyclics accelerated (reduced plasma concentrations); manufacturer advises avoid with MAOIs or within 2 weeks of MAOIs.
- *Other Antiepileptics:* concomitant administration of two or more antiepileptics may enhance toxicity without a corresponding increase in antiepileptic effect; moreover interactions between individual antiepileptics can complicate monitoring of treatment; interactions include enhanced effects, increased sedation, and reductions in plasma concentrations.
- *Antimalarials:* Chloroquine and Mefloquine antagonize anticonvulsant effect
- *Antipsychotics:* antagonism of anticonvulsant effect (convulsive threshold lowered); metabolism of Clozapine, Haloperidol and Olanzapine accelerated (reduced plasma concentrations).
- *Antivirals:* plasma concentration of Saquinavir possibly reduced.

- *Calcium-channel Blockers:* Diltiazem and Verapamil enhance effect of Carbamazepine; effect of Felodipine and probably Nifedipine and other Dihydropyridines reduced.
- *Corticosteroids:* metabolism accelerated (reduced plasma-ciclosporin concentration).
- *Diuretics:* increased risk of hyponatraemia; Acetazolamide increases plasma-Carbamazepine concentration.
- *Hormone Antagonists:* Danazol inhibits metabolism of Carbamazepine (enhanced effect).
  Lithium: neurotoxicity may occur without increased plasma-lithium concentration.
  Muscle Relaxants: effect of non-depolarizing muscle relaxants antagonized (recovery from neuromuscular blockade accelerated).
  Oestrogens and Progestogens: Carbamazepine accelerates metabolism of oral contraceptives (reduced contraceptive effect).
  Retinoids: plasma concentration possibly reduced by Isotretinoin.
  Theophylline: metabolism of theophylline accelerated (reduced effect).
  Thyroxine: metabolism accelerated (may increase Thyroxine requirements in hypothyroidism).
- *Ulcer-healing Drugs:* metabolism inhibited by Cimetidine (increased plasma-Carbamazepine concentration).
  Vitamins: Carbamazepine possibly increases vitamin D requirements.

Cardiac Glycosides

ACE Inhibitors: Captopril possibly increases plasma concentration Digoxin.
Analgesics: NSAIDs may exacerbate heart failure reduce GFR and increase plasma-cardiac glycoside concentrations.
Antacids and Adsorbents: Antacids and Kaolin possibly reduce absorption of Digoxin.

- *Anti-arrhythmics:* plasma concentration of Digoxin increased by Amiodarone, Propafenone, and Quinidine (halve maintenance dose of Digoxin).
  Antibacterials: Erythromycin and possibly other Macrolides enhance effect of Digoxin.
- *Antifungals:* plasma concentration Digoxin increased by Itraconazole.
- *Antimalarials:* quinine (includes use of quinine for cramp), hydroxychloroquine and possibly Chloroquine raise plasma concentration of Digoxin; possible increased risk of bradycardia with Mefloquine.
  Barbiturate: see under Antiepileptics, above.
  Beta-blockers: increased AV block and bradycardia.
- *Calcium Salts:* large intravenous doses of calcium can precipitate arrhythmias.
- *Calcium-channel Blockers:* plasma concentration Digoxin increased by Diltiazem, Verapamil and possibly Nifedipine; increased AV block and bradycardia with Verapamil.
  Corticosteroids: increased risk of hypokalaemia.
- *Diuretics:* increased toxicity if hypokalaemia occurs with Acetazolamide, loop diuretics, and Thiazides; effects of Digoxin enhanced by Canrenoate and Spironolactone.
- *Lipid-regulating Drugs:* plasma concentration of Digoxin possibly increased by Atorvastatin.
- *Muscle Relaxants:* arrhythmias with Suxamethonium.
- *Sulphasalazine:* absorption of Digoxin possibly reduced.
- *Ulcer-healing Drugs:* plasma concentration of Digoxin possibly increased by proton pump inhibitors; absorption possibly reduced by Sucralfate.

Absorption of cefdinir is decreased by antacids or iron supplements and doses should be separated by an interval of at least 2 hours. Probenecid reduces the renal excretion of cefdinir.

Cefditoren

Absorption of cefditoren after oral doses is decreased by antacids or histamine H2-receptor antagonists. Probenecid reduces the renal excretion of cefditoren.

Cephalosporins

- *Anticoagulants:* anticoagulant effect of Warfarin enhanced by Cephamandole and possibly others.
  Diuretics: Loop diuretics may increase nephrotoxicity of Cephalosporines.
  Uricosurics: excretion of Cephalosporins reduced by Probenecid (increased plasma concentrations).

Chloramphenicol

Other Antibacterials: Rifampicin accelerates metabolism (reduced Chloramphenicol-plasma concentration).

- *Anticoagulants:* anticoagulant effect of Warfarin enhanced.
- *Antidiabetics:* effect of Sulphonylureas enhanced.
- *Antiepileptics:* metabolism accelerated by Phenobarbital (reduced Chloramphenicol-plasma concentration); increased plasma concentration of Phenytoin (risk of toxicity).
- *Barbiturates:* see under Antiepileptics, above.

Chloroquine and Hydroxychloroquine

- *Analgesics:* Chloroquine and Hydroxychloroquine increase risk of ventricular arrhythmia with Levacetylmethadol (avoid concomitant use).
  Antacids and Adsorbents: antacids reduce absorption of Chloroquine and Hydroxychloroquine; Kaolin educes absorption of Chloroquine.
- *Antiarrhythmics:* Chloroquine and Hydroxychloroquine increase risk of ventricular arrhythmias with Amiodarone (avoid concomitant use).
- *Antiepileptics:* antagonism of anticonvulsant effect of other Antimalarials; increased risk of convulsions with Mefloquine; increased risk of arrhythmias with Halofantrine.
- *Cardiac Glycosides:* Hydroxychloroquine and possibly Chloroquine increase plasma concentration of Digoxin.
- *Ciclosporin:* Chloroquine increases plasma-Ciclosporin concentration (increased risk of toxicity).

  Parasympathomimetics: Chloroquine and Hydroxychloroquine have potential to increase symptoms of myasthenia gravis and thus diminish effect of Neostigmine and Pyridostigmine.

  Ulcer-healing Drugs: Cimetidine inhibits metabolism of Chloroquine (increased plasma concentration).

Cilostazol

Cilostazol is extensively metabolised to active and inactive metabolites by cytochrome P450 isoenzymes, mainly CYP3A4 and to a lesser extent CYP2C19. Therefore, use with other drugs that inhibit or are metabolised by these hepatic enzymes may result in changes in plasma concentrations of either drug and, possibly, adverse effects. Cilostazol should therefore be used with caution in patients taking drugs metabolised by these enzymes; in patients taking enzyme inhibitors it should be avoided or a reduced dose should be considered.

The risk of bleeding is increased if cilostazol is given with clopidogrel and aspirin; its use, therefore, is contra-indicated in patients receiving two or more other antiplatelet or anticoagulant drugs.

Cisplatin

- *Antibacterials:* Aminoglycosides increased risk of nephrotoxicity and possibly of ototoxicity.

  Diuretics: increased risk of nephrotoxicity and ototoxicity.

Clindamycin

Muscle Relaxants: enhancement of effect of non-depolarizing muscle relaxants.

Parasympathomimetics: antagonism of effect of Neostigmine and Pyridostigmine.

Clofazimine

Some preliminary data have suggested that the anti-inflammatory action of clofazimine in Type 2 lepra reactions may

be reduced by dapsone, although US licensed product information (Lamprene; Novartis, USA) states that these findings have not been confirmed; the antimycobacterial effect was not affected.

Elevated plasma and urine concentrations of clofazimine have been detected in patients receiving high doses of clofazimine with isoniazid, although skin concentrations were found to be lower.

For a report of the effect of clofazimine on rifampicin absorption.

Clonidine

- ACE Inhibitors: enhanced hypotensive effect when clonidine given with ACE inhibitors;
- Adrenergic Neurone Blockers: enhanced hypotensive
- Alcohol: enhanced hypotensive effect
- Aldesleukin: enhanced hypotensive effect
- Alpha-blockers: enhanced hypotensive effect
- Anaesthetics, General: enhanced hypotensive effect
- Analgesics: hypotensive effect
- Angiotensin-II Receptor Antagonists: enhanced hypotensive effect
- Antidepressants: enhanced hypotensive effect when clonidine given with MAOIs; hypotensive effect of clonidine possibly antagonised by mirtazapine, tricyclics, also increased risk of hypertension on clonidine withdrawal
- Antipsychotics: enhanced hypotensive effect when clonidine given with phenothiazines
- Anxiolytics and Hypnotics: enhanced hypotensive effect when clonidine given with anxiolytics and hypnotics
- Beta-blockers: increased risk withdrawal hypertension when clonidine given with beta-blockers
- Calcium-channel Blockers: enhanced hypotensive effect
- Corticosteroids: hypotensive effect of clonidine antagonized by corticosteroids
- Cytotoxics: possible increased risk of bradycardia when clonidine given with crizotinib
- Diazoxide: enhanced hypotensive effect when clonidine given with diazoxide
- Diuretics: enhanced hypotensive effect when clonidine given with diuretics
- Dopaminergics: enhanced hypotensive effect when clonidine given with levodopa
- Histamine: avoidance of clonidine advised by manufacturer of histamine
- Methyldopa: enhanced hypotensive effect when clonidine given with methyldopa
- Moxisylyte: enhanced hypotensive effect when clonidine given with moxisylyte
- Moxonidine: enhanced hypotensive effect when clonidine given with moxonidine
- Muscle Relaxants: enhanced hypotensive effect when clonidine given with baclofen or tizanidine
- Nitrates: enhanced hypotensive effect when clonidine given with nitrates
- Oestrogens: hypotensive effect of clonidine antagonized by oestrogens
- Prostaglandins: enhanced hypotensive effect when clonidine given with alprostadil.
- Sympathomimetics: possible risk of hypertension when clonidine given with adrenaline (epinephrine) or noradrenaline (norepinephrine); serious adverse events reported with concomitant use of clonidine and methylphenidate (causality not established)
- Vasodilator Antihypertensives: enhanced hypotensive effect when clonidine given with hydralazine, minoxidil or sodium nitroprusside

Clonazepam (general sedative interactions as for Anxiolytics and Hypnotics).

Clopidogrel

Analgesics: increased risk of bleeding with NSAIDs (including aspirin)

- *Anticoagulants*: enhanced effect due to antiplatelet action of Clopidogrel; manufacturer advises avoid concomitant use of Warfarin.

- *Other Antiplatelet drugs*: increased risk of bleeding.

Contraceptives, Oral

Note: Also covers Oestrogens taken alone; interactions unlikely with low dose hormone replacement therapy.

ACE Inhibitors: Oestrogens and combined oral contraceptives antagonize hypotensive effect.

- *Antibacterials:* Rifampicin accelerate metabolism of both combined and Progestogen-only oral contraceptives (reduced contraceptive effect); when broad-spectrum antibiotics such as Ampicillin and Tetracycline given with combined oral contraceptives possibility have reduced contraceptive effect (risk probably small).
- *Anticoagulants:* antagonism of anticoagulant effect of Nicoumalone, Phenindione, and Warfarin.
  Antidepressants: antagonism of antidepressant effect has been reported, but side effects of Tricyclics may be increased due to higher plasma concentration.
  Antidiabetics: antagonism of hypoglycemic effect.
- *Antiepileptics:* Carbamazepine, Phenobarbital and Phenytoin accelerate metabolism (reduce effect of both combined and Progestogen-only contraceptives).
- *Antifungals:* Griseofulvin accelerates metabolism (reduced contraceptive effect) anecdotal reports of contraceptive failure with Fluconazole, Itraconazole, Ketoconazole and possibly others.
  Antihypertensives: combined oral contraceptives antagonize hypotensive effect
- *Barbiturates:* see under Antiepileptics, above.
  Beta-blockers: Oestrogens and combined oral contraceptives antagonize hypotensive effect.
- *Bile Acids:* Oestrogens increase elimination of cholesterol in bile.
- *Ciclosporin:* increased plasma Ciclosporin concentration.
  Corticosteroids: oral contraceptives increase plasma concentration of Corticosteroids.
  Diuretics: combined oral contraceptives antagonize diuretic effect.
- *Retinoids:* oral Tretinoin reduces efficacy of Progestogen-only and possibly combined oral contraceptives.
  Tacrolimus: efficacy of oral contraceptives possibly decreased.
  Theophylline: combined oral contraceptives delay excretion (increased plasma-theophylline concentration).
  Ulcer-healing drugs: manufacturer advises Lansoprazole possibly accelerates metabolism.

Corticosteroids

Note: Do not generally apply to Corticosteroids used for topical action (including inhalalation).
Analgesics: increased risk of gastro-intestinal bleeding and ulceration with aspirin and NSAIDs. Corticosteroids reduce plasma-salicylate concentration.

- *Antibacterials:* Rifampicin accelerate metabolism of Corticosteroids (reduced effect); Erythromycin inhibits metabolism of Methylprednisolone and possibly other Corticosteroids.
  Antihypertensives: antagonism of hypoglycemic effect.
  Antivirals: plasma concentration of Saquinavir possibly reduced by Dexamethasone.
- *Barbiturates:* see under Antiepileptics, above.
- *Cardiac Glycosides:* increased toxicity if hypokalaemia occurs with Corticosteroids.
- *Ciclosporin:* plasma-Ciclosporin concentration increased by high-dose of Methylprednisolone (risk of convulsions); Ciclosporin increases plasma concentration of Prednisolone.
  Diuretics: antagonism of diuretic effect; Acetazolamide, loop diuretics, and Thiazides increase risk of hypokalaemia.
  Hormone Antagonists: Aminoglutethimide accelerates metabolism of Corticosteroids (reduced effect).

Oestrogens and Progestogens: oral contraceptives increase plasma concentration Corticosteroids.
Somatropin: growth promoting effect may be inhibited.
Sympathomimetics: increased risk of hypokalaemia if high does of Corticosteroids given with high doses of Ritodrine, Salbutamol, Salmeterol and Terbutaline; Ephedrine accelerates metabolism of Dexamethasone.
Ulcer-healing Drugs: Carbenoxolone increases risk of hypocalcaemia.

Co-Trimoxazole and Sulphonamides

Note: For interactions with co-trimoxazole see also under Trimethoprim.

Anesthetics: effect of Thiopental enhanced.

- *Anti-arrhythmics:* Co-trimoxazole increases risk of ventricular arrhythmias with Amiodarone (avoid concomitant use).
- *Anticoagulants:* effect of Warfarin enhanced.
- *Antidiabetics:* effect of Sulphonylureas enhanced.
- *Antiepileptics:* antifolate effect and plasma concentration of Phenytoin increased by Co-trimoxazole and possibly other Sulphonamides.
- *Antimalarials:* increased risk of antifolate effect with Pyrimethamine (includes Fansidar and Maloprim).
- *Ciclosporin:* increased risk of nephrotoxicity; plasma Ciclosporin concentration possibly reduced by Sulphadiazine.
- *Cytotoxics:* antifolate effect of Methotrexate increased by Co-trimoxazole; risk of Methotrexate toxicity increased by Sulphonamides.

Cyclophosphamide

- *Anticoagulants:* possibly enhances effect of Warfarin.
- *Muscle Relaxants:* Cyclophosphamide enhances effect of Suxamethonium.

Cycloserine

Patients receiving cycloserine and taking alcohol are at increased risk of convulsions; for reference to increased blood-alcohol concentrations in patients receiving cycloserine. Neurotoxic effects may be potentiated by use of cycloserine with ethionamide, and concurrent use ofcycloserine and isoniazid may result in increased CNS toxicity, such as dizziness and drowsiness.

Cyclosporin

Note: Grapefruit juice increases plasma-Ciclosporin concentration (risk of toxicity).

- *ACE Inhibitors:* increased risk of hyperkalaemia.
  Allopurinol: possibly increases plasma-ciclosporin concentration (risk of toxicity).
- *Analgesics:* increased risk of nephrotoxicity with NSAIDs; Ciclosporin increases plasma concentration of Diclofenac (halve diclofenac dose).
- *Anti-arrhythmics:* Amiodarone and Propafenon possibly increase plasma-Ciclosporin concentration.
- *Antibacterials:* Aminoglycosides, Co-trimoxazole (and Trimethoprim alone), and Quinolones increase risk of nephrotoxicity; Doxycycline possibly increases plasma-Ciclosporin concentration; Erythromycin, Clarithromycin and possibly other Macrolides increase plasma-Ciclosporin concentration; Erythromycin; Clarithromycin and possibly other Macrolides increase plasma-Ciclosporin concentration; Rifampicin, intravenous Trimethoprim (and possibly Sulphadiazine) reduce plasma-ciclosporin concentration.
- *Antiepileptics:* Carbamazepine, Phenobarbitone, Phenytoin, and Primidone accelerate metabolism (reduced plasma-Ciclosporin concentration).
- *Antifungals:* Griseofulvin possibly reduces plasma-Ciclosporin concentration; Itraconazole, Ketoconazole, and possibly Fluconazole and Miconazole inhibit metabolism (increased plasma-Ciclosporin concentration).
- *Antimalarials:* Chloroquine increases plasma-Ciclosporin concentration (risk of toxicity).

Barbiturates: see under Antiepileptics, above.

- *Calcium-channel Blockers:* Diltiazem and Verapamil increase plasma-Ciclosporin concentration; Ciclosporin possibly increases plasma concentration of Nifedipine.
- *Corticosteroids:* high-dose Methylprednisolone increases plasma-Ciclosporin concentration (risk of convulsions); Ciclosporin increases plasma concentration Prednisolone.
- *Cytotoxics:* increased risk of neurotoxicity with Doxorubicin, increased toxicity with Methotrexate; in vitro studies suggest possible interaction with Docetaxel-consult product literature.
- *Diuretics:* potassium-sparing diuretics increase risk of hyperkalaemia.
- *Hormone Antagonists:* Danazol inhibits metabolism (increased plasma-Ciclosporin concentration).
- *Lipid-regulating Drugs:* increased risk of myopathy with statins.
- *Oestrogens and Progestogens:* Progestogens inhibit metabolism (increased plasma-Ciclosporin concentration).
- *Potassium Salts:* increased risk of hyperkalaemia.
- *Tacrolimus:* plasma-Ciclosporin half-life prolonged (increased risk of toxicity).
- *Ulcer-healing Drugs:* Cimetidine possible increased plasma-Ciclosporin concentration.

Cytarabine

Flucytosine: plasma-flucytosine concentration possibly reduced.

Daclatasvir

May cause severe bradycardia and heart block when concomitantly used with amiodarone (in conjunction with sofosbuvir). Decreased plasma concentration and therapeutic effect with moderate CYP3A4 enzyme inducers. Increased plasma concentration with strong CYP3A4 enzyme inhibitors (e.g. clarithromycin, itraconazole, ketoconazole, ritonavir, etc.). May increase systemic exposure to drugs that are substrates of P-gp transporter (e.g. digoxin), OATP 1B1/1B3, and BCRP.

Potentially Fatal: Decreased plasma concentration and therapeutic effect with strong CYP3A4 enzyme inducers (e.g. carbamazepine, phenytoin, rifampicin, etc.).

Danazol

- *Anticoagulants:* effect of Warfarin enhanced (inhibits metabolism).
- *Antiepileptics:* inhibits metabolism of Carbamazepine (increased plasma-Carbamazepine concentration).
- *Ciclosporin:* inhibits metabolism (increased plasma-ciclosporin concentration).

Dapagliflozin

- Increased risk of dehydration and hypotension when used w/ diuretics.
- Additive hypoglycaemic effect if concomitantly used w/ insulin and insulin secretagogues (e.g. sulfonylureas).

Dapsone

Antibacterials: plasma concentration reduced by Rifampicin.

Probenecid: Dapsone excretion reduced (increased risk of side effects).

Darbepoetin alfa Antagonism of hypotensive effect and increased risk of hyperkalemia with ACE inhibitors and angiotensin II receptor antagonists. Ethanol.

Dasatinib

Concomitant use w/ drugs that have narrow therapeutic index (e.g. alfentanil, cisapride, ciclosporin, fentanyl, pimozide, quinidine, simvastatin, sirolimus, tacrolimus, ergot alkaloids) as it may increase the serum levels of these drugs. Increased risk of bleeding and thrombocytopenia w/ antiplatelet drugs, anticoagulants, and NSAIDs.

Potentially Fatal: May reduce plasma levels w/ antacids, administer antacid 2 hr apart from the admin of dasatinib. May increase plasma levels w/ CYP3A4 inhibitors (e.g. atazanavir, clarithromycin, erythromycin, indinavir, itraconazole, ketoconazole, nefazodone, nelfinavir, ritonavir, saquinavir, telithromycin or voriconazole). May reduce plasma levels

w/ CYP3A4 inducers (e.g. carbamazepine, dexamethasone, phenytoin, phenobarbital or rifampicin).

Deflazacort

Desferrioxamine

Antipsychotics: manufacturer advises avoid Prochlorperazine (also Methotrimeprazine of theoretical grounds).

Desmopressin

Analgesics: effect of Desmopressin potentiated by Indomethacin.

Dextromethorphan Hydrobromide + Phenylephrine Hydrochloride + Triprolidine Hydrochloride see de

- Additive CNS effect when used w/ antihistamines, psychotropics and other CNS depressants.
- Increased toxic effect when used w/ potent CYP2D6 enzyme inhibitors (e.g. fluoxetine, paroxetine, quinidine, terbinafine).
- Potentially Fatal: Increased risk of serotonin syndrome (e.g. hyperpyrexia, hallucinations, gross excitation or coma) when concomitantly used w/ MAOIs or SSRIs.

Diethylcarbamazine

- Ammonium chloride: Making the urine acidic with ammonium chloride appears to markedly increase the excretion of diethylcarbamazine.
- Sodium bicarbonate: Making the urine alkaline with sodium bicarbonate appears to markedly increase the retention of diethylcarbamazine.

Dipyridamole

Antacids: patient information leaflet advises avoidance of antacids.

- *Anti-arrhythmics:* effect of adenosine enhanced and extended (important risk of toxicity).
- *Anticoagulants:* enhanced effect due to antiplatelet action of Dipyridamole.

  Cytotoxics: efficacy of Fludarabine possibly reduced.

Disopyramide

- *Other Anti-arrhythmics:* Amiodarone increases risk of ventricular arrhythmias (avoid concomitant use); increased myocardial depression with any antiarrhythmic.
- *Antibacterials:* plasma concentration of Disopyramide reduced by Rifampicin but increased by erythromycin and possibly Clarithromycin (risk of toxicity).
- *Antidepressants:* increased risk of ventricular arrhythmics with Tricyclics.
  Antiepileptics: plasma concentration of Disopyramide reduced by Phenobarbital, Phenytoin.
  Antihistamines: increased risk of ventricular arrhythmias with Mizolastine (avoid concomitant use).
- *Antimuscarinics:* increased antimuscarinic side effects.
- *Antipsychotics:* increased risk of ventricular arrhythmias –avoid concomitant use with Pimozide or Thioridazine.
  Barbiturates: see under Antiepileptics, above.
- *Beta-blockers:* increased myocardial depression; increased risk of ventricular arrhythmias associated with Sotalol (avoid concomitant use).
- *Calcium-channel blockers:* increased myocardial depression with Verapamil.
- *Diuretics:* cardiac toxicity of Disopyramide increased if hypokalaemia occurs with Acetazolamide, Loop diuretics, and Thiazides.
- *Nitrates:* reduced effect of sublingual nitrates (failure to dissolve under tongue owing to dry mouth).

Diuretics

- *ACE Inhibitors:* enhanced hypotensive effect (can be extreme) risk of severe hyperkalaemia with potassium-risk of severe hyperkalaemia with potassium-sparing diuretics.

- *Analgesics:* diuretics increase risk of nephrotoxicity of NSAIDs; NSAIDs notably Indomethacin and Ketorolac antagonize diuretic effect; Indomethacin and possibly other

NSAIDs increase risk of hyperkalaemia with potassium-sparing diuretics; occasional reports of decreased renal function when Indomethacin given with Triamterene; diuretic effect of Spironolactone antagonized by Aspirin; Aspirin reduces excretion of Acetazolamide (risk of toxicity).

- *Anti-arrhythmics:* cardiac toxicity of Amiodarone, Disopyramide and Quinidine increased if hypokalaemia occurs; action of Lignocaine and Mexiletine antagonized by hypokalaemia; Acetazolamide reduces excretion of Quinidine (increased plasma concentration).
- *Antibacterials:* loop diuretics increase ototoxicity of Aminoglycosides and Vancomycin.
- *Antidepressants:* increased risk of postural hypotension with Tricyclics.
- *Antidiabetics:* hypoglycemic effect antagonized by Loop and Thiazide diuretics; Chlorpropamide increases risk of hyponatraemia associated with Thiazides in combination with potassium-sparing diuretics.
- *Antiepileptics:* increased risk of hyponatraemia with Carbamazepine; Acetazolamide increases plasma concentration of Carbamazepine; carbonic anhydrase inhibitors possibly increase risk of osteomalacia with antiepileptics such as Phenytoin.
  Antifungals: Hydrochlorothiazide increases plasma concentration Fluconazole.
- *Antihypertensives:* enhance hypotensive effect; increased risk of first-dose hypotensive effect of post-synaptic alpha-blockers such as Prazosin.
- *Antimalarials:* electrolyte disturbances increase risk of ventricular arrhythmias with Halofantrine.
- *Antipsychotics:* in hypokalaemia increased risk of ventricular arrhythmias with Pimozide (avoid concomitant use).
  Beta-blockers: enhanced hypotensive effect: in hypokalaemia increased risk of ventricular arrhythmias with Sotalol.
  Calcium Salts: increased risk of hypercalcaemia with Thiazides.
  Calcium-channel Blockers: enhanced hypotensive effect.
- *Cardiac Glycosides:* increased toxicity if hypokalaemia occurs with Acetazolamide, Loop diuretics, and Thiazides; effect enhanced by Canrenoate and Spironolactone.
  Corticosteroids: increased risk of hypokalaemia with Acetazolamide, Loop diuretics, and Thiazides, antagonism of diuretic effect.
- *Ciclosporin:* increased risk of hyperkalaemia with potassium-sparing diuretics.
  Cytotoxics: increased risk of nephrotoxicity and ototoxicity with Cisplatin.
  Other Diuretics: increased risk of hypokalaemia if Acetazolamide, Loop diuretics or Thiazides given together; profound diuresis possible if Metolazone given with Frusemide.
  Hormone Antagonists: increased risk of hyponatraemia with Aminoglutethimide.
- *Lithium:* Lithium excretion reduced by Loop diuretics, potassium-sparing diuretics and Thiazides (increased plasma-lithium concentration and risk of toxicity-loop diuretics safer than Thiazides); lithium excretion increased by Acetazolamide.
- *Oestrogens and Progestogens:* Oestrogens and combined oral contraceptive antagonize diuretic effect.
- *Potassium Salts:* hyperkalaemia with potassium-sparing diuretics.
  Sympathomimetics: increased risk of hypokalaemia if Acetazolamide, Loop diuretics, and Thiazides given with high does of Ritodrine, Salbutamol, Salmeterol and Terbutaline.

  Ulcer-healing Drugs: increased risk of hypokalaemia if Acetazolamide, Loop diuretics, and Thiazides given with Carbenoxolone; Carbenoxolone antagonizes diuretic effect; Amiloride and Spironolactone antagonize ulcer-healing effect of Carbenoxolone.

  Vitamins: increased risk of hypercalcaemia if Thiazides given with vitamin D.

Docetaxel Trihydrate

Antibacterials: in-vitro studies suggest possible interaction with erythromycin-consult product literature.

Antifungals: in-vitro studies suggest possible interaction with Ketoconazole-consult product literature. *Ciclosporin:* in-vitro studies suggest possible interaction with Ciclosporin.

Dofetilide

Increased plasma concentration when used w/ drugs secreted by renal tubular cationic transport (e.g. amiloride, metformin, triamterene). Increased risk of toxicity when used w/ QT prolonging agents (e.g. class I/III antiarrhythmics, bepridil, cisapride, phenothiazines, TCAs, certain fluoroquinolones and oral macrolides).
Potentially Fatal: Increased risk of torsade de pointes when used w/ hydrochlorothiazide (w/ or w/o triamterene), verapamil, and renal cation transport inhibitors (e.g. cimetidine, dolutegravir, trimethoprim, ketoconazole, prochlorperazine, megestrol).

Domperidone

Analgesics: opioid analgesics antagonize effect on gastro-intestinal activity; absorption of Paracetamol accelerated (enhanced effect).

Antimuscarinics: antagonism of effect on gastrointestinal activity.

Dopaminergics: possible antagonism of hypoprolactinaemic effect of Bromocriptine.

Doxepin

Increased plasma concentration when concurrently used w/ CYP2D6 inhibitors (e.g. quinidine, SSRIs), methylphenidate, and anxiolytics. Cimetidine may fluctuate steady-serum concentration of doxepin. Increased risk of arrhythmias, hypotension, or HTN if given w/ anaesthetics. Increased rate of metabolism w/ barbiturates. May decrease antihypertensive effects of clonidine, guanethidine, debrisoquine, and bethanidine. May reduce effect of sublingual nitrates owing to dry mouth. **Potentially Fatal:** May cause serious adverse effects w/ MAOIs.

Doxofylline This drug should not be administered together with other xanthine derivatives, including beverages and foods containing caffeine. Toxic synergism with ephedrine has been documented for xanthines. Concomitant therapy with erythromycin, troleandomycin, lincomycin, clindamycin, allopurinol, cimetidine, propranolol and anti-flu vaccine may decrease the hepatic clearance of xanthines causing an increase in blood levels.

Doxorubicin

Note: Antivirals may inhibit effect of Stavudine.

- *Ciclosporin:* increased risk of neurotoxicity.

Doxylamine Succinate + Pyridoxine Hydrochloride

Econazole

Econazole is a known inhibitor of CYP3A4/2C9. Due to the limited systemic availability clinically, relevant interactions are unlikely to occur but have been reported with oral anticoagulants. In patients taking oral anticoagulants, such as warfarin or acenocoumarol, caution should be exercised and the anticoagulant effect should be monitored more frequently.

Adjustment of the oral anticoagulant dosage may be necessary during and after the treatment with econazole.

Efavirenz

Efavirenz is metabolised mainly by cytochrome P450 isoenzymes including CYP3A4. Consequently, it may compete with other drugs metabolised by this system, potentially resulting in mutually increased plasma concentrations and toxicity. Enzyme inducers may decrease plasma concentrations of efavirenz; efavirenz itself acts as an enzyme inducer and can reduce plasma concentrations of other drugs. Inhibition of some P450 isoenzymes has also been found in vitro.

Efavirenz is contra-indicated with drugs that are highly dependent on CYP3A4 for clearance and for which elevated plasma concentrations are associated with serious or life-threatening events. These drugs include antihistamines (astemizole and terfenadine), calcium-channel blockers (bepridil), ergot derivatives (dihydroergotamine, ergometrine, ergotamine, methylergometrine), gastrointestinal prokinetics (cisapride), antipsychotics (pimozide), and sedatives and hypnotics (midazolam and triazolam). St John's wort decreases the concentration of efavirenz; use with the antiretroviral is not recommended due to the possible loss of its activity and development of resistance.

Empagliflozin Additive hypoglycaemic effect if concomitantly used w/ insulin and insulin secretagogues (e.g. sulfonylureas). Increased risk of dehydration and hypotension when used w/ diuretics (e.g. thiazides, loop diuretics).

Eltrombopag

- Antacids decrease the absorption of eltrombopag
- Oral calcium salts decrease the absorption of eltrombopag.
- Dairy products are predicted to decreases the absorption of eltrombopag.
- Iron (oral) is predicted to decrease the absorption of eltrombopag.
- Selenium is predicted to decrease the absorption of eltrombopag
- Eltrombopag is predicted to increase the exposure to statins. Monitor and adjust dose.
- Zinc is predicted to decrease the absorption of eltrombopag.

Eluxadoline

- Alcohol (Ethyl): May enhance the adverse/toxic effect of Eluxadoline. Specifically, alcohol use may increase the risk of pancreatitis. Avoid combination
- Alosetron: May enhance the constipating effect of Eluxadoline.
- Anticholinergic Agents: May enhance the constipating effect of Eluxadoline. Avoid combination
- Atazanavir: May increase the serum concentration of Eluxadoline. Management: Decrease the eluxadoline dose to 75 mg twice daily if combined with atazanavir and monitor patients for increased eluxadoline effects/toxicities. Consider therapy modification
- Cyclosporine (Systemic): May increase the serum concentration of Eluxadoline. Management: Decrease the eluxadoline dose to 75 mg twice daily if combined with cyclosporine and monitor patients for increased eluxadoline effects/toxicities. Consider therapy modification
- Loperamide-Loperamide Oxide: May enhance the constipating effect of Eluxadoline. Monitor therapy
- Lopinavir: May increase the serum concentration of Eluxadoline. Management: Decrease the eluxadoline dose to 75 mg twice daily if combined with lopinavir and monitor patients for increased eluxadoline effects/toxicities.
- Opioid Analgesics: May enhance the constipating effect of Eluxadoline. Avoid combination
- RifAMPin: May increase the serum concentration of Eluxadoline. Management: Decrease the eluxadoline dose to 75 mg twice daily if combined with rifampin and monitor patients for increased eluxadoline effects/toxicities. Consider therapy modification
- Ritonavir: May increase the serum concentration of Eluxadoline. Management: Decrease the eluxadoline dose to 75 mg twice daily if combined with ritonavir and monitor patients for increased eluxadoline effects/toxicities. Consider therapy modification
- Rosuvastatin: Eluxadoline may increase the serum concentration of Rosuvastatin. Management: Use the lowest effective dose of rosuvastatin if combined with eluxadoline. Consider therapy modification

- Saquinavir: May increase the serum concentration of Eluxadoline.
- Teriflunomide: May increase the serum concentration of OAT3 Substrates. Monitor therapy

Entacapone

Antidepressants: manufacturer advises avoid concomitant use of MAOIs, Tricyclics or Maprotiline.

Antihypertensives: effect of Methyldopa possibly enhanced.

Iron: absorption of Entacapone reduced.

Sympathomimetics: effect of Adrenaline, Dobutamine, Dopamine, Isoprenaline and Noradrenaline possibly enhanced.

Entecavir

Ephedrine

Caution should be exercised when entecavir is given with other drugs eliminated by active tubular secretion as competition for the elimination pathway may increase the serum concentrations of either drug.

Epoetin Beta

ACE Inhibitors and Angiotensin-II Antagonists: antagonism of hypotensive effect; increased risk of hyperkalaemia.

Eptifibatide

*Warfarin and dipyridamole: Eptifibatide did not appear to increase the risk of major and minor bleeding associated with concomitant use of warfarin and dipyridamole. Eptifibatide -treated patients who had a prothrombin time (PT) > 14.5 seconds and received warfarin concomitantly did not appear to be at an increased risk of bleeding.

*Eptifibatide and thrombolytic agents: Data are limited on the use of eptifibatide in patients receiving thrombolytic agents. There was no consistent evidence that eptifibatide increased the risk of major or minor bleeding associated with tissue plasminogen activator in either a PCI or an acute myocardial infarction study; Eptifibatide appeared to increase the risk of bleeding when administered with streptokinase in an acute myocardial infarction study. The combination of reduced dose tenecteplase and eptifibatide compared to placebo and eptifibatide significantly increased the risk of both major and minor bleeding when administered concomitantly in an acute ST-elevation myocardial infarction study.

In an acute myocardial infarction study involving 181 patients, eptifibatide (in regimens up to a bolus injection of 180 microgram/kg, followed by an infusion up to 2 microgram/kg/min for up to 72 hours) was administered concomitantly with streptokinase (1.5 million units over 60 minutes). At the highest infusion rates (1.3 microgram/kg/min and 2.0 microgram/kg/min) studied, eptifibatide was associated with an increased incidence of bleeding and transfusions compared to the incidence seen when streptokinase was given alone.

Ergotamine and Ergometrine

- Anaesthetics: Halothane reduces effect of ergometrine on the parturient uterus
- *Antibacterials:* increased risk of ergotism with Azithromycin, Clarithromycin and Erythromycin – avoid concomitant use; increased risk of ergotism with Tetracyclines.
- *Antivirals:* risk of ergotism with Nelfinavir and Ritonavir-avoid concomitant use
- *Beta-blockers:* increased peripheral vasoconstriction.

Ertapenem

Probenecid inhibits the renal excretion of ertapenemthereby increasing its plasma concentrations and prolonging its elimination half-life.

Erythromycin and Other Macrolides

Note: Interactions do not apply to small amounts used topically.

Antacids: antacids reduce absorption of Azithromycin.

- *Anti-arrhythmics:* plasma concentration of Disopyramide increased by erythromycin and possibly Clarithromycin (risk of toxicity);

erythromycin (parenteral) increases risk of ventricular arrhythmias with Amiodarone (avoid concomitant use).

- *Other Antibacterials:* Clarithromycin and possibly other Macrolides increase plasma concentration of Rifabutin (risk of uveitis-reduce Rifabutin dose).
- *Anticoagulants:* effect of Warfarin enhanced by Erythromycin and possibly enhanced by Clarithromycin and some other Macrolides.
  Antidiabetics: Erythromycin possibly increase plasma concentration of Repaglinide (manufacturer advises avoid concomitant use).
- *Antihistamines:* manufacturer advises possibility of increased plasma-loratadine concentration with erythromycin and possibly other Macrolides (avoid concomitant use).
- *Antipsychotics:* risk of arrhythmias if Clarithromycin and possibly erythromycin given with Pimozide (avoid concomitant use); Erythromycin possibly increases plasma concentration Clozapine (possible increased risk of convulsions).
- *Antivirals:* Clarithromycin tablets reduce absorption of Zidovudine; Ritonavir possibly increases plasma concentration Macrolides.
- *Anxiolytics and Hypnotics:* Erythromycin inhibits metabolism of Midazolam (increased plasma-Midazolam concentration, with profound sedation) and Zopiclone.
  Calcium-channel Blockers: erythromycin possibly inhibits metabolism of Felodipine (increased plasma concentration).
  Cardiac Glycosides: effect of Digoxin enhanced by Erythromycin and possibly enhanced by other Macrolides.

  Corticosteroids: Erythromycin inhibits metabolism of Methylprednisolone and possibly other Corticosteroids.

- *Ciclosporin:* Erythromycin, Clarithromycin and possibly other Macrolides inhibit metabolism (increased plasma-ciclosporin concentration).

  Cytotoxics: in-vitro studies suggest possible interaction between Erythromycin and Docetaxel- consult product literature.

  Dopaminergics: plasma concentration of Bromocriptine increased by Erythromycin and possibly other Macrolides.

- *Ergotamine:* ergotism reported.

  Leukotriene Antagonists: erythromycin reduces plasma concentration of Zafirlukast.

  Lipid-regulating Drugs: Clarithromycin and erythromycin increase risk of myopathy with Simvastatin.

- *Tacrolimus:* Clarithromycin and Erythromycin increase plasma-tacrolimus concentration.

- *Theophylline:* Clarithromycin and Erythromycin inhibit metabolism (increased plasma-Theophylline concentration (if Erythromycin given by mouth also decreased plasma-erythromycin concentration).

  Ulcer-healing Drugs: Cimetidine increases plasma-erythromycin concentration (increased risk of toxicity, including deafness).

Ethambutol none

Ethionamide

The adverse effects of other antimycobacterials may be increased when ethionamide is used see Effects on the Liver, and under Cycloserine, Interactions.

Ezetimibe

- Anticoagulants: ezetimibe possibly enhances Anticoagulant effect of coumarins
- Ciclosporin: plasma concentration of both drugs may increase when ezetimibe given with ciclosporin
- Lipid-regulating Drugs: increased risk of cholelithiasis and gallbladder disease when ezetimibe given with fibrates - discontinue if suspected

Fibrates

- *Anticoagulants:* enhancement of effect of Nicoumalone, Phenindione, and Warfarin.
  Antidiabetics: may improve glucose tolerance and have additive effect; increased risk of severe hypoglycaemia with gemfibrozil (avoid concomitant use)
- *Cyclosporin:* possible increased risk of renal impairment with fenofibrate.
- *Other Lipid-regulating Drugs:* increased risk of myopathy with statins (preferably avoid concomitant use of gemfibrozil with statins)

Filgrastim

Note: Use not recommended in period form 24 hours before to 24 hours after

chemotherapy - for further details consult product literature.

Cytotoxics: possible exacerbation of neutropenia with Fluorouracil.

Finasteride

Note: No clinically important interactions reported.

Flucytosine

Flucytosine is commonly used with amphotericin B. Amphotericin B can cause a deterioration in renal function, which can result in raised flucytosine blood concentrations and increased toxicity. However, the two drugs are generally regarded as having synergistic antifungal activity. Cytarabine has been claimed to reduce blood concentrations of flucytosine and to antagonise its antifungal activity, although the evidence is limited.

Fluorouracil

Antibacterials: Metronidazole inhibits metabolism (increased toxicity

Filgrastim: possible exacerbation of neutropenia.

Ulcer-healing Drugs: Cimetidine inhibits metabolism (increased plasma-fluorouracil concentration).

Flutamide

- *Anticoagulants:* effect of Warfarin enhanced.

Fluticasone Propionate + Formoterol Fumarate Dihydrate

- Fluticasone: Increased plasma concentration w/ CYP3A4 inhibitors (e.g. ketoconazole, HIV protease inhibitors, clarithromycin, ketoconazole).
- Formoterol: May induce hypokalaemia w/ xanthine derivatives, steroids and diuretics. Increased risk of ventricular arrhythmias w/ digitalis glycoside, halogenated hydrocarbon anaesthetics. May prolong QTc-interval w/ TCAs, MAOIs, antipsyschotics, quinidine, disopyramide, procainamide, and antihistamines. Reduced therapeutic effect w/ β-blockers. May impair cardiac tolerance w/ L-dopa, L-thyroxine, oxytocin.

Folic Acid and Folinic Acid

- *Antiepileptics:* plasma concentrations of Phenobarbital and Phenytoin possibly reduced.

Fosfomycin

Additive or synergistic effect w/ β-lactam antibiotics (e.g. penicillin, ampicillin, cefazolin, carbapenems) and anti-staphylococcal agents (e.g. linezolid, quinupristin/dalfopristin, moxifloxacin). Reduced serum levels w/ drugs which increase GI motility (e.g. metoclopramide).

Gabapentin

- *Antacids:* reduced Gabapentin absorption.
- *Antidepressants:* antagonism of anticonvulsive effect (convulsive threshold lowered)
  Other Antiepileptics: none demonstrated with Carbamazepine, Phenobarbital, Phenytoin, or Valproate.

  Antimalarials: Mefloquine antagonises anticonvulsant effect; Chloroquine occasionally reduces convulsive threshold.

Glyceryl Trinitrate

Note: General hypotensive interactions as for Hydralazine.

Anti-arrhythmics: Disopyramide may reduce effect of sublingual nitrates (owning to dry mouth).

- *Anticoagulants:* excretion of heparin increases by Glyceryl Trinitrate infusion (reduced anticoagulant effect).
  Antidepressants: Tricyclics may reduce effect of sublingual nitrates (owing to dry mouth).
  Antimuscarinics: Antimuscarinics such as Atropine and Propantheline may reduce effect of sublingual nitrates (owing to dry mouth).

Griseofulvin

- *Anticoagulants:* metabolism of Nicoumalone and Warfarin accelerated (reduced anticoagulant effect).
  Antiepileptics: absorption reduced by Phenobarbital (reduced effect).
  Barbiturates: see under Antiepileptics above.
  Ciclosporin: plasma-ciclosporin concentration possibly reduced.
- *Oestrogens and Progestogens:* metabolism of oral contraceptives accelerated (reduced contraceptive effect.

Halofantrine

- *Anti-arrhythmics:* increased risk of ventricular arrhythmias with drugs that prolong QT interval (including Amiodarone, Disopyramide, Flecainide, Procainamide and Quinidine).
- *Antidepressants:* increased risk of ventricular arrhythmias with Tricycles.
- *Other Antimalarials:* increased risk of arrhythmias with Chloroquine, Mefloquine and Quinine (important: see also advice under Halofantrine).
- *Antipsychotics:* increased risk of ventricular arrhythmias with Phenothiazines.
- *Beta-blockers:* increased risk of ventricular arrhythmias with Sotalol.
- *Diuretics:* increased risk of ventricular arrhythmias if electrolyte disturbances occur.

Heparin

ACE Inhibitors and Angiotensin–II Antagonists: Increased risk of hyperkalaemia

- *Analgesics:* aspirin enhances anticoagulant effect; increased risk of hemorrhage with parenteral Diclofenac and Ketorolac (avoid concomitant use, including low-dose Heparin).

  Antiplatelet Drugs: Aspirin, Dipyridamole and possibly Clopidogrel enhance anticoagulant effect.

- *Nitrates:* Glyceryl Trinitrate infusion increases excretion (reduced anticoagulant effect).

Histamine H_2-Antagonists

Analgesics: Cimetidine inhibits metabolism of opioid analgesics notably Pethidine (increased plasma concentrations) Cimetidine possibly increases plasma concentration of Azapropozone.

Anthelmintics: Cimetidine possibly inhibits metabolism of Mebendazole (increased plasma concentration).

- *Anti-arrhythmics:* Cimetidine increases plasma concentrations of Amiodarone, Flecainide, Lignocaine, Procainamide, Propafenone, Quinidine, and possibly Moracizine.

  Antibacterials: Cimetidine increases plasma-erythromycin concentration (increased risk of toxicity, including deafness); Rifampicin accelerates metabolism of Cimetidine (reduced plasma-cimetidine concentration); Cimetidine inhibits metabolism of Metronidazole (increased plasma-metronidazole concentration).

  Anticoagulants: Cimetidine enhances anticoagulant effect.

  Antidepressants: Cimetidine inhibits metabolism of Amitriptyline, Doxepin, Imipramine, Moclobemide, Nortriptyline and Sertraline (increased plasma concentration).

  Antidiabetics: Cimetidine inhibits real excretion of Metformin (increased

plasma concentration; Cimetidine enhances hypoglycemic effect of Sulphonylureas.

Antiepileptics: Cimetidine inhibits metabolism of Carbamazepine, Phenytoin, and Valproate (increased plasma concentration).

Antifungals: absorption of Itraconazole and Ketoconazole reduced; plasma concentration of Terbinafine increased by Cimetidine.

Antihistamines: manufacturer advises possibility of increased plasma-loratadine concentration with Cimetidine.

Antimalarials: Cimetidine inhibits metabolism of Chloroquine and Quinine (increased plasma concentration).

Antipsychotics: Cimetidine possibly enhance effect of chlorpromazine, Clozapine, and possibly other antipsychotics.

Antivirals: plasma concentration of Zalcitabine possibly increased by Cimetidine.

Anxiolytics and Hypnotics: Cimetidine inhibits metabolism of Benzodiazepines and Chlormethiazole and Zaleplon (increased plasma concentration).

Beta-blockers: Cimetidine inhibits metabolism of beta-blockers such as Labetalol, Metoprolol and Propranolol (increased plasma concentrations).

Calcium-channel Blockers: Cimetidine inhibits metabolism of some calcium-channel blockers (increased plasma concentration).

- *Ciclosporin:* Cimetidine possibly increases plasma-ciclosporin concentration.

Cytotoxics: Cimetidine increases plasma concentration of Fluorouracil.

Hormone Antagonists: Octreotide possibly delays absorption of Cimetidine.

$5HT_1$- Agonists: Cimetidine inhibits metabolism of Zolmitriptan (reduce dose of Zolmitriptan).

- *Theophylline:* Cimetidine inhibits metabolism (increased plasma-theophylline concentration).

Hormone Antagonists see Aminoglutethimide; Bicalutamide; Danazol; Finasteride; Flutamide; Gestfrinone; Octeotide; Tamoxifen; Toremifene; Trilostane.

$5HT_1$ -Agonists

Note: There are currently no recognized drug interaction with Naratriptan.

Antibacterials: Quinolones possibly inhibit metabolism of Zolmitriptan (reduce dose of Zolmitriptan).

- *Antidepressants:* risk of CNS toxicity with MAOIs including Lobemide (avoid Rizatriptan or Sumatriptan for 2 weeks after MAOI, reduce dose of Zolmitriptan when given with Moclobemide); Sumatriptan increases risk of CNS toxicity with SSRIs (avoid concomitant use); Fluvoxamine possibly inhibits metabolism of Zolmitriptan (reduce dose of Zolmitriptan).
  Beta-blockers: Propranolol may increase plasma concentration of Rizatriptan (reduce Rizatriptan dose).
- *Ergotamine:* increased risk of vasospasm (avoid Ergotamine for 6 hours after Rizatriptan, Sumatriptan or Zolmitriptan, avoid Rizatriptan or Sumatriptan for 24 hours and Zolmitriptan for 6 hours after Ergotamine).
- *Lithium:* Sumatriptan increases risk of CNS toxicity (avoid concomitant use)

Ulcer-healing Drugs: Cimetidine inhibits metabolism of Zolmitriptan (reduce dose of Zolmitriptan (reduce dose of Zolmitriptan).

Hydralazine

ACE Inhibitors: enhanced hypotensive effect.

Alcohol: enhanced hypotensive effect.

- *Anaesthetics:* enhanced hypotensive effect.

  Analgesics: NSAIDs antagonize hypotensive effect.

  Antidepressants: enhanced hypotensive effect.

  Other Antihypertensives: additive hypotensive effect.

  Antipsychotics: enhanced hypotensive effect.

  Anxiolytics and Hypnotics: enhanced hypotensive effect.

  Beta-blockers: enhanced hypotensive effect.

  Calcium-channel Blockers: enhanced hypotensive effect.

  Corticosteroids: antagonism of hypotensive effect.

  Diuretics: enhanced hypotensive effect.

  Dopaminergics: Levodopa enhanced hypotensive effect.

  Muscle Relaxant: Baclofen and Tizanidine enhances hypotensive effect.

  Nitrates: enhanced hypotensive effect.

  Oestrogens and Progestogens: Oestrogens and combined oral contraceptives antagonize hypotensive effect.

  Thymoxamine: enhanced hypotensive effect.

Imatinib

- *Analgesics*: manufacturer of imatinib advises restriction or avoidance of concomitant regular paracetamol.

  Anticoagulants: manufacturer of imatinib advises replacement of Warfarin with a Heparin (possibility of enhanced Warfarin effect)

  Antiepileptics: plasma concentration of Imatinib reduced by Phenytoin.

  Antifungals: plasma concentration of Imatinib increased by Ketoconazole.

  Lipid-regulating Drugs: plasma concentration of Simvastatin increased by Imatinib.

Immunoglobulins

Note: for advice on Immunoglobulins and live virus vaccines, see under Normal

Immunoglobulin section.

Indinavir

Indinavir is metabolised mainly by the cytochrome P450 isoenzyme CYP3A4. It may compete for the same metabolic pathways with many drugs that are metabolised similarly, often resulting in mutually increased plasma concentrations. A drug that is a significant inducer of microsomal enzymes, particularly CYP3A4, may reduce plasma concentrations of indinavir. HIV-protease inhibitors may themselves induce metabolism and may reduce plasma concentrations of other drugs.

Although specific guidance varies between licensing authorities, licensed product information generally contra-indicates the use of HIV-protease inhibitors, includingindinavir with drugs that are highly dependent on CYP3A4 for clearance and for which elevated plasma concentrations are associated with serious or life-threatening events. These include

- the alpha1-adrenoceptor antagonist alfuzosin
- antiarrhythmics (amiodarone)
- antihistamines (astemizole and terfenadine)
- antipsychotics (pimozide)
- ergot derivatives (dihydroergotamine, ergometrine, ergotamine, and methylergometrine)
- gastrointestinal prokinetics (cisapride)
- sedatives and hypnotics (alprazolam, oral midazolam, and triazolam)
- statins (lovastatin and simvastatin)

When indinavir is boosted with ritonavir, use with bepridil, clozapine, dextropropoxyphene, fusidic acid, diazepam, estazolam, flurazepam, quinidine, pethidine, and piroxicam should also be avoided. Similarly, ritonavir-

boosted indinavir should not be used with drugs having narrow therapeutic windows that are highly dependent on CYP2D6 for clearance, such as the antiarrhythmics encainide, flecainide, and propafenone. Owing to the potential for increased serum concentrations of sildenafil, indinavir should be avoided with sildenafil when given at the doses needed for the treatment of pulmonary hypertension. Similarly, indinavir may increase serum concentrations of inhaled salmeterol and the combination is not recommended. Use of indinavir with rosuvastatin should also be avoided. Rifampicin and St John's wort decrease the concentration ofindinavir; use with the antiretroviral is contra-indicated due to the possible loss of its activity and development of resistance. Use of indinavir with atazanavir is contra-indicated as both drugs have been associated with indirect hyperbilirubinaemia.

Interferons

Note: Consult product literature for interactions of interferon beta and gamma.

Theophylline: interferon alpha inhibits metabolism of Theophylline (enhanced effect).

Iron

Antacids: Magnesium Trisilicate reduces absorption of oral iron.

Antibacterials: Tetracyclines reduce absorption of oral iron (and vice versa); absorption of Ciprofloxacin, Norfloxacin, and Ofloxacin reduced by oral iron

Bisphosphonates: reduced absorption.

Dopaminergics: absorption of Entacapone and Levodopa may be reduced.

Penicillamine: reduced absorption of Penicillamine.

Trientine: reduced absorption of oral iron.

Zinc: reduced absorption of oral iron (and vice versa).

Isoniazid

Anaesthetics: hepatotoxicity possibly potentiated by Isoflurane.

Antacids and Adsorbents: antacids reduce absorption.

Other Antibacterials: increased CNS toxicity with Cycloserine.

- *Antiepileptics:* metabolism of Carbamazepine, Ethosuximide, and Phenytoin inhibited (enhanced effect); also, with Carbamazepine, Isoniazid hepatotoxicity possibly increased.

  Antifungals: plasma concentration of Ketoconazole may be reduced.

  Anxiolytics and hypnotics: metabolism of diazepam inhibited.

  Theophylline: Isoniazid possibly increases plasma-theophylline concentration.

Ivabradine

- Anti-arrhythmics: increased risk of ventricular arrhythmias when ivabradine given with amiodarone or disopyramide
- Antibacterials: plasma concentration of Ivabradine possibly increased by clarithromycin and telithromycin — avoid concomitant use; increased risk of ventricular arrhythmias when ivabradine given with erythromycin—avoid concomitant use
- Antidepressants: plasma concentration of Ivabradine reduced by St John’s wort
- Antifungals: plasma concentration of ivabradine increased by fluconazole—reduce initial dose of vabradine; plasma concentration of ivabradine possibly increased by itraconazole
- Antimalarials: increased risk of ventricular arrhythmias when ivabradine given with mefloquine
- Antipsychotics: increased risk of ventricular arrhythmias when ivabradine given with pimozide
- Antivirals: plasma concentration of ivabradine possibly increased by ritonavir
- Beta-blockers: increased risk of ventricular arrhythmias when ivabradine given with sotalol
- Calcium-channel Blockers: plasma concentration of ivabradine increased by diltiazem and verapamil

- Grapefruit Juice: plasma concentration of ivabradine increased by grapefruit juice
- Pentamidine Isetionate: increased risk of ventricular arrhythmias when ivabradine given with pentamidine isetionate

Ivermectin

- Levamisole: Levamisole appears to increase the exposure to ivermectin. Ivermectin does not alter the pharmacokinetics of levamisole.
- Acenocoumarol: A patient showed a marked increase in his response to acenocoumarol when exposed to insecticides containing ivermectin and methidathion.
- Warfarin: The US manufacturer notes that cases of raised INRs have been rarely reported with ivermectin and warfarin.
- Alcohol: Alcohol may increase the bioavailability of ivermectin, which could increase adverse effects such as postural hypotension.

Kaolin

Analgesics: absorption of aspirin possibly reduced.

Anti-arrhythmics: absorption of Quinidine possibly reduced (possibly reduced plasma concentration).

Antibacterials: absorption of Tetracyclines possibly reduced.

Antimalarials: absorption of Chloroquine reduced.

Antipsychotics: absorption of Phenothiazines possibly reduced.

Cardiac Glycosides: absorption of Digoxin possibly reduced.

Lamivudine

Antibacterials: Trimethoprim increases plasma concentration. - avoid concomitant use of high-dose co-trimoxazole.

Lamotrigine

- *Other Antiepileptics:* concomitant administration of two or more Antiepileptics may enhance toxicity without a corresponding increase in antiepileptic effect; moreover, interactions between individual antiepileptics can complicate monitoring of treatment; interactions include enhanced effects, increased sedation, and reductions in plasma concentrations.

Leflunomide

Note: Increased risk of toxicity with other haematotoxic and hepatotoxic drugs.

Lenograstim

Note: Use not recommended from 24 hours before until 24 hours after chemotherapy; for further details consult product literature.

Lercarnidipine see Calcium channel Blockers

Leukotriene Antagonists

Analgesics: aspirin increases plasma concentration of Zafirlukast.

Antibacterials: Erythromycin reduces plasma concentration of Zafirlukast.

Anticoagulants: anticoagulant effect of Warfarin enhanced by Zafirlukast.

Barbiturates: plasma concentration of Montelukast reduced by Phenobarbital.

Theophylline: Zafirlukast possibly increases plasma-theophylline concentration; plasma-Zafirlukast concentration reduced.

Levamisole

Alcohol: US licensed product information states that levamisole can produce a disulfiram-like reaction withalcohol.

- Anticoagulants: Increase in the activity of warfarin when given with levamisole and fluorouracil.
- Antiepileptics: Increased phenytoin concentrations when given with levamisole and fluorouracil.

Levodopa

- *Antidepressants:* hypertensive crisis with MAOIs (including Moclobemide)- avoid for at least 2 weeks after stopping MAOI.

- *Antihypertensives:* enhanced hypotensive effect.
- *Antipsychotics:* antagonism of effect.

  Anxiolytics and Hypnotics: occasional antagonism of effect by Chlordiazepoxide, Diazepam, Lorazepam and possibly other Benzodiazepines.

  Iron: absorption of Levodopa may be reduced.

  Metoclopramide and Domperidone: Levodopa-plasma concentrations increased by Metoclopramide.

  Vitamins: effect of Levodopa antagonized by pyridoxine unless a dopa- decarboxylase inhibitor also given.

Lignocaine

Other Anti-arrhythmics: increased myocardial depression.

Beta-blockers: increased risk of myocardial depression; increased risk of Lignocaine toxicity with Propranolol.

Diuretics: effect of Lignocaine antagonized by hypokalaemia with Acetazolamide, loop diuretics, and Thiazides.

Muscle Relaxants: action of Suxamethonium prolonged.

Ulcer-healing Drugs: Cimetidine inhibits metabolism of Lignocaine (increased risk of toxicity).

Linagliptin + Metformin Hydrochloride

- Concomitant cationic drugs that interfere w/ renal tubular transport systems (e.g. ranolazine, vandetanib, dolutegravir, cimetidine) may increase metformin levels.
- Thiazides and other diuretics, corticosteroids, phenothiazines, thyroid products, OCs, sympathomimetics, phenytoin, niacin, Ca channel blockers and isoniazid may produce hyperglycaemia which may lead to loss of glycaemic control.
- Increased risk of lactic acidosis w/ topiramate or other carbonic anhydrase inhibitors (e.g. zonisamide, acetazolamide, dichlorphenamide).
- Plasma concentration of linagliptin may be decreased by strong inducers of P-glycoprotein (e.g. rifampicin) and may be increased by strong P-glycoprotein inhibitors (e.g. ritonavir).
- Linagliptin may increase risk of hypoglycaemia when used in combination w/ sulfonylureas or insulin.

Lipid-regulating Drugs see Cholestyramine and Colestipol; Clofibrate Group; Nicotinic Acid; Statins.

Lithium

- *ACE Inhibitors:* lithium excretion reduced (increased plasma-lithium concentration).
- *Analgesics:* excretion of lithium reduced by Azapropazone, Diclofenac, Ibuprofen Indomethacin, Ketorolac (avoid concomitant use), Mefenamic acid, Naproxen, Piroxicam and probably other NSAIDs (risk of toxicity).
- *Antacids:* Sodium bicarbonate increases excretion of Lithium (reduced plasma-lithium concentrations).
- *Anti-arrhythmics:* increased risk of hypothyroidism with Amiodarone.
- *Antibacterials:* lithium toxicity reported with Metronidazole and Spectinomycin.
- *Antidepressants:* SSRIs increase risk of CNS effects (lithium toxicity reported).

  Antidiabetics: Lithium may occasionally impair glucose tolerance.

  Antiepileptics: neurotoxicity may occur with Carbamazepine and Phenytoin without increased plasma-lithium concentration.

- *Antihypertensives:* neurotoxicity may occur with Methyldopa without increased plasma-lithium concentration.

  Antipsychotics: increased risk of extrapyramidal effects and possibility of neurotoxicity (notably with Haloperidol).

Calcium-channel Blockers: neurotoxicity may occur with Diltiazem and Verapamil without increased plasma-lithium concentration.

- *Diuretics:* Lithium excretion reduced by loop diuretics, potassium-sparing diuretics, and Thiazides (increased plasma-lithium concentration and risk of toxicity- loop diuretics safer than Thiazides); lithium excretion increased by Acetazolamide.
- *$5HT_1$ -Agonists:* Sumatriptan increases risk of CNS toxicity.

  Metoclopramide and Domperidone: increased risk of extrapyramidal effects and possibility of neurotoxicity with Metoclopramide.

  Muscle Relaxants: muscle relaxant effect enhanced, Baclofen possibly aggravates hyperkinesis.

  Parasympathomimetics: Lithium antagonizes effect of Neostigmine and Pyridostigmine.

  Theophylline: lithium excretion increased (reduced plasma-lithium concentration).

Loteprednol May increase the risk of intraocular pressure with cycloplegics and other ocular hypotensive agents.

Lurasidone HCl

Strong CYP3A4 Inhibitors: increased exposure to lurasidone, should not be used concomitantly with such drugs (e.g. clarithromycin, ketoconazole, mibefradil, ritonavir, voriconazole, etc.).

Moderate CYP3A4 Inhibitors: increased exposure to lurasidone when used concomitantly with such drugs (e.g. atazanavir, diltiazem, erythromycin, fluconazole, verapamil, etc.). Lurasidone HCl dose should be reduced to half of the original level when used concomitantly.

Strong CYP3A4 Inducers: decreased exposure to lurasidone when used with strong CYP3A4 inducers, *viz.* avasimibe, carbamazepine, phenytoin, rifampin, St. John's wort, etc. So, strictly avoid concomitant use with these drugs.

Moderate CYP3A4 Inducers: decrease the exposure of lurasidone, drugs that should not be used concomitantly include bosentan, efavirenz, etravirine, modafinil, nafcillin, etc. Dose of Lurasidone HCl should be increased when used concomitantly with such moderate inducers of CYP3A4.

Macrogol 3350 (a component of bowel cleansingProprietary Preperations). Other oral drugs should not be taken 1 hour before, or after, administration of bowel cleansingProprietary Preperations because absorption may be impaired. Consider withholding ACE inhibitors, angiotensin-II receptor antagonists, and NSAIDs on the day that bowel cleansingProprietary Preperations are given and for up to 72 hours after the procedure. Also consider withholding diuretics on the day that bowel cleansingProprietary Preperations are given.

MagnesiumSalt

Muscle Relaxants: effect of non-depolarizing muscle relaxants enhanced by parenteral magnesium salts.

MAOIs

Note: For interactions of reversible MAO-A inhibitors (RIMAS), see Moclobemide, and for interactions of MAO-B inhibitors see Selegiline.

- *Alcohol:* some alcoholic and dealcoholised beverages contain Tyramine which interacts which interacts with MAOIs (hypertensive crisis)-but if no Tyramine, enhanced hypotensive effect; foods, see section.
- *$Alpha_2$–adrenoceptor Stimulants:* manufacturers of Apraclonidine and Brimonidine advise to avoid concomitant use.
- *Altretamine:* risk of severe postural hypotension.
- *Analgesics:* CNS excitation or depression (hypertension or hypotension) with Pethidine and possibly other opioid analgesics- avoid concomitant use and for two weeks after MAOI discontinued; manufacturer advises avoid Nefopam

- *Anorectics:* see Sympathomimetics, below.
- *Other Antidepressants:* enhancement of CNS effects and toxicity with other MAOIs (avoid for at least a week after stopping previous MAOIs then start with reduced dose); increased risk of toxicity with Nefazodone (important: if MAOIs discontinued shortly before, initiate Nefazodone cautiously with gradual dose increase); CNS effects of SSRIs increased by MAOI should not be started until at least I week after Citalopram or Fluvoxamine have been stopped, at least 5 weeks for Fluoxetine, at least 2 weeks for Paroxetine and Sertraline; CNS excitation and hypertension with most Tricyclics and related antidepressants (avoid for at least 2 weeks after stopping MAOI, and avoid MAOI for at least I week 1 week after stopping Tricyclic); CNS excitation and confusion with Tryptophan (reduce Tryptophan dose); enhancement of CNS effects and toxicity possible with Reboxetine and Venlafaxine (avoid for at least 2 weeks after stopping MAOI, and avoid MAOI for at least 1 week after stopping Reboxetne or Venlafaxine).
- *Antidiabetics:* effect of Insulin, Metformin, and Sulphonylureas enhanced
- *Antiepileptics:* antagonism of anticonvulsant effect (convulsive threshold lowered); manufacturer advises avoid Carbamazepine with or within 2 weeks of MAOIs.
- *Antihypertensives:* hypotensive effect enhanced; manufacturer advises avoidance of Indoramin; manufacturer advises avoid concomitant use with Methyldopa.
- *Antihistamines:* increased antimuscarinic and sedative effects.
- *Antimuscarinics:* increased side effects.
- *Antipsychotics:* CNS excitation and hypertension with Oxypertine; Clozapine possibly enhances central effects.
- *Anxiolytics and Hypnotics:* manufacturer advises avoidance of Buspirone
- *Barbiturates:* see under Antiepileptics, above.
- *Dopaminergics:* hypertensive crisis with Levodopa (avoid for at least 2 weeks after stopping MAOI); hypotension with Selegiline; manufacturer advises avoid concomitant use with Entacapone.
- *5HT$_1$Angonists:* risk of CNS toxicity (avoid Rizatriptan or Sumatriptan for 2 weeks after MAOI).
- *Sympathomimetics:* hypertensive crisis with sympathomimetics such as Dopamine, Dopexamine, Ephedrine, Isometheptene, Methylphenidate, Phentermine, Phenylephrine, Phenylpropanolamine, and Pseudoephedrine
- *Tetrabenazine:* CNS excitation and hypertension.

Maraviroc

Maraviroc is a substrate for the cytochrome P450 isoenzyme CYP3A4 and for P-glycoprotein, and may therefore have several clinically significant interactions. Inhibitors of CYP3A4, such as HIV-protease inhibitors (other than tipranavir), increase the serum concentration of maraviroc. Inducers of CYP3A4 such as efavirenz may decrease serum maraviroc concentrations. No clinically significant interaction is expected between maraviroc and NRTIs, nevirapine, or boosted fosamprenavir or tipranavir.

Non-antiretroviral medications that significantly alter maravirocmetabolism include the CYP3A4 inhibitors ketoconazole, itraconazole, clarithromycin, and nefazodone and the CYP3A4 inducers rifampicin and St John's wort. Maraviroc does not appear to cause clinically significant changes in concentrations of other medications.

Mebendazole

Ulcer-healing Drugs: metabolism possibly inhibited by Cimetidine (increased plasma-mebendazole concentration).

Mefloquine

- *Anti-arrhythmics:* increased risk of ventricular arrhythmias with

Amiodarone (avoid concomitant use) and Quinidine.

- *Antiepileptics:* antagonism of anticonvulsant effect.
- *Other Antimalarials:* increased risk of convulsions with Chloroquine and Quinine, but should not prevent use of intravenous quinine in severe cases; increased risk of ventricular arrhythmias with Halofantrine (important: see also advice under Halofantrine).
- *Antipsychotics:* increased risk of ventricular arrhythmias-avoid concomitant use with Pimozide.

Beta-blockers: possible increased risk of bradycardia with some calcium-channel blockers.

Cardiac Glycosides: possible increased risk of bradycardia with Digoxin.

Megestrol Acetate

- Indinavir: Due to the significant decrease in the exposure of indinavir by Megestrol acetate, administration of a higher dose of indinavir should be considered when coadministering with Megestrol acetate
- Zidovudine and Rifabutin: No dosage adjustment for zidovudine and rifabutin is needed when Megestrol acetate is coadministered with these drugs

Melphalan

Antibacterials: increased toxicity with Nalidixic acid.

- *Ciclosporin:* increased risk of nephrotoxicity.

Mercaptopurine

- Allop*urinol:* enhancement of effect (increased toxicity-reduce dose of Mercaptopurine).

Meropenem

Antiepileptics: plasma concentration of Valproate reduced.

***Uricosurics*:** excretion reduced by Probenecid (concomitant use not recommended by manufacturer)

Methotrexate

- *Analgesics:* excretion reduced by aspirin, Azapropazone (avoid concomitant use), Diclofenac, Ibuprofen, Indomethacin, Ketoprofen, Meloxicam, Naproxen and probably other NSAIDs (increased risk of toxicity).

  Antibacterials: antifolate effect increased by Co-trimoxazole and Trimethoprim; risk of Methotrexate toxicity in creased by Sulphonamides; excretion reduced by Penicillins (increased risk of toxicity).

  Antiepileptics: Phenytoin increases antifolate effect.

  Antimalarials: antifolate effect increased by Pyrimethamine (ingredient of Fansidar ®).

- *Ciclosporin:* increased toxicity.
- *Retinoids:* plasma concentration of Methotrexate increased by Acitretin (also increased risk of hepatotoxicity).

Methyldopa

Alcohol: enhanced hypotensive effect.

- *Anaesthetics:* enhanced hypotensive effect.

  Analgesics: NSAIDs antagonize hypotensive effect.

  Antidepressants: enhanced hypotensive effect.

  Other Antihypertensives: enhanced hypotensive effect.

  Antipsychotics: increased risk of extrapyramidal effects; enhanced hypotensive effect.

  Anxiolytics and Hypnotics: enhanced hypotensive effect.

  Beta-Blockers: enhanced hypotensive effect.

  Calcium-channel Blockers: enhanced hypotensive effect.

  Corticosteroids: antagonism of hypotensive effect.

Diuretics: enhanced hypotensive effect.

Dopaminergics: antagonism of antiparkinsonian effect; Levodopa enhances hypotensive effect; effect of Methyldopa possible enhanced by Entacapone

Lithium: neurotoxicity may occur without increased plasma-lithium concentration

Muscle Relaxants: enhanced hypotensive effect with Baclofen and Tizanidine

Nitrates: enhance hypotensive effect.

Oestrogens and Progestogens: Oestrogens and combined oral contraceptives antagonize hypotensive effect.

Sympathomimetics: see Sympathomimetics (main list).

Ulcer-healing Drugs: Carbenoxolone antagonizes hypotensive effect.

Methylphenidate see Clonidine, MAOIs and Sympathomimetics. Methylphenidate is predicted to increase the risk of elevated blood pressure when given with linezolid and increase the risk of a hypertensive crisis when given with moclobemide and monoamine-oxidase A and B inhibitors. Methylphenidate is predicted to decrease the effects of apraclonidine.

Metoclopramide

Analgesics: increased absorption of aspirin and Paracetamol (enhanced effect); opioid analgesics antagonize effect on gastro-intestinal activity.

Antipsychotics: increased risk of extrapyramidal effects.

Atovaquone: plasma concentration reduced by Metoclopramide.

Dopaminergics: antagonism of hypoprolactinaemic effect of Bromocriptine; increased plasma concentration of Levodopa; antagonism of antiparkinsonian effects of Pergolide.

Lithium: increased risk of extrapyramidal effects and possibility of neurotoxicity.

Tetrabenazine: increased risk of extrapyramidal effects.

Metronidazole

Alcohol: Disulfiram-like reaction.

- *Anticoagulants:* effect of Nicoumalone and Warfarin enhanced.
- *Antiepileptics:* Metronidazole inhibits metabolism of Phenytoin (increased plasma-Phenytoin concentration); Phenobarbital accelerates metabolism of Metronidazole (reduced plasma-metronidazole concentration).
- *Barbiturates:* see under Antiepileptics, above.

  Cytotoxics: Metronidazole inhibits metabolism of Fluorouracil (increased toxicity)

Disulfiram: psychotic reactions reported.

Lithium: increased toxicity reported.

Ulcer-healing Drugs: Cimetidine inhibits metabolism (increased plasma-metronidazole concentration).

Mianserin

Alcohol: enhanced effect.

Alpha$_2$- Adrenoceptor Stimulants: manufactures of Apraclonidine and Brimonidine advise to avoid concomitant use.

Other Antidepressants: as for Antidepressants, Tricyclic.

- *Antiepileptics:* antagonism (convulsive threshold lowered); metabolism accelerated by Carbamazepine, Phenobarbital, and Phenytoin (reduced plasma-mianserin concentration).

  Anxiolytics and Hypnotics: enhanced effect.

- *Barbiturates:* see under Antiepileptics, above.

Mirabegron

Increased exposure w/ strong CYP3A inhibitors (e.g. ketoconazole). May

increase exposure to CYP2D6 substrates (e.g. desipramine, metoprolol), digoxin, and warfarin. Increased risk of urinary retention w/ antimuscarinic agents (e.g. solifenacin, darifenacin) due to additive pharmacologic effect.

Mirtazapine

Alcohol: enhanced sedative effect.

Anticoagulants: Mirtazapine enhances anticoagulant effect of Warfarin.

Other Antidepressants: as for Antidepressants, tricyclic.

Antiepileptics: Carbamazepine and Phenytoin reduce plasma concentration of Mirtazapine.

Antifungals: Ketoconazole increases plasma concentration of Mirtazapine.

Antimalarials: manufacturer of Artemether with Lumefentrine advises avoid concomitant use.

Anxiolytics and Hypnotics: enhanced sedative effect.

Ulcer-healing Drugs: Cimetidine increases plasma concentration of Mirtazapine.

Misoprostol

Analgesics: increased risk of CNS toxicity with Phenylbutazone.

Moxonidine

The hypotensive effect of moxonidine may be enhanced by other antihypertensives and drugs that cause hypotension. The effect of sedatives and hypnotics, including benzodiazepines, may be enhanced bymoxonidine.

Muscle Relaxants

ACE Inhibitors and Angiotensin-II Antagonists: enhanced hypotensive effect with Baclofen and Tizanidine**.**

Alcohol: enhanced sedative effect with Baclofen and Tizanidine.

Analgesics: ibuprofen and possible other NSAIDs reduce excretion of Baclofen

(increased risk of toxicity).

- *Anti-arrhythmics:* Procainamide and Quinidine enhance muscle relaxant effect; Lignocaine prolongs action of Suxamethonium.
- *Antibacterials:* effect of non-depolarizing muscle relaxants enhanced by Aminoglycosides, Azlocillin, Clindamycin, Colistin and Piperacillin.

  Antidepressants: Tricyclics enhance muscle relaxant effect of Baclofen.

  Antiepileptics: effect of non-depolarizing muscle relaxants antagonized by Carbamazepine and Phenytoin (recovery form neuromuscular blockade accelerated).

  Antihypertensives: enhanced hypotensive effect with Baclofen and Tizanidine.

  Anxiolytics and Hypnotics: enhanced sedative effect with Baclofen and Tizanidine.

  Beta-blockers: Propranolol enhances muscle relaxant effect; possible enhanced hypotensive effect and bradycardia with Tizanidine.

- *Botulinum Toxin:* neuromuscular block enhances by non-depolarizing muscle relaxants (risk of toxicity).

  Calcium-channel Blockers: Nifedipine and Verapamil enhance effect of non-depolarizing muscle relaxants; hypotension, myocardial depression, and hyperkalaemia reported with intravenous Dantrolene and Verapamil; risk of arrhythmias with Diltiazem and intravenous Dantrolene.

  Cardiac Glycosides: arrhythmias if Suxamethonium given with Digoxin; possible bradycardia if Tizanidine given with Digoxin.

  Cytotoxics: Cyclophosphamide and Thiotepa enhance effect of Suxamethonium

  Diuretics: enhanced hypotensive effect with Baclofen and Tizanidine.

  Lithium: lithium enhances muscle relaxant effect; Baclofen possibly aggravates hyperkinesis.

Magnesium Salts: parenteral magnesium enhances effect of non-depolarizing muscle relaxants.

Parasympathomimetics: Ecothiophate eye-drops, Edrophonium, Neostigmine, Pyridostigmine, Rivastigmine and possibly Donepezil enhance effect of Suxamethonium but antagonize effect of non-depolarizing muscle relaxants.

Sympathomimetics: Bambuterol enhances effect of Suxamethonium.

Mycophenolate Mofetil

Anion-exchange Resins: Cholestyramine reduces absorption.

Antacids: reduced absorption of Mycophenolate Mofetil.

Antivirals: higher plasma concentrations of Mycophenolate Mofetil and of Aciclovir on concomitant administration.

Nelfinavir

Nelfinavir is reported to be metabolised in part by cytochrome P450 isoenzymes CYP3A4 and CYP2C19. Drugs that induce these isoenzymes may reduce the plasma concentration of nelfinavir. Conversely, whennelfinavir is given with drugs that inhibit CYP3A4 plasma concentrations, nelfinavir concentrations may be increased. It may also alter the pharmacokinetics of drugs metabolised by this isoenzyme system and possibly cause serious adverse effects.

Although specific guidance varies between licensing authorities, licensed product information generally contra-indicates the use ofnelfinavir with drugs that are highly dependent on CYP3A4 for clearance and for which elevated plasma concentrations are associated with serious or life-threatening events. These drugs include

- the alpha1-adrenoceptor antagonist alfuzosin
- antiarrhythmics (amiodarone and quinidine)
- antihistamines (astemizole and terfenadine)
- antipsychotics (pimozide)
- ergot derivatives (dihydroergotamine, ergometrine, ergotamine, and methylergometrine)
- gastrointestinal motility agents (cisapride)
- sedatives and hypnotics (triazolam and oral midazolam)
- statins (simvastatin and lovastatin)

Owing to the potential for increased serum concentrations of sildenafil, nelfinavir should be avoided with sildenafil when given at the doses needed for the treatment of pulmonary hypertension. Similarly, nelfinavir may increase serum concentrations of inhaled salmeterol and the combination is not recommended. Omeprazole, rifampicin, and St John's wort decrease the concentration ofnelfinavir; use with the antiretroviral is not recommended due to the possible loss of its activity and development of resistance.

Nevirapine

Nevirapine is metabolised mainly by the cytochrome P450 isoenzymes CYP3A4 and CYP2B6. Consequently it may compete with other drugs metabolised by this system, possibly resulting in mutually increased plasma concentrations and toxicity. Alternatively, enzyme inducers may decrease plasma concentrations ofnevirapine; nevirapine itself acts as a mild to moderate enzyme inducer and may thus reduce plasma concentrations of other drugs.

Rifampicin and St John's wort decrease the concentration ofnevirapine; use with the antiretroviral is not recommended due to the possible loss of its activity and development of resistance.

Nicorandil

Nicorandil should not be used with phosphodiesterase type-5 inhibitors such as sildenafil as the hypotensive effect of nicorandil may be significantly enhanced.

Nicotinic Acid

Note: Interactions apply to lipid-regulating doses of nicotinic acid.

Other Lipid-regulating Drugs: increased risk of myopathy with Statins.

Nitrofurantoin

Antacids and Adsorbents: Magnesium Trisilicate reduces excretion of Nitrofurantoin (risk of toxicity).

NSAIDs (also see Aspirin).

Note: Interaction do not generally apply to topical NSAIDs.

- *ACE Inhibitors:* antagonism of hypotensive effect; increased risk of renal impairment and increased risk of hyperkalaemia on administration with Ketorolac and possibly other NSAIDs.
- *Other Analgesics:* avoid concomitant administration of two or more NSAIDs, including Aspirin (increased side effects).
- *Antacids:* absorption of Diflunisal reduced.

- *Antibacterials:* NSAIDs possibly increase risk of convulsions with Quinolones; Indomethacin possibly increases plasma concentration of Gentamicin and Amikacin in neonates.

- *Anticoagulants:* anticoagulant effect of Nicoumalone, Warfarin (and possibly Phenindione) seriously enhanced by Azapropazone (avoid concomitant use) and possibly enhanced by Diclofenac, Diflunisal, Flurbiprofen, Ibuprofen, Mefenamic acid, Meloxicam, Piroxicam, Sulindac, and other NSAIDs; increased risk of hemorrhage with parenteral Diclofenac and Ketorolac and all anticoagulants, including low-dose heparin (avoid concomitant use).

  Antidepressants: Moclobemide enhances effect of Ibuprofen and possibly other NSAIDs.

- *Antidiabetics:* effect of Sulphonylureas enhances effect of ibuprofen and possibly other NSAIDs.
- *Antiepileptics:* effect of Phenytoin enhanced by Azapropazone (avoid concomitant use) and possibly other NSAIDs.

  Antihypertensives: antagonism of hypotensive effect.

  Antiplatelet Drugs: possibly increased risk of gastrointestinal bleeding with Clopidogrel.

  Antipsychotics: severe drowsiness possible if Indomethacin given with Haloperidol.

- *Antivirals:* plasma concentration of Piroxicam increased by Ritonavir (risk of toxicity-avoid concomitant use); plasma concentration of other NSAIDs possibly increased by Ritonavir.

  Beta-blockers: antagonism of hypotensive effect.

  Bisphosphonates: bioavailability of Tiludronic acid increased by Indomethacin; Alendronic acid possibly increases gastro-intestinal side effects of NSAIDs.

  Cardiac Glycosides: NSAIDs may exacerbate heart failure, reduce GFR, and increase plasma-cardiac glycoside concentration.

  Corticosteroids: increased risk of gastro-intestinal bleeding and ulceration.

- *Ciclosporin:* increased risk of nephrotoxicity; Ciclosporin increases plasma concentration of Diclofenac (halve Diclofenac dose).

  Cytotoxics: excretion of Methotrexate reduced by Aspirin, Azaproazone (avoid concomitant use), Diclofenac, Ibuprofen, Indomethacin, Ketoprofen, Meloxicam, Naproxen and probably other NSAIDs (increased risk of toxicity).

  Desmopressin: effect potentiated by Indomethacin.

  Diuretics: risk of nephrotoxicity of NSAID increased; NSAIDs notably Indomethacin and Ketorolac antagonize diuretic effect; Indomethacin and possibly other NSAIDs increase risk of hyperkalaemia with potassium-sparing diuretics; occasional reports of decreased renal function when Indomethacin given with Triamterene.

- *Lithium:* excretion of Lithium reduced by Azapropazone, Diclofenac, Ibuprofen, Indomethacin, Ketorolac (avoid concomitant use), Mefenamic acid, Naproxen, Piroxicam, and probably other NSAIDs (risk of toxicity).
  Muscle Relaxants: Ibuprofen and possibly other NSAIDs reduce excretion of Baclofen (increased risk of toxicity).
- *Tacrolimus:* Ibuprofen increases risk of nephrotoxicity.
  Ulcer-healing drugs: plasma concentration of Azapropazone possibly increased by Cimetidine.
- *Uricosurics:* Probenecid delays excretion of Indomethacin, Ketoprofen, Ketorolac (avoid concomitant use), and Naproxen and increases plasma – NSAID concentration.

- *Vasodilators:* risk of Ketorolac-associated bleeding increased by Oxpentifylline (avoid concomitant use).

Opioid Analgesics

Alcohol: enhanced sedative and hypotensive effect.

Antiarrhythmics: delayed absorption of Mexiletine.

Antibacterials: Rifampicin accelerates metabolism of methadone (reduced effect); Erythromycin increases plasma concentration of Alfentanil; manufacturer of Ciprofloxacin advises avoid premedication with opioid analgesics (reduced plasma-Ciprofloxacin concentration).

- *Anticoagulants:* Dextropropoxyphene may enhance effect of Nicomumalone and Warfarin.
- *Antidepressants:* CNS excitation or depression (hypertension or hypotension) if Pethidine and possibly other opioid analgesics given to patients receiving MAOIs (including Moclobemide)-avoid concomitant use and for 2 weeks after MAOI discontinued; Tramadol possibly increases risk of convulsions with SSRIs and Tricyclics.
- *Antiepileptics:* Dextropropoxyphene enhances effect of Carbamazepine; effect of Methadone and Tramadol decreased by Carbamazepine; Phenytoin accelerates Methadone metabolism (reduced effect and risk of withdrawal effects)
  Antifungals: metabolism of Alfentanil inhibited by Ketoconazole (risk of prolonged or delayed respiratory depression).

  Antipsychotics: enhanced sedative and hypotensive effect.

- *Antivirals:* Methadone possibly increases plasma concentration of Zidovudine; plasma concentration of Dextroproposyphene and Pethidine increased by Ritonavir (risk of toxicity — avoid concomitant use); plasma concentration of other opioid analgesics possibly in increased by Ritonavir.

  Anxiolytics and Hypnotics: enhanced sedative effect.

- *Dopaminergics:* hyperpyrexia and CNS toxicity reported if Pethidine given to patients receiving Selegiline (avoid concomitant use).

  Metoclopramide and Domperidone: antagonism of gastro-intestinal effects.

  Ulcer-healing Drug: Cimetidine inhibits metabolism of opioid analgesics notably Pethidine (increased plasma concentration).

Ornidazole

- Alcohol: A disulfiram-like reaction has been reported in a patient taking ornidazole after drinking alcohol.
- Rifampicin: Rifampicin slightly decreases ornidazole exposure.

Orlistat

Antidiabetics: manufacturer advises avoid concomitant use with Acarbose or Metformin.

Lipid-regulating Drugs: manufacturer advises avoid concomitant use with Clofibrate group; Orlistat increases plasma concentration of Pravastatin (increased risk of toxicity-reduce dose of Pravastatin).

Sympathomimetics: manufacturer advises avoid concomitant use with Phentermine.

Oseltamivir

Pharmacokinetic properties of oseltamivir, such as low protein binding and metabolism independent of the CYP450 and glucuronidase systems, suggest that clinically significant drug interactions via these mechanisms are unlikely.

Oxazepam see Anxiolytics and Hypnotics.

Oxcarbazepine

- *Antibacterials*: see Linezolid
- *Antidepressants*: antagonism of anticonvulsant effect (convulsive threshold lowered); manufacturer advises avoid concomitant use with MAOIs.
- *Other Antiepileptics*: interactions include enhanced effects, increased sedation, and reductions in plasma concentrations.
- *Antimalarials*: Mefloquine antagonises anticonvulsant effect; Chloroquine and hydroxychloroquine occasionally reduce seizure threshold.
- *Oestrogens and Progestogens*: Oxcarbazepine accelerates metabolism of oral Contraceptives (reduced contraceptive effect)

Oxytocin

Anaesthetics: inhalational anaesthetics possibly reduce oxytocic effect (also enhanced hypotensive effect and risk of arrhythmias).

Prostaglandins: uterotonic effect potentiated.

Sympathomimetics: enhancement of vasopressor effect of vasoconstrictor sympathomimetics.

Paclitaxel

Antifungals: Ketoconazole possibly inhibits metabolism of Paclitaxel.

Paliperidone Increased risk of QT prolongation with class IA (e.g. quinidine, disopyramide) and class III (e.g. amiodarone, sotalol) antiarrhythmics. Additive effects with drugs that cause orthostatic hypotension (e.g. other antipsychotics, tricyclics). May antagonise actions of levodopa and other dopaminergics. Additive effect with drugs known to lower seizure threshold (e.g. phenothiazines or butyrophenones, clozapine, tricyclics or SSRIs, tramadol, mefloquine). May reduce plasma levels with carbamazepine. Enhanced central effects with other CNS depressants. May increase plasma levels with valproate. May affect the absorption with metoclopramide.

Pancreatin

Antidiabetics: hypoglycemic effect of Acarbose reduced.

PARA-Aminosalicylic acid same as Aminosalicylic acid

The adverse effects of aminosalicylates and salicylates may be additive. Probenecid may also increase toxicity by delaying renal excretion and enhancing plasma concentrations of aminosalicylate. The activity of aminosalicylic acid may be antagonised by ester-type local anaesthetics such as procaine.

Paracetamol

Anion-exchange Resins: Cholestyramine reduces absorption of Paracetamol.

Anticoagulants: prolonged regular use of Paracetamol possibly enhances Warfarin.

Metoclopramide and Domperidone: Metoclopramide and Domperidone accelerate absorption of Paracetamol (enhanced effect).

Parasympathomimetics

Anti-arrhythmics: Procainamide, Quinidine and possibly Propafenone antagonize effect of Neostigmine and Pyridostigmine.

Antibacterials: Aminoglycoside, Clindamycin and Colistin antagonize effect of Neostigmine and Pyridostigmine.

Antimalarials: Chloroquine and Hydroxychloroquine have potential to increase symptoms of myasthenia gravis and thus diminish effect of Neostigmine and Pyridostigmine.

Antimuscarinics: antagonism of effect.

Beta-blockers: Propranolol antagonizes effect of Neostigmine and Pyridostigmine.

Lithium: antagonism of effect of Neostigmine and Pyridostigmine.

Muscle Relaxants: Ecothiophate eye-drops, Edrophonium, Neostigmine, Pyridostigmine, Rivastigmine and possibly Donepezil enhance effect of Suxamethonium, but antagonize effect of non-depolarizing muscle relaxants.

Penicillamine

Antacids: reduced absorption of Penicillamine.

Iron: reduced absorption of Penicillamine.

Zinc: reduced absorption of Penicillamine.

Penicillins

Antacids: reduced absorption of Pivampicillin.

Anticoagulants: see Phenindione and Warfarin.

Cytotoxics: reduced excretion of Methotrexate (increased risk of toxicity).

Muscle relaxants: enhanced by Azlocillin and Piperacillin.

Oestrogens and Progestogens: see Contraceptives, Oral.

Uricosurics: excretion of Penicillins reduced by Probenecid.

Phenytoin

- *Analgesics:* plasma-phenytoin concentration increased by Aspirin, Azapropazone (avoid concomitant use) and possibly other NSAIDs; metabolism of Methadone accelerated (reduced effect and risk of withdrawal effects).

  Antacids: reduced Phenytoin absorption.

- *Anti-arrhythmics:* Amiodarone increases plasma-phenytoin concentration; phenytoin reduces plasma concentrations of Disopyramide, Mexiletine, and Quinidine.
- *Antibacterials:* plasma-phenytoin concentration increased by Chloramphenicol, Cycloserine, Isoniazid, and Metronidazole; plasma-phenytoin concentration and antifolate effect increased by Co-trimoxazole and Trimethoprim and possibly by other Sulphonamides; plasma-phenytoin concentration reduced by Rifampicin; plasma concentration of Doxycycline reduced by Phenytoin; plasma-phenytoin concentration possibly altered by Ciprofloxacin.
- *Anticoagulants:* metabolism of Nicoumalone and Warfarin accelerated (possibility of reduced anticoagulant effect, but enhancement also reported).
- *Antidepressants:* antagonism of anticonvulsant effect (convulsive threshold lowered); Fluoxetine, Fluvoxamine, and Viloxazine increase plasma-phenytoin concentration; Phenytoin reduces plasma-concentrations of Mianserin, Paroxetine, and Tricyclics.

  Antidiabetics: plasma-phenytoin concentration transiently increased by Tolbutamide possibility of toxicity); Phenytoin possibly reduces plasma concentration of Repaglinide (manufacturer advises avoid concomitant use).

- *Other Antiepileptics:* concomitant administration of tow or more antiepileptics may enhance toxicity without a corresponding increase in Antiepileptic effect; moreover interactions between individual Antiepileptics can complicate monitoring of treatment; interactions include enhanced effects, increased sedation, and reductions in plasma concentrations.
- *Antifungals:* plasma-phenytoin concentration increased by Fluconazole and Miconazole; plasma concentration of Itraconazole and Ketoconazole reduced
- *Antimalarials:* antagonism of anticonvulsant effect; increased risk of

antifolate effect with Pyrimethamine (includes Fansidar ® and Maloprim ®).
- *Antiplatelet Drugs:* plasma-phenytoin concentration increased by aspirin.
- *Antipsychotics:* antagonism of anticonvulsant effect (convulsive threshold lowered); Phenytoin accelerates metabolism of Clozapine and Quetiapine (reduced plasma concentrations).
- *Antivirals:* plasma concentration of Indinavir, Nelfinavir and Saquinavir possibly reduced; plasma-phenytoin concentrations increased or decreased by Zidovudine.
- *Anxiolytics and Hypnotics:* Diazepam and possibly other Benzodiazepines increase plasma-phenytoin concentration.
- *Calcium-channel Blockers:* Diltiazem and Nifedipine increase plasma concentration of Phenytoin; effect of Felodipine, Isradipine and probably Nicardipine, Nifedipine and other Dihydropyridines, Diltiazem, and Verapamil reduced.

  Cardiac Glycosides: metabolism of digitoxin only accelerated (reduced effect).

- *Corticosteroids:* metabolism of Corticosteroids accelerated (reduced effect).

- *Ciclosporin:* metabolism of Ciclosporin accelerated (reduced plasma concentration).

  Cytotoxics: reduced absorption of Phenytoin; increased antifolate effect with Methotrexate.

- *Disulfiram:* Plasma-phenytoin concentration increased.
- *Diuretics:* increased risk of osteomalacia with Carbonic Anhydrase inhibitors.
- *Folic Acid and Folinic Acid:* plasma-phenytoin concentration possibly reduced by Folic acid and Folinic acid.
- *Hormone Antagonists:* metabolism of Toremifene possibly accelerated.
- *Lithium:* neurotoxicity may occur without increased plasma-lithium concentration.
- *Muscle Relaxants:* effect of non-depolarizing muscle relaxants antagonized (recovery from neuromuscular blockade accelerated).
- *Oestrogens and Progestogens:* metabolism of Gestrinone, Tibolone, and oral contraceptives accelerated (reduced contraceptive effect).
- *Sympathomimetics:* plasma-phenytoin concentration increased by Metheylphenidate.
- *Theophylline:* metabolism of Theophylline accelerated (reduced plasma-theophylline concentration).
- *Thyroxine:* metabolism of Thyroxine accelerated (may increase Thyroxine requirements in hypothyroidism).
- *Ulcer-healing Drugs:* Cimetidine inhibits metabolism (increased plasma-phenytoin concentration); Sucralfate reduces absorption; Omeprazole enhances effect of Phenytoin (interaction with Lansoprazole possibly differs).
- *Uricosurics:* Plasma-phenytoin concentration increased by Sulphinpyrazone.
- *Vaccines:* effect enhanced by influenza vaccine vitamins D requirements possibly increased.

Pimecrolimus

Alcohol intolerance, described as flushing, rash, burning, itching, or swelling, has occurred rarely after the consumption of alcohol by patients using topical pimecrolimus.

Pitavastatin

The interactions of statins with other drugs are described under simvastatin. Pitavastatin is only marginally metabolised by the cytochrome P450 isoenzyme CYP2C9 and may not have the same interactions with CYP3A4 inhibitors as simvastatin. However, ciclosporin significantly increases pitavastatin exposure and the combination should be avoided. On theoretical grounds, use with ritonavir-boosted lopinavir is also contra-indicated. Rifampicin and erythromycin also increase pitavastatin exposure; if such combinations must be used, lower doses of pitavastatin should be used.

Pizotifen

Antihypertensives: hypotensive effect of adrenergic neurone blockers antagonized.

Potassiam Salts (including salt substitutes)

- *ACE Inhibitors:* increased risk of hyperkalaemia.
- *Ciclosporin:* increased risk of hyperkalaemia.
- *Diuretics:* hyperkalaemia with potassium-sparing diuretics.

Prasugrel

- Analgesics: possible increased risk of bleeding when prasugrel given with NSAIDs
- Anticoagulants: possible increased risk of bleeding when prasugrel given with coumarins or phenindione
- Clopidogrel: possible increased risk of bleeding when prasugrel given with clopidogrel

Primaquine

Mepacrine: increased plasma concentration of Primaquine (risk of toxicity).

Primidone see Barbiturates and Primidone.

Probenecid

- *ACE Inhibitors:* reduced excretion of Captopril.
- *Analgesics:* Aspirin antagonizes effect; excretion of Indomethacin, Ketoprofen, Ketorolac (avoid concomitant use), and Naproxen delayed and increased plasma-NSAID concentrations.
- *Antibacterials:* reduced exertion of Cephalosporins, Cinoxacin, Ciprofloxacin, and Penicillins (increased plasma-concentrations); antagonism by Pyrazinamide.
- *Antivirals:* reduced excretion of Aciclovir, Vanciclovir, Zidovudine, and possibly Famciclovir and Zalcitabine (increased plasma concentrations).
- *Cytotoxics:* reduced excretion of Methotrexate (increased risk of toxicity).

Procainamide

ACE Inhibitors: increased risk of toxicity with captopril, especially in renal impairment.

- *Other Anti-arrhythmics:* Amiodarone increases Procainamide-plasma concentrations (increased risk of ventricular arrhythmias-avoid concomitant use); increased myocardial depression with any anti-arrhythmic.
- *Antibacterials:* increased risk of arrhythmias with Grepafloxacin (avoid concomitant use); Trimethoprim increases plasma concentration of Procainamide.
- *Antidepressants:* increased risk of ventricular arrhythmias with Tricyclics.
- *Antihistamines:* increased risk of ventricular arrhythmias with Mizolastine (avoid concomitant use).
- *Antimalarials:* increased risk of ventricular arrhythmias with Halofantrine.
- *Antipsychotics:* increased risk of ventricular arrhythmias –.avoid concomitant use with Pimozide, Sertindole or Thioridazine.
- *Beta-blockers:* increased risk of ventricular arrhythmias associated with Sotalol (avoid concomitant use).
- *Muscle Relaxants:* muscle relaxant effect enhanced.
- *Parasympathomimetics:* antagonism of effect of Neostigmine and Pyridostigmine.
- *Ulcer-healing Drugs:* Cimetidine inhibits excretion increased plasma-procainamide concentration).

Progestogens (see also Contraceptives, Oral).

Antibacterials: metabolism accelerate by Rifampicin (reduced effect).

- *Antivirals:* Nevirapine accelerates metabolism of hormonal contraceptives (reduced contraceptive effect).
- *Ciclosporin:* increased plasma-ciclosporin concentration (inhibition of metabolism).

Hormone Antagonists: Aminoglutethimide reduces plasma concentration of Medroxyprogesterone.

Propafenone

Propafenone is extensively metabolised by the cytochrome P450 enzyme system, mainly by the isoenzyme CYP2D6, although CYP1A2 and CYP3A4 are also involved. Interactions may therefore occur with other drugs that are metabolised by these enzymes. Plasma-propafenone concentrations may be reduced by enzyme inducers such as rifampicin; enzyme inhibitors, such as cimetidine, fluoxetine, quinidine, and HIV-protease inhibitors, may increase plasma-propafenoneconcentrations. Propafenone itself may alter the plasma concentrations of other drugs, including beta blockers, ciclosporin, desipramine, digoxin, theophylline, venlafaxine, and warfarin. The absorption of propafenone may be reduced by orlistat. There may be an increased risk of arrhythmias if propafenone is given with other antiarrhythmics or arrhythmogenic drugs.

Prostaglandins

Oxytocin: uterotonic effect enhanced.

Proton Pump Inhibitors

Analgesics: plasma concentration of Omeprazole increased by Valdecoxib.

Antacids: possibly reduced absorption of Lansoprazole.

- *Anticoagulants:* effect of Warfarin enhanced by Omeprazole; interaction with Lansoprazole possibly differs.
- *Antiepileptics:* effects of Phenytoin enhanced by Esomeprazole and Omeprazole; interaction with Lansoprazole possibly differs.

  Antifungals: absorption of Ketoconazole and possibly Itraconazole reduced.

  Anxiolytics and Hypnotics: metabolism of diazepam possibly inhibited by Omeprazole and Esomeprazole (increased effect possible).

  Cardiac Glycosides: plasma concentration of Digoxin possibly increased.

  Oestrogens and Progestogens: manufacturer advises that Lansoprazole possibly accelerates metabolism of oral contraceptives.

  Tacrolimus: Omeprazole possibly increases plasma-tacrolimus concentration.

  Ulcer-healing Drugs: Sucralfate reduces absorption of Lansoprazole.

Pyrantel

- Piperazine: Piperazine opposes the anthelmintic actions of pyrantel.
- Aminophylline: A single case report describes rapidly increased theophylline levels in a child given pyrantel.

Pyrazinamide

Uricosurics: antagonism of effect of Probenecid and Sulphinpyrazone.

Pyridoxine see Vitamins.

Pyrimethamine

- *Antibacterials:* increased antifolate effect with Co-trimoxazole and Trimethoprim.

  Antiepileptics: increased antifolate effect with Phenytoin.

  Cytotoxics: increased antifolate effect with Methotrexate.

Quinidine

Antacids and Adsorbents: reduced excretion in alkaline urine (plasma-quinidine concentration occasionally increased); absorption possibly reduced by Kaolin (possibly reduced plasma concentration).

- *Other Anti-arrhythmics:* Amiodarone increases plasma-quinidine. Concentrations (and increases risk of concentration of Propafenone increased; increased myocardial depression with any anti-arrhythmic.

- *Antibacterials:* Rifampicin accelerates metabolism and leads to reduced plasma-quinidine concentration.

  Antidepressants: increased risk of ventricular arrhythmias with Tricyclic antidepressants.

  Antiepileptics: Phenobarbitone, Phenytoin, and Primidone accelerate metabolism (reduced plasma-quinidine concentration).

- *Antihistamines:* increased risk of ventricular arrhythmias with Mizolastine (avoid concomitant use).
- *Antimalarials:* increased risk of ventricular arrhythmias with Halofantrine and Mefloquine.
- *Antipsychotics:* increased risk of ventricular arrhythmias- avoid concomitant use with Pimozide, Sertindole or Thioridazine.
- *Antivirals:* increased risk of ventricular arrhythmias with Nelfinavir and Ritonavir (avoid concomitant use).
- *Barbiturates:* see under Antiepileptics.
- *Beta-blockers:* increased risk of ventricular arrhythmias associated with Sotalol (avoid concomitant use).
- *Calcium-channel Blockers:* Nifedipine reduces plasma-quinidine concentration; Verapamil increases plasma-quinidine concentration (possibility of extreme hypotension).
- *Cardiac Glycosides:* plasma concentration of Digoxin increased (halve Digoxin maintenance dose).
- *Diuretics:* Acetazolamide reduces excretion (plasma-quinidine concentration occasionally increased); Quinidine toxicity increased if hypokalaemia occurs with Acetazolamide, loop diuretics, and Thiazides.
- *Muscle Relaxants:* muscle relaxant effect enhanced.
  Parasympathomimetics: antagonism of effect of Neostigmine and Pyridostigmine.
- *Ulcer-healing Drugs:* Cimetidine inhibits metabolism (increased plasma-quinidine concentration).

Quinine

- *Anti-arrhythmics:* plasma concentration of Flecainide increased; increased risk of ventricular arrhythmias with Amiodarone (avoid concomitant use).
- *Antipsychotics:* increased risk of ventricular arrhythmias-avoid concomitant use with Pimozide.
- *Other Antimalarials:* see Halofantrine, Mefloquine.
- *Cardiac Glycosides:* plasma concentration of Digoxin increased (halve Digoxin maintenance of Digoxin increased use of quinine for cramps.
- *Ulcer-healing Drugs:* Cimetidine inhibits metabolism (increased plasma-quinine concentration).

Quinolones

- *Analgesics:* possible increased risk of convulsions with NSAIDs; manufacturer of Ciprofloxacin advises to avoid premedication with opioid analgesics (reduced plasma-Ciprofloxacin concentration).

  Antacids and adsorbents: Antacids reduce absorption of Ciprofloxacin, Levofloxacin, Moxifloxacin, Norfloxacin and Ofloxacin.

- *Anti-arrhythmics:* increased risk of arrhythmias with drugs that prolong QT interval (avoid concomitant use with Moxifloxacin, Amiodarone, Disopyramide, Procainamide and Quinidine).

  Other Antibacterials: increased risk of ventricular arrhythmias with Moxifloxacin and parenteral Erythromycin (avoid concomitant use)

  Anticoagulants: anticoagulant effect of Warfarin enhanced by Ciprofloxacin, Nalidixic acid, Norfloxacin and Ofloxacin.

  Antidepressants: increased risk of ventricular arrhythmias with Moxifloxacin and tricyclic antidepressants (avoid concomitant use)

  Antidiabetics: effect of Glibenclamide possibly enhanced by Ciprofloxacin.

Antiepileptics: Ciprofloxacin possibly alters plasma concentration of Phenytoin.

Antimalarials: manufacturer of Artemether with Lumefantrine advises avoid concomitant use; increased ventricular arrhythmias with Moxifloxacin and Chloroquine, Mefloquine or Quinine (avoid concomitant use)

Antipsychotics: increased risk of ventricular arrhythmias with Moxifloxacin and Haloperidol, Phenothiazines (avoid concomitant use).

- *Beta-blockers:* increased risk of ventricular arrhythmias with Moxifloxacin and Sotalol, avoid concomitant use.

  Calcium Salts: reduced absorption of Ciprofloxacin.

- *Ciclosporin:* increased risk of nephrotoxicity.

  Cytotoxics: toxicity of Melphalan increased by Nalidixic acid.

- *5HT$_1$-Agonists:* Quinolones possibly inhibit metabolism of Zolmitriptan (reduce dose of Zolmitriptan).

  Iron: absorption of Ciprofloxacin, Levofloxacin, Moxifloxacin, Norfloxacin, and Ofloxacin reduced by oral iron.

- *Theophylline:* possible increased risk of convulsions; Ciprofloxacin and Norfloxacin increase plasma-theophylline concentration.

  Ulcer-healing Drugs: Sucralfate reduces absorption of Ciprofloxacin, Levofloxacin, Moxifloxacin, Norfloxacin, and Ofloxacin.

  Uricosurics: Probenecid reduces excretion of Ciprofloxacin, Nalidixic acid and Norfloxacin.

  Zinc Salts: Zinc reduces absorption of Ciprofloxacin, Moxifloxacin and Norfloxacin.

Racecadotril No interactions with other medicinal products have been described in humans til to date. In humans, joint treatment with racecadotril and loperamide, or nifuroxazide does not modify the kinetics of racecadotril.

Raloxifen

Anticoagulants: antagonism of anticoagulant effect of Warfarin.

Raltegravir

Raltegravir is not a substrate for cytochrome P450 isoenzymes, and does not appear to interact with drugs metabolised by this mechanism. However, rifampicin induces the glucuronidase responsible for raltegravirmetabolism (UGT1A1) and reduces plasma concentrations ofraltegravir; if use with rifampicin cannot be avoided, increasing the dose of raltegravir may be considered.

- Antivirals: Plasma concentrations of raltegravir were modestly increased by atazanavir and ritonavir-boosted atazanavir in healthy subjects; this increase is not considered to be clinically significant.

  In a pharmacokinetic study, use of raltegravir andmaraviroc together resulted in decreased plasma concentrations of both drugs, although these changes were also not thought to be clinically significant.

- Gastrointestinal drugs: The solubility of raltegravir is pH-dependent, and use ofomeprazole has been noted to increase plasma concentrations of raltegravir in healthy subjects. However, some HIV-infected patients (and particularly those with AIDS) have increased gastric pH relating to their illness, and data from HIV-infected patients suggests acceptable safety and only modest pharmacokinetic interaction when gastric-acid reducing drugs are used withraltegravir. US licensed product information forraltegravir therefore suggests that no dose adjustment is needed whenraltegravir is used with gastric-acid reducing drugs, although UK licensed information has advised that such combinations should be avoided unless considered essential.

Ranolazine

- Anti-arrhythmics: manufacturer of ranolazine advises avoid concomitant use with disopyramide.
- Antibacterials: plasma concentration of ranolazine possibly increased by clarithromycin and telithromycin; plasma concentration of ranolazine reduced by rifampicin.
- Antidepressants: plasma concentration of ranolazine increased by paroxetine.
- Antifungals: plasma concentration of ranolazine possibly increased by itraconazole, posaconazole and voriconazole.
- Antivirals: plasma concentration of ranolazine possibly increased by atazanavir, darunavir, fosamprenavir, indinavir, lopinavir, ritonavir, saquinavir and tipranavir.
- Beta-blockers: manufacturer of ranolazine advises avoid concomitant use with sotalol.
- Calcium-channel Blockers: plasma concentration of ranolazine increased by diltiazem and verapamil (consider reducing dose of ranolazine).
- Cardiac Glycosides: ranolazine increases plasma concentration of digoxin.
- Ciclosporin: plasma concentration of both drugs may increase when ranolazine given with ciclosporin.
- Grapefruit Juice: plasma concentration of ranolazine possibly increased by grapefruit juice - manufacturer of ranolazine advises avoid concomitant use.
- Lipid-regulating Drugs: ranolazine increases plasma concentration of simvastatin.
- Tacrolimus: ranolazine increases plasma concentration of tacrolimus.

Retinoids

Alcohol: Etretinate formed from Acitretin in presence of alcohol.

Antibacterials: possible increased risk of benign intracranial hypertension with Tetracyclines and Acitretin, Isotretinoin and Tretinoin.

- *Anticoagulants:* Acitretin possibly reduces anticoagulant effect of Warfarin.
- *Antiepileptics:* plasma concentration of Carbamazepine possibly reduced by Isotretinoin.
- *Cytotoxics:* Acitretin increases plasma concentration of Methotrexate (also increased risk of hepatotoxicity).
- *Oestrogens and Progestogens:* Tretinoin reduces efficacy of Progestogen only and possibly combined oral contraceptives.

Vitamins: risk of hypervitaminosis A with vitamin A and Acitretin, Isotretinoin and Tretinoin.

Ribavirin May exacerbate immunosuppression w/ azathioprine. Increased risk of mitochondrial toxicity and lactic acidosis in HIV-positive patients taking nucleoside reverse transcriptase inhibitor (e.g. didanosine, stavudine). Increased risk of anaemia w/ zidovudine. Decreased bioavailability w/ antacids containing Mg, Al and simethicone. Increased risk of lactic acidosis w/ other nucleoside analogues.

Rifampicin

Analgesics: metabolism of methadone accelerated (reduced effect).

Antacids: reduced absorption of Rifampicin.

- *Anti-arrhythmics:* metabolism accelerated-reduced plasma concentrations of Disopyramide, Mexiletine, Propafenone, and Quinidine.
- *Other Antibacterials:* metabolism of Chloramphenicol accelerated by Rifampicin (reduced plasma concentration); plasma concentration of Dapsone reduced; plasma concentration of Rifabutin increased by Clarithromycin and possibly other Macrolides (risk of uveitis-reduce Rifabutin dose).
- *Anticoagulants:* metabolism of Nicoumalone and Warfarin accelerated (reduced anticoagulant effect).

- *Antidepressants:* metabolism of some Tricyclics accelerated by Rifampicin (reduced plasma concentration).
- *Antidiabetics:* metabolism of Chlorpropamide, Tolbutamide and possibly other Sulphonylureas accelerated (reduced effect); Rifampicin possibly reduces plasma concentration of Repaglinide (manufacturer advises avoid concomitant use).
- *Antiepileptics:* metabolism of Carbamazepine and Phenytoin accelerated (reduced plasma concentration).
- *Antifungals:* metabolism of Fluconazole, Itraconazole and Ketoconazole accelerated by Rifampicin (reduced plasma concentrations); plasma concentration of Rifampicin may be reduced by Ketoconazole; plasma concentration of Terbinafine reduced plasma concentration of Terbinafine reduced by Rifampicin; plasma concentration of Rifabutin increased by Fluconazole and possibly other Triazoles (risk of uveitis - reduce Rifabutin dose).
- *Antipsychotics:* metabolism of Haloperidol accelerated by Rifampicin (reduced plasma concentration).
- *Antivirals:* concomitant administration of Indinavir and Rifabutin increases plasma-Rifabutin concentration and decreases plasma-indinavir concentration (reduce dose of Rifabutin and increase dose of Indinavir); metabolism of Indinavir enhanced by Rifampicin (plasma-indinavir concentration significantly reduced - avoid concomitant use); plasma concentration of Nelfinavir significantly reduced by Rifampicin (avoid concomitant use); plasma concentration of Rifabutin increased by Nelfinavir (halve Rifabutin dose); plasma concentration of Rifabutin increased by Ritonavir (risk of uveitis-avoid concomitant use); plasma concentration of Saquinavir reduced (avoid concomitant use).
- A*nxiolytics and Hypnotics:* metabolism of Diazepam and possibly other Benzodiazepines accelerated (reduced plasma concentration).
- *Atovaquone:* plasma concentration reduced by Rifampicin (possible therapeutic failure of Atovaquone).
- *Beta-blockers:* metabolism of Bisoprolol and Propranolol accelerated by Rifampicin (plasma concentrations significantly reduced).
- *Calcium-channel Blockers:* metabolism of Diltiazem, Nifedipine, and Verapamil and possibly Isradipine, Nicardipine (plasma concentrations significantly reduced).
- *Cardiac Glycosides:* metabolism of Digitoxin only accelerated (reduced effect).
- *Corticosteroids:* metabolism of Corticosteroids accelerated (reduced effect).
- *Ciclosporin:* metabolism accelerated (reduced plasma-ciclosporin concentration).
- *Cytotoxics:* manufacturer reports interaction with Azathioprine (transplants possibly rejected).
- *Lipid-regulating Drugs:* metabolism of Fluvastatin accelerated (reduced effect).
- *Oestrogens and Progestogens:* metabolism accelerated (contraceptive effect of both combined and Progestogen-only oral contraceptives reduced).
- *Tacrolimus:* Rifampicin decreases plasma-tacrolimus concentration.

  Theophylline: metabolism accelerated by Rifampicin (reduced plasma-theophylline concentration).

  Thyroxine: metabolism of Thyroxine accelerated by Rifampicin (may increase requirements in hypothyroidism).

  Ulcer-healing Drugs: metabolism of Cimetidine accelerated by Rifampicin (reduced plasma concentration).

Rifaximin

There is no experience regarding administration of rifaximin to subjects who are taking another rifamycin antibacterial agent to treat a systemic bacterial infection.

In vitro data show that rifaximin did not inhibit the major cytochrome P-450 (CYP) drug metabolizing enzymes (CYPs1A2, 2A6, 2B6, 2C8, 2C9, 2C19, 2D6, 2E1, and 3A4). In in vitro induction studies, rifaximin did not induce CYP1A2 and CYP 2B6 but was a weak inducer of CYP3A4.

In healthy subjects, clinical drug interaction studies demonstrated that rifaximin did not significantly affect the pharmacokinetics of CYP3A4 substrates, however, in hepatic impaired patients it cannot be excluded that rifaximin may decrease the exposure of concomitant CYP3A4 substrates administered (e.g. warfarin, antiepileptics, antiarrhythmics), due to the higher systemic exposure with respect to healthy subjects.

An in vitro study suggested that rifaximin is a moderate substrate of P-glycoprotein (P-gp) and metabolized by CYP3A4. It is unknown whether concomitant drugs which inhibit P-gp and/or CYP3A4 can increase the systemic exposure of rifaximin.

The potential for drug-drug interactions to occur at the level of transporter systems has been evaluated in vitro and these studies suggest that a clinical interaction between rifaximin and other compounds that undergo efflux via P-gp and other transport proteins is unlikely (MDR1, MRP2, MRP4, BCRP and BSEP).

Riluzole

Caffeine, theophylline, amitriptyline, quinolones may decrease the rate of riluzole elimination. Cigarette smoke, rifampin, omeprazole may increase the rate of riluzole elimination.

Ritonavir

- *Analgesics:* plasma concentration of Dextropropoxyphene, Pethidine and Piroxicam increased (risk of toxicity - avoid concomitant use); plasma concentrations of other opioid analgesics and other NSAIDs possibly increased.
- *Anti-arrhythmics:* increased plasma concentration of Amiodarone, Flecainide, Propafenone and Quinidine 9 increased risk of ventricular arrhythmia-avoid concomitant use).
- *Antibacterials:* plasma concentration of Rifabutin increased by Ritonavir (risk of uveitis - avoid concomitant use); plasma concentration of Macrolides possibly increased.
- *Anticoagulants:* plasma concentration of Warfarin and other anticoagulants possibly increased.
- *Antidepressants:* plasma concentration of SSRIs and Tricyclics possibly increased.
- *Antidiabetics:* plasma concentration of Tolbutamide possibly increased.
- Antiepileptics: plasma concentration of Carbamazepine possibly increased.
- *Antifungals:* plasma concentration of Imidazoles and Triazoles possibly increased.
- *Antihistamines:* plasma concentration of non-sedating antihistamines possibly increased.
- *Antipsychotics:* increased plasma concentration of Pimozide (risk of ventricular arrhythmias - avoid concomitant use); increased plasma concentration of Clozapine (risk of toxicity - avoid concomitant use); possibly increased plasma concentration of other antipsychotics.
- *Other Antivirals:* combination with Nelfinavir may lead to increased plasma concentration of either drug; Ritonavir increases plasma concentration of Saquinavir.
- *Anxiolytics and Hypnotics:* plasma concentration of Alprazolam, Clorazepate, Diazepam, Flurazepam, Midazolam and Zolpidem increased (risk of extreme sedation and respiratory depression – avoid concomitant use); plasma concentration of other anxiolytics and hypnotics possibly increased.
- *Calcium-channel Blockers:* plasma concentration of calcium-channel blocker possibly increased.
- *Corticosteroids:* plasma concentration of Dexamethasone and Prednisolone (and possibly other Corticosteroids) possibly increased.
- *Ciclosporin:* plasma-ciclosporin concentration possibly increased.

- *Ergotamine:* risk of ergotism - avoid concomitant use.
- *Oestrogens and Progestogens:* metabolism accelerated by Ritonavir (contraceptive effect of combined oral contraceptives reduced).
- *Tacrolimus:* plasma-tacrolimus concentration possibly increased.
- *Theophylline:* metabolism accelerated by Ritonavir (reduced plasma-theophylline concentration).

Rivaroxaban

Rivaroxaban is metabolised by the cytochrome P450 isoenzyme CYP3A4 and is also a substrate for P-glycoprotein. It should not be given with potent inhibitors of both CYP3A4 and P-glycoprotein, such as ketoconazole, itraconazole, posaconazole, voriconazole, or HIV-protease inhibitors, although it may be used cautiously with fluconazole. Drugs that inhibit only one of these pathways or are less potent inhibitors, such as clarithromycin and erythromycin, do not appear to have clinically relevant effects. Potent inducers of CYP3A4, such as rifampicin, may reduce the effect of rivaroxaban.

Caution is needed if rivaroxaban is given with other anticoagulants or with drugs that affect bleeding, including NSAIDs and antiplatelet drugs.

Sacubitril + Valsartan

- Additive hypotensive effect with sildenafil and other PDE5 inhibitors. Increased risk of acute renal failure with NSAID(s).
- Increased serum concentration with rifampicin, ciclosporin, ritonavir.
- May reduce serum concentration of metformin.
- Sacubitril: May increase serum concentration of OATP1B1, OATP1B3 substrates (e.g. atorvastatin). Increased concentration of statins.
- Valsartan: May increase serum lithium concentration and toxicity.
- Increased risk of hyperkalaemia with potassium-sparing diuretics (e.g. triamterene), mineralocorticoid antagonists (e.g. spironolactone), K supplements, or other K-containing salt substitutes (e.g. heparin).
- Potentially Fatal: Increased risk of angioedema with ACE inhibitors/ARBs. Increased risk of hypotension, hyperkalaemia, and acute renal failure with aliskiren in patients with diabetes mellitus.

Salicylic acid **there are no interaction messages.**

Saquinavir

Note: Limited clinical data available, but possibly of interactions with number of drugs consult product literature for details.

- *Antibacterials:* metabolism accelerated by Rifampicin (reduced plasma concentration - avoid concomitant use).
- *Antiepileptics:* plasma concentration possibly reduced by Carbamazepine, Phenobarbitone and Phenytoin.
- *Other Antivirals:* Nevirapine reduces plasma concentration of Saquinavir (avoid concomitant use); combination with Nelfinavir may lead to increased plasma concentration of Saquinavir.
- *Barbiturates:* see under Antiepileptics above.
- *Corticosteroids:* plasma concentration possibly reduced by Dexamethasone.

Selegiline

Note: Selegiline is a MAO-B inhibitor.

- *Analgesics:* hyperpyrexia and CNS toxicity with Pethidine (avoid concomitant use).
- *Antidepressants:* hypertension and CNS excitation with Fluoxetine, Paroxetine and Sertraline (Selegiline should not be started until 5 weeks after discontinuation of Fluoxetine, avoid Fluoxetine for 2 weeks after stopping Selegiline); hypotension with MAOIs; CNS toxicity reported with Tricyclic antidepressants.

Sildenafil

- Alpha-blockers: enhanced hypotensive effect when sildenafil given with alpha-blockers (avoid alphablockers for 4 hours after sildenafil)

- Anti-arrhythmics: avoidance of sildenafil advised by manufacturer of disopyramide (risk of Ventricular arrhythmias)
- Antibacterials: plasma concentration of sildenafil increased by clarithromycin, erythromycin and telithromycin— reduce initial dose of sildenafil
- Antifungals: plasma concentration of sildenafil increased by itraconazole
- Antivirals: side effects of sildenafil possibly increased by atazanavir; plasma concentration of sildenafil reduced by etravirine; plasma concentration of sildenafil possibly increased by fosamprenavir; plasma concentration of sildenafil increased by indinavir—reduce initial dose of sildenafil; plasma concentration of sildenafil significantly increased by ritonavir— avoid concomitant use; increased risk of ventricular arrhythmias when sildenafil given with saquinavir— avoid concomitant use; avoidance of sildenafil advised by manufacturer of telaprevir Bosentan: plasma concentration of sildenafil reduced by bosentan
- Calcium-channel Blockers: enhanced hypotensive effect when sildenafil given with amlodipine
- Cobicistat: plasma concentration of sildenafil possibly increased by cobicistat manufacturer of cobicistat advises avoid concomitant use of sildenafil for pulmonary arterial hypertension or reduce dose of sildenafil for erectile dysfunction
- Dapoxetine: avoidance of sildenafil advised by manufacturer of dapoxetine
- Grapefruit Juice: plasma concentration of sildenafil possibly increased by grapefruit juice
- Nicorandil: sildenafil significantly enhances hypotensive effect of nicorandil (avoid concomitant use)
- Nitrates: sildenafil significantly enhances hypotensive effect of nitrates (avoid concomitant use)
- Ulcer-healing Drugs: plasma concentration of sildenafil increased by cimetidine (consider reducing dose of sildenafil)

Sodium Aurothiomalate

Note: Increased risk of toxicity with other nephrotoxic and meylosuppressive drugs.

Sodium Bicarbonate see Antacids.

Sodium Fusidate

Although the exact metabolic pathways of fusidic acid are not known, an interaction has been suspected with drugs metabolised by the hepatic cytochrome P450 isoenzyme CYP3A4, and UK licensed product information suggests avoiding their use with fusidic acid.

Somatropin

Corticosteroids: may inhibit growth promoting effect of Somatropin.

Spectinomycin

- *Botulinum Toxin:* neuromuscular block enhanced (risk of toxicity).
- *Lithium:* increased toxicity reported.

Spiramycin see drug interactions of macrolide antibacterials, or see Erythromycin

Spironolactone see Diuretics (potassium-sparing).

Statins

Note: Grapefruit juice increases plasma concentration of Simvastatin.

- *Antibacterials:* metabolism of Fluvastatin accelerated by Rifampicin (reduced effect); Clarithromycin and Erythromycin increase risk of myopathy with Simvastatin (avoid concomitant use); Erythromycin possibly increases risk of myopathy with Atorvastatin; Clarithromycin increases plasma concentration of Atorvastatin.
- *Anticoagulants:* effect of Nicoumalone and Warfarin enhanced by Simvastatin.
- *Antifungals*: Itraconazole, Ketoconazole and possibly other Imidazoles and Triazoles increase risk of myopathy with Simvastatin – avoid concomitant use of Itraconazole, Ketoconazole or Miconazole with Simvastatin; Itraconazole and possibly other Imidazoles and Triazoles increase risk of myopathy with

Atorvastatin – avoid concomitant use of Itraconazole with Atorvastatin.
Cardiac Glycosides: plasma-digoxin concentration possibly increased by Atorvastatin.

- *Ciclosporin:* increased risk of myopathy.
- *Cytotoxics*: plasma concentration of Simvastatin increased by Imatinib.
- *Other Lipid-regulating Drugs:* increased risk of myopathy with Fibrates and Nicotinic acid.

Sucralfate

Antibacterials: reduced absorption of Ciprofloxacin, Grepafloxacin, Levofloxacin, Norfloxacin, Ofloxacin, and Tetracycline.

- *Anticoagulants:* absorption of Warfarin possibly.
- *Antiepileptics:* reduced absorption of Phenytoin.

Antifungals: reduced absorption of Ketoconazole.

Cardiac Glycosides: absorption of Cardiac Glycosides possibly reduced

Thyroxine: reduced absorption of Thyroxine.

Other Ulcer-healing Drugs: reduced absorption of Lansoprazole.

Sulphasalazine

Cardiac Glycosides: absorption of Digoxin possibly reduced.

Suvorexant Suvorexant is primarily metabolized by CYP3A. Therefore, decreased systemic exposure of suvorexant may occur during concurrent use with CYP3A inducers. Thus, suvorexant exposure can be substantially decreased when co-administered with strong CYP3A inducers (e.g., rifampin, carbamazepine and phenytoin). On the otherhand, concomitant use of Suvorexant with strong inhibitors of CYP3A (e.g., ketoconazole, itraconazole, posaconazole, clarithromycin, nefazodone, ritonavir, saquinavir, nelfinavir, indinavir, boceprevir, telaprevir, telithromycin and conivaptan) is not recommended.

Suxamethonium see Muscle Relaxants.

Sympathomimetics (see below for $Beta_2$-Sympathomimetics).

$Alpha_2$-adrenoceptor Stimulants: possible risk of hypertension with Adrenaline and Noradrenaline.

- *Anaesthetics:* risk of arrhythmias if adrenaline and Isoprenaline given with volatile liquid anaesthetics such as halothane.

- *Antidepressants:* with Tricyclics administration of adrenaline and Noradrenaline may cause hypertension and arrhythmias (but local anaesthetics with adrenaline appear to be safe); methylphenidate may inhibit metabolism of Tricyclics; with MAOIs administration of inotropics such as Dopamine and Dopexamine may cause hypertensive crisis; also with MAOIs administration of dexamphetamine and other Amphetamines, Ephedrine, Isometheptene, Methylphenidate, Phentermine, Phenylephrine, Phenylpropanolamine, and Pseudoephedrine may cause hypertensive crisis(these drugs are contained in anorectics or cold and cough remedies).

  Antiepileptics: methylphenidate increases plasma concentration of Phenytoin and possibly of Phenobarbitone and Primidone.

- *Antihypertensives:* Sympathomimetics in anorectics and cold and cough remedies (see above) and methylphenidate antagonize hypotensive effect of adrenergic neurone blockers.

  Barbiturates: see under Antiepileptics, above.

- *Beta-blockers:* severe hypertension with Adrenaline and Noradrenaline and possibly with Dobutamine (especially with non-selective beta-blockers).

  Corticosteroids: ephedrine accelerates metabolism of Dexamethasone.

- *Dopaminergics:* increased risk of toxicity when Isometheptene or

Phenylpropanolamine given with Bromocriptine; effect of Adrenaline, Dobutamine, Dopamine, Isoprenaline and Noradrenaline possibly enhanced by Entacapone.

Orlistat: manufacturer advises avoid concomitant use with Phentermine.

Doxapram: risk of hypertension.

Oxytocin: hypertension with vasoconstrictor Sympathomimetics.

- *Other Sympathomimetics:* Dopexamine possibly potentiates effect of Adrenaline and Noradrenaline.

Sympathomimetics, Beta$_2$

Corticosteroids: increased risk of hypokalaemia if high doses of Corticosteroids given with high doses of Bambuterol, Eformoterol, Fenoterol, Reprotrol, Ritodrine, Salbutamol, Salmeterol, Terbutaline and Tulobuterol.

Diuretics: increased risk of hypokalaemia if with high doses of Bambuterol, Eformoterol, Fenoterol, Reproterol, Ritodrine, Salbutamol, Salmeterol, Terbutaline, and Tulobuterol.

Muscle Relaxants: effect of Suxamethonium enhanced by Bambuterol.

Theophylline: increased risk of hypokalaemia if given with high doses of Bambuterol, Eformoterol, Fenoterol, Reproterol, Ritodrine, Salbutamol, Salmeterol, Terbutaline, and Tulobuterol.

Tamoxifen

- *Anticoagulants:* anticoagulant effect of Nicoumalone and Warfarin enhanced.

  Other Hormone Antagonists: Aminoglutethimide reduces plasma-tamoxifen concentration.

Tedizolid

- Tedizolid is predicted to increase the exposure to imatinib, lapatinib, methotrexate, sulfasalazine, statins, topotecan.
- Monoamine-oxidase A and B inhibitors, moclobemide are predicted to increase the risk of side effects when given with tedizolid.

Tenofovir

Decreased plasma concentrations of atazanavir and increased plasma concentration of tenofovir when given concomitantly. Increased plasma concentration w/ ritonavir-boosted lopinavir. Tenofovir increases the plasma concentrations of didanosine. Increased risk of nephrotoxicity w/ drugs that reduce renal function (e.g. cidofovir, aciclovir, valaciclovir, aminoglycosides, high-dose or multiple NSAIDs). Decreased therapeutic effect of adefovir.

Terbinafine

Antibacterials: plasma concentration reduced by Rifampicin.

Ulcer-healing Drugs: plasma concentration increased by Cimetidine.

Testosterone

- *Anticoagulants:* anticoagulant effect of Warfarin, Nicoumalone and Phenindione enhanced.

  Antidiabetics: hypoglycemic effect possibly enhanced.

Tetracyclines

ACE Inhibitors: Quinapril reduces absorption (tablets contain Magnesium Carbonate excipient).

Antacids and Adsorbents: reduced absorption with antacids and possibly with Kaolin.

Anticoagulant: see Phenindione and Warfarin.

Antiepileptics: Carbamazepine, Phenobarbitone and Phenytoin increase metabolism of Doxycycline (reduced plasma concentration).

Atovaquone: plasma-atovaquone concentration reduced by tetracycline.

Barbiturates: see under Antiepileptics.

Calcium Salts: reduced absorption of Tetracyclines.

- *Ciclosporin:* Doxycycline possibly increases plasma-ciclosporin concentration.

  Dairy products: reduced absorption (except Doxycycline and Minocycline).

  Iron: absorption of oral iron reduced by Tetracyclines and vice versa.

  Oestrogens and Progestogens: see Contraceptives, Oral (main list).

  Retinoids: possible increased risk of benign intracranial hypertension with Tetracyclines and Acitretin, Isotretinoin and Tretinoin.

  Ulcer-healing Drugs: Tripotassium Dicitrato-bismuthate and Sucralfate reduce absorption.

  Zinc Salts: reduced absorption (and vice versa).

Theophylline

Anaesthetics: increased risk of arrhythmias with halothane.

Anthelmintics: Thiabendazole may increase plasma-theophylline concentration.

Anti-arrhythmics: antagonism of anti-arrhythmic effect of adenosine; plasma-theophylline concentration increased by Mexiletine and Propafenone; plasma-theophylline concentration reduced by Moracizine.

- *Antibacterials:* possible increased risk of convulsions with Quinolones; plasma-theophylline concentration increased by Ciprofloxacin, Clarithromycin, Erythromycin (if erythromycin given by mouth, also decreased plasma-erythromycin concentration), and Norfloxacin and possibly increased by Isoniazid; plasma-theophylline concentration reduced by Rifampicin.
- *Antidepressants:* plasma-theophylline concentration increased by Fluvoxamine (concomitant use should usually be avoided, but where not possible halve theophylline dose and monitor plasma-theophylline concentration) and Viloxazine.

  Antiepileptics: plasma-theophylline concentration reduced by Carbamazepine, Phenobarbital and Phenytoin.
- *Antifungals:* plasma-theophylline concentration possibly increased by Fluconazole and Ketoconazole.
- *Antivirals:* plasma-theophylline concentration reduced by Ritonavir.

  Barbiturates: see under Antiepileptics.

  Beta-blockers: should be avoided on pharmacological grounds (bronchospasm).

- *Calcium-channel Blockers:* plasma-theophylline concentration increased by Diltiazem, Verapamil, and possibly other calcium-channel blockers.

  Disulfiram: increased plasma-theophylline concentration.

  Doxapram: increases CNS stimulation.

  Hormone Antagonists: plasma-theophylline concentration reduced by Aminoglutethimide.

  Interferons: plasma-theophylline concentration increased by interferon alfa.

  Leukotriene Antagonists: Zafirlukast possibly increases plasma-theophylline concentration; plasma-zafirlukast concentration reduced.

  Lithium: Lithium excretion accelerated (reduced plasma-lithium concentration).

  Nicotine and Tobacco: plasma-theophylline concentration reduced by tobacco smoking.

  Oestrogens and Progestogens: plasma-theophylline concentration increased by combined oral contraceptives.

  Sympathomimetics: increased risk of hypokalaemia if theophylline given with high doses of Bambuterol, Eformoterol, Fenoterol, Reproterol, Ritodrine, Salbutamol, Salmeterol, Terbutaline and Tulobuterol.

- *Ulcer-healing Drugs:* plasma-theophylline concentration increased by cimetidine.

  Uricosurics: plasma-theophylline concentration increased by Cimetidine.

  Vaccines: plasma-theophylline concentration occasionally increased by influenza vaccine.

Thiabendazole

Theophylline: plasma concentration may be increased.

Thioacetazone may enhance the ototoxicity of streptomycin

Tioconazole there are no interaction messages

Thyroxine

Anion-exchange Resins: Cholestyramine reduces absorption of Thyroxine.

Antibacterials: Rifampicin accelerates metabolism of Thyroxine (may increase requirements in hypothyroidism).

- *Anticoagulants:* effect of Nicoumalone, Phenindione and Warfarin enhanced.

  Antidepressants: manufacturer of Lofepramine advises avoid Thyroxine.

  Antiepileptics: Carbamazepine, Phenobarbital and Phenytoin accelerate. metabolism of Thyroxine (may increase requirements in hypothyroidism).

  Barbiturates: see under Antiepileptics.

  Beta-blockers: metabolism of Propranolol accelerated (reduced effect).

  Ulcer-healing Drugs: Sucralfate reduces absorption of Thyroxine.

Tranexamic Drugs with actions on haemostasis should be given with caution to patients on antifibrinolytic therapy. The risk of thrombosis may be increased if tranexamic acid is given with factor IX complex concentrates or factor VIII inhibitor bypassing fraction, and such combinations are not recommended. Antifibrinolytics and thrombolytics have antagonistic effects, and concomitant use may reduce the efficacy of both. The potential for thrombus formation may be increased by oestrogens.

- Retinoids: Antifibrinolytics should be used with caution in patients receiving oral tretinoin as thrombotic events have been reported in patients being treated with tranexamic acid and tretinoin.

Trimetaphan

Trimetaphan should be used with caution in patients being treated with other antihypertensives, drugs that depress cardiac function, or muscle relaxants, and in those taking NSAIDs or corticosteroids. The hypotensive effect is enhanced by general and spinal anaesthetics. Adrenaline should not be infiltrated locally at the site of incision when trimetaphan is being given since this may antagonise the effect of trimetaphan.

Trimetazidine no clinically significant drug interaction is reported.

Trimethoprim

Anti-arrhythmics: plasma concentration of Procainamide increased.

Anticoagulants: effect of Nicoumlone and antifolate effect of Phenytoin increased.

- *Antimalarials:* increased risk of antifolate effect with Pyrimethamine (in Fansidar® and Maloprim).

  Antivirals: plasma concentration of Lamivudine and possibly Zalcitabine increased - avoid high-dose Co-trimoxazole with Lamivudine.

- *Ciclosporin:* increased risk of nephrotoxicity; plasma-ciclosporin concentration possibly reduced by intravenous Trimethoprim.

  Cytotoxics: antifolate effect of Methotrexate increased.

Valproate

Analgesics: aspirin enhances effect.

Anion- exchange Resins: Cholestyramine possibly reduces absorption.

Antibacterials: erythromycin possibly inhibits metabolism (increased plasma-

valproate concentration).

Anticoagulants: anticoagulant effect of Nicoumalone and Warfarin possibly increased.

- *Antidepressants:* antagonism of anticonvulsant effect (convulsive threshold lowered).
- *Other Antiepileptics:* concomitant administration of two or more antiepileptics may enhance toxicity without a corresponding increase in antiepileptics effect; Moreover, interactions between individual antiepileptics can complicate monitoring of treatment; interactions include enhanced effects, increased sedation, and reductions in plasma concentrations.
- *Antimalarials:* Chloroquine and Mefloquine antagonize anticonvulsant effect.
- *Antipsychotics:* antagonism of anticonvulsant effect (convulsive threshold lowered).

Antivirals: plasma concentration of Zidovudine possibly increased (risk of toxicity).

Ulcer-healing Drugs: Cimetidine inhibits metabolism (increased plasma-valproate concentration).

Valsartan see ACE Inhibitors and Angiotensin-II Antagonists.

Vancomycin

Anaesthetics: hypersensitivity-like reactions can occur with concomitant Vancomycin infusion.

Anion-exchange Resins: Aminoglycosides and Capreomycin.

Diuretics: increased risk of ototoxicity with Loop diuretics.

Vecuronium like Muscle Relaxants (non-depolarizing).

Verapamil like Calcium-channel Blockers.

Vincristine

Antifungals: Itraconazole may inhibit metabolism (increased risk of neurotoxicity).

Vitamins

- *Anticoagulants:* anticoagulant effect of Nicoumalone, Phenindione, and Warfarin antagonized by vitamin K (present in some enteral feeds).

  Antiepileptics: Vitamin D requirements possibly increased by Carbamazepine, Phenobarbital and Phenytoin.

  Barbiturates: see Antiepileptics.

  Diuretics: increased risk of hypercalcaemia if Thiazides given with vitamin D.

  Dopaminergics: effect of Levodopa antagonized by pyridoxine (unless a dopa decarboxylase inhibitor also given).

  Retinoids: risk of hypervitaminosis A with Vitamin A and Acitretin, Isotretinoin and Tretinoin.

Voglibose

May enhance effects of other antidiabetics including insulin.

Warfarin and Other Coumarins

Note: Change in patient's clinical condition particularly associated with liver disease,

intercurrent illness, or drug administration, necessitates more frequent testing. Major

changes in diet (especially involving salads and vegetables) and in alcohol consumption may also affect Warfarin control.

- *Alcohol:* enhanced anticoagulant effect with large amounts (see also above).
- *Allopurinol:* anticoagulant effect possibly enhanced.
- *Anabolic Steroids:* Oxymetholone, Stanozolol and others enhance anticoagulant effect.
- *Analgesics:* Aspirin increases risk of bleeding due to antiplatelet effect ; anticoagulant effect seriously enhanced by Azapropazone (avoid concomitant use) and possibly enhanced by Diclofenac, Diflunisal, Flurbiprofen, Ibuprofen, Mefenamic acid, Meloxicam, Piroxicam, Sulindac, and other NSAIDs; anticoagulant effect possibly also enhanced by

Dextropropoxyphene and by prolonged regular use of Paracetamol; increased risk of hemorrhage with parenteral Diclofenac and Ketorolac(avoid concomitant use).

- *Anion-exchange Resins:* Cholestyramine may enhance or reduce anticoagulant effect.
- *Anti-arrhythmics:* Amiodarone and Propafenone enhance anticoagulant effect; Quinidine may enhance anticoagulant effect.
- *Antibacterials:* anticoagulant effect reduced by Rifampicin; anticoagulant effect enhanced by Cephamandole, Chloramphenicol, Ciprofloxacin, Co-trimoxazole, Erythromycin, Metronidazole, Ofloxacin, and Sulphonamides; anticoagulant effect possibly also enhanced by Aztreonam, Clarithromycin and some other Macrolides, Nalidixic acid, Neomycin, Norfloxacin. Tetracyclines, and Trimethoprim; although studies have failed to demonstrate interaction, common experience in anticoagulant clinics is that INR can be altered following course of oral broad-spectrum antibiotic, such as Ampicilli (may also apply to antibiotics given for local action on gut such as Neomycin).
- *Antidepressants:* SSRIs and Viloxazine possibly enhance anticoagulant effect
- *Antidiabetics:* possibly enhanced hypoglycemic effects of Sulphonylureas and changes to anticoagulant effect.
- *Antiepileptics:* reduced anticoagulant effect with Carbamazepine and Phenobarbital; anticoagulant effect possibly increased by Valproate; both reduced and enhanced effects reported with Phenytoin.
- *Antifungals:* anticoagulant effect reduced by Griseofulvin; anticoagulant effect enhanced by Fluconazole, Itraconazole, Ketoconazole, and Miconazole (note: oral gel absorbed).
- *Antimalarials:* anticoagulant effect possibly enhanced by Proguanil.
- *Antiplatelet Drugs:* Aspirin, Clopidogrel and Dipyridamole increase risk of bleeding due to antiplatelet effect.
- *Antivirals:* Ritonavir possibly increases plasma concentration.
  Anxiolytics and Hypnotics: Chloral may transiently enhance anticoagulant effect
  Barbiturates: Anticoagulant effect reduced.
- *Corticosteroids:* anticoagulant effect possibly altered.
- *Cytotoxics:* anticoagulant effect possibly enhanced by Ifosfamide.
- *Disulfiram:* enhanced anticoagulant effect.
- *Hormone Antagonists:* Aminoglutethimide reduces anticoagulant effect; Danazol, Flutamide, Tamoxifen and possibly Bicalutamide and Toremifene enhance anticoagulant effect.

  Leukotriene Antagonists: Zafirlukast enhances anticoagulant effect of Warfarin.
- *Lipid-regulating Drugs:* Fibrate group and Simvastatin enhance anticoagulant effect.

  Raloxifene: antagonism of anticoagulant effect.
- *Retinoids:* Acitretin possibly reduces anticoagulant effect.

  Rowachol: possibly reduced anticoagulant effect.
- *Testosterone:* anticoagulant effect of Warfarin and Nicoumalone enhanced.
- *Thyroxine:* enhanced anticoagulant effect.
- *Ulcer-healing Drugs:* Sucralfate possibly reduces anticoagulant effect (reduced absorption); Cimetidine and Omeprazole enhance anticoagulant effect.
- *Uricosurics:* Sulphinpyrazone enhances anticoagulant effect.

  Vaccines: Influenza vaccine occasionally enhances anticoagulant effect.

  Vitamins: Vitamin K reduces anticoagulant effect; major changes in diet. (especially involving vegetables) may affect control; vitamin K also present in some enteral feeds.

Appendices
and
Indices

Appendix-i

MANAGEMENT AND TREATMENT GUIDELINES

Treatment Guidelines for Acute Respiratory Tract Infections

For Pneumonia, Acute Ear Infection, Very Sever Disease or Severe Malnutrition, If Injectable Drugs are not available

A. Oral Amoxicillin can be given, in very severe disease; it is not possible to administer injectable Ampicillin, Gentamycin)
B. Amoxicillin give two times daily for 5 days
C. COTRIMOXAZOLE (Trimethoprim + Sulphamethoxazole) can be given two times daily for 5 days

Treatment Guidelines for Burn Injury

Burn Management:

1. Take clinical picture before starting treatment
2. Wound lavage with normal saline, wash with mild soap
3. Bister: if ruptured-debride if cause functional impairments-debride
4. Cover with moisture retaining no-adherent dressing/hydrocolloid dressing/ Collagen/silver sulfadiazine
5. If contaminated wound, devitalized skin-topical antibiotic, silver sulhadiazine, Instruct-Change dressing daily. 24-48 hours after first dressing, check infection, give antibiotic, see at 2-3 days interval, Heals within 2-3 weeks (if partial thickness). Report on admission day of same unit.
6. Face open-bacitracin ointment/collagen
7. Analgesic
8. Elevation of affected extremity
9. Injection T.T. ± TIG
10. Weekly fixed follow up days for one month or till all the wounds have healed and advice pressure garments if there is tendency to develop hypertrophy

Monitoring in first 24 hours

Clinical-
(Monitoring the following parameters, be alert, look for signs of shock or heart failure)

1. Pulse -4hourly
2. BP -4 hourly
3. Urine output - hourly
4. Respiratory rate -4 hourly
5. Pulse oximetry -
6. Temp->105^0 (Mild fever expected secondary to hypermetobolic state)
7. Pain-

   VAS- utilize and document

   A) **If severe pain-** IV morphin + diclofenac
   Or, ibuprofen+ paracetamol (in combination)
   A narcotic infusion can be commenced once the initial treatments have stabilized the patient.
   B) **Moderate pain – codeine 1mg/Kg + diclofenac 1mg/Kg/dose**
   Or, Ibuprofen + Paracetamol

c) **Mild Pain-**Ibuprofen 10mg/Kg + paracetamol oral 20mg/Kg/dose, per-rectal 30mg/kg/dose

Monitoring after 24 hours

A daily progress note will include:

1. All vital sign (Pulse, BP, Temp, RR)
2. Level of consciousness
3. Systemic Exam-Chest, abdomen, lower limb for DVT, pressure areas
4. Intake output
5. Pain scoring
6. Notes on dressing change, wound condition/Color/Discharge/ odor
7. Nutritional adequacy
8. Physiotherapy-required or not

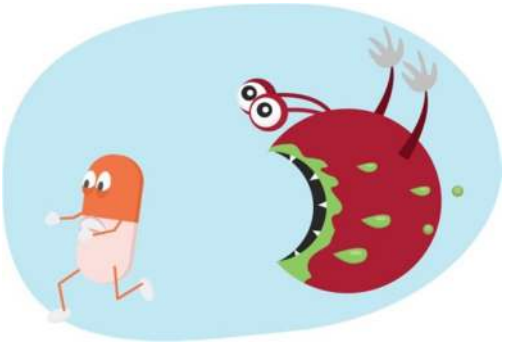
Drugs

1. Analgesic- adjust according to pain score
2. Antiemetic-Metachlorpromide/ondansetron
3. Antiulcer
4. Antihistamine
5. DVT Prophylaxis-Heparin 5000 IU s/c bd or Clexane 0.5mg/kg s/c
6. Nystatin (200,000I.U.) -3 times daily PO/NGT
7. Folate 1mg PO/NGT once daily
8. If 50% burn MgSO4 500ml once a week
9. Codeine 30mg PO 6 hours (for diarrhea)
10. Antibiotics

Appendix-ii

Antimicrobial Resistance (AMR): Mechanisms and AWaRe Categorization of Antibiotics

Antimicrobial Resistance:



Antimicrobial resistance (AMR) is a means whereby a naturally susceptible microorganism acquires ways of not being affected by the drug. In other words, AMR is the ability of microbes to survive or grow during proper antimicrobial treatment.

Antimicrobial resistance to antimicrobial agents is not a new phenomenon; it has been going on in soil microorganisms since the dawn of time, as competitive/survival mechanisms by microorganisms against other microorganisms.

Although antimicrobial resistance is a natural biological phenomenon, it is often enhanced as a consequence of infectious agents' adaptation to exposure to antimicrobials used in humans or agriculture and the widespread use of disinfectants at the farm and household levels. It is now accepted that antimicrobial use is the single most important factor responsible for increased antimicrobial resistance[1].

Clinical versus Microbiological Resistance:

From a microbiological point of view, resistance is defined as a state in which an isolate has a resistance mechanism rendering it less susceptible than other members of the same species lacking any resistance mechanism. This definition is valid irrespective of the level of resistance (i.e. low or high level of resistance) and does not necessarily correlate with clinical resistance.

From a clinical point of view, resistance is defined as a state in which a patient, when infected with a specific pathogen, is treated with an adequate antimicrobial dosage and administration schedule, but clinical criteria of cure (at a clinical and/or a microbiological level) are not reached.

Clinical resistance can be due to non-microbial factors such as penetration to the sire of infection, walled off abscesses being a prime example. On the other hand there can be microbiological resistance defined in the laboratory but clinical cure despite this. An example is topical therapy in ears or on the skin, where the amount of antimicrobial applied is so great that the infection is controlled anyway.

A clinical breakpoint is an MIC value that correlates with the clinical outcome and that separates those isolates that are considered as clinically susceptible or associated with a

high likelihood of therapeutic success from those that are considered as clinically resistant or associated with a high likelihood of therapeutic failure[1].

Why and how AMR spread so rapidly in bacterial species:

When AMR develop in one community of bacteria it spreads rapidly along with the following growth mechanism of it-

1. **Transformation:**
   DNA, which may include AMR genes, is present in the environment. This can be from a dead bacterial cell but it can be taken up by a live bacterial cell and transformed into its own DNA by recombination. Reflect on the fact that this is environmental DNA and we have already looked at the selection for resistant genes due to high levels of antimicrobials in the environment.

2. **Transduction:**
   A virus (bacteriophage) can infect the bacterium, replicate inside it and can acquire bacterial DNA when the bacteria break down and the bacterial nucleus is lysed. When the bacterial cell dies, the phage containing bacterial DNA is released into the environment and can infect other bacteria of the same species. The bacterial DNA in the phage can then recombine with the bacterial DNA in the new cells. If this fragment contains AMR genes, the resistant gene can be passed to the new bacteria.

3. **Conjugation:**
   Conjugation is a type of sexual reproduction where genetic material is passed between cells. The bacterial cell may contain a plasmid, which is a circular piece of DNA that is self-replicating and it can pass a copy of itself into another bacterial cell through conjugation (horizontal transmission).

4. **Binary Fission:**
   Binary fission is a kind of asexual reproduction. In binary fission DNA replication and segregation occur simultaneously. In binary fission, the fully grown parent cell splits into two halves, producing two new cells. After replicating its genetic material, the parent cell divides into two equal-sized daughter cells. The genetic material is replicated, then equally split. The daughter cells are genetically identical unless a mutation occurs during replication.

Why AMR to antibiotics is so important for the world?

- The majority of all antimicrobials used globally are antibiotics.
- The majority of communicable human and livestock diseases are caused by bacteria
- Bacteria have novel ways of acquiring genetic material
- Bacteria have exponential growth and a short generation time
- Bacteria can pass genetic material across different species
- Antibiotics can cure bacterial infections as long as there is no AMR.

Mechanisms of Resistance

The major resistance mechanisms of microbes are decreased drug uptake, efflux pumps, enzymes that inactivate an antimicrobial chemical and target alterations by mutation. There also are biofilms.

- **Decreased drug uptake:**

  Reduced inflow of the drug reduces intracellular drug levels. Gram-negative bacteria have a much thinner cell wall itself and this is protected by a lipopolysaccharide molecule in the capsule, an outer membrane and what is known as the periplasmic space. In short, it is a much more heavily armoured vehicle. Porins are openings in the cytoplasmic membrane through which antimicrobial agents can gain entry a reduced number of such porins is one means of antimicrobial resistance.

- **Increase efflux pumps:**

  Increased outflow of the drug reduces intracellular drug levels. Resistant bacteria may have a greater number of efflux pumps on their cell surfaces. Some bacteria can decrease the specificity of their efflux pumps, increasing the number of different antibiotics the pumps can eliminate. Some bacteria can change the chemical structure of the antibiotic. e.g. Pseudomonas.

- **Enzyme inactivation:**

  Some microorganisms have developed the ability to produce enzymes that can inactivate certain antimicrobials. The most notable example is penicillinase that can inactivate penicillin.

- **Target alterations:**

  When an antimicrobial attacks a specific target, whether it be cell wall peptides, ribosomes or nuclear DNA, it locks on to specific receptors on the target.

  Bacterial mutation results in the alteration of these receptors so that the antimicrobial can no longer fit and the organism is thus resistant to the effects of the antimicrobial.

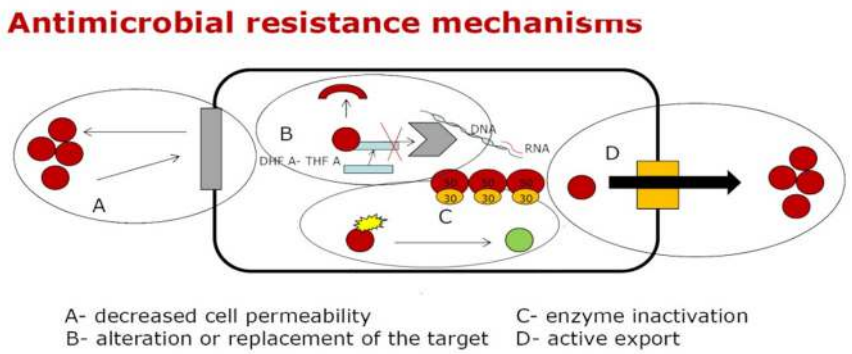


Figure 1: The four major processes of Antimicrobial Resistance.[1]

- **Biofilms Biofilms:**
  Biofilms are complex microbial communities containing bacteria and fungi. The microorganisms synthesise and secrete a protective matrix that attaches the biofilm firmly to a living or non-living surface. At the most basic level a biofilm can be described as bacteria embedded in a thick, slimy barrier of sugars and proteins. The biofilm barrier protects the microorganisms from external threats.

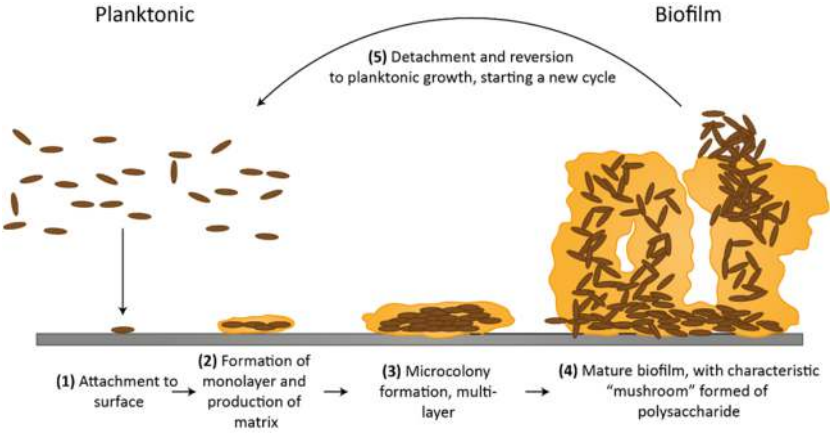


Figure 2: Schematic representation of a biofilm formation.[2]

Factors that enhance the AMR:

- Use of antimicrobials without CS test or Justification
- Incomplete course of antimicrobials
- Use of antimicrobials in subnormal dose
- Illegal use of antimicrobials as growth promoter in Veterinary field

Recommendation for Reduce AMR:

- Use antimicrobials rationally by CS test when possible
- Avoid antimicrobials in viral infection
- Maintain the full course of antimicrobials with proper dose
- Avoid use of Antimicrobials as growth promoter
- Don't use reserve group of antibiotics in Veterinary field specially Colistin. Ciprofloxacin and Azithromycin also dedicated only for human use.
- Personal hygiene should be improved in human health practice.
- Strict biosecurity should be maintained in farming.

AWaRe antibiotics

The AWaRe classification of antibiotics was developed in 2017 by the WHO Expert Committee on Selection and Use of Essential Medicines as a tool to support antibiotic stewardship efforts at local, national and global levels, Antibiotics are classified into three groups, Access, Watch and Reserve, taking into account the impact of different

antibiotics and antibiotic classes on antimicrobial resistance, to emphasize the importance of their appropriate use. It is updated every 2 years.

The AWaRe classification is intended as a tool for monitoring antibiotic consumption, defining targets and monitoring the effects of stewardship policies that aim to optimize antibiotic use and curb antimicrobial resistance.

The AWaRe means **Access, Watch & Reserve.** The AWaRe categorization focuses on which antibiotics should be accessible, but among them, some antibiotics should be used less than others. Furthermore, the AWaRe categorization reserves certain antibiotics due to their importance as last resort use, and they are key targets of national and international monitoring and utilization reporting, to preserve their effectiveness.[3]

Access: Empirical first and second choice for common infectious syndromes. Should be widely available, at affordable prices, inappropriate formulations, and of assured quality

Watch: Antibiotics with higher resistance potential. Use as first and second choice treatment should be limited to few syndromes or patient groups. Includes the highest priority agents on *Critically important antimicrobials for human medicine* (CIA List) which ranks antimicrobials according to their relative importance in human medicine. Apply for risk management strategies for the use of antimicrobials in food-production animals.

Reserve: The reserve group includes the antibiotics that should be considered as the last resort options or tailored to highly specific patients and settings i.e when other alternatives are inadequate or have already failed (eg. MDR infections). These antibiotics have a high resistance potential and their restricted use of these antibiotics is designed to reduce the risk of AMR.

These antibiotics should be protected by national and international stewardship programmes.

Key ACCESS	WATCH	RESERVE
Penicillins	**Ureidopenicillin with beta-**	**4th-generation**
benzathine benzylpenicillin	**lactamase inhibitor**	**Cephalosporins**
benzylpenicillin	piperacillin + tazobactam	e.g. cefepime
phenoxymethylpenicillin	**3rd-generation**	**5th-generation**
procaine benzyl penicillin	**Cephalosporins**	**Cephalosporins**
Penicillinase-resistant	cefixime	e.g. ceftaroline
penicillins	cefotaxime	**Polymyxins**
cloxacillin	ceftriaxone	e.g. colistin, polymyxin B
Aminopenicillins	ceftazidime	**Oxazolidinones**
amoxicillin	**Carbapenems**	e.g. linezolid
amoxicillin + clavulanic acid	ertapenem	**Monobactam**
ampicillin	meropenem	aztreonam
1st-generation Cephalosporins	imipenem + cilastatin	**Other**
cefazolin	**Quinolones**/	fosfomycin (IV)
cephalexin	**Fluoroquinolones**	tigecycline
cephradine	ciprofloxacin	daptomycin
Aminoglycosides	enrofloxacin (vet)	
amikacin	levofloxacin	
gentamycin	marbofloxacin (vet)	

Key ACCESS	WATCH	RESERVE
neomycin (vet)	moxifloxacin	
streptomycin (vet)	orbifloxacin (vet)	
Lincosamides	**Macrolides**	
clindamycin	azithromycin	
lincomycin (vet)	clarithromycin	
Tetracyclines	erythromycin	
doxycycline	tylosin (vet)	
tetracycline (vet)	**Glycopeptides**	
oxytetracycline (vet)	vancomycin (oral)	
Sulfonamides (vet)	vancomycin (parental)	
sulfadimethoxine, sulfamerazine	teicoplanin	
sulfamethazine, sulfaquinoxaline	**Penems**	
sulfathiazole	faropenem	
Other		
chloramphenicol		
florfenicol (vet)		
metronidazole		
nitrofurantoin/furazolidone (vet)		
spectinomycin (EML only)		
sulfamethoxazole + trimethoprim		

Appendix-iii

Monitoring and Evaluation of the Global Action Plan on Antimicrobial Resistance

Antimicrobial resistance (AMR) is the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it. As a result, standard treatments become ineffective, infections persist and may spread to others. The Global Action Plan on antimicrobial resistance (hereinafter "GAP") is the world's blueprint for tackling the emergence and spread of antimicrobial resistance (AMR), which threatens many of the global Sustainable Development Goals (SDGs) on health, food security, environmental well-being and socioeconomic development.

Non-Prescription Use of Antibiotics, Selected Countries:

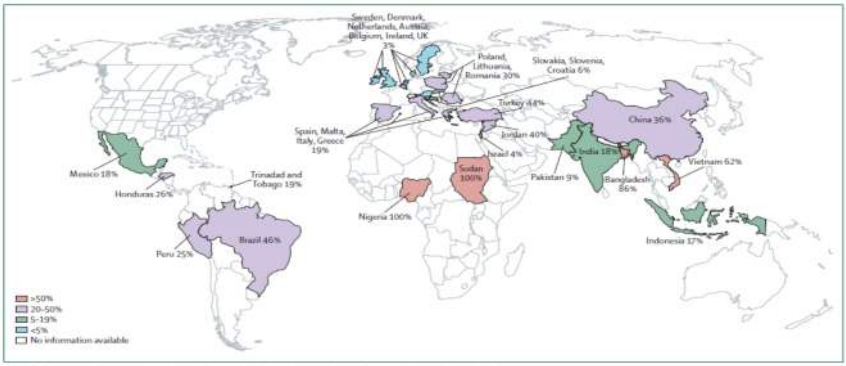
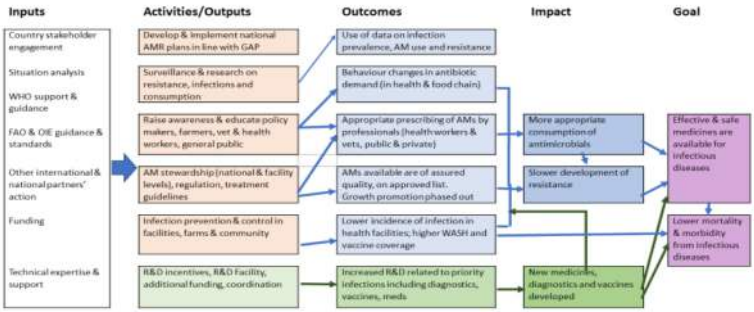


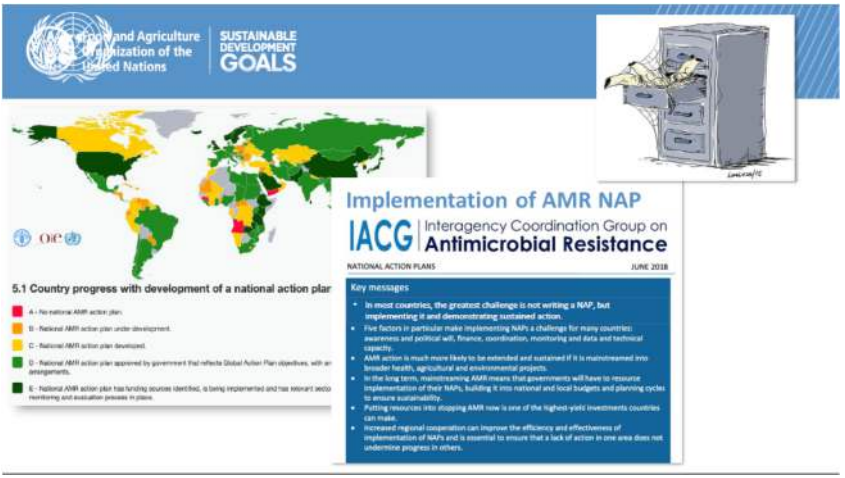
Figure 2: **Frequency of non-prescription use of antimicrobials in the general population based on published works**
In small areas, countries with similar frequency of non-prescription antimicrobial use have been grouped.

Figure 1. Framework for monitoring AMR Global Action Plan



Conscience of Antimicrobial Resistance Accountability, an alliance of independent organizations whose purpose is to monitor global progress toward the goals set forth in the UNGA's political declaration. To meet its commitments, CARA branches will track a set of indicators keyed directly to political declarations and documents from other relevant entities, such as WHO, WOAH (OIE), and FAO.

FAO Progressive Management Pathway for Antimicrobial Resistance (FAO-PMP-AMR)



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FAO PROGRESSIVE MANAGEMENT PATHWAY FOR AMR

Launched in 2019

- Assist countries with developing and implementing their NAPs within a One Health context
- Stepwise approach to reach comprehensive management of AMR and AMU
- Scale-up of activities according to available resources

Food and Agriculture Organization of the United Nations | SUSTAINABLE DEVELOPMENT GOALS

STEPWISE APPROACH

01

ASSESS THE SITUATION

Inventory of existing training opportunities on AMR and AMU for food and agriculture producers (e.g. livestock farmers, crops producers, etc.)

02

SMALL-SCALE INITIATIVES

Develop and organize small-scale training courses on AMR and AMU for food and agriculture producers in key commodities (e.g. poultry, swine, beef)

03

NATIONWIDE INITIATIVES IN PRIORITY SECTORS

Develop and organize nationwide training courses on AMR and AMU for food and agriculture producers in key commodities

04

NATIONWIDE APPROACH WITH ALL SECTORS INVOLVED

Develop and organize nationwide training courses on AMR and AMU for all food and agricultural sectors

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FOUR MAJOR FOCUS AREAS

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FOUR MAJOR FOCUS AREAS

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TOPICS

AWARENESS

AWARENESS RAISING
- Conducting Awareness Assessment
- Implementing Awareness Raising Campaigns
- Publishing Annual Reports on AMR & AMU

TRAINING & EDUCATION
- Training Courses for Food & Agriculture Producers
- Training Courses for Health Professionals
- Include AMR & AMU in Education Programs

EVIDENCE

ANTIMICROBIAL USE MONITORING
- Distribution of Antimicrobials
- AMU data collection
- AMU reporting to OIE
- End-user monitoring

ANTIMICROBIAL RESISTANCE SURVEILLANCE
- Laboratory Capacity
- AMR Surveillance
- AMR Reporting Unit
- AMR Reporting Quality
- Extended Surveillance on Animal Health
- Environmental spill-over of Antimicrobials
- Extended Surveillance on Plant Health

GOVERNANCE

MULTISECTOR COORDINATION GROUP
- MCG Establishment
- MCG Operations

NATIONAL ACTION PLAN
- Strategic Plan
- Operational Plan

SUSTAINABILITY
- Regulatory Framework
- Financial Sustainability
- AMR & AMU Research

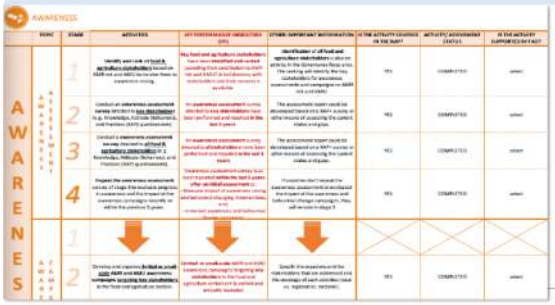
PRACTICE

BEST PRACTICES
- Country-specific AMU Guidance
- Good Practices Implementation
- Coaching on Good Practices

RESPONSIBLE USE
- Antimicrobial Residues in Food
- Antimicrobial Residues in Feed
- AMU Regulation
- Manufacturing and Quality Control
- Distribution and Commercialization
- Prescription Control
- Farm Waste Management Associated to AMU
- AMU Benchmarking

Food and Agriculture Organization of the United Nations | SUSTAINABLE DEVELOPMENT GOALS

ASSESSMENT TOOL



The tools allows a country to self-evaluate by assessing:
- Specific activities,
- Achievements or Key Performance Indicators (KPI) for each stage
- From small scale to nationwide
- From priority sectors to 'One Health'

References:

1. Mechanism of Antibiotic resistance, Dennis Scott BVSc MANZCVS AMRLG; https://cdn.ymaws.com/www.nzva.org.nz/.../Mechanics_AMR_March2017
2. Adapted from Vasudevan, 2014, J Microbiol Exp 1(3): 00014. DOI: 10.15406/jmen.2014.01.00014.
3. Access, watch, reserve: WHO committee advises when to use common antibiotics.

Appendix-iv

Critically Important Antimicrobials (CIA)

1. Preamble

The WHO List of Critically Important Antimicrobials for Human Medicine (WHO CIA List) was originally developed following recommendations from two consecutive expert meetings organized by the Food and Agriculture Organization of the United Nations (FAO), the World Organization for Animal Health (OIE), and World Health Organization (WHO). The first workshop was convened in Geneva, December 2003 (*1*) and the second workshop in Oslo, March 2004 (*2*) to address the public health consequences associated with the use of antimicrobial agents in food producing animals.

The first expert workshop concluded that antimicrobial resistance was a global public and animal health concern that has been impacted by the use of antimicrobial agents in all sectors, and highlighted that the types of antimicrobials used in animals for growth promotion, prophylactic or therapeutic purposes were frequently the same, or closely related to those used in human medicine. The workshop therefore recommended that an expert clinical medical group, appointed by WHO, define and provide a list of antimicrobials that were considered critically important in humans.

The second expert workshop recommended that the OIE identify and list antimicrobial agents that are critically important for veterinary medicine. The overlap of the two lists should be considered for risk management options, allowing an appropriate balance between animal health needs, human health needs, and public health considerations.

A third FAO/OIE/WHO expert meeting met in Rome in 2007 (*3*) to consider the WHO and OIE lists of critically important antimicrobials and begin to address the overlap of the two lists, for example, the potential hazards to public health resulting from this overlap and the combinations of pathogen, antimicrobial and animal species of most concern. The meeting concluded that the lists of critically important antimicrobials should be revised on a regular basis in a collaborative and coordinated approach by FAO, OIE and WHO.

2. The Criteria

Criterion 1 (C1): *The antimicrobial class is the sole, or one of limited available therapies, to treat serious bacterial infections in people.*

Explanation: It is evident that antimicrobials that are the sole or one of few alternatives for the treatment of serious bacterial infections in humans occupy an important place in human medicine. Serious infections are likely to result in significant morbidity or mortality if left untreated.

It is of prime importance, then, that the use of such antibacterial agents be preserved, as loss of efficacy in these drugs due to the emergence of resistance would have a significant impact on human health, especially for people with life-threatening infections.

Criterion 2 (C2): The antimicrobial class is used to treat infections in people caused by either: (1) bacteria that may be transmitted to humans from non- human sources, or (2) bacteria that may acquire resistance genes from non- human sources.

Explanation: Antimicrobial agents used to treat diseases caused by bacteria that may be transmitted to humans from non-human sources are considered of higher importance because these infections are most amenable to risk- management strategies related to non-human antimicrobial use. The organisms that cause disease need not be drug-resistant at the present time. However, the potential for transmission shows the path for acquisition of resistance now or in the future. The evidence for a link between non-human sources and the potential to cause human disease is greatest for certain bacteria (e.g. non-typhoidal *Salmonella*, *Campylobacter spp.*, *Escherichia coli*, *Enterococcus spp.*, and *Staphylococcus aureus*). Commensal organisms from non-human sources (animals, water, food, or the environment) may also transmit resistance determinants to human pathogens; the commensals themselves may also be pathogenic in immunosuppressed hosts. It is important to note that the transmission of such organisms or their genes need not be demonstrated; rather, it is considered sufficient that the potential for such transmission exists.

3. Interpretation of categorization

Critically important: Antimicrobial classes which meet both C1 and C2 are termed *critically important* for human medicine.

Highly important: Antimicrobial classes which meet either C1 or C2 are termed *highly important* for human medicine.

Important: Antimicrobial classes used in humans which meet neither C1 nor C2 are termed *important* for human medicine.

The list below is meant to show examples of members of each class of drugs, and is not meant to be inclusive of all drugs. Not all drugs listed in a given class have necessarily been proven safe and effective for the diseases listed.

Table 1. List and classification of antimicrobials important for human medicine

Antimicrobial class	Example of drug(s)
CRITICALLY IMPORTANT ANTIMICROBIALS	
Aminoglycosides	gentamicin
Ansamycins	rifampicin
Carbapenems and other penems	meropenem
Cephalosporins (3rd, 4th and 5th generation)	ceftriaxone, cefepime, ceftaroline
Glycopeptides	vancomycin
Glycylcyclines	tigecycline
Lipopeptides	daptomycin
Macrolides and ketolides	erythromycin, telithromycin
Monobactams	aztreonam

Antimicrobial class	Example of drug(s)
Oxazolidinones	linezolid
Penicillins (natural, aminopenicillins, and antipseudomonal)	ampicillin
Phosphonic acid derivatives	fosfomycin
Polymyxins	colistin
Quinolones	ciprofloxacin
Drugs used solely to treat tuberculosis or other mycobacterial diseases	isoniazid
HIGHLY IMPORTANT ANTIMICROBIALS	
Amidinopenicillins	mecillinam
Amphenicols	chloramphenicol
Cephalosporins (1^{st} and 2^{nd} generation) and cephamycins	cefazolin
Lincosamides	clindamycin
Penicillins (anti-staphylococcal)	oxacillin
Pseudomonic acids	mupirocin
Riminofenazines	clofazimine
Steroid antibacterials	fusidic acid
Streptogramins	quinupristin/dalfopristin
Sulfonamides, dihydrofolate reductase inhibitors and combinations	sulfamethoxazole, trimethoprim
Sulfones	dapsone
Tetracyclines	chlortetracycline
IMPORTANT ANTIMICROBIALS	
Aminocyclitols	spectinomycin
Cyclic polypeptides	bacitracin
Nitrofurantoins	nitrofurantoin
Nitroimidazoles	metronidazole
Pleuromutilins	retapamulin

4. Prioritization within the Critically Important category

Antimicrobials within the critically important category are prioritized to assist in allocating resources towards agents for which risk-management strategies are needed most urgently (see section 8 for more details). The following three criteria are used for prioritization:

Prioritization criterion 1 (P1): *High absolute number of people, or high proportion of use in patients with serious infections in health care settings affected by bacterial diseases for which the antimicrobial class is the sole or one of few alternatives to treat serious infections in humans.*

Prioritization criterion 2 (P2): *High frequency of use of the antimicrobial class for any indication in human medicine, or else high proportion of use in patients with serious infections in health care settings, since use may favour selection of resistance in both settings.*

Prioritization criterion 3 (P3): *The antimicrobial class is used to treat infections in people for which there is evidence of transmission of resistant bacteria (e.g., non-*

typhoidal Salmonella and Campylobacter spp.) or resistance genes (high for E. coli and Enterococcus spp.) from non-human sources.

Explanation: The first two prioritization criteria relate to the volume of antimicrobial use in humans. Increased volume of use directly relates to the development of resistance and, therefore, poses a greater threat to their use as sole therapies. Furthermore, humans receiving antimicrobials for any indication have a greater susceptibility to acquiring infection by a foodborne pathogen resistant to those antimicrobial agents.

The third prioritization criterion relates to transmission. Risk-management strategies are most urgently needed in situations where evidence suggests that the transmission of resistant bacteria or resistance genes from non-human sources is already occurring, or has occurred previously.

Antimicrobial classes that meet all three prioritization criteria (P1, P2, and P3) are considered the *highest priority critically important antimicrobials*.

Changes in prioritization criteria 2 (P2) were made for aminoglycosides, phosphonic acid derivatives, and polymyxins.

Table 3. Summary of classification and prioritization

Antimicrobial class	**Criterion**				
CRITICALLY IMPORTANT NTIMICROBIALS	**C1**	**C2**	**P1**	**P2**	**P3**
Highest Priority Critically Important Antimicrobials					
Cephalosporins (3rd, 4th and 5th generation)	Yes	Yes	Yes	Yes	Yes
Glycopeptides	Yes	Yes	Yes	Yes	Yes
Macrolides and ketolides	Yes	Yes	Yes	Yes	Yes
Polymyxins	Yes	Yes	Yes	Yes	Yes
Quinolones	Yes	Yes	Yes	Yes	Yes
High Priority Critically Important Antimicrobials					
Aminoglycosides	Yes	Yes	No	Yes	Yes
Ansamycins	Yes	Yes	Yes	Yes	No
Carbapenems and other penems	Yes	Yes	Yes	Yes	No
Glycylcyclines	Yes	Yes	Yes	No	No
Lipopeptides	Yes	Yes	Yes	No	No
Monobactams	Yes	Yes	Yes	No	No
Oxazolidinones	Yes	Yes	Yes	No	No
Penicillins (natural, aminopenicillins, and antipseudomonal)	Yes	Yes	No	Yes	Yes
Phosphonic acid derivatives	Yes	Yes	Yes	Yes	No
Drugs used solely to treat tuberculosis or other mycobacterial diseases	Yes	Yes	Yes	Yes	No
HIGHLY IMPORTANT ANTIMICROBIALS	**C1**	**C2**			
Amidinopenicillins	No	Yes			
Amphenicols	No	Yes			
Cephalosporins (1st and 2nd generation) and cephamycins	No	Yes	NA		
Lincosamides	No	Yes			
Penicillins (anti-staphylococcal)	No	Yes			

Antimicrobial class	Criterion		
Pseudomonic acids	No	Yes	
Riminofenazines	Yes	No	
Steroid antibacterials	No	Yes	
Streptogramins	No	Yes	

Antimicrobial class	Criterion		
Sulfonamides, dihydrofolate reductase inhibitors and combinations	No	Yes	
Sulfones	Yes	No	
Tetracyclines	Yes	No	
IMPORTANT ANTIMICROBIALS	**C1**	**C2**	
Aminocyclitols	No	No	
Cyclic polypeptides	No	No	
Nitrofurantoins	No	No	NA
Nitroimidazoles	No	No	
Pleuromutilins	No	No	

5. Highest Priority Critically Important Antimicrobials

These are the classes of drugs that met all three priorities (P1, P2, and P3): quinolones, third- and fourth- and fifth-generation cephalosporins, macrolides and ketolides, glycopeptides and polymyxins.

Quinolones are known to select for quinolone-resistant *Salmonella* and *E. coli* in animals. At the same time, quinolones are one of few available therapies for serious *Salmonella and E. coli* infections. Given the high incidence of human disease due to *Salmonella* and *E. coli*, the absolute number of serious cases is substantial.

Cephalosporins (3rd and higher generation) are known to select for cephalosporin-resistant Salmonella *and* E. *coli in* animals. At the same time, third- and higher generation cephalosporins are one of few available therapies for serious *Salmonella* and *E. coli* infections in humans, particularly in children. Given the high incidence of human disease due to *Salmonella and E. coli*, the absolute number of serious cases is substantial.

Macrolides and ketolides are known to select for macrolide-resistant *Campylobacter* spp. in animals, especially *Campylobacter jejuni in* poultry. At the same time, macrolides are one of few available therapies for serious *Campylobacter* infections, particularly in children, for whom quinolones are not recommended for treatment. Given the high incidence of human disease due to *Campylobacter* spp., especially *Campylobacter jejuni,* the absolute number of serious cases is substantial.

Glycopeptides areknown to select for glycopeptide-resistant Enterococcus *spp.* in food animals (e.g. when avoparcin was used as a growth promoter, vancomycin- resistant enterococci (VRE) developed in food animals and were transmitted to people). At the same time, glycopeptides are one of the few available therapies for serious enterococcal infections. Given the high number of cases, the previously documented occurrence of transmission of VRE to people from food animals, and the very serious consequences of

treatment failures in such cases, glycopeptides are classified as being of the highest priority.

Polymyxins (e.g. colistin) are known to select for plasmid mediated polymyxin- resistant *E. coli* in food animals. At the same time, intravenous polymyxins are one of few available therapies for serious Enterobactericeae *and Pseudomonas aeruginosa* multi-resistant infections in people in healthcare settings in many countries, especially in seriously ill patients in critical care. Given the high incidence of human disease due to *Enterobactericiae*, the absolute number of serious cases where colistin is needed can be considered substantial.

Reference:

1. Joint FAO/OIE/WHO expert workshop on non-human antimicrobial usage and antimicrobial resistance: scientific assessment. Food and Agriculture Organization of the United Nations/World Organisation for Animal Health/World Health Organization. 2003. (http://apps.who.int/iris/bitstream/10665/68883/1/WHO_CDS_CPE_ZFK_2004.7.pdf?ua=1 , accessed 10 April 2017).

2. Second joint FAO/OIE/WHO expert workshop on non-human antimicrobial usage and antimicrobial resistance: management options. Food and Agriculture Organization of the United Nations / World Organisation for Animal Health / World Health Organization. 2004.
3. (http://apps.who.int/iris/bitstream/10665/68701/1/WHO_CDS_CPE_ZFK_2004.8.pdf?ua=1, accessed 10 April 2017).

4. Joint FAO/WHO/OIE expert meeting on critically important antimicrobials. Report of the FAO/WHO/OIE Expert meeting. Food and Agriculture Organization of the United Nations / World Organisation for Animal Health / World Health Organization. 2007. (ftp://ftp.fao.org/docrep/fao/010/i0204e/i0204e00.pdf, accessed 10 April, 2017).

Appendix-v

Dose Calculations and Units

Accurate dosing is critical to the proper utilization of all pharmaceuticals. To calculate the correct dose of drug you need to know the concentration of the drug, the weight of the animal, and the recommended dose rate of the drug in question for the specific animal you are administering the drug to.

Units of measurements

SI unit is another name for the metric system of measurement. The aim of metrication is to make calculations easier than with the imperial system (which includes ounces, pounds, stones, inches, pints etc). SI stands for *Systeme Internationale* and it is now recognized as the standard system for measurement in most disciplines around the world. The SI system defines a base unit for a particular measurement (for example the gram for measuring weight) and a prefix (e.g. kilo, milli) when the actual numbers in the measurement become very large or very small. For example, one millionth of a gram could be written as 0.000001g or 1mcg. The second version is easier to read than the first and easier to work with once you understand how to use units and prefixes. It is also less likely to lead to errors, especially when administering drug doses.

Conversion table:

Kilogram	Hectogram	Decagram	Gram	Decigram	Centigram	Milligram
1	0	0	0	0	0	0
	1	0	0	0	0	0
		1	0	0	0	0
			1	0	0	0
				1	0	0
					1	0

1 gram = 1000 milligrams and 1 milligram =1000 micrograms

300mg = 0.3g 0.5g = 500mg 750micrograms = 0.75 mg

2500ml = 2.5l 0.025m = 25mm 0.05mg = 50 micrograms

Common routes of drug administration include:

a) Oral administration

b) Parenteral administration

- Intravenous
- Intramuscular
- Subcutaneous
- Intraperitoneal
- Intrathoracic
- Intradermal

c) Inhalation (pulmonary route)

d) Topical administration (local application)

PharmaceuticalProprietary Preperations are often expressed as:

Percentage: It simply means per hundred. 5% means 5 parts of the active ingredient in 100 parts of theProprietary Preperations. For example, a 10% solution of xylazine is 100mg/ml and a 2% solution of xylazine is 20mg/ml. Percentage concentration of the drug is expressed in 3 ways.

- **Weight in weight (w/w):** Is the percentage of solids in solids. E.g. Ointments and powders. However, percentage solutions of solids in liquids are rarely made weight in weight (e.g. when both solids and liquids are taken in weight).
- **Weight in volume (w/v):** Percentage solutions of liquids are usually made weight in volume. These types of percentage solutions are common in pharmacy where solids are taken by weight and liquids are taken by volume. eg. Mixtures and lotions. **mg/ml -** Manufacturers usually provide concentrations of their product in milligrams (mg) of drug per (ml) of solvent.
- **Volume in volume (v/v):** Percentage solutions of liquids are usually made volume in volume. Since both solute and the solvent liquid are taken by volume, use of same subunit of volume for both is essential. Eg. Emulsions and spirits.

Parts per million (ppm): This is the way of expressing strength particularly concentrations of very diluteProprietary Preperations. A 1ppm solution contains one part of the solute in one million parts of solution. It is important that two parts must have same units except in metric system where 1gm = 1ml.

International unit (IU):

International Units per ml of solvent are used for someProprietary Preperations like penicillin and some of the fat soluble vitamins. This is actually a measurement of activity and doses use the same unit of measure to make calculations easier.

Powders:

You may receive drugs in a powdered form and be given the milligram/gram of active drug in the vial. For example, Dicrysticin sulfate comes in powdered form with 2.5gm (2500mg) per vial.

Percent solutions:

One part of a substance solid or liquid mixed with 99 parts of a solvent to make a total of 100 parts of the prescribed formulation makes 1-% solution. In metric system 1gm of solid or 1ml of a liquid dissolved in 99 ml of solvent to make 100 ml of prepared solution makes 1-% solution.

Examples of solution of various strength:

Strength percentage

1 in 1 (100%)
1 in 10 (10%)
1 in 100 (1%)
1 in 1000 (0.1%)
1 in 10,000 (0.01%)

To convert into percentage

1 in 400 = 1/400 X 100 = 0.25%
1 in 700 = 1/700 X 100 = 0.143%
1 in 2500 = 1/2500 X 100 = 0.04%
3 in 1000 = 3/1000 X 100 = 0.3%

Some examples of calculations:

Anaesthetics

Thiopentone sodium injection: Calculate the total dose for a dog weighing 12kg at the dose rate of 25mg/kg body weight! For safety reasons the drug should be administered as 2.5% solution.

Comes as 0.5gm vial, dose rate is 25mg/kg as 2.5% solution and body weight of animal is 12kg.

To prepare 2.5% solution

2500mg in 100ml 2.5% solution
500mg in X (?) ml 2.5% solution
= 100 X 500/2500
= 20ml
= 25mg/ml

Total dose required

= 12 X 25
= 300mg

Therefore, total dose will be 300/25

=12ml.

Xylazine hydrochloride:

Comes as 2% solution
Required dose rate is 1mg/kg
To be given for 10 kg dog.
Total dose required 1X10 = 10mg
Solution contains 20mg/ml
= 0.5ml

Ø **Antibiotics**

Example:

The conc. of antibiotic is 50 mg/ml
Dose rate is 5mg/kg body weight
The weight of the animal is 300 kg.

Calculation:

The animal weighing 300 kg @ dose rate of 5 mg/kg body wt. = 1500 mg
The conc. of antibiotic is 50 mg/ml,
Therefore the animal of 300 kg requires = 1500/50 =30 ml of antibiotic.

Ø **Deworming drugs**

Example:

A cow suffering with chronic diarrhea is found to have 500epg of fasciola. Using Triclabendazole 900 mg bolus, find the quantity of bolus to be given to the animal weighing 430 kg at the dose rate of 10mg/kg body wt. Solution:

Dosage = 430 kg x 10mg/kg body wt = 4300 mg

As one bolus contains 900 mg of triclabendazole, 4300 mg will be in = 4300/900 = 5 bolus approximately.

Ø **Dilution of liquids**

The basic formula

Concentration of final solution (% or ratio)
Total quantity of stock solution = …… X Total quantity of Concentration of stock Final solution.

Solution (% or ratio)

Example:

We have cythion with stock concentration of 50%. Making a total of 5 litres of diluted solution, how much quantity of cythion we need to mix with water to make a final concentration of 2%?

Solution:

Concentration of stock cythion……..50%
Concentration of final solution……2 %

Total quantity of final solution……..5 litres (5000 ml)

Substituting in the above formula:
2
X (?) = **……** X 5000 ml = 2/50 x 5000 = 200 ml. Of stock cythion
50
i.e. add 200 ml of stock cythion in 4800 ml of water to make 2% final concentration of cythion.

Example:

Make a 1/200 dilutions of a neat sample in a final volume of 4 ml.
4000 = 200 x X (4ml = 4000 µl)
X= 4000/200 = 0.02 ml (20 µl)
i.e. 0.02 ml of neat sample in 3.98 ml water or 20 µl in 3980 µl of water.

Intravenous Drips:

The rate of flow of fluid down intravenous infusion lines must be regulated and this is often controlled by a device known as an infusion controller. The controller measures precise volumes of liquid and releases tiny droplets, each of exactly the same volume, down the IV line (tube) at precise intervals. The infusion controller has a thumb-wheel which allows the operator to alter the flow of liquid. Some controllers require you to set the Flow Rate, which is measured in Millilitres per Hour. Others require you to set the Drip Rate, measured in Drips per Minute. It is important that you know which you are dealing with. This will be written on the machine itself. To calculate the Flow Rate, this is simply the volume in millilitre divided by the duration in hours. Both these values will be prescribed. Example: A dog requires 500ml IV infusion over twelve hours. What is the flow rate?

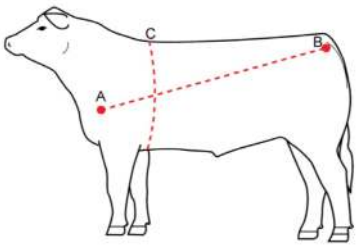
Answer: 500 divided by 12 is 41.66ml/hr. If you do not the facility to enter decimals then round to the nearest whole number. The answer would then be 42ml/hr.

Appendix-vi

How to Calculate Body Weight of Different Animals

Beef Cattle:

1. Measure the length of body, from the point-of-shoulder (A) to the point-of-rump or pin bone (B).
2. Measure the circumference or heart girth (C). Measure from a point slightly behind the shoulder blade, down the fore-ribs and under the body behind the elbow all the way around. After these measurements are made in inches – use the following formula.
1. (Heart girth X heart girth X body length) ÷ 300 = weight in pounds.

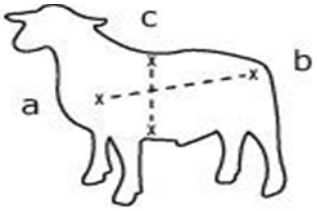


Example:

Heart girth (76") X heart girth (76") X body length (66") divided by 300 = 1,270 pounds.
76 X 76 = 5,776 and 5,776 X 66 = 381,216
381,216 divided by 300 = 1,270 pounds

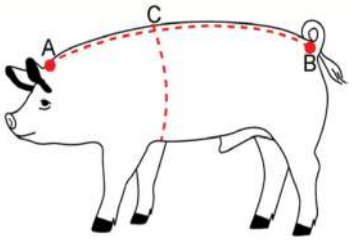
Sheep and Goats:

For sheep and goats, use the same method described for beef cattle. When working with unshorn sheep, be sure to part or compress the wool to insure an accurate heart girth measurement.



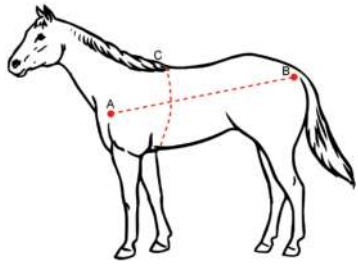
Hogs/Pigs:

1. Measure the length of body from A to B. Do this by restraining the animal and measuring the length of body from between the ears (poll) over the backbone to the base of the tail.
2. Measure the circumference (heart girth) of body (C). After these measurements are made in inches – use the following formula.
3. (Heart girth X heart girth X body length) ÷ 400 = weight in pounds



Note: For hogs weighing less than 150 pounds, add 7 pounds to the weight figure from this formula; for hogs weighing 150 to 400 pounds, no further adjustment is needed.

Horses:



1. Measure the length of body from, from the point-of-shoulder (A) to the point-of-rump (B).
3. Measure the circumference (heart girth) of body (C). Measure from the base of the withers, down under the belly, just behind the elbow and foreleg, and all the way back around. After these measurements are made in inches – use the following formula.
4. (Heart girth X heart girth X body length) ÷ 330 = weight in pounds.

Example:

Heart girth (70") X heart girth (70") X body length (65") divided by 330 = 965 pounds.
70 X 70 = 4,900 and 4,900 X 65 = 318,500
318,500 divided by 330 = 965 pounds

Tips for increasing Accuracy and Safety:

- Make certain the animal is standing squarely on level ground.
- Have someone stand on the opposite side to help with the girth measurement. Make sure the tape lays flat and is not twisted.
- Pull the tape snug.
- When using a weigh tape, position the tape according to the manufacturer's directions.
- A cloth measuring tape is preferred.
- You may need to restrain the pig or some feed may help you get the needed measurements.
- Be calm, don't rush in. Make sure the animal is comfortable with the measuring tape.
- When monitoring an animal's weight over time, it is best to have the same person using the same method.
- By following a set procedure, you will be able to monitor change that can be used as an indicator of health.
- The weight estimation formulas and weigh tapes may be used effectively for many animals, but are not highly accurate for pregnant animals or those with extreme conformational irregularities.
- Keep a record that you can refer back to over time.

References:

Arizona Cooperative Extension. Estimate Animal Weight from Body Measurement. University of Arizona. Q65.

Gibbs, P.G. and D.D. Householder. Estimating Horse Body Weight with a Simple Formula. Texas A & M University. http://smith-tx.tamu.edu/publications/hrg012-bodyweight.pdf

Appendix-vii

Pregnancy and Lactation

When prescribing, it must be borne in mind that medicines can harm the embryo or fetus at any time during pregnancy. Therefore, the expected benefit to the mother must outweigh the risk to the fetus. Drugs commonly used in pregnancy that generally appear safe should be preferred to new or unproven drugs. Below is a list of medications to avoid or use cautiously during pregnancy. However, excluding a drug from the list does not mean it is safe. The US Food and Drug Administration (FDA) has classified all drugs into six categories based on human and animal studies, which have a good impact on safety and are easier to understand. Therefore, the FDA's pregnancy drug category is listed here for quick access. While Category A represents the safest drug, Category X represents potentially harmful drugs that must be avoided. While no risk to the fetus has been demonstrated for category B drugs, category C drugs have adversely affected the fetus in animal reproduction studies. However, no adequate and well-controlled human studies exist for category B and C medicinal products. There is positive evidence of a risk to the human fetus from category D drugs.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Abacavir	C	All treatment options need careful assessment.
Aceclofenac	D	Avoid the use of NSAIDs during pregnancy or avoid them unless the potential benefit outweighs the risk. It should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn.**3**
Acemetacin	D	Avoid the use of NSAIDs during pregnancy or avoid them unless the potential benefit outweighs the risk. It should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn.
Acetazolamide	C	Toxicity in animal studies; avoid, especially in first trimester.
Acetylcysteine	B	Acetylcysteine is only recommended for use during pregnancy when benefit outweighs risk.
Acetylsalicylic acid or Aspirin	D	Aspirin inhibits prostaglandin synthesis. When given late in pregnancy, it may cause premature closure of the fetal ductus arteriosus, delay labour and birth. Aspirin increases the bleeding time both in the newborn infant and in the mother because of its antiplatelet effects. Products containing aspirin should be avoided in the last trimester.
Acitretin	X	Avoid—teratogenic; effective contraception must be used
Acrivastine	B	No evidence of teratogenicity except for hydroxyzine where toxicity has been reported with high doses in animal studies. The use of sedating antihistamines in the latter part of the third trimester may cause adverse effects in neonates such as irritability, paradoxical excitability and tremor.
Acyclovir	B	Avoid unless the potential benefit outweighs the risk; limited absorption from topicalProprietary Preperations.
Adefovir dipivoxil	C	Toxicity in animal studies, avoid unless the potential benefit outweighs the risk; effective contraception needed during treatment

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Adenosine	C	Large doses may produce fetal toxicity; use only if the potential benefit outweighs the risk.
Adrenaline	C	May reduce placental perfusion and can delay 2nd stage of labor; use only if benefit outweighs risk
Albendazole	C	Should not be used in pregnant animal xcept in clinical circumstances where no alternative management is appropriate.
Alendronate sodium	C	Avoid.
Alendronic acid	C	Avoid.
Alfuzosin	B	Alfuzosin should only be given during pregnancy when need has been clearly established.
Aliskiren	D	Avoid, no information available; other drugs acting on the renin-angiotensin system have been associated with fetal malformations and neonatal death.
Amantadine	C	Avoid; toxicity in animal studies.
Ambrisentan	X	Avoid (teratogenic in animal studies); pregnant animals should not be treated with this drug and effective contraception during treatment is mandatory; monthly pregnancy tests recommended.
Amikacin	D	Chance of damage of 8th cranial nerve; if prescribed then monitor plasma concentration. **2,3**
Amiloride	B	Avoid. **1,2,3**
Aminocaproic acid	C	Aminocaproic acid is only recommended for use during pregnancy when benefit outweighs the risk.
Aminophylline	C	Asthma should be well controlled during pregnancy, the manufacturer makes no recommendation regarding use during pregnancy.
Amiodarone	D	Possible risk of neonatal goiter; use only if no alternative is available.
Amitriptyline	C	Use only if potential benefit outweighs risk
Amlexanox	B	Should be used during pregnancy only if clearly needed.
Amlodipine	C	Avoid, but risk to fetus should be balanced against risk of uncontrolled maternal hypertension.
Amoxicillin	B	Not known to be harmful
Amphotericin	B	Avoid unless potential benefit outweighs risk.
Anastrozol	D	Avoid.
Aripiprazole	C	Use only if potential benefit outweighs risk.
Artemether with lumefantrine	C	Toxicity in animal studies with artemether. Use is contraindicated during the first trimester of pregnancy. It should only be used if the potential benefit outweighs the risk. (**1**)
Artesunate		Use only if the potential benefit outweighs the risk.
Asenapine	C	Use only if the potential benefit outweighs the risk, toxicity in animal studies.
Atenolol & acebutolol	D	Cause intrauterine growth retardation, neonatal hypoglycemia and bradycardia. (**3**)
Atomoxetine	C	Avoid unless potential benefit outweighs risk.
Atorvastatin	X	Should be avoided in pregnancy as congenital anomalies have

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		been reported and the decreased synthesis of cholesterol possibly affects fetal development. Adequate contraception is required during treatment and for 1 month afterwards.
Atracurium	C	Avoid unless benefit outweighs risk. There may be fetal distress (slower to start breathing). (**1,2)**
Atropine	C	Prescribe with caution.
Azathioprine	C	The treatment should not be started during pregnancy. Evidence that this drug is teratogenic and delays intrauterine growth **(1,2,3)**
Azelaic Acid	B	Should only be used during pregnancy when need has been clearly established.
Azilsartan medoxomil	C	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Azithromycin	B	No adverse fetal outcomes were reported.
Aztreonam	B	Avoid unless essential.
Bacitracin	C	Potential benefits may warrant use of the drug in pregnant animal despite potential risks.
Baclofen	C	Potential benefits may warrant use of the drug in pregnant animal despite potential risks.
Benzalkonium Chloride	N	Prescribe with caution.
Benzocaine	C	Benzocaine topical is only recommended for use during pregnancy when benefit outweighs the risk.
Betahistine hydrochloride	B	Manufacturers advise to avoid.
Betaine	C	Avoid; the manufacturer recommends effective contraception during and for at least 1 month after treatment.
Betamethasone	C	Transient effect on fetal movements and heart rate.
Betaxolol	C	Use when benefit outweighs risk.
Bevacizumab	C	Avoid, toxicity in animal studies; effective contraception required during and for at least 6 months after treatment.
Bimatoprost	C	Use only if potential benefit outweighs risk.
Bisacodyl	B	Animal studies have failed to reveal evidence of teratogenicity or fetotoxicity.
Bismuth subcitrate/subsalicylate	X	Avoid.
Bisoprolol fumarate	C	Beta-blockers may cause intra-uterine growth restriction, neonatal hypoglycemia, and bradycardia; the risk is greater in severe hypertension. If beta-blockers are used close to delivery, infants should be monitored for signs of beta-blockade. (and alpha-blockade with labetalol or carvedilol).
Bosentan	X	Avoid (teratogenic in animal studies); effective contraception required during administration (hormonal contraception not considered effective); monthly pregnancy tests are advised.
Brinzolamide	C	Avoid; toxicity in animal studies.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Bromfenac	C	Should be avoided during late pregnancy.
Bromocriptine	B	Exclude pregnancy before starting treatment and stop 1 month before the intended conception. Discontinue if pregnancy occurs during treatment (specialist advice required). .
Bumetanide	C	Avoid, should not be used to treat gestational hypertension because of the maternal hypovolemia associated with this condition.
Bupivacaine	C	High doses during delivery can cause neonatal respiratory depression, hypotonia, and bradycardia after epidural block; use lower doses for intrathecal use during late pregnancy.
Buprenorphine	C	Acute withdrawal of opioids should be avoided in pregnancy because it can cause fetal death. Opioid substitution therapy is recommended during pregnancy because it carries a lower risk to the fetus than continued use of illicit drugs.
Bupropion hydrochloride	C	Manufacturer advises to avoid.
Buspirone hydrochloride	B	Manufacturer advises to avoid.
Busulphan	D	Avoid; toxicity in animal studies; effective contraceptive measure must be taken during administration
Butenafine	B	Use only if benefit outweighs risk.
Calcitonin	C	Avoid unless benefit outweighs risk; toxicity in animal studies.
Candesartan cilexetil	D	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Capecitabine	D	Animals should not be pregnant while receiving treatment with it.
Capsaicin	B	Should be used during pregnancy only when benefit outweighs risk.
Captopril	D	Avoid; may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios; toxicity in animal studies. (**1, 2, 3)**
Carbamazepine	D	Teratogenic; increased risk of neural tube defects if used in first trimester; neonatal bleeding if used in third trimester. **(1, 3)**
Carbimazole		Neonatal goiter and hypothyroidism if used in second or third trimester. (**2,3)**
Carbocysteine		Avoid. (**1)**
Carboplatin	D	Avoid.
Carvedilol	C	Beta-blockers may cause intra-uterine growth restriction, neonatal hypoglycemia, and bradycardia; the risk is greater in severe hypertension. Information on the safety of carvedilol during pregnancy is lacking. If beta-blockers are used close to delivery, infants should be monitored for signs of beta-blockade (and alpha-blockade with labetalol or carvedilol).
Cefaclor	B	Not known to be harmful.
Cefadroxil	B	Not known to be harmful.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Cefdinir	B	Should be given during pregnancy only if need is clearly established.
Cefditoren	B	Recommended for use during pregnancy when benefit outweighs risk.
Cefepime	B	Should only be given in pregnancy when the need has been clearly established.
Cefotaxime	B	Should be given during pregnancy only if need is clearly established.
Cefoxitin	B	Should be given during pregnancy only if need is clearly established.
Cefpodoxime	B	Should only be given in pregnancy when the need has been clearly established.
Cefprozil	B	Recommended for use during pregnancy when benefit outweighs the risk.
Ceftazidime	B	Should only be given in pregnancy when the need has been clearly established.
Ceftriaxone	B	Should only be given in pregnancy when the need has been clearly established.
Cefuroxime	B	Manufacturers advise to avoid.
Celecoxib	D	Avoid (teratogenic in animal studies).
Cephalexin	B	Should only be given in pregnancy when the need has been clearly established.
Cephradine	B	Should only be given in pregnancy when the need has been clearly established.
Cetirizine hydrochloride	B	No evidence of teratogenicity except for hydroxyzine where toxicity has been reported with high doses in animal studies. The use of sedating antihistamines in the latter part of the third trimester may cause adverse effects in neonates such as irritability, paradoxical excitability and tremor. (**3**)
Cetrimide	B	Not known to do any harm.
Chloramphenicol	C	Avoid; Grey baby syndrome may occur. (**3)**
Chlorhexidine gluconate	B	Should only be given in pregnancy when the need has been clearly established.
Chloroquine phosphate	N	Prescribe with caution; potential teratogenic effect; in malaria when the benefit outweighs the risk.**(1,3)**
Chloroxylenol		outweighs the risk.
Chlorpheniramine maleate	B	No evidence of teratogenicity except for hydroxyzine where toxicity has been reported with high doses in animal studies. The use of sedating antihistamines in the latter part of the third trimester may cause adverse effects in neonates such as irritability, paradoxical excitability and tremor. **(1)**
Chlorpromazine	C	Prescribe with caution; possibility of lethargy an extrapyramidal effect due to slow elimination. (**3)**
Chlorpromazine hydrochloride	C	Extrapyramidal effects and withdrawal syndrome have been reported occasionally in the neonate when antipsychotic drugs are taken during the third trimester of pregnancy. Following maternal use of antipsychotic drugs in the third trimester, neonates should be monitored for symptoms including agitation,

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		hypertonia, hypotonia, tremor, drowsiness, feeding problems, and respiratory distress. **(3)**
Chlortetracycline	B	Should be used only if benefit outweighs the risk.
Chlorthalidone	B	Should not be used, may cause neonatal thrombocytopenia, bone marrow suppression, jaundice, electrolyte disturbances and hypoglycemia.
Ciclesonide	C	Only recommended for use during pregnancy when there are no alternatives.
Cilastatin	C	Should be used only if benefit outweighs the risk.
Cilostazol	C	An increase in the incidence of stillbirth and of cardiovascular, renal, and skeletal defects has been reported in animal. Should be used only if benefit outweighs the risk.
Cimetidine	B	Avoid unless benefit outweighs risk.
Cinacalcet	C	Patient taking the drug should be under observation.
Cinnarizine	C	Most manufacturers of antihistamines advise avoiding their use during pregnancy; however, there is no evidence of teratogenicity. The use of sedating antihistamines in the latter part of the third trimester may cause adverse effects in neonates such as irritability, paradoxical excitability, and tremor.
Ciprofloxacin	C	Prescribe with caution. (**1, 2, 3)**
Cisatracurium	B	Non-depolarizing neuromuscular blocking drugs are highly ionized at physiological pH and are therefore unlikely to cross the placenta in significant amounts. Contact with physician before use.
Cisplatin	D	Avoid; toxicity in animal studies.
Citalopram	C	SSRIs should not be used during pregnancy unless the potential benefit outweighs the risk. There is small increased risk of congenital heart defects when SSRIs are taken during early pregnancy. If SSRIs are of neonatal withdrawal symptoms, and persistent pulmonary hypertension in the newborn has been reported.
Citicoline	D	Avoid.
Clarithromycin	C	Avoid unless potential benefit outweighs risk.
Clindamycin	B	Use when benefit outweighs risk.
Clioquinol	C	Potential benefits may warrant use of the drug in pregnant animal despite potential risks.
Clobazam	C	Use during pregnancy when benefit outweighs risk. Avoid in late pregnancy. **(3)**
Clobetasol propionate	C	Use when there are no alternatives.
Clomifene citrate	X	Exclude pregnancy before treatment; possible effects on fetal development.
Clomipramine	C	Neonatal withdrawal symptoms reported if used during third trimester.
Clonazepam	D	Risk of neonatal withdrawal symptoms when benzodiazepines are used during pregnancy. Avoid regular use and use only if a clear indication such as seizure control. High doses administered during late pregnancy or labor may cause neonatal hypothermia,

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		hypotonia and respiratory depression.
Clonidine hydrochloride	C	Use when benefit outweighs risk.
Clopidogrel	B	Use when the need is clearly established.
Cloprostenol		Use with caution.
Clotrimazole	B	Use when established need is clearly. No proven risk in human.
Cloxacillin	B	Use when established need is clearly. No proven risk in human.
Clozapine	B	Potential benefit should outweigh the potential risk.
Colestipol hydrochloride	N	Should be used with caution as although the drugs are not absorbed, they may cause fat-soluble vitamin deficiency on prolonged use.
Colistin sulphate	C	Use only if benefit outweighs risk.
Crotamiton	C	Avoid especially during the first trimester. 1
Cyanocobalamin	C	Administer as recommended dose.
Cyclizine	B	Use only if benefit outweighs risk. However, there is no evidence of teratogenicity.
Cyclobenzaprine	B	Use of drug is not recommended unless clearly needed.
Cyclopentolate	C	Discuss with physician before use.
Cyclophosphamide	D	Avoid; evidence of embryotoxicity and fetotoxicity.
Cyclosporine	C	Evidence of toxicity in animals. Use with caution.
Cypermethrin	C	Evidence of toxicity in animals. Use with caution.
Cytarabine	D	Most of the manufacturers advises to avoid.
Danazol	X	Avoid; has weak androgenic effects and virilisation of female fetus reported.
Dactinomycin	X	Avoid; teratogenic in animal studies.
Dapsone	C	Neonatal hemolysis and methemoglobinemia; adequate Folate supplements should be given to mother.
Darifenacin	C	Only recommended for use during pregnancy when benefit outweighs risk.
Daunorubicin	D	Avoid; teratogenic and carcinogenic in animal studies.
Deferasirox	B	Use only when the need is established.
Deferiprone	D	Animals should not be pregnant when taking deferiprone.
Demeclocycline	D	Only recommended for use during pregnancy when there are no alternatives and benefit outweighs risk.
Desferrioxamine	C	Toxicity in animal studies.
Desloratadine	C	No evidence of teratogenicity except for hydroxyzine where toxicity has been reported with high doses in animal studies. The use of sedating antihistamines in the latter part of the third trimester may cause adverse effects in neonates such as irritability, paradoxical excitability and tremor.
Desmopressin	C	Small oxytocic effect if used in third trimester.
Desogestrel	X	Avoid.
Desonide	C	Should only be used during pregnancy when benefit outweighs risk.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Dexamethasone	C	The benefit of treatment with corticosteroids during pregnancy and breast-feeding outweighs the risk; pregnant animals with fluid retention should be monitored closely.
Dexibuprofen	C	Should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn.
Dexketoprofen	C	Should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn.
Dexlansoprazole	B	No evidence of human toxicity, use with caution.
Dexpanthanol	C	Discuss with physician before use.
Dextran 70	C	Avoid , reports of anaphylaxis in mother.
Dextromethorphan	C	Prescribe with caution.
Dextromethorphan	C	Use when benefit outweighs risk.
Diacerein	N	Contraindicated in pregnancy.
Diazepam	N	Prescribe with caution; neonatal withdrawal symptoms or floppy instant syndrome may develop if used in third trimester.
Dibromopropamidine isethionate	N	Avoid; no information available.
Diclofenac	D	Avoid unless benefit outweighs risk.
Dicloxacillin	B	Use when the need is clearly established.
Dicycloverine hydrochloride	C	Use when no alternative is available.
Diethylstilbestrol	C	In first trimester, high doses associated with vaginal carcinoma, urogenital abnormalities and reduced fertility in female offspring; increased risk of hypospadias in male offspring.
Diflorasone diacetate	C	Consult with physician before use.
Digoxin	C	Dosage adjustment is required.
Dihydroergotamine		Oxytocic effects on pregnant uterus. **1, 2, 3**
Diloxanide fuorate	C	Avoid.
Diltiazem hydrochloride	C	Avoid; teratogenic in animal studies.
Dimethothiazine mesylate	C	Avoid.
Dinoprostone	C	Use during pregnancy when benefit outweighs risk.
Diosmin	B	No evidence of toxicity. Use with caution.
Diphenhydramine	B	Use only if potential benefit outweighs risk.
Dipyridamole	B	Use only if potential benefit outweighs risk.
Disopyramide	C	Avoid; may induce labor due to uterine contraction if used in third trimester.
Dobutamine	B	Use only if potential benefit outweighs risk.
Docetaxel	D	Avoid; toxicity in animal studies.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Docosanol	N	Consult with physician before use.
Domperidone	N	Avoid.
Donepezil hydrochloride	C	Use only if potential benefit outweighs risk.
Dopamine hydrochloride	C	Use only if potential benefit outweighs risk.
Dorzolamide	C	Use only if potential benefit outweighs risk.
Doxepin	C	Use with caution.
Doxorubicin hydrochloride	D	Avoid; teratogenic in animal studies.
Doxycycline	D	When travel to malarious areas is unavoidable during pregnancy, doxycycline can be used for malaria prophylaxis if other regimens are unsuitable and if the entire course of doxycycline can be completed before 15 weeks gestation.
Dronedarone	X	Avoid, toxicity in animal studies.
Drospirenone	X	Avoid.
Drotaverine hydrochloride	C	Use only if potential benefit outweighs risk.
Duloxetine	C	Toxicity in animal studies, use only if potential benefit outweighs risk; risk of neonatal withdrawal symptoms.
Dutasteride	X	Avoid.
Dydrogesterone	B	Use with caution.
Ebastine	B	Use with caution.
Econazole nitrate	C	Use only if potential benefit outweighs risk.
Efavirenz	D	Avoid (effective contraception required during treatment and for 12 weeks after treatment); use efavirenz only if no alternative available.
Enalapril maleate	D	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Enoxaparin	B	Manufacturer advises avoid.
Enrofloxacin	C	Use only if benefit outweighs risk.
Entacapone	C	Avoid.
Entecavir	C	Toxicity in animal studies, use only if potential benefit outweighs risk effective contraception required during treatment.
Ephedrine hydrochloride	C	Use only if benefit outweighs risk.
Epinastine hydrochloride	C	Use only if benefit outweighs risk.
Epirubicin hydrochloride	D	Use of epirubicin is not recommended unless there are no alternatives and benefit outweigh risk.
Eplerenone	B	Use only if needed clearly.
Epoetin	X	Avoid.
Eprosartan	D	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		renal function; skull defects and oligohydramnios have also been reported.
Eptifibatide	B	Use only if potential benefit outweighs risk.
Ergometrine maleate	X	Avoid.
Ergotamine		Oxytocic effects on pregnant uterus. **1, 2, 3**
Erlotinib	D	Avoid; harmful for fetus.
Ertapenem	B	Avoid; unless potential benefit outweighs risk.
Erythromycin	B	Avoid; unless potential benefit outweighs risk.
Escitalopram	C	Should not be used during pregnancy unless the potential benefit outweighs the risk. A small increased risk of congenital heart defects when SSRIs are taken during early pregnancy. If SSRIs are used during the third trimester a risk of neonatal withdrawal symptoms and persistent pulmonary hypertension in the newborn has been reported.
Eslicarbazepine acetate	C	Women of child-bearing potential should discuss with a specialist the impact of both epilepsy and its treatment, on the outcome of pregnancy. An increased risk of teratogenicity associated with the use of antiepileptic drugs (especially if used during the first trimester and particularly if the animal takes two or more antiepileptic drugs).
Esomeprazole	C	Use with caution.
Eszopiclone	C	Use only if potential benefit outweighs risk.
Ethambutol	C	Use only if potential benefit outweighs risk.
Ethosuximide	N	Women of child-bearing potential should discuss with a specialist the impact of both epilepsy and its treatment on the outcome of pregnancy.
Etodolac	C	Avoid during pregnancy or avoid unless the potential benefit outweighs the risk, should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn.
Etomidate	C	May depress neonatal respiration if used during delivery.
Etoposide	D	Avoid, teratogenic in animal studies.
Etoricoxib	X	Avoid.
Etravirine	B	Treatment of HIV infection in pregnancy aims to reduce the risk of toxicity to the fetus (although the teratogenic potential of most antiretroviral drugs is unknown) to minimize the viral load and disease progression in the mother and to prevent transmission of infection to the neonate.
Everolimus	D	Avoid.
Ezetimibe	C	Use only if potential benefit outweighs risk.
Famotidine	B	Avoid unless benefit outweighs risk.
Febuxostat	C	Avoid unless benefit outweighs risk.
Felodipine	C	Avoid.
Fenofibrate	C	Avoid , embryo toxicity in animal studies.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Fentanyl	C	Depress neonatal respiration; withdrawal effects in neonates of dependent mothers; gastric stasis and risk of inhalation pneumonia in mother during labor**. 3**
Fenticonazole nitrate	C	Use only if potential benefit outweighs risk.
Filgrastim	C	There have been reports of toxicity in animal studies and not to use granulocyte-colony stimulating factors during pregnancy unless the potential benefit outweighs the risk.
Finasteride	X	Unprotected intercourse may cause feminization of male fetus **1, 2, 3**
Flavoxate hydrochloride	B	Use during pregnancy when there are no alternatives and benefit outweighs risk.
Flucloxacillin	B	Use during pregnancy when there are no alternatives and benefit outweighs risk.
Fluconazole	C, D	Avoid; teratogenic, craniofacial and limb abnormality with long term high doses.
Fludrocortisone acetate	C	The benefit of treatment with corticosteroids during pregnancy and breast-feeding outweighs the risk; Pregnant animal with fluid retention should be monitored closely.
Fluocinolone acetonide	C	Avoid.
Fluorescein sodium	C	Use during pregnancy when there are no alternatives and benefit outweighs risk.
Fluorometholone	C	Only recommended for use during pregnancy when benefit outweighs risk.
Fluorouracil	X	Avoid.
Fluoxetine	C	Should not be used during pregnancy unless the potential benefit outweighs the risk. a small increased risk of congenital heart defects when SSRIs are taken during early pregnancy. If SSRIs are used during the third trimester a risk of neonatal withdrawal symptoms, and persistent pulmonary hypertension in the newborn has been reported.
Flupenthixol	C	Only recommended for use during pregnancy when benefit outweighs risk.
Fluphenazine hydrochloride	C	Prescribe with caution. **3**
Flurazepam	N	Prescribe with caution; discourage regular use.
Flurbiprofen	C	Avoid during pregnancy or avoid unless the potential benefit outweighs the risk, should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn.
Flutamide	D	Should only be given during pregnancy when there are no alternatives and benefit outweighs risk.
Fluticasone furoate	C	Prescribe with caution.
Fluvastatin	X	Avoid, teratogenic
Fluvoxamine	C	Should not be used during pregnancy unless the potential benefit

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
maleate		outweighs the risk, a small increased risk of congenital heart defects when SSRIs are taken during early pregnancy. If SSRIs are used during the third trimester a risk of neonatal withdrawal symptoms and persistent pulmonary hypertension in the newborn has been reported.
Folinic acid	C	Should only be given during pregnancy when there are no alternatives and benefit outweighs risk.
Follitropin alfa & beta	X	Avoid.
Formoterol fumarate	C	It is particularly important that asthma should be well controlled during pregnancy.
Frusemide	C	Should not be used to treat gestational hypertension because of the maternal hypovolemia associated with this condition.
Fusidic Acid	C	Use with caution.
Gabapentin	C	Women of child-bearing potential should discuss with a specialist the impact of both epilepsy and its treatment on the outcome of pregnancy, an increased risk of teratogenicity associated with the use of antiepileptic drugs (especially if used during the first trimester and particularly if the patient takes two or more antiepileptic drugs).
Gadodiamide	C	Use with caution.
Gadoversetamide	C	Should only be given during pregnancy when there are no alternatives and benefit outweighs risk.
Galantamine	C	Use with caution.
Ganciclovir	C	Avoid; women of childbearing potential should use effective contraception during ganciclovir therapy.
Gatifloxacin	C	Should only be given during pregnancy when there are no alternatives and benefit outweighs risk.
Gemcitabine	D	Avoid.
Gemefloxacin	C	Use with caution.
Gemfibrozil	C	Avoid; theoretical possibility of interference with embryonic growth and development due to anti-cholesterol effect.
Gentamicin	C, D	Avoid unless benefit outweighs risk; probably very small auditory or vestibular nerve damage. (**1, 2, 3)**
Glibenclamide		Insulin is substituted. (**3)**
Gliclazide	C	Insulin is substituted. (**3)**
Glimepiride	C	Avoid; toxicity in animal studies. (**3)**
Glipizide	C	Insulin is substituted.
Glycerin	C	Use with caution.
Glycopyrrolate	B	Use only when benefit outweighs risk.
Gonadorelin	B	Consult with physician.
Granisetron	B	Use during pregnancy when there are no alternatives and benefit outweighs risk.
Griseofulvin	C	Avoid; teratogenic. (**1, 2, 3)**
Guaiphenesin	C	Potential benefits may warrant use of the drug in pregnant animals despite potential risks.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Halcinonide	C	Potential benefits may warrant use of the drug in pregnant animals despite potential risks.
Halobetasol propionate	C	Potential benefits may warrant use of the drug in pregnant animals despite potential risks.
Haloperidol	C	Prescribe with caution; extra pyramid effects reported in neonates if administered in third trimester. (**3)**
Halothane		Depress neonatal respiration if administered in third trimester.
Heparin sodium	C	Safer than warfarin for fetus; mother may develop hemorrhage, thrombocytopenia; osteoporosis may develop after prolonged use.
Hexachlorophene	C	Use when benefit outweighs risk.
Homatropine hydrobromide	C	Use when benefit outweighs risk.
Hydrochlorothiazide	B	Not recommended to treat hypertension; causes neonatal thrombocytopenia if used in third trimester. (**3)**
Hydrocortisone	C	The benefit of treatment with corticosteroids during pregnancy and breast-feeding outweighs the risk; pregnant animals with fluid retention should be monitored closely.
Hydroquinone	C	Consult with physician before use.
Hydroxocobalamin	C	Use when benefit outweighs risk.
Hydroxyurea	D	Avoid.
Hydroxychloroquine	N	It is not necessary to withdraw an antimalarial drug during pregnancy if the rheumatic disease is well controlled; however, the manufacturer of hydroxychloroquine advises avoiding use.
Hydroxyzine hydrochloride	C	Avoid; may associate with fetal abnormality.
Hyoscine butyl bromide	C	Avoid unless benefit outweighs.
Hyoscine hydrobromide	C	Use only if potential benefit outweighs the risk, injection may depress neonatal respiration.
Hypromellose	X	Avoid.
Ibandronic Acid	C	Avoid unless benefit outweighs risk.
Ibuprofen	C,D	Avoid unless benefit outweighs risk. **3**
Idoxuridine	C	Toxicity in animal studies.
Ifosfamide	D	Avoid.
Imatinib	D	Avoid, potential benefits may warrant use of the drug in pregnant animals despite potential risks.
Imipramine hydrochloride	N	Tachycardia, irritability and muscle spasm in neonate. (**1, 2, 3)**
Indapamide	B	Prescribe with caution.(**1, 3)**
Indomethacin	C	Most avoid or avoid taking NSAIDs during pregnancy unless the potential benefit outweighs the risk. NSAIDs should be avoided during the third trimester as use is associated with the risk of obstruction of the fetal ductus arteriosus in utero and possible sustained pulmonary hypertension in the newborn.
Inositol	C	Avoid unless potential benefit outweighs risk.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Insulin	B	Dose should be adjusted frequently
Interferons	C	Avoid unless compelling reasons.
Iodixanol	B	Use with caution.
Iohexol	B	Use with caution.
Iopamidol	B	Use with caution.
Ipratropium bromide	B	It is particularly important that asthma should be well controlled during pregnancy.
Irbesartan	D	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Isoflurane	C	May depress neonatal respiration if used during delivery.
Isoniazid	C	Embryocidal effects were noted in both rats and rabbits after administration of isoniazid orally during pregnancy. While cases of suspected isoniazid induced anomalies have been reported, causality is unknown and retrospective analyses have failed to document significant teratogenic risk. It should only be given during pregnancy when need has been clearly established.
Isosorbide dinitrate	C	May cross placenta, avoid unless potential benefit outweighs risk.
Isosorbide mononitrate	C	Avoid unless potential benefit outweighs risk.
Isotretinoin	X	Topical retinoids are contra-indicated in pregnancy. women of child-bearing age must use effective contraception (oral progestogen-only contraceptives not considered effective).
Itraconazole	C	Use only in life threatening situations (toxicity at high doses in animal studies); ensure effective contraception during treatment and until the next estrus period following end of treatment.
Ivabradine	D	Avoid, toxicity in animal studies.
Ivermectin	C	Consult physician before use.
Ketamine	C	Depress neonatal respiration if used during delivery.
Ketoconazole	C	Teratogenicity in animal studies; packs carry a warning to avoid in pregnancy.
Ketoprofen	C	Toxicity in animal studies.
Ketorolac tromethamine	C	Avoid; manufacturer advises use only if potential benefit outweighs the risk.
Ketotifen	C	Prescribe with caution.
Levothyroxine sodium	A	Monitor maternal serum thyrotropin levels because levothyroxine can cross the placenta and excessive maternal levels can be harmful to the fetus.
Labetalol hydrochloride	C	Use only if potential benefit outweighs the risk.
Lacidipine		Avoid; may inhibit labor.
Lacosamide	C	Increased risk of teratogenicity associated with the highest risk of major and minor congenital malformations.
Lactulose	B	Use only when need has been clearly established.
Lamivudine	C	Avoid during first trimester. (**1**)

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Lamotrigine	C	Prescribe with caution; increased risk when used more than one antiepileptic drug.
Lansoprazole	B	Avoid.
Latanoprost	C	Use only if potential benefit outweighs risk.
Leflunomide	X	Avoid.
Letrozole	D	Avoid (isolated cases of birth defects reported).
Levamisole	C	Use only if potential benefit outweighs risk.
Levetiracetam	C	Use when the potential benefits justify the potential risk to the fetus.
Levobunolol hydrochloride	C	Use only if potential benefit outweighs risk.
Levobupivacaine hydrochloride		High doses during delivery can cause neonatal respiratory depression, hypotonia and bradycardia after epidural block; avoid if possible in the first trimester, toxicity in animal studies.
Levocarnitine	B	Use only if potential benefit outweighs the risk.
Levocetirizine hydrochloride	B	Use only if potential benefit outweighs the risk.
Levofloxacin	C	Avoid-shown to cause arthropathy in animal studies.
Lidocaine	B	Use only if potential benefit outweighs the risk.
Linagliptin	B	The use of linagliptin during pregnancy is only recommended if there are no alternatives and the benefit outweighs the risk.
Linezolid	C	Use only if potential benefit outweighs risk.
Lisinopril	D	Animal studies show still birth, renal failure and oligohydramnios.(**1,2,3)**
Lithium carbonate	D	Avoid in possible if first trimester, risk of teratogenicity including cardiac abnormalities; dose requirement is increased if necessary as because of the risk of toxicity in neonate. (**1,2, 3)**
Lomefloxacin	C	Use only if potential benefit outweighs risk.
Lomustine	D	Use only when there are no alternatives and benefit outweigh the risk.
Loperamide	C	Avoid.
Loratidine	C	Avoid.
Lorazepam	D	Risk of neonatal withdrawal symptoms high doses administered during late pregnancy or labor may cause neonatal hypothermia, hypotonia and respiratory depression.
Losartan potassium	D	Use only if potential benefit outweighs the risk.
Loteprednol etabonate	C	Use only if potential benefit outweighs the risk.
Lovastatin	X	Use only if potential benefit outweighs the risk.
Lubiprostone	C	Use only if clearly needed and benefit outweighs potential risk.
Magaldrate		Use only if potential benefit outweighs the risk.
Magnesium hydroxide		Use only if potential benefit outweighs the risk.
Magnesium sulphate		It is not known to be harmful for short-term intravenous administration in eclampsia, but excessive doses in the third

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		trimester cause respiratory depression in the newborn..
Mannitol	C	Use only if clearly needed and benefit outweighs potential risk.
Maprotiline hydrochloride	B	Use only when need has been clearly established.
Mebendazole	C	Manufacturer advises to avoid, toxicity in animal Studies.
Mebeverine hydrochloride		Prescribe with caution.
Meclizine hydrochloride	B	Use only if potential benefit outweighs risk.
Medroxyprogesterone acetate	X	Avoid, genital malformations and cardiac defects reported.
Mefenamic acid	C	See Acetylsalicylic acid. (**3**)
Mefloquine	B	Adequate contraception during prophylaxis and for 3 months after stopping (teratogenicity in animal studies).
Melatonin	N	Avoid.
Meloxicam	C	Avoid; use only if potential benefit outweighs the risk.
Memantine hydrochloride	B	Use only if potential benefit outweighs risk.
Mercaptopurine	D	Avoid (teratogenic).
Meropenem	B	Use only if potential benefit outweighs the risk.
Mesalazine		Negligible quantities cross placenta.
Mesna disulfide	B	Use only if potential benefit outweighs risk.
Metaraminol	C	May reduce placental perfusion, manufacturer advises use only if potential benefit outweighs risk.
Metformin	B	Avoid; insulin is substituted. (**1, 2, 3**)
Methionine	C	Use only when need has been clearly established.
Methotrexate	X	Avoid; teratogenic; fertility may be reduced during therapy which may be reversible.
Methyl prednisolone	C	Use when there are no alternatives and benefit outweigh risk.
Methyldopa	C	Use only if potential benefit outweighs the risk.
Methylphenidate hydrochloride	C	Use only if potential benefit outweighs the risk.
Metoclopramide hydrochloride	B	Use only when compelling reasons.
Metoprolol tartarate	C	Prescribe with caution.
Metronidazole	B	Avoid high doses; increased risk of teratogenicity if used during first trimester. (**1**)
Miconazole	C	Avoid unless essential.
Miconazole nitrate		Absorbed from skin in small amounts; manufacturer advises caution.
Midazolam	D	Increased risk of teratogenicity, associated with the highest risk

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		of major and minor congenital malformations
Mifepristone	X	Avoid.
Miglitol	B	Use only when need has been clearly established.
Milnacipran hydrochloride	C	Use only if potential benefit outweighs risk.
Minoxidil	C	Avoid , possible toxicity including reduced placental perfusion; neonatal hirsutism reported.
Mirtazapine	C	Use with caution—limited experience.
Misoprostol	X	Avoid; teratogenic; potent stimulant of uterus.(**1, 2, 3)**
Mitomycin		Avoid (teratogenic in animal studies).
Mizolastine		Avoid.
Mometasone furoate	C	Use when there are no alternatives and benefit outweigh risk.
Montelukast	B	Avoid unless essential.
Morphine sulphate	C	Use only if potential benefit outweighs risk.
Moxifloxacin	C	Cause arthropathy in animal studies.
Moxonidine		Avoid—no information available.
Mupirocin	B	Use only when need has been clearly established.
Mycophenolate mofetil	D	Avoid; toxicity in animal studies; effective contraceptive measures must be taken during and for 6 weeks of treatment.
Nalbuphine hydrochloride	B	Use only if potential benefit outweighs risk.
Nalidixic acid	C	Shown to cause arthropathy in animal studies.
Naloxone	C	Use only if potential benefit outweighs risk.
Naltrexone	C	Use only if potential benefit outweighs risk.
Nandrolone	X	Avoid, masculinization of female fetus. (**1, 2, 3)**
Naphazoline nitrate	C	Prescribe with caution.
Naproxen	C	Prescribe with caution. (**3)**
Natamycin	C	Prescribe with caution.
Nateglinide	C	Avoid, toxicity in animal studies.
Nebivolol	C	Use only if potential benefit outweighs the risk.
Nefopam hydrochloride		Avoid unless no safer treatment.
Nelfinavir	B	Use only if potential benefit outweighs the risk.
Neomycin	D	Prescribe with caution. (**2, 3)**
Neostigmine	C	Neonatal myasthenia with large doses. (**3)**
Nepafenac	C	Use only if potential benefit outweighs risk.
Nevirapine	B	Use only when need has been clearly established.
Niacin	C	Use when there are no alternatives and benefit outweigh the risk.
Nicorandil		Use only if potential benefit outweighs the risk.
Nicotine	D	Use only if potential benefit outweighs the risk.
Nifedipine	C	Prescribe with caution.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Nimodipine	C	Use only if potential benefit outweighs the risk.
Nitazoxanide	B	Use only if potential benefit outweighs the risk.
Nitrazepam		Prescribe with caution.
Nitrofurantoin	B	Avoid at term, may produce neonatal Hemolysis.
Nitroglycerin	C	Use only if potential benefit outweighs the risk.
Nitrous oxide		May depress neonatal respiration if used during delivery.
Nizatidine	B	Avoid unless essential.
Noradrenaline/ norepinephrine	C	Avoid, may reduce placental perfusion.
Norethisterone		Masculinization of female fetuses and other defects reported.
Norgestrel	X	Use only if potential benefit outweighs risk.
Nortriptyline		Prescribe with caution. **3**
Ofloxacin	C	Should be avoided in pregnancy because they have been shown to cause arthropathy in animal studies; safer alternatives are available; however, a single dose of ciprofloxacin may be used for the prevention of a secondary case of meningococcal meningitis.
Olanzapine	C	Use only if potential benefit outweighs risk; neonatal lethargy, tremor, and hypertonia reported when used in third trimester.
Olmesartan medoxomil	D	Avoid unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Olopatadine	C	Only recommended when there are no alternatives and benefit outweigh risk.
Omega-3 acid ethyl esters	C	use only if potential benefit outweighs risk—no information available.
Omeprazole	C	Not known to be harmful.
Ondansetron	B	Avoid unless potential benefit outweighs risk.
Orlistat	X	Use with caution.
Oseltamivir	C	Use only if potential benefit outweighs risk.
Oxaliplatin	D	Avoid, toxicity in animal studies; effective contraception required during and for 4 months after treatment in female and 6 months after treatment in male animals.
Oxaprozin	C	Avoid; only recommended when benefit outweighs risk.
Oxazepam	N	Risk of neonatal withdrawal symptoms when benzodiazepines are used during pregnancy. Avoid regular use and use only if a clear indication such as seizure control. High doses administered during late pregnancy or labor may cause neonatal hypothermia, hypotonia, and respiratory depression.
Oxybutynin hydrochloride	B	Avoid unless essential, toxicity in animal studies.
Oxcarbazipine	C	Teratogenic, if used in first trimester; neonatal bleeding occurs if used in third trimester.
Oxiconazole	B	No controlled data in human pregnancy. Oxiconazole topical should only be used when need has been clearly established.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Oxymetazoline hydrochloride	C	Use when benefit outweighs risk.
Oxytetracycline		Should not be given to pregnant animals. Effects on skeletal development when tetracyclines have been used in the first trimester in animal studies. Administration during the second or third trimester may cause discoloration of the child's teeth and maternal hepatotoxicity. However, when travel to malicious areas is unavoidable during pregnancy.
Oxytocin	X	Avoid.
Paclitaxel	D	Avoid (toxicity in animal studies); ensure effective contraception during and for at least 6 months after treatment.
Palonosetron	B	Avoid, no information available.
Pancreatin		Not known to be harmful.
Pancuronium bromide	C	Non-depolarizing neuromuscular blocking drugs are highly ionized at physiological pH and are therefore unlikely to cross the placenta in significant amounts.
Pantoprazole	B	Avoid unless potential benefit outweighs risk, fetotoxic in animals.
Paracetamol	C	Not known to be harmful.
Paricalcitol	C	Avoid unless potential benefit outweighs risk.
Paroxetine	D	Increased risk of congenital malformations, especially if used in the first trimester.
Pegfilgrastim	C	There have been reports of toxicity in animal studies and not to use granulocyte-colony stimulating factors during pregnancy unless the potential benefit outweighs the risk.
Peginterferon alfa-2a	C,X	Use when potential benefit outweighs risk.
Pemirolast potassium	C	Only recommended for use during pregnancy when benefit outweighs risk.
Pentazocine hydrochloride	C	Use when need has been clearly established.
Pentoxifylline	C	Use when benefit outweighs risk.
Peppermint oil		Not known to be harmful.
Perindopril erbumine	C, D	Avoid unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Permethrin	B	Only use when benefit outweighs risk.
Pethidine		Respiratory depression and withdrawal symptoms can occur in the neonate if opioid analgesics are used during delivery; also gastric stasis and inhalation pneumonia has been reported in the mother if opioid analgesics are used during labor.
Pheniramine maleate	B	Unlikely to harm an unborn baby.
Phenobarbitone	C	Congenital abnormality occurs if used in first trimester; neonatal bleeding occurs if used in third trimester. (**1, 2, 3)**

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Phenoxymethyl penicillin	B	Only be given when need has been clearly established.
Phenytoin hydrochloride	D	Changes in plasma-protein binding make interpretation of plasma-phenytoin concentrations difficult, monitor unbound fraction.
Pholcodine		Avoid unless potential benefit outweighs risk.
Phytomenadione		Use if potential benefit outweighs risk.
Pilocarpine hydrochloride	C	Avoid; stimulation of smooth muscle; toxicity in animal studies.
Pioglitazone	C	Avoid.
Pindolol	D	See Atenolol.
Piracetam		Avoid.
Piroxicam	C	Avoid
Pitavastatin	X	Avoid
Pivmecillinam	B	Avoid; not known to be harmful.
Pizotifen		Avoid unless potential benefit outweighs risk.
Podophyllotoxin	C	Avoid.
Poly ethylene glycol 3350	C	Use when benefit outweighs risk.
Potassium chloride	C	Use only when benefit outweighs risk.
Potassium citrate	C	Use only when benefit outweighs risk.
Potassium guaiacol sulphonate	C	Use only when benefit outweighs risk.
Potassium iodide	D	Avoid.
Povidone		Use only when benefit outweighs risk.
Povidone iodine	C/D	Sufficient iodine may be absorbed to affect the fetal thyroid in the second and third trimester.
Pralidoxime chloride	C	Use only when benefit outweighs risk.
Prazosin	C	No evidence of teratogenicity; use only if potential benefit outweighs risk.
Prednisolone	C	Use only when benefit outweighs risk
Pregabalin	C	Increased risk of teratogenicity, associated with the highest risk of major and minor congenital malformations.
Primaquine		Risk of neonatal hemolysis and methemoglobinemia in third trimester.
Procarbazine	X	Avoid; teratogenic in animal studies.
Prochlorperazine maleate		Use only when benefit outweighs risk.
Prochlorperazine mesilate		Extrapyramidal effects and withdrawal syndrome have been reported occasionally in the neonate when antipsychotic drugs are taken during the third trimester of pregnancy. Following maternal use of antipsychotic drugs in the third trimester, neonates should be monitored for symptoms including agitation,

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		hypertonia, hypotonia, tremor, drowsiness, feeding problems, and respiratory distress.
Procyclidine hydrochloride		Use only if potential benefit outweighs risk.
Progesterone	B	Not known to be harmful.
Promethazine hydrochloride	C	Avoid.
Promethazine theoclate	C	Avoid.
Propafenone hydrochloride	C	use only if potential benefit outweighs risk.
Propantheline bromide	C	Avoid.
Propofol	B	May depress neonatal respiration if used during delivery; max. dose for maintenance of anesthesia 6 mg/kg/hour.
Propranolol hydrochloride	C	May cause intra-uterine growth restriction, neonatal hypoglycemia and bradycardia; the risk is greater in severe hypertension. If beta-blockers are used close to delivery, infants should be monitored for signs of beta-blockade.
Protamin sulphate	C	Use only when need has been clearly established.
Pseudoephedrine hydrochloride		defective closure of the abdominal wall (gastroschisis) reported very rarely in newborns after first trimester exposure.
Pyrazinamide	C	Use only if potential benefit outweighs risk.
Pyridostigmine	C	Use only if potential benefit outweighs risk.
Pyridoxine hydrochloride	A,C	Use only if potential benefit outweighs risk.
Pyrimethamine	C	Theoretical teratogenic risk in first trimester (folate antagonist); adequate folate supplements should be given to mother.
Quetiapine	C	Use only if potential benefit outweighs risk. Extrapyramidal effects and withdrawal syndrome have been reported.
Quinine dihydrochloride	C	High doses are teratogenic in first trimester; but in malaria benefit of treatment outweighs risk.
Quinine sulphate	C	High doses are teratogenic in first trimester; but in malaria benefit of treatment outweighs risk.
Rabeprazole sodium	B	Avoid—no information available.
Raloxifene hydrochloride	X	Avoid.
Ramipril	D	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Ranitidine	B	Avoid unless essential, but not known to be harmful.
Ranolazine	C	Avoid unless essential — no information available.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Repaglinide	C	Avoid; insulin is substituted.
Retapamulin	B	Use only if potential benefit outweighs risk.
Ribavirin	X	Avoid; teratogenicity in animal studies.
Riboflavin	A, C	Use with caution.
Rifampicin	C	Teratogenic in animal studies in first trimester; risk of neonatal bleeding may be increased in third trimester.
Rifaximin	C	Avoid, toxicity in animal studies.
Rimexolone	C	Use only if potential benefit outweighs risk.
Risedronate sodium	C	Use only if potential benefit outweighs risk.
Risperidone	C	Use only if potential benefit outweighs risk.
Ritodrine hydrochloride	B	Not for use in first or third trimester.
Rituximab	C	Use only if potential benefit outweighs risk.
Rivaroxaban	C	Avoid.
Rivastigmine	B	Use only if potential benefit outweighs risk.
Rizatriptan	C	Avoid unless the potential benefit outweighs the risk.
Rofecoxib	C	Prescribe with caution.
Rocuronium bromide	C	Use only if potential benefit outweighs risk.
Roflumilast	C	Avoid.
Ropinirole	C	Animal studies have reported teratogenic effect.
Rosiglitazone	C	Use only if potential benefit outweighs risk.
Rosuvastatin	X	Avoid.
Rupatadine	B	Take caution—limited information available.
Salmeterol	C	Use only if potential benefit outweighs risk.
Salmon calcitonin	C	Avoid unless potential benefit outweighs risk.
Salsalate	C	Avoid use in late pregnancy as it may cause premature closure of the ductus arteriosus
Saxagliptin	B	Avoid unless essential, toxicity in animal studies.
Sennosides	C	Use only if potential benefit outweighs risk.
Sertraline	C	Avoid unless potential benefit outweighs risk.
Sevelamer hydrochloride	C	Use only if potential benefit outweighs risk.
Sibutramine hydrochloride	C	Use only if potential benefit outweighs risk.
Sildenafil	B	Use only if potential benefit outweighs risk.
Silver sulphadiazine	B	This medicine can cause serious medical problems in a newborn and should not be used during late pregnancy. Use only if potential benefit outweighs the risk.
simethicone		Use only if potential benefit outweighs risk.
Simvastatin	X	Avoid.
Sitagliptin	B	Avoid.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Sodium bicarbonate	C	Use only if potential benefit outweighs risk.
Sodium fusidate		Not known to be harmful; use only if potential benefit outweighs risk.
Sodium hyaluronate		Use only if potential benefit outweighs risk.
Sodium stibogluconate		Use only if potential benefit outweighs risk.
Sodium thiosulfate	C	Use only if potential benefit outweighs risk.
Sodium valproate	D, X	Avoid, increased risk of teratogenicity, associated with the highest risk of major and minor congenital malformations.
Somatropin	C	Discontinue if pregnancy occurs.
Solifenacin succinate	C	Caution-no information available.
Sorafenib	D	This drug is embryotoxic and teratogenic when administered to pregnant animals. Avoid unless essential.
Sotalol hydrochloride	B	Beta-blockers may cause intra-uterine growth restriction, neonatal hypoglycemia, and bradycardia; the risk is greater in severe hypertension. For the treatment of hypertension in pregnancy.
Sparfloxacin	C	Use only if potential benefit outweighs risk.
Spectinomycin	B	Take caution.
Spironolactone	C	Use only if potential benefit outweighs risk.
Streptokinase	C	Thrombolytic drugs can possibly lead to premature separation of the placenta in the first 18 weeks of pregnancy, risk of maternal hemorrhage throughout pregnancy and post-partum, and also a theoretical risk of fetal hemorrhage throughout pregnancy.
Streptomycin	D	Avoid unless essential; greatest risk of auditory or vestibular nerve damage in the infant.
Sulfasalazine	B	Theoretical risk of neonatal hemolysis in third trimester; adequate folate supplements should be given to mother.
Sulfinpyrazone		Caution—no information available.
Sulindac	C	Avoid unless the potential benefit outweighs the risk.
Sulphanilamide	C	Use only if potential benefit outweighs risk.
Sumatriptan	C	Use only if potential benefit outweighs risk.
Sunitinib	D	Avoid unless the potential benefit outweighs the risk.
Suxamethonium chloride	C	Mildly prolonged maternal neuromuscular blockade may occur.
Tacrolimus	C	Exclude before treatment; avoid unless potential benefit outweighs risk, risk of premature delivery, intra-uterine growth restriction, and hyperkaliemia.
Tadalafil	B	Avoid
Tamoxifen	D	Avoid, possible effects on fetal development; effective contraception must be used during treatment and for 2 months after stopping.
Tamsulosin	B	Consult veterinarian

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
hydrochloride		
Tapentadol	C	Respiratory depression and withdrawal symptoms can occur in the neonate if opioid analgesics are used during delivery; also gastric stasis and inhalation pneumonia has been reported in the mother if opioid analgesics are used during labor.
Tazarotene	X	Avoid.
Tegaserod	B	Use only if potential benefit outweighs risk.
Teicoplanin		Use only if potential benefit outweighs risk.
Telmisartan	D	Should be avoided in pregnancy unless essential. They may adversely affect fetal and neonatal blood pressure control and renal function; skull defects and oligohydramnios have also been reported.
Temazepam	X	There is a risk of neonatal withdrawal symptoms when benzodiazepines are used during pregnancy. Avoid regular use and use only if a clear indication such as seizure control. High doses administered during late pregnancy or labor may cause neonatal hypothermia, hypotonia, and respiratory depression.
Temozolomide	D	Avoid (teratogenic and embryotoxic in animal studies); manufacturer advises adequate contraception during treatment; men should avoid fathering a child during and for at least 6 months after treatment.
Tenofovir disoproxil fumarate	B	Use only if potential benefit outweighs risk.
Tenoxicam		Avoid unless the potential benefit outweighs the risk.
Terazosin	C	No evidence of teratogenicity; use only when potential benefit outweighs risk.
Terbinafine	B	Avoid.
Terbutaline sulphate	C	Use only if potential benefit outweighs risk.
Testosterone		Avoid; causes masculinization of female fetus.
Tetanus vaccines		Live vaccines should not be administered routinely to pregnant animals because of the theoretical risk of fetal infection.
Tetracosactide		Avoid.
Tetracycline		Avoid; effects on skeletal development in animal studies; dental discoloration if used in second and third trimester. **1, 2, 3**
Theophylline	C	Prescribe with caution; neonatal irritability and apnea. **3**
Thioridazine		Prescribe with caution.
Thiamine hydrochloride	A	Use only if potential benefit outweighs risk.
Thiopentone sodium		May depress neonatal respiration when used during delivery.
Tibolone		Avoid, toxicity in animal studies.
Ticlopidine hydrochloride	B	Avoid unless essential.
Tigecycline	D	Should not be given to pregnant animals. Effects on skeletal development have been documented with the use of tetracyclines

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
		in animal studies in the first trimester. Administration during the second or third trimester may cause discoloration of the infant's teeth, and maternal hepatotoxicity has been reported at high parenteral doses.
Timolol maleate	C	Beta-blockers may cause intra-uterine growth restriction, neonatal hypoglycemia and bradycardia; the risk is greater in severe hypertension. If beta-blockers are used close to delivery, infants should be monitored for signs of beta-blockade.
Tinidazole		Avoid in first trimester.
Tioconazole	C	Manufacturer advises avoid.
Tiotropium	C	Manufacturer advises use only if potential benefit outweighs risk.
Tizanidine	C	Avoid.
Tobramycin		Prescribe with caution.
Tolfenamic acid		Avoid the use of NSAIDs during pregnancy or avoiding them unless the potential benefit outweighs the risk. NSAIDs should be avoided during the third trimester because use is associated with a risk of closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension of the newborn. In addition, the onset of labour may be delayed and its duration may be increased.
Tolmetin	C	Avoid, in late pregnancy may cause premature closure of ductus arteriosus in the fetus. Use only if the potential benefit outweighs the risk.
Tolnaftate		Use only if the potential benefit outweighs the risk.
Tolterodine tartrate	C	Avoid.
Topiramate	D	Use only if the potential benefit outweighs the risk; increased risk of cleft palate if taken in the first trimester of pregnancy. (**1**)
Torasemide	B	Manufacturer advises avoid, toxicity in Animal studies.
Tramadol hydrochloride	C	Embryotoxic in animal studies, avoid.
Tranexamic acid		Use only if the potential benefit outweighs the risk.
Trastuzumab	D	Manufacturer advises to avoid, oligohydramnios reported; effective contraception must be used during treatment and for 6 months after stopping.
Travoprost	C	Avoid.
Tretinoin	X	Teratogenic, effective concentration must be used for at least 1 month before oral treatment, during treatment and at 1 month after stopping also avoid topical treatment. **1, 2, 3**
Triamcinolone acetonide	C	Use only if the potential benefit outweighs the risk.
Trifluoperazine	C	Prescribe with caution.
Trihexyphenidyl hydrochloride	C	Use only if the potential benefit outweighs the risk.
Trimethoprim	C	Avoid; teratogenic risk in first trimester (folate antagonist).
Trimipramine	C	Use only if the potential benefit outweighs the risk.
Tropicamide	C	Use only if the potential benefit outweighs the risk.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Ulipristal acetate	X	Manufacturer advises to avoid, no information available..
Urokinase	B	Thrombolytic drugs can possibly lead to premature separation of the placenta in the first 18 weeks of pregnancy. There is also a risk of maternal hemorrhage throughout pregnancy and post-partum, and also a theoretical risk of fetal hemorrhage throughout pregnancy.
Ursodeoxycholic acid		No evidence of harm but the manufacturer advises avoidance.
Valacyclovir	B	Use only if the potential benefit outweighs the risk.
Valsartan		Avoid.
Sodium valproate	D, X	Avoid, increased risk of teratogenicity, associated with the highest risk of major and minor congenital malformations.
Vancomycin	B	Use only if the potential benefit outweighs the risk.
Vasopressin	C	
Varenicline	C	Avoid, toxicity in animal studies.
Vecuronium bromide	C	Highly ionized at physiological pH and are therefore unlikely to cross the placenta in significant amounts.
Venlafaxine	C	Avoid unless potential benefit outweighs the risk, toxicity in animal studies; risk of withdrawal effects in neonate.
Verapamil hydrochloride	C	May decrease uterine blood flow with fetal hypoxia; The manufacturer advises avoidance in the first trimester unless absolutely necessary; may inhibit labour.
Vildagliptin		Avoid, toxicity in animal studies.
Vinblastine	D	Avoid (teratogenicity and fetal loss in animal studies).
Vincristine	D	Avoid (teratogenicity and fetal loss in animal studies).
Vinorelbine	D	Avoid unless essential. Teratogenicity and fetal loss have been reported in animal studies. The manufacturer recommends effective contraception for both male and female animals during and for 3 months after treatment.
Vinpocetine		Avoid.
Vitamin A	X	Excessive doses may be teratogenic.
Vitamin C	A	Use only if the potential benefit outweighs the risk.
Vitamin E	A	Use only if the potential benefit outweighs the risk.
Voriconazole	D	Toxicity in animal experiments. Effective contraception is required during treatment. The manufacturer advises avoidance unless the potential benefit outweighs the risk.
Warfarin sodium	X	Teratogenic.
Xylometazoline		Manufacturer advises to avoid.
Zalcitabine	C	Use only if the potential benefit outweighs the risk.
Zafirlukast	B	Avoid.
Zaleplon		Avoid in first trimester; neonatal withdrawal symptoms if used in third trimester.
Zidovudine	C	Use only if the potential benefit outweighs the risk.
Zinc oxide		Use only if the potential benefit outweighs the risk.
Zinc sulfate	C	Crosses placenta; risk theoretically minimal, but no information available.

Drugs	FDA pregnancy drug category	Comments (Trimester risks 1,2,3)
Zinc sulphate monohydrate	C	Use only if the potential benefit outweighs the risk.
Ziprasidone	C	There is evidence of adverse effect on the fetus in animal experiments. Use only if potential benefit outweighs risk.
Zoledronic acid	D	Evidence of toxicity, fetal malformations and embryo-fetal lethality in animal experiments Should be avoided.
Zolmitriptan	(C)	Limited experience of using $5HT_1$-receptor agonists during pregnancy; that they should be avoided unless the potential benefit outweighs the risk.
Zolpidem tartrate	C	Avoid regular use (risk of neonatal withdrawal symptoms); high doses during late pregnancy or labour may cause neonatal hypothermia, hypotonia, and respiratory depression.

Appendix-viii

Lactating and Milking Animals

When nursing lactating and milking animals take some categorical drugs that affect the infant, most of the drugs are found in milk. Some in too small quantity to be harmful for the neonate but some are found pharmacologically toxic to the infants and also for human consumption. Some drugs also inhibit the infant's sucking reflex (e.g. phenobarbitone). Concentration of some drugs in milk may exceed those in (like iodides) the maternal plasma so that therapeutic doses in the mother may cause toxicity to the infant as well as such residues cause toxicity to human being after consumption of milk from that animals.

For some drugs information available is so insufficient therefore providing guidance is difficult. It is better to use only essential drugs by a lactating and milking animal.

The following table of information about drugs can be used as a guideline; however, absence of drugs from the table does not imply safety.

Chemotherapeutics, though harmful to infant, must be administered to the affected lactating and milking animals in certain cases like cancer etc. In such cases, milk from lactating and milking animals must be suspended both for infant and human consumption.

Drugs present in milk:

Drug	Comment
Acarbose	Avoid.
ACE inhibitors.	Avoid.
Aceclofenac	Avoid; no information available.
Atenolol & Acebutolol	Grater amount found in the milk, avoid.
Acetazolamide	Can be used, very small amount found in the milk.
Acetylsalicylic acid	Avoid, because regular intake has a
or Aspirin	possible risk of Raye's syndrome; regular use of high doses could impair platelet function and produce hypoprothrombinemia in infant if neonatal vitamin K stores low.
Acitretin	Avoid.
Aciclovir	Significant amount is found in milk after systemic administration.
Alendronate sodium	Avoid.
Allopurinol	Present in milk.
Alprazolam	Present in milk; avoid.
Amantadine	Should not be used
Amiodarone	Should not be used

Androgens	Avoid; may cause masculinisation in the female infant or precocious development in the male infant; high dose suppresses lactation.
Amiloride	Avoid, no information available
Antidepressants	Amount of tricyclic antidepressants (including related drugs such as mianserin and trazodone) too small to be harmful; avoid.
Atracurium	Avoid, no information available.
Atropine	Use with caution, very small amount available in milk.
Azithromycin	Prescribe with caution; no harmful effect is known; use only if adequate alternatives not available.
Bendrofluazide	Amount too small to be harmful; large doses may suppress lactation.
Beta-blokers	Monitor infants; possible toxicity due to beta-blockade but amount of most beta-blockers excreted in milk too small to affect infant; acebutolol. Atenolol, nadolol and solatol are present in higher amounts than other beta-blockers; manufacturers advice to avoid celiprolol and nebivolol.
Bismuth	
Subcitrate/Subsalicylate	Avoid.
Benzoiazepines	Present in milk; avoid if possible.
Benzylpenicillin trace amount present in milk; safe in usual dosage; monitor infant.	
Betamethasone Systemic effect in infant unlikely with maternal dose of less than equivalent of Prednisolone 40mg daily; monitor Infants adrenal function with higher dosage.	
Bromazepam	See benzoiazepines.
Bupivacaine	Amount too small to be harmful.
Busulphan	Discontinue breast-feeding.
Calcipotriol	Avoid if possible; no information available.
Carbamazepine	Amount too small to be harmful; but 1-2 cases of reported skin rashes in infants.
Carbimazole	Amounts in milk may be sufficient to affect neonatal thyroid function, therefore lowest effective dose should be used.
Carbocisteine	Avoid.
Ceftriaxone	Excreted in low concentration; safe in usual dosage; monitor infant in higher dosage.
Clindamycin	Should avoid.
Clomiphene	May inhibit lactation; Avoid.
Clonidine	May decrease milk supply; Avoid.
Clozapine	Should not be used.

Carboplatin	Discontinue breast-feeding.
Chloramphenicol	Use replacement, may cause bone-marrow toxicity in infants; concentration in milk usually insufficient to cause Grey syndrome.
Chlorthalidone	May inhibit lactation; Avoid.
Chlorambucil	Discontinue breast-feeding.
Chloroquine	Amount too small to be harmful; inadequate for reliable protection against malaria.
Chlorpromazine	Drowsiness in infants reported.
Chlorpropamide	Caution; theoretical possibility of hypoglycemia in infants.
Cilazapril	Avoid; excreted in milk.
Cimetidine	Significant amount present in milk; till not known to be harmful; but better to avoid.
Citalopram	Can cause infant drowsiness; should avoid.
Ciprofloxacin	High concentrations in breast milk; avoid.
Cisatracurium	No information available.
Cisplatin	Discontinue breast-feeding.
Contraceptives (oral)	Combined OCP inhibit lactation; Should avoid.
Co-trimoxazole	Small risk of kernicterus in jaundiced infants and of haemolysis in G6PD-deficient infants.
Clarithromycin	Avoid; excreted in milk.
Dactinomycin	Discontinue breast-feeding.
Dalteparin	No information available.
Dapsone	Haemolytic anaemia; although significant amount in milk risk to infant very small.
Daunorubicin	Discontinue breast-feeding.
Diazepam	Present in milk, avoid if possible.
Diclofenac	Amount too small to be harmful.
Digoxin	Amount too small to be harmful.
Dihydroergotamine	Avoid, ergotism may occur in infants; repeated doses may inhibit lactation.
Diloxanide	Avoid.
Diltiazem	Avoid; significant amount present in milk.
Disopyramide	Present in milk; use only if essential and monitor infant for antimuscarinic effects.
Docetaxel	Discontinue breast-feeding.
Domperidone	Amount probably too small to be harmful.
Doxepin	Should avoid.

Doxorubicin	Discontinue breast-feeding.
Doxycycline	Avoid, or if necessary, discontinue breast-feeding.
Droperidol	Although amount excreted in milk probably too small to be harmful, animal studies indicate possible adverse effects of these drugs on developing nervous system, therefore avoid unless absolutely necessary.
Enoxaparin	Avoid, no information available.
Epoetin	Avoid, no information available.
Ergotamine	Avoid, ergotism may occur in infant; repeated doses may inhibit lactation.
Erythromycin	only a small amount is present in breast milk; safe in usual dosage; monitor infant.
Ethosuximide	Should avoid.
Etoposide	Discontinue breast-feeding.
Famotidine	Present in milk, not known to be harmful; avoid.
Felodipine	Appears in milk; avoid.
Fentanyl	Avoid.
Filgrastim	Avoid, no information available.
Fluconazole	Avoid; present in milk.
Fluorouracil	Discontinue breast-feeding.
Fluoxetine	Should Avoid.
Fluphenazine	Amount excreted in milk too small to be harmful. Animal studies showed harmful effect.
Flurazepam	See benzodiazepine.
Fluvastatin	Manufacturer advises to avoid.
Fosinopril	Present in milk; avoid.
Frusemide	Too small to be harmful.
Gemcetabine	Discontinue breast-feeding.
Gemfibrozil	Avoid; no information available.
Gentamicin	Avoid.
Haloperidol	Excreted in milk, but too small to be harmful.
Halothane	Excreted in milk.
Heparin	Avoid, risk of haemorrhage in infants.
Hydralazine	Present in milk but not known to be harmful. Monitor infants.
Hydrocortisone	Systemic effect in infant unlikely with maternal dose of less than equivalent of Prednisolone 40mg daily; monitor Infants adrenal function with higher dosage.

Hydrochlorothiazide	Amount too small to be harmful, large doses may suppress lactation.
Hydroxyzine	Avoid; significant amount found in milk.
Hyoscine butylbromide	Amount too small to be harmful.
Ibuprofen	Too small to be harmful, but better if avoided.
Idoxuridine	May possibly make taste of milk unpleasant.
Imipramine	May cause respiratory depression; avoid.
Indapamide	Avoid; no information available.
Indomethacin	Avoid; too small amount found in milk; convulsion reported in some infants.
Insulin	Amount too small to be harmful.
Interferons	Avoid; no information available.
Iodine	Stop breast-feeding; danger of neonatal hypothyroidism or goiter; appears to be concentrated in milk.
Irinotecan	Discontinue breast-feeding.
Isoniazide	Monitor infants for possible toxicities; theoretical risk of convulsion and neuropathy; prophylactic Pyridoxine is advisable for mother and infant.
Isotretinoin	Avoid.
Ivermectin	Avoid until infant is 1 week old.
Itraconazole	Small amount found in milk, not harmful.
Ketorolac	Avoid.
Ketotifen	Significant amount present in milk, not harmful but drowsiness in infants reported.
Lacidipine	Avoid; no information available.
Lamivudine	Breast-feeding not advised in HIV infection.
Lamotrigine	Small amount found in milk, not harmful.
Lignocaine	Amount too small to be harmful.
Lipid lowering agents	Should not be used.
Lisinopril	Caution to be taken; no information available.
Lithium	Present in milk, and risk of toxicity in infant.
Loperamide	Amount found in milk not harmful for infant.
Mebendazole	No information available.
Mebeverine	Amount in milk too small to be harmful.
Mefloquine	Present in breast milk but risk to infant is minimal.
Melphalan	Discontinue breast-feeding.

Mercaptopurine	Discontinue breast-feeding.
Meropenem	Avoid.
Methadone	Withdrawal symptoms in infant; breast-feeding permissible during maintenance but dose should be as low as possible and infant monitored to avoid sedation.
Methotrexate	Discontinue breast-feeding.
Metoclopramide	Although amount in milk is small, avoid unless essential.
Metronidazole	Significant amount in milk; do not take single large doses.
Mianserin	Risk of respiratory depression in infants.
Miconazole	Take caution; no information available.
Misoprostol	Avoid; no information available.
Mitomycin	Discontinue breast-feeding.
Morphine	Therapeutic doses unlikely to affect infants; withdrawal symptoms in infants of dependent mothers.
Mycophenolate	Avoid; no information available.
Nadolol	Should avoid.
Naloxone	Avoid; no information available.
Naproxen	Amount too small to be harmful.
Neostigmine	Amount too small to be harmful. Monitor infant.
Nifedipine	Amount too small to be harmful.
Nitrofurantoin	Only small amounts in milk but could be enough to produce G6PD-deficient infant.
Nortryptyline	Risk of respiratory depression in infants.
Ofloxacin	Avoid.
Olanzapine	Avoid; adverse reactions occur.
Omeprazole	Avoid; no information available.
Orlistat	Avoid; no information available.
Oxytetracycline	Avoid; teeth deformity in infants.
Paclitaxel	Discontinue breast-feeding.
Penicillamine	Trace amount in milk, use with caution.
Pethidine	Avoid.
Phenobarbital	Avoid.
Phenytoin	Small amount present in milk, avoid.
Piroxicam	should avoid.
Pilocarpine	Avoid; no information available.

Pindolol	Too small amount found in milk to be harmful; monitor infants.
Praziquantel	Avoid breast feeding during and 72 hours after treatment.
Prazosin	Amount probably too small to be harmful.
Primaquine	Avoid; risk of hemolysis in G-6PD deficit infant.
Procarbazine	Discontinue breast-feeding.
Propafenone	Avoid. No information available.
Propranolol	Monitor infant; possible toxicity due to beta-blockade but amount of most beta-blockers excreted in milk too small to affect infants.
Pyrazinamide	Amount too small to be harmful.
Pyrimethamine	Significant amount, avoid administration of other folate antagonists to infants.
Quinidine	Significant amount, but not known to be harmful.
Ranitidine	Significant amount present in breast milk but not known to be harmful.
Repaglinide	Avoid.
Reserpine	Should avoid.
Retinol	Theoretical risk of toxicities in infants of mother taking larger dose.
Rifampicin	Amount too small to be harmful.
Ritonavir	Breast-feeding not advised in HIV infections.
Recuronium	Avoid.
Rofecoxib	Avoid. Present in milk in animal studies.
Simvastatin	Avoid.
Sodium autothiomalate	Avoid.
Sodium valproate	Amount too small to be harmful.
Somatropin	Avoid, no information available.
Sotalol	Should avoid.
Sulphonylureas	Caution, theoretical possibility of hypoglycemia in infants.
Sulphasalazine	Small amounts in milk. Theoretical risk of neonatal hemolysis especially in G6PD- deficient infants. Sulpride Significant amount in milk; avoid.
Tamoxifen	Avoid; no information available.
Terbinafne	Present in milk; avoid.
Tetracycline	Avoid; deformity and dental decolorization in infants.

Theophylline	Irritability in infant reported; modified releaseProprietary Preperations probably safe.
Thioridazine	Avoid.
Ticlopidine	Avoid.
Timotol	Avoid.
Tinidazole	Avoid.
Trimethoprime	Present in milk; short-term use not harmful.
Tretinoin	Avoid.
Trifluoperazine	Avoid.
Valsartan	Avoid.
Valproic acid	Amount too small to be harmful.
Vancomycin	Avoid; present in milk.
Verapamil	Amount probably too small to be harmful.
Venlaflaxine	Should avoid.
Vinblastine	Discontinue breast-feeding.
Vincristine	Discontinue breast-feeding.
Warfarin	Should avoid.
Zafirlukast	Avoid; present in milk.

Appendix-ix

Clinical Management of Poisoning in Animals

Poisoning can be defined as an interaction between a foreign chemical (toxin) and a biological system that results in damage to a living organism.

In general, the medical profession has been more concerned with the acute effects of toxins and the clinical management of toxicity, but chronic effects of toxins have much more importance on a global scale. For example, acute ingestion of ethanol may result in intoxication, which can cause death directly from its acute depressant effects and also through intoxication-related accidents and violence.[1]

Toxicosis, poisoning, and intoxication are synonymous terms for the disease produced by a toxic agent. Toxicity (sometimes incorrectly used instead of poisoning) refers to the amount of a toxic agent necessary to produce a detrimental effect.

A toxic agent is referred to as a toxicant or poison. The term toxin refers to a poison produced by a biologic source (eg, venoms, plant toxins); the redundant term biotoxin is occasionally used. A toxicant is generally considered a toxic substance that is either the main product or a byproduct of human activity (eg, pesticides manufactured for commercial use, dioxins produced as a byproduct of industrial processes). [2]

Overdose toxicity refers to serious, often harmful, and sometimes fatal toxic reactions to an accidental overdose of a drug (because of an error on the part of the doctor, pharmacist, or person taking the drug) or to an intentional overdose (homicide or suicide).[3] Even excessive water intake may cause toxicity (water toxicity). The kidneys can remove 20–28 liters of water per day, but they cannot excrete more than 0.8 to 1.0 liters per hour. Drinking more than this can be harmful.[4]

Drug errors are mistakes made by doctors, health care practitioners, pharmacists, and patients when drugs are prescribed, given, taken, or stored. Drug errors can make people ill and allow diseases to worsen.[5]

Types of Intoxication/ Toxicosis:

Acute Toxicosis: Refers to effects during the first 24-hour period.

Chronic Toxicosis: Effects produced by prolonged exposure (≥3 months) are referred to as chronic toxicosis.

Terms such as subacute and subchronic are used to cover the large gap between acute and chronic.

All toxic effects are dose dependent. A dose may cause undetectable, therapeutic, toxic, or lethal effects. A dose is expressed as the amount of compound per unit of body weight, and toxicant concentration as part per million or part per billion.

These quantitative expressions are also used for feedstuffs, water, and air, as well as for tissue levels.

LD_{50} is the dose that is lethal to 50% of the subjects in a test sample. It is an estimator of lethality and the most common expression used to rate the potency of toxicants. Other terms used for prediction of illness or lethality include No Observed Effect Level (NOEL), Maximum Nontoxic Dose (MNTD), and Maximum Tolerated Dose or Minimum Toxic Dose (MTD). [2]

The intoxication may be voluntary or involuntary. Involuntary intoxication occurs when someone is tricked into consuming a substance like drugs or alcohol or when someone is forced to do so. These are malicious case. Voluntary intoxication also common in animal.

They may intake poisons with contaminated Grass or Grain or Water. Most of the cases in animals are voluntary intoxication.

Sources of poisoning[8]

There are two major sources of poisoning in animals -

A. Natural sources, B. Human oriented sources

A. Natural sources

1. Plants: Ipomea carnea, Datura alba, Atropa belladona, Strychnus, Nuxvomica, Young shoots of sorghum, Nitrate rich plants.
2. Animals: Poisonous snake bite (Cobra, Krait, Russel viper and Rattle snake), Scorpion bite, Toad toxin, Tick toxins and Spider venom.
3. Minerals or metals: Arsenic, Lead, Mercury, Selenium, Fluorine.

B. Human oriented sources

1. Accidental causes:

a. Fertilizers: Urea, Phosphate or Nitrate fertilizers.
b. Insecticides: Organophosphates, Organochlorines, Carbamates, Pyrethroids.
c. Rodenticides: Zinc phosphide.
d. Industrial effluents Lead, Fluorine, Cyanide, Mercury, Nitrate.
e. Radiation hazards.
f. d. Faulty medicine Application: paracetamol Poisoning in Cat, Dog.

2. Malacious poisoning: Unlawful discriminal killing of animals by administering poisons e.g. Zinc phosphide, Strychnine, Abrus etc.[8]

General Treatment of Poisoning: [6,7]

At initial examination, certain immediate, life-saving measures may be needed. Beyond this, treatment for Toxicosis includes three basic principles:

1. Preventing further absorption of the poison,
2. Providing supportive treatment, and
3. Administering specific antidotes.

Prevention of Further Absorption of Toxic Agents in Animals: [7]

- Removal of suspected feed, grass, water, proper cleaning & decontamination of feeder, waterer, floor, house & other utensils.
- Topically applied toxic agents usually can be removed by thorough washing with soap and water; clipping of the hair or wool may be necessary.
- Emesis is of value in dogs, cats, and pigs if done within a few hours of ingestion. Emesis is contraindicated when the swallowing reflex is absent; the animal is convulsing; corrosive agents, volatile hydrocarbons, or petroleum distillates are involved; or risk of aspiration pneumonia is imminent.
- Hydrogen peroxide (3% solution, 1–2 mL/kg, PO) is an oral emetic and can be repeated one additional time. Apomorphine can be used in dogs parenterally at a dosage of 0.05–0.1 mg/kg, 0.04 mg/kg IM, or 0.03 mg/kg IV. Cats can be induced to vomit by treating with xylazine (0.44 mg/kg, IM) or dexmedetomidine (5–10 mcg/kg, IM). The efficacy of emetics in cats is as low as 50% and there can be excess sedation or cardiovascular collapse.
- Inappropriate methods of decontamination include oral administration salt or syrup of ipecac, forced vomiting by means of digital stimulation of the throat. Substances or solutions such as liquid dish soap, raw eggs, hot sauce,

mustard, or similar are also contraindicated and owners should be advised against these things.

- Gastric lavage, with placement of an endotracheal tube to prevent aspiration via largest bore nasogastric tube possible, is done after appropriate sedation or general anesthesia is administered. The head is lowered to a 30° angle, and 5–10 mL of lavage fluid (tepid water or 0.9% saline solution) per kg of body weight is gently flushed into the stomach and then removed. This process is repeated until returned fluid is clear.
- Concurrent administration of cathartics and laxatives may be indicated in some patients for more rapid elimination of the toxic agent from the GI tract. In ruminants, a gastrotomy or rumenotomy may be necessary when lavage techniques are insufficient. Gastric lavage are particularly relevant in species such as horses that do not vomit; and if emesis is unsuccessful, if there is a large volume of stomach contents, in symptomatic patients with a history of large volume ingestion, or for potentially life-threatening toxicosis.
- When the toxic agent cannot be physically removed via lavage, certain agents administered orally can adsorb it and prevent its absorption from the GI tract. Activated charcoal (1–5 g/kg) effectively adsorbs a wide variety of compounds and usually is the adsorbent and detoxicant of choice when toxicosis is suspected. The maximum amount of a drug adsorbed by activated charcoal is ~100–1,000 mg/g of charcoal. Sorbitol is sometimes added to activated charcoal to increase its palatability (in people) and to increase the GI transit time and flush out charcoal-bound toxins more rapidly.
- Activated charcoal should not be used in animals with known hypersensitivity or allergy to the drug. With administration of high doses, vomiting, constipation, or diarrhea may occur, and feces will appear black. Contraindications to using activated charcoal include:
    - Ingestion of a caustic substance or hydrocarbon
    - Planned endoscopy or abdominal surgery
    - Risk for or suspected gastric or intestinal obstruction
    - High risk of aspiration pneumonia
    - Severe dehydration
    - Hypernatremia
    - Hypovolemic shock
    - Ileus
    - Recent intestinal surgery
    - Protracted vomiting

Supportive Therapy for Toxicosis in Animals: [7]

Supportive therapy is often necessary until the toxic agent can be metabolized and eliminated. The type of support required depends on the animal's clinical condition. Supportive efforts may include control of convulsive seizures, maintenance of respiration, treatment for shock, correction of electrolyte imbalance and fluid loss, and control of cardiac dysfunction, as well as alleviation of pain.

Specific Antidotes for Toxicosis in Animals

Specific antidotes for various toxic agents work by various mechanisms. Some complex with the compound (eg, the oximes bind with organophosphorous insecticides, and EDTA chelates lead). Others block or compete for receptor sites (eg, vitamin K competes with the receptor for coumarin anticoagulants). A few affect metabolism of the toxic agent (eg, nitrite and thiosulfate ions release and bind cyanide). Specific antidotes for use in food animal species have been limited for the past 10 years, but options are being considered by the FDA in the US. [7]

Treatment of Common Poisonings in Animals

NB: Removal of sources: Removal of suspected feed, fodder is common in all cases.

1. Hydrocyanic acid Poisoning[9]:

Causes:

Ingestion of cyanogenetic plants c.g. immature jawar plants & Linseed Stunted, wilted & drought affected plants

Clinical Signs:

Severe dyspnoea, bloat, blood & mucosae-bright red, muscle tremor, staggering gait, restlessness, opisthotonus.

convulsions, nystagnus, bitter almond smell to rumen. Death within 1-2 hours if untreated.

Treatment:

1. Sodium nitrite 3 g+ Sodium thiosulfate 15 g+distilled water 200 ml IV – Cattle, Buffalo.
2. Sodium nitrite 1g + Sodium thiosulfate 3g + Distilled water 50ml IV – Sheep, Goat. Repeat after 1-2 hrs.

Follw up with Sodium thiosulfate 30-60g orally

2. Nitrate/Nitrite Poisoning[9]: Common in ruminants at Rainy Season.

Causes:

Accidental ingestion of fertilizers containing nitrates - Nitrate rich plants/New Succulent Green Grass/ water, Water from deep wells.

Clinical Signs:

Salivation, colic, diarrhea, dyspnoea, brownish mucosae, chocolate colored blood, muscle tremors, staggering gait, convulsions. Death within 2- 6 hours if untreated.

Treatment:

Methylene blue@ 4-8 mg/kg IV as 1% solution, Ascorbic acid 15 mg /kg IV.

3. Oxalate poisoning[9]:

Causes:

Ingestion of oxalate rich plants e.g. Anagallis arvensis (Dihorkakada), Feeding of fodder infected with black fungus Aspergillus niger.

Clinical Signs:

Anorexia, weakness, ruminal atony, constipation, oliguria, haematuria, dribbling of urine, oedematous swelling on perineum and around genitalia.

Treatment:

Lime water1-1.5 lit orally T:ID. , CalciumProprietary Preperations IV, Rumenotorics, Vit. B complex

4. Urea poisoning[9]: (common in ruminants)

Causes:

Accidental ingestion of urea fertilizer or water intake just after Urea Mollases Treated Straw/Block.

Clinical Signs:

Severe colic, inco-ordination, muscle tremor, dyspnoea, bloat, Violent struggling & bellowing, Ammoniacal pungent smell to breath. Death within 3-4 hours

Treatment:

Vinegar or 5% Acetic acid, Large animals 2-4 lit., small animals 0.5 lit. orally, Ca, Mg salts IV.

Activated Charcol, Evacuation of rumen contents.

5. Lead poisoning[9]: (All species susceptible)

Causes:

- Licking of lead, oil paints, Ingestion of lead products like Car batteries, bullets, golf balls.
- Ingestion of herbage contaminated by metal processing industries & automobile exhausts.

Clinical Signs:

Acute: Bellowing, staggering, muscle tremor, excitement, blindness, circling, head pressing, convulsions and death.

Subacute: Constipation or diarrhoea, vomiticn, colic

Chronic: Blue-black discoloration of gums, locomotor disturbances, anemia, abortion,

Treatment:

- Calcium Disodium Versenate (Ca EDTA) 6.6% solution @ 70 mg/kg/day IV divided in 2-3 doses for 3-5 days.
- Sedatives-Diazepam (o.1-o.5mg/kg) IV, IM.
- Saline purgatives-orally.

6. Fluorine poisoning/Fluorosis[9]: (All species susceptible)

Causes:

"Ingestion of fodder/water contaminated by industrial effluents, Drinking of fluorine rich water from deep wells

Treatment:

- Lameness, stiff gait, pain in bones & joints, Mottling, wear & tear of teeth
- No specific antidotal therapy
- Aluminium sulphate @ 30 gm daily orally may be tried.
- Supplementation of diet with Ca, P& Vit D.

7. Organophosphates & Carbamates[9]:

Causes: Accidenta/ malicious ingestion or spraying of Malathion, Parathion, Sumithion, Carbaryl etc.

All species susceptible

Clinical Signs: Profuse salivatioı, lacrimation, miosis, diarrhoea, dyspnoea, muscle tremor, weakness, mild convulsions, paralysis, coma & death.

Treatment:

- Atropine sulphate @ 0.25mg/kg (2/3 rd IV, 1/3rd IM) Repeat above dose, if necessary
- Pralidoxime 4-6 mg/kg IV
- Sedatives if nervous signs present.
- Saline purgati ves
- Intensive fluid therapy

8. Strychnine poisoning[9]:

Causes:

Commonly used for killing dogs & rodents but accidental or malicious ingestion.

Clinical Signs:

Salivation, dyspnoea, clonic convulsions, opisthotonus & rapid death

Treatment:

- Intraval sodium30 mg/kg IV or Diazepam 1-2 mg/kg IV, Emetics & fluid therapy

9. Snake bite[9]:

Causes:

Poisonous snakes bite of Viper, Krait, Cobra

Clinical Signs:

- Eviderce of fang marks on muzzle & lower extremities.
- Local swelling & pain, Nervous signs in cobra bite, Red urine in viper bite
- Death within 1-10 hrs.

Treatment:

Polyvalent anti-snake venom serum V. Give 2 vials initially & then depending upon response to treatment.

Broadspectrum antibiotics, Corticosteroids, Analgesics, Fluid therapy & Neostigmine 5-7.5 mg IM.

10. Bracken Fern Poisoning[10]:

Causes: Prolonged ingestion of Bracken fern (Pteridium aquilinum).

Clinical Signs: Clinical signs are largely determined by the dose and duration of exposure and the species of the poisoned animal.

a. Enzootic Hematuria, the most common form of bracken fern poisoning, primarily affects cattle and less frequently affects sheep. It is characterized by intermittent hematuria and anemia.

Affected cattle are weak, rapidly lose weight, and develop fever (106°–110°F [41°–43°C]). Calves often have difficulty breathing, with pale mucosal membranes. Hemorrhages vary from minor mucosal petechia to effusive bleeding, and, at times, large blood clots may be passed in the feces.

a. Coagulation is prolonged, and bleeding may be pronounced and excessive even at small wounds such as insect bites or other minor scratches.

b. Bracken Staggers, in monogastric animals was first recognized as a neurologic disease when horses consumed contaminated hay.
c. In severe cases, tachycardia and arrhythmias may occur, and death (usually 2–10 days after onset) is preceded by convulsions, clonic spasms, and opisthotonos.
d. Bright Blindness, A less common presentation of ptaquiloside toxicity is called bright blindness.
e. Affected animals often have many of the other bracken fern-associated lesions such as bone marrow suppression, hemorrhage, immunosuppression, and urinary tract neoplasia.
f. Postmortem examinations usually reveal multiple hemorrhages or bruises throughout the carcass. There may also be necrotic and hemorrhagic ulcers in the GI tract. The bladder mucosa often contains small hemorrhages, dilated vessels, or vascular, fibrous, or epithelial neoplasms. Other neoplasms in the upper GI tract of cattle and other species have also been reported. In most cases, mixtures of hemorrhagic and neoplastic lesions are found.

Prevention & treatment:

- Poisoning has been attributed to bracken fern thiaminases, because clinical disease is similar to vitamin B1 deficiency. Most animals respond with thiamine therapy. Injection of a thiamine solution at 5 mg/kg is suggested, given initially IV every 3 hours, then IM for several days. Oral supplementation may be required for an additional 1–2 weeks, although SC injection of 100–200 mg daily for 6 days has been successful in some cases.
- Certainly, poisoning can be avoided by removing animals from bracken fern exposure and improving pasture management to increase production of alternative forage. It has been suggested that alternating bracken fern-contaminated and non-contaminated pastures at 3-week intervals can minimize poisoning.
- Antibiotics may be useful to prevent secondary infections.
- Blood or even platelet transfusions may be appropriate but require large volumes to effectively treat cattle (2–4 L blood).
- Activated charcoal & gastric evacuation may done.

11. Datura Poisoning[11]:

Causes: Leaves and seeds are the usual source of poisoning[12]. It is more poisonous to humans than ruminants. An individual seed contains about 0.1 mg of atropine, and the approximate fatal dose for adult humans is >10 mg atropine, that is 100 seeds!

Clinical signs:

- Mydriasis (dilated pupils)
- Abdominal discomfort (colic)
- Tremors, Convulsions
- Respiratory paralysis, Coma
- Excessive doses of atropine may cause mania and excitement.
- The plant contains the parasympatholytic alkaloids, atropine, hyoscine and hyoscyamine, all of which exert mainly an antimuscarinic effect which causes the symptoms of dry mouth (xerostomia), blurred vision, photophobia, tachycardia, difficulty in urination, hyperthermia, glaucoma, and mental confusion. High doses block transmission of autonomic impulses at ganglia and neuromuscular junctions.

Treatment

- Neostigmine - Physostigmine should be given intravenously to an adult in a dose of 0.5–2.0 mg at a rate of no more than 1 mg/min; a second dose may be administered if necessary. [5]
- Extracorporeal elimination and forced diuresis of the belladonna alkaloids are not viable options.
- Remove suspected & contaminated feeds and change pasture camp/land.
- Gastric evacuation & activated charcoal.
- Moving indoors (out of sunlight)
- Providing supportive feed and water.
- Pain relief (if colic signs).

12. Acetaminophen (Commonly Known as Paracetamol) Poisoning[13]:

Acetaminophen (4'-Hydroxyacetanilide N-acetyl-p-aminophenol N-(4-Hydroxyphenyl) acetamide is a synthetic non-opiate derivative of p-aminophenol. 10 to 100 milligrams per kg is extremely toxic.

Cats have less ability to metabolize acetaminophen because they are deficient in glucuronyl transferase.

Clinical Signs

- Clinical signs are related to methemoglobinemia and hepatotoxicity.
- Clinical signs include depression, weakness, tachypnea, dyspnea, cyanosis, icterus, vomiting, methemoglobinemia, hypothermia, facial or paw edema, hepatic necrosis, and death. Methemoglobinemia causes the mucous membranes to appear muddy or brown in color and is usually accompanied by tachycardia, tachypnea, weakness, and lethargy.
- Centri lobular necrosis is the most common form of hepatocellular damage seen with acetaminophen toxicity.
- Liver necrosis is considered to be less common with cats than with dogs. Large doses of acetaminophen can also cause nephrotoxicity characterized by proximal tubule necrosis.

Treatment

- The objective of treatment in acetaminophen toxicity is to replenish glutathione, convert methemoglobin back to hemoglobin, and prevent or treat hepatic necrosis.
- Stabilization is always a priority. If the animal is dyspneic, oxygen therapy should be given. Whole blood transfusions or Oxyglobin may be necessary.
- Activated charcoal at a dose of 1-3 grams/kg adsorbs acetaminophen and should be repeated, since acetaminophen undergoes enterohepatic recirculation.
- A 5% solution of N-acetylcysteine (NAC) is given orally to dogs or cats at an initial loading dose of 140mg/kg and then 70 mg/kg every 4 hours for at least 3-5 treatments. For severely affected animals, an initial dose of 280mg/kg PO or IV is recommended.
- Ascorbic acid (vitamin C) provides a reserve system for the reduction of methemoglobin back to hemoglobin. The effective dose of Vitamin C is 30

mg/kg BID-QID oral or injectible. However, ascorbic acid has questionable efficacy and may cause GI upset.

- Emesis should be induced in asymptomatic dogs or cats, unless contraindications exist. Gastric lavage is considered to be less effective than emesis, but may be performed if emesis is contraindicated. For emesis – Xylazine 0.4–0.5 mg/kg, IV or IM, Hydrogen peroxide 5–10 mL, PO.15

The duration of treatment depends on the dosage of acetaminophen ingested and the clinical signs presented. Treatment for hepatic necrosis may continue for weeks.

13. Ibuprofen Poisoning[13,14]:

Ibuprofen (2-(p-Isobutylphenyl) propionic acid) is a substituted phenylalkanoic acid with nonsteroidal anti- inflammatory, antipyretic, and analgesic properties.

Clinical Signs

- Most common signs of ibuprofen toxicoses include anorexia, nausea, vomiting, lethargy, diarrhea, melena, ataxia, polyuria, and polydipsia, Acute renal failure, severe CNS depression, hyperkalemia, respiratory depression, and metabolic acidosis are also possible, although serious acid-base disturbances are rare and usually transient.
- Post mortem lesions associated with ibuprofen toxicoses include perforations, erosion, ulceration, and hemorrhage of the upper (stomach and duodenum) and, on occasion, lower (colon) gastrointestinal tract.

Treatment

- The primary goal of treatment is to prevent or treat gastric ulceration, renal failure, CNS effects, and possibly hepatic effects. Prognosis is good if animal is treated promptly and appropriately. Delay in treatment can decrease survival potential with large exposures.
- Assisted ventilation and supplemental oxygen may be required if the animal is comatose. Seizures should be treated with diazepam (0.5-1.0mg/kg IV in increments of 5-10mg to effect in cats and dogs).
- Intravenous fluids, whole blood, inotropic agents such as dopamine (2-5 micrograms/ kg per minute in dogs and cats), and electrolytes should be given to control hypotension and hemorrhage, manage acute bleeding ulcers, maintain renal function, and correct electrolyte abnormalities.
- Acid base imbalances should be corrected. Metabolic acidosis is treated with slow IV infusion of sodium bicarbonate in fluids. Bicarbonate and fluid therapy must be monitored closely via blood gases and adjusted if pulmonary edema or metabolic alkalosis develops.
- Decontamination procedures with ibuprofen are similar to those described for acetaminophen toxicoses.
- Gastric protection is an important part of treating an ibuprofen toxicosis.

14. Ivermectin toxicity:

Causes: over dose of Ivermectin.

Clinical signs:

- Lack of coordination
- Vomiting and diarrhea

- Tremors and exaggerated wide movements.
- Dilated pupils.
- Hypersalivation.
- Difficulty breathing
- Paralysis in the hind legs

Treatment

Neostigmine methyl sulphate

- It is also used in anaesthesia to end the effects of non-depolarising neuromuscular blocking medication.
- Stigmin/G-Neostigmin- 0.5mg, 1ml ample.
- 0.02-0.04 mg/kg @12.5-25 kg.[15]
- Sedation (if excitement present)
- Diazepam- @1-2.5/kg
- Sedil 10mg/2ml, 1ml -2-5kgs.
- Medazolam- 0.5-1mg/kg
- Hypnofast @1ml-5-10kg
- Normal saline (IV/SC 10-20ml/kg)
- Nerve Tonic
- Dexamethasone if in coma.

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Appendix-x

List of Over-The-Counter (OTC) Drugs

1. Albendazole Chewable Tablet
2. Antacid Chewable Tablet/ Suspension
3. Ascorbic Acid Chewable Tablet/ Syrup
4. Benzyl Benzoate Lotion
5. Calcium Tablet
6. Chloramphenicol Eye/Ear Ointment/Drops
7. Chlorhexidine Lotion/ Cream
8. Chloroxylenol Lotion/ Cream
9. Chlorpheniramine Maleate Tablet/ Syrup
10. Condoms
11. Diclofenac Gel
12. Dextromethorphan Syrup
13. Ferrous (Sulphate, Gluconate & Fumarate) Tablet/ Capsule/ Syrup
14. Gentian Violet
15. Glycerin Suppository
16. Low Dose Contraceptive Pills
17. Mebendazole Tablet
18. Metronidazole Tablet/ Suspension
19. Methyl Salicylate Gel
20. Milk of Magnesia Suspension
21. MouthwashProprietary Preperations
22. Multivitamin Tablet/ Capsule/ Drops
23. Neomycin/ Gentamycin/ Bacitracin or combination Ointment/ Cream/ Dusting Powder
24. Omeprazole capsule
25. Oral Rehydration Salt (ORS) (with or without glucose or flavors) Sachets
26. Paracetamol/Acetaminophen Tablet/ Syrup/ Suspension/Suppository
27. Permethrin Ointment/ Cream
28. Potassium Permanganate Granules for Gargle
29. Povidone Iodine
30. Promethazine Theoclate Tablet
31. Riboflavine tablet
32. Salbutamol Tablet
33. Salicylic Acid + Benzoic Acid Ointment
34. Silver Sulphadiazine Ointment
35. SunscreenProprietary Preperations
36. Vitamin A Capsule
37. Vitamin B Complex (individual or combinations) Tablet/ Syrup/ Drops
38. Xylometazoline 0.1% Nasal Drops

Appendix-xi

List of Controlled Drugs

Controlled drugs are classified in this list according to the First Schedule of the Narcotics Control Act, 1990. Note that the said Schedule contains also the names of other narcotic and psychotropic substances that are not used either in their crude forms or otherwise in theProprietary Preperations of pharmaceutical or medicinal products. The penalties applicable for offences involving the different classes of the listed drugs are graded broadly according to the degree of harmfulness attributable to a drug when it is misused. For details of such offences, see the Narcotics Control Act, 1990.

1. A-Class Controlled Drugs

Alfentanil; buprenorphine; cocaine and its salts; codeine phosphate; dextromoramide; dihydrocodeine tartrate; diphenoxylate; ethylmorphine; fentanyl; heroin (diamorphine) hydrochloride; hydromorphone hydrochloride; meptazinol; methadone hydrochloride; morphine and its salts; pentazocine; pethidine hydrochloride; phenazocine hydrobromide; pholcodeine; tetrahydro cannabinol or cannabis resin in any form; and remifentanil.

2. B-Class Controlled Drugs

a. Amphetamine/ methylamphetamine and related other drugs (these drugs are prohibited in Bangladesh for medicinal purposes); barbiturates (e.g. amylobarbitone, butobarbitone, methyl phenobarbitone, phenobarbitone, phenobarbitone sodium, quinalbarbitone/ secobarbital, etc.)
b. Ethyl alcohol and all kinds of wine, spirit, liquor and beer; rectified spirit; any medicine or liquid containing more than 5% of ethyl alcohol.
c. Herbal cannabis in any form; LSD or any other drug containing LSD.

3. C-Class Controlled Drugs

Benzodiazepines (e.g. alprazolam. bromazepam, chlorazepate, chlordiazepoxide, diazepam, flurazepam, loprazolam, lorazepam, lormetazepam, nitrazepam, oxazepam etc.); denatured spirit or methylated spirit; meprobamate; other tranquilizer or hypnotic drugs not included in B-Class.

Appendix-xii

Pharmacovigillance System and ADR Monitoring in Bangladesh

Pharmacovigilance (PV) is defined by the World Health Organization (WHO) as - "The science and activities relating to the **detection, assessment, understanding, and prevention of adverse effects or any other drug-related problem".**

Major aims of Pharmacovigilance are-

- Early detection of unknown safety problems
- Identification and quantification of risk factors
- Preventing patients from being affected unnecessarily
- Collection of more information about safety of drugs
- To ensure Rational use of Medicines and Patient Safety

Some Drug Reactions Defined by WHO

Adverse Event (AE): any untoward medical occurrence that may be present during treatment with a pharmaceutical product but which does not necessarily have a casual relationship with this treatment.

Adverse Drug Reaction (ADR): "any response to a medicinal product that is noxious and unintended and which occurs at doses normally used for the prophylaxis, diagnosis or modification of physiological function."

Side Effect: any unintended effect of a pharmaceutical product occurring at doses normally used by a patient which is related to the pharmacological properties of the product.

An ADR may therefore include any of the following:

a. a harmful drug response,
b. an unwanted effect on an organ system different from that being treated,
c. an allergic or hypersensitivity reaction,
d. an idiosyncratic reaction, or
e. a drug interaction that causes either an increased or diminished response.

A *side effect* and a drug allergy are both types of ADRs. A side effect is an example of a dose-related, predictable reaction to a drug. It is typically accepted that a side effect of a drug is known to occur in a given percentage of the population and has been observed with regular frequency. A *drug allergy* is an example of a non-dose-related, unpredictable adverse effect to a drug.

Any reaction to a new drug (e.g., a drug on the market 3 years or less), whether or not included in the product labeling and regardless of its severity, should be reported. Reporting for biologic agents (e.g., vaccines) as well as devices, and any reactions for these agents or products should be reported as well. Table-1 below shows the reportable adverse drug reactions.

Importance of Pharmacovigilance

- Adverse Drug Reactions are among the top ten causes of mortality
- The percentage of hospital admissions due to drug related events is about or more than 10%. More than 50% of ADRs are *preventable.*
- Drug classes frequently involved in Adverse Drug Reactions (ADRs) related admissions include drugs of abuse, anticonvulsants, antibiotics, respiratory drugs, and pain medications. ADRs can also occur in hospitalized patients and require an increase in length of stay and treatment with medical and pharmacologic interventions.

Table 1: Reportable Adverse Drug Reactions.
• For "new" drugs – report all suspected reactions, including minor ones. • For established or well-known drugs – report all serious or unexpected (unusual) suspected ADRs; • Report if an increased frequency of a given reaction is observed; • Report all suspected ADRs associated with drug-drug, drug-food or drug-food supplements (including herbal and complementary products) interactions; • Report ADRs in special fields of interest such as drug abuse and drug use in pregnancy and during lactation; • Report when suspected ADRs are associated with drug withdrawals; • Report ADRs occurring from overdose or medication error; • Report when there is a lack of efficacy or when suspected pharmaceutical defects are observed.
An event is serious and should be reported when it: 1. resulted in death. 2. was life-threatening. 3. required prolonged hospitalization 4. directly resulted in disability. 5. resulted in congenital anomaly.

How to recognize ADRs

Since ADRs may act through the same physiological and pathological pathways as different diseases, they are difficult and sometimes impossible to distinguish. However, the following step-wise approach may be helpful in assessing possible drug-related ADRs:

1. Ensure that the medicine received as per prescription and actually taken by the patient at the dose advised;

2. Verify that the onset of the suspected ADR was after the drug was taken, not before and discuss carefully the observation made by the patient;

3. Do a thorough physical examination with appropriate laboratory investigations, when possible;

4. A full drug and medical history should be done, when possible;

5. Determine the time interval between the beginning of drug treatment and the onset of the event;

6. Evaluate the suspected ADR after discontinuing the drugs or reducing the dose and monitor the patient's status. If appropriate, restart the drug treatment and monitor recurrence of any adverse events.

7. Analyze the alternative causes (other than the drug) that could on their own have caused the reaction;

8. Use relevant up-to-date literature and personal experience as a health professional on drugs and their ADRs and verify if there are previous conclusive reports on this reaction.

9. Report any suspected ADR to the person nominated (if any) for ADR reporting in the hospital or directly to the ADRM Cell, Directorate General of Drugs Administration, Aushadh Bhabon, Mohakhali, Dhaka-1

10. Collected reports are primarily assessed by ADRM cell, then Technical sub-committee. Finally, these are reviewed by ADR Advisory Committee (ADRAC) and pass comment. The ADRAC also make regulatory recommendation if needed to the DGDA. Thus, ADRs are identified. All safety information are being disseminated to the relevant stakeholders through different means.

11. The reports are uploaded to Uppsala Monitoring Centre VigiBase (Global database) for further analysis in broader aspect. As a member country Bangladesh gets WHO-UMC collaboration in Pharmacovigilance activities.

Drug Induced Diseases

Disease management, collective management of all aspects of a patient's disease, rather than isolated drug treatment of a disease is rapidly becoming the accepted practice in health care. Adverse drug monitoring and management should be thought of in a similar fashion. It is impossible to consider the desired outcomes of drug therapy without taking into consideration all adverse, as well as beneficial, consequences of treatment. The remaining sections of this chapter will focus on major organ systems most commonly associated with adverse pharmacologic reactions. Throughout the remainder of this chapter, the reader may be referred to other chapters in this book that describe in detail the mechanism of specific drug-induced diseases.

Hypersensitivity Reactions: True hypersensitivity reactions are immunologically mediated through a series of reproducible steps. Hypersensitivity reactions are most frequently associated with β-lactam antibiotics, which include penicillin and cephalosporin. While allergic reactions to penicillin have been reported to occur in 0.7 to 8% of the general population, anaphylaxis only occurs in 0.01% of identified treatment courses.

Hypersensitivity reactions may manifest as acute urticaria, rhinitis, bronchial asthma, and angioedema. Depending on the severity of the reaction, there may also be peripheral circulatory collapse; therefore, immediate medical care should be sought. The offending agent should be removed. Epinephrine should be administered 0.1—0.2 mg IV over 2 to 3 minutes. This dose may be repeated every 15 to 20 minutes as needed up to 3 doses. Oxygen should be administered if available. Since the patient may be experiencing vascular collapse, fluid therapy should be initiated as needed to maintain blood pressure. If the patient is unresponsive to fluid replacement, a dopamine infusion may be necessary at a rate of 2 to 15 mg/kg. β-Agonists, diphenhydramine, and hydrocortisone should also be administered after the emergent situation is controlled.

Hepatotoxicity*:* Drug-induced hepatotoxicity has been associated with over 600 drugs. Hepatotoxicity can be difficult to diagnose because the literature consists primarily of case reports and because injury can present acutely or after prolonged drug administration. Table-2 illustrates some of the risk factors associated with developing hepatotoxic reactions. Table-3 lists a number of drugs that have been implicated in causing chronic active hepatitis. Acute liver injury can be cytotoxic or cholestatic. Cytotoxic injury involves direct injury to the hepatocytes with necrosis that can be localized or diffuse throughout the liver. Aminotransferase levels can be elevated to up to

500 times the normal levels. Prominent signs and symptoms include fatigue, anorexia, nausea, and jaundice. Drug-induced cytotoxic injury can progress to fulminant hepatic failure. Isoniazid, methyldopa, and phenytoin have been associated with direct cytotoxic reactions that have led to mortality rates of 10% or higher. Cholestatic injury results in a characteristic decrease in bile flow. Hepatic injury of this type leads to jaundice and pruritus, and aminotransferase levels are only moderately elevated. Cholestatic hepatic injury has a much better prognosis as compared to cytotoxic injury with a mortality rate of less than 1%.

Table 2 : Risk Factors Associated with Developing Hepatotoxic Reactions		
	Factor	**Example**
Age	Adult > Children	Isoniazid, halothane
	Elderly> others	NSAIDs
	Children > Adults	Valproic acid, aspirin
Sex	Female > Male	Methyldopa, Drug-induced chronic active hepatitis
Drugs	Alcohol & Phenobarbital	Can induce Cytochrome p 450 system and enhance the toxicity of agents converted to active metabolites
Pathological State	AIDS	Increased susceptibility to hepatotoxic effects of Sulfamethoxazole-Trimethoprim
	Diabetes	Enhances toxicity of carbon tetrachloride
	Hyperthyroidism	Enhances toxicity of carbon tetrachloride
Adapted from Zimmerman HJ. Hepatotoxicity. Disease-a-Month 39:675 787. 1993.		

Table 3 . Drugs Implicated in Causing Chronic Active Hepatitis		
Acetaminophen	Isoniazid	Papaverine
Dantrolene	Nitrofurantoin	Propylthiouracil
Diclofenac	Methyldopa	Sulfonamides
Adapted from Zimmerman HJ. Hepatotoxicity. Disease-a-Month 39:675 787. 1993.		

Pancreatitis: Pancreatitis can also be characterized as being either acute or chronic. A large number of medications can cause acute pancreatitis. Clinical symptoms of pancreatitis include acute abdominal pain and increased blood and urine pancreatic enzyme concentrations. Morphologic changes in the pancreas itself are minor or absent. Table-4 given below.

Table 4: Examples of Drugs Suspected in Drug-Induced Pancreatitis		
Asparginase	Furosemide	Sulindac
Azathioprine	Mercaptopurine	Tetracyclines
Didanosine	Pentamidine	Thiazides
Estrogens	Sulfonamides	Valporic Acid

Nephrotoxicity: Drug-induced nephrotoxicity depends on the concentration of drug presented to the kidney and the biochemical or physiologic effect of the drug on the affected tissue. Factors that influence the concentration of given drugs in the kidney include mechanisms for the transport of drugs across the tubular epithelium, the rate of water versus drug reabsorption, plasma protein binding, and rate of urine flow. A list of drugs and chemicals associated with each of these lesions is provided in Table-5.

Table 5: Drugs Associated with Nephrotoxicity			
Acute tubular necrosis Glomerulo-nephritis	***Antibiotics***	**Acutetubulointerstitial disease**	***Penicillins***
	Aminoglycosides		Amoxicillin
	Amphotericin B		Carbenicillin
	Bacitracin		Methicillin
	Cephalosporins		Nafcillin
	Polymixins		Oxacillin
	Sulfonamides		Penicillin
	Metals		***Other antibiotics***
	Antimony		Cephalosporins
	Bismuth		Cotrimoxazole
	Mercurials		Erythromycin
	Platinum		p-Aminosalicylate
	Chelates		Polymixins
	Dimercaprol		Rifampin
	EDTA		Sulfonamides
	Contrast media		***NSAIDs***
	Miscellaneous		Fenoprofen
	Acetaminophen		Ibuprofen
	Aminocaproic acid		Indomethacin
	Carbamazepine		Mefenamic acid
	Cisplatin		Phenylbutazone Tolmetin
	Cyclosporine		*Miscellaneous*
	Methotrexate		Allopurinol
	Methoxyflurane		Azathioprine
	Phenazopyridine		Captopril
	Streptozocin		Cimetidine
	Allopurinol		Clofibrate
	Captopril		Furosemide
	Cyclophosphamide		Phenytoin
	Daunorubicin		Thiazides
	Fenoprofen		
	Hydralazine	**Chronic tubulointerstitial disease**	Acetaminophen
	Rifampin		Aspirin
	Sulfonamides		Lithium
	Thiazides		Methyl-CCNU
	Trimethadone		Phenacetin

Gastrointestinal Diseases: Nausea and vomiting are among the most frequent drug-induced symptoms and they occur more often in women. Almost any orally administered drug can produce these symptoms by a direct irritant effect on the gastric or small-bowel mucosa, or by central stimulation of the chemoreceptor zones and vomiting center in the medulla. The most common drugs causing these reactions included potassium chloride, heparin, docusate and aluminum and magnesium hydroxide suspension. The most clinically significant ADRs affecting the upper gastrointestinal tract result from the use of nonsteroidal anti-inflammatory drugs (NSAIDs), partly because of their widespread use in this country. There are two types of gastrointestinal toxicity associated with NSAIDs: dyspepsia and ulceration of the gastric mucosa. Ulcerogenic properties of NSAIDs have received intensive study both in the laboratory and epidemiologically. The anti-

inflammatory activity of these agents is derived from their ability to inhibit cyclooxygenases (prostaglandin synthetases), which, unfortunately, results in an impairment of the gastrointestinal mucosa to resist acid attack.

Hematologic Disorders: Drug-induced hematologic disorders encompass a wide variety of disorders, only some of which are mechanistically understood. Hematologic disorders such as, aplastic anemia, agranulocytosis, hemolytic anemia, megoblastic anemia, and thrombocytopenia have been associated with drug-induced etiologies.

Aplastic anemia is the most serious drug-induced blood disorder, and it has been estimated that drugs are responsible for nearly one-half of all cases of aplastic anemia. The first clinical manifestations of aplastic anemia usually are related to hemorrhage. Pancytopenia is observed in a majority of the patients on initial examination, and a hypocellular bone-marrow biopsy may be obtained at some time in the course of the illness. Many drugs can cause suppression of bone-marrow activity or aplasia in a dose-dependent manner, as is the case with cytotoxic drugs. For many other drugs, aplastic anemia can occur suddenly in the form of an idiosyncratic reaction, unrelated to the dose. Cytostatic drugs are used in the treatment of neoplastic disorders because of their action on dividing cells. All of these agents, which include alkylating agents, antibiotics, antimetabolites and vinca alkaloids, in large doses, can produce bone-marrow aplasia.

In agranulocytosis resulting from allergic mechanisms, signs and symptoms appear in a few days to weeks following administration. There is an abrupt onset of high fever, rigors and occasional episodes of localized infections. Drugs associated with this type of reaction include sulfonamides, sulfonylureas, phenothiazines, antithyroid agents, phenyl-butazone and semisynthetic penicillins. Drugs that can produce a lupus-like syndrome and result in agranulocytosis are procainamide, hydralazine, isoniazid, rifampicin and propylthiouracil.

Cardiovascular Effects: Adverse drug reactions involving the cardiovascular system are not specifically limited to those agents used to treat cardiovascular disease. For example, bronchodilator therapy and sympathomimetic effects of various cough and cold remedies often negatively affect cardiac rate and rhythm regulation. Many antiarrhythmic agents may also be proarrhythmic. Tricyclic antidepressants in an overdose situation cause ECG changes that can be life-threatening. In addition to certain cardiac medications, bradycardia can also be induced by agents such as carbamazepine, methyldopa, and H_2 antagonists. Some agents used in chemotherapy regimens, such as the anthracyclines, have a dose limiting side effect of causing congestive cardiomyopathy. Additionally, some diuretics and β-blockers may adversely affect lipid risk profiles.

Pulmonary Effects: Pulmonary injury secondary to pharmacologic treatment has been shown to occur with the administration of over 150 medications. Table-6 lists agents known to cause pulmonary disease.

Table 6: Agents Known to Cause Pulmonary Disease

Cardiovascular	Anti-inflammatory	Chemotherapeutic Agents
Amiodarone	Aspirin	Azathioprine
ACE inhibitors	Ifosfamide	Bleomycin
Anti-coagulants	Methotrexate	Busulphan
β-Blockers	NSAIDs	Chlorambucil

Dipyridamole	Penicillamine	Cyclophosphamide
Tocainide	Miscellaneous	Etoposide
Antibiotics	Bromocriptine	Melphalan
Amphotericin B	Dantrolene	Mitomycin
Nitrofurantoin	Oral Contraceptives	Nitrosoureas
Sulfasalazine	Hydrochlorothiazide	Procarbazine
Pentamidine	Tricyclic Antidepressants	Vinblastine
Adapted from Rosenow ECIII. Drug-induced pulmonary disease. Disease-a-Month. 5:258—310, 1994.		

Ototoxicity: Ototoxicity from drug therapy may be manifested in two ways, depending on the portion of the inner ear affected. Vestibular toxicity can result in dizziness or vertigo, while cochlear toxicity usually results in hearing loss. Manifestations of ototoxicity may range from mild tinnitus or dizziness to total bilateral irreversible hearing loss and/or permanent disabling vertigo. Aminoglycosides such as neomycin, streptomycin, gentamicin, amikacin and netilmicin are considered to be the most ototoxic, in terms of permanent damage. These drugs destroy the outer hair cells in the cochlea in such a way that high-frequency hearing loss occurs first; lower and midrange frequencies or conversational tones are affected later. Topically administered aminoglycoside antibiotics can be absorbed sufficiently to result in ototoxicity. Oral or peritoneal administration or topical use of neomycin for wound irrigation has also resulted in ototoxicity. Similarly ototoxicity has followed the application of a 0.1% gentamicin cream to the skin. Loop diuretics, ethacrynic acid, furosemide and bumetanide all possess the potential to produce ototoxicity. There have been numerous case reports of transient effects of ethacrynic acid on auditory function and reports of permanent deafness, even after oral administration. High intravenous doses of furosemide may cause vertigo and transient hearing loss, particularly in patients with renal impairment. Even in the absence of renal failure, oral doses of furosemide have been reported to result in permanent hearing impairment.

Ocular Toxicity: The list of drugs that are toxic to the eye is extensive. Nearly every structure of the eye has been affected adversely by drugs. Decreased tear production has been shown to have damaging effects on the eye. Tear secretion can be diminished by anticholinergic and by ganglionic blocking drugs. A decrease in tear production occasionally has been noted in patients receiving phenothiazines. Patients using chloroquine, or related aminoquinolines, for diseases such as systemic lupus erythematous and rheumatoid arthritis take high doses for prolonged periods and are at risk of developing ocular toxicity. Ocular damage normally does not occur with lower dosages used in the suppression and treatment of malaria. Both chloroquine and hydroxychloroquine produce numerous forms of ocular toxicity, which include whitening of the lashes, extraocular muscle palsy, corneal deposits, decreased corneal sensitivity and retinal damage. Elevated intraocular pressure is a well-documented side effect of both local and systemic corticosteroid therapy. The increased intraocular pressure occurs a few weeks after topical application and a few months after systemic therapy. Severe increases in intraocular pressure, similar to those seen in acute glaucoma, have resulted in cupping of the optic discs and visual field defects similar to those seen in open-angle glaucoma. Corticosteroid-induced glaucoma develops more commonly in patients with a family history of glaucoma.

Sexual Dysfunction:

Normal sexual function is mediated by various physiologic mechanisms including neurogenic, psychogenic, vascular, and hormonal factors. It is expected, then, that medications that interfere with any of these systems may also interfere with sexual Function. Sexual dysfunction is often associated with antihypertensive and antipsychotic medications.

Thiazide diuretics, peripheral and central sympatholytics, and β-blockers have all have been associated with a decline in sexual function. The adverse events range from loss of libido to impotence, ejaculatory failure, and anorgasmia, with impotence being the most frequently reported. Calcium channel blockers and ACE inhibitors appear to have a relatively decreased potential for causing sexual dysfunction. Antipsychotic or antidepressant medications are also associated with a variety of effects on sexual function (e.g., impotence, priapism, anorgasmia, and diminished libido); however, ejaculatory failure is the most frequently reported.

Additional medications that have been associated with sexual dysfunction, although less frequently than the aforementioned agents, are the H_2 antagonists, metoclopramide, anticonvulsants (e.g., carbamazepine, phenytoin, phenobarbital, and primidone), and opioids when used chronically.

Appendix-xiii

History of Adverse Drug Reactions Monitoring (ADRM)

Background

- In 1962, in the wake of the thalidomide disaster, World Health Assembly requested WHO to establish an international system of monitoring adverse reactions to drugs using information derived from national centres.
- The Sixteenth World Health Assembly in 1963 adopted a resolution (WHA 16.36)
- WHO Pilot Research Project started for International Drug Monitoring in 1968
- In 1978 International Drug Monitoring Centre (Uppsala Monitoring Centre, Sweden) has been established
- More than 147 countries are member of the WHO-UMC.
- Bangladesh is the 120th member of WHO-UMC.

Before an effective international system could become operative, a common reporting form had to be developed, agreed guidelines for entering information had to be formulated, common terminologies and classifications had to be prepared and compatible systems for transmitting, storing, retrieving and disseminating data had to be created. Upon the successful completion of these tasks the operational activities sub serving the international data base were relocated in 1978 to a WHO collaborating centre situated in Uppsala, Sweden.

ADRM and Pharmacovigilance in Bangladesh

Under the guidance of WHO, an Adverse Drug Reaction Monitoring (ADRM) Cell was established in the Directorate of Drug Administration, now known as Directorate General of Drug Administration (DGDA) in 1996. Initially the Cell circulated posters bearing awareness slogans of drug use throughout the country, organized awareness meetings among the chemists of different area and also published awareness instructions in the daily newspapers and broadcasted these awareness slogans on Radio Bangladesh. The Cell has been trying since its inception to introduce a systematic mechanism for ADR monitoring in Bangladesh and for collection, analysis and compilation of ADRs, spontaneously reported by the medical and pharmaceutical professional of all health services outlets of the country. With this end in view, DGDA has been organizing ADR Monitoring Workshops/meetings in the Medical Colleges and Hospitals of the country and distributing printed ADR reporting forms to the doctors for spontaneous reporting of ADR cases since 2000. On 6 July 1997, the Ministry of Health & Family Welfare (MOHFW) formed a 10-Member ADR Advisory Committee (ADRAC) to evaluate, analyze and make recommendations for solving problems of medicinal hazards due to ADRs.

Present Position of PV

- It is functioning well after re-starting in 2013 with technical support of USAID funded MSH/SIAPS program.
- Adverse Drug Reaction Monitoring (ADRM) Cell of DGDA has been declared as **the National Drug Monitoring Centre (National PV Centre) for Bangladesh**
- Bangladesh has been awarded 120th Membership of the WHO-UMC in 2014.

- Standard Suspected AE Reporting form is available in the DGDA website and hard copies are also available in the Health facilities and in the Pharmaceutical Companies.
- WHO-UMC is providing support for using their tools VigiFlow, VigiBase etc
- PV newsletter, posters, pamphlets for risk communication and awareness building among satkeholders.
- Technical sub-committee and ADR Advisory Committee work for technical evaluation of Suspected AE reports and provide regulatory recommendation.
- ADRM cell first started PV activities with primarily selected 20 Pharma Industry and 20 Hospitals
- Then the number has been increased in 30 and 32 respectively. Now the area has been extended to all the Pharmaceutical Industries, all Govt. Medical College Hospitals & General Hospitals.
- Public Health Programs (specially Kala-azar Porgram) are also collaborating in this regard. They are providing reports regular basis.
- ADRM Cell is regularly meeting with stakeholders, visiting hospitals and companies for exchanging views to improve the PV awareness.

What to Report

The National Drug Monitoring Centre shall encourage reporting of all suspected adverse drug related events, whether it is seemingly insignificant or common adverse reactions, as it may highlight widespread prescribing problem. The reporter should made aware not to wait until he feels certain that a causal link can be considered proven or disproven. In any case of doubt it is better to report than not to report.

A case report in pharmacovigilance can be defined as: A notification relating to a patient with an adverse medical event (or laboratory test abnormality) suspected to be induced by a medicine. It should also be a comprehensive and complete medical description of the case.

An updated and standardized suspected adverse event reporting form has been developed and adopted by Bangladesh to report all cases of ADRs. The ADR form is available at DGDA and on the website in a fillable pdf format. ADR case report should (as a minimum to aim at) contain information on the following elements:

1. The patient: name or initials, age, sex, contact information, and brief medical history
2. Suspected Adverse event: type of event, description (nature, localization, severity, characteristics), results of investigations and tests, start/end date, course and outcome.
3. Suspected drug(s): name (brand or generic name, manufacturer) dose, dosage form, frequency, Batch number, start/stop date, indication for use, seriousness of event, outcomes attributed, other relevant history.
4. All concomitant drugs information (including self medication): names, doses, routes, indication, frequency, start/stop dates.
5. Relevant history of the patient (e.g., impaired renal faction, previous exposure to suspected drug, previous allergies)

6. Name and address of the reporter (to be considered confidential and to be used only for date verification, completion and case follow-up)

NB: *The mandatory fields of the Suspected AE Reporting form have been marked `star'.*

Who Should Report

12. **Government/Private Hospitals/Clinics/Pharmaceutical Companies:** Every hospitals and clinics must decide for itself how the reporting system should be operated and by whom. The arrangements will depend on the hospital's / clinic's own organization and traditions. Conversely, during the launch of Bangladesh as a National Pharmacovigilance Program on September 2, 2013, DGDA identified Focal Point persons at 20 public & private hospitals and 20 Pharmaceutical Companies, which has subsequently be increased to 30 in 2014 that would be responsible for collecting ADRs and submitting to DGDA. Recently this number has been increased to 50, although all the Pharmaceutical Companies have been served administrative order from DGDA to form functional PV team with focal (responsible) person for performing Pharmacovigilance of their own products. All the Medical College Hospitals and General Hospitals have been requested to form PV team also to perform PV activities at their own facilities. All pharmaceutical companies and hospitals/clinics are encouraged to do the same. Generally the Healthcare Providers (Doctors, Pharmacists, Nurses) themselves act as reporters, completing the reporting form, keeping a record and sending them to the Focal Person at the hospital, who will forward the report to: **ADRM Cell, Directorate General of Drug Administration,** Aushadh Bhabon, Mohakhali, Dhaka-1212, Bangladesh.

The hospital pharmacist may act as a reporter, completing the forms in consultation with the reporting physician. Patients/Consumers may also act as reporters and contact the pharmaceutical companies regarding any suspect adverse event or ADRM Cell directly.

A reporter should report

a. Apparent ADRs previously unknown to the reporter
b. Serious ADRs
c. All suspected ADRs to new drugs
d. Medication Errors
e. Suspected events due to product quality issues.

Suspected AE reporting forms: are available as printed hard copy. It is also available in the DGDA website: www.dgda.gov.bd.com. It can be downloaded easily, then after filling up to be sent to the e-mail ids: adrmcell.dgda@gmail.com or dgda.gov@gmail.com

Conclusion

Pharmacovigilance is an important task for patient safety. It is very much crucial and important to ensure the safety of marketed drug products**.** It can save us from any unwanted disaster for unidentified risks of drugs. So, we need to perform Pharmacovigilance intensely throughout the country.

Appendix-xiv

Medicinal Gases

The following is a brief description of the medical gases in common use, together with some details of their administration, health hazard information, contraindication, and color coding of cylinders.

1. OXYGEN (O_2)

Uses: Oxygen is used extensively in medical practice to increase oxygenation in patients with acute and chronic lung disease and cardiac disorders, for resuscitation, and for the treatment of victims of poisoning. It is always administered during anesthesia. Oxygen therapy is also used in several applications: to supplement the breathing of patients whose respiratory system has become comprised from ailments such as bronchitis, or emphysema; to treat patients who are suffering from hemorrhage, shock, convulsions or other trauma; to administer atomized, liquid medication into the lungs; or as a treatment itself, due to pure oxygen's vasoconstrictive properties.

Administration: Oxygen is administered by mask, tent, endotracheal tube, nasal catheter and by special equipment for prolong treatment. Masks are used for controlled flows which may give concentrations over 60% by volume. Tents are used when the concentration need not to exceed 50% by volume. Respiratory facemasks are used to provide oxygen concentrations of approximately 30% of inhaled air.

Humidification of the gas may be needed when nasal catheters are used with a flow rate of over 3 liters/minute. Dependent on whether masks, tents or nasal catheters are used the flow rate is determined by the clinician. The dosage is adapted to the patient on the basis of the clinical course of the illness and generally ranges from 1 to 10 liters of gas per minute. In circumstances where oxygen is being mixed with other gases (anesthetics and analgesics) it is essential that the proportion of oxygen in the inspired mixture never falls below the concentration in air.

Health Hazard Information: At normal atmospheric pressures, oxygen is non-toxic up to about 20 hours exposure. At increasing pressures, oxygen becomes toxic to the lungs and central nervous system. Oxygen toxicity may result from the long-term exposure to partially reduced oxygen products which alter the metabolic function and structure of lung cells.

Contraindications: Newly born and premature infants should be given oxygen only if absolutely necessary because of the risk of the development of retinal damage. Patients who have chronic respiratory disease with carbon dioxide retention may develop apnea if given oxygen, due to the reduction in stimulation of the respiratory system by carbon dioxide. Careful monitoring of these patients for hypoventilation is required during oxygen therapy.

Color code of cylinders: Black body, white shoulder.

2. CARBON DIOXIDE (CO_2)

Uses: Carbon dioxide stimulates the respiratory centre directly and if its concentration is raised from the normal concentration in air, the rate and depth of respiration are increased. At 3 percent concentration the depth is doubled while at 5 percent it is trebled with a great increase in respiration rate. Its use is not without danger and, therefore, it is reserved mainly for emergencies; for example, to induce and improve respiration rate in new-born infants, drowning persons, and cases of poisoning by carbon monoxide, morphine, hypnotics and other depressants. Generally, concentrations of 5 to 7 percent mixed with oxygen are used. Solid carbon dioxide is used in tissue freezing techniques. Carbon dioxide is also used: to increase the depth of anesthesia rapidly, when volatile

agents are being administered, it increases depth of respiration and helps to overcome breath holding and bronchial spasm, to increase cerebral blood flow in arteriosclerotic patients undergoing surgery, in gynecological investigation for insufflation into fallopian tubes and abdominal cavities.

Administration: Carbon dioxide should only be administered by medical personnel trained in the appropriate techniques. Cylinders should only be used in conjunction with medical carbon dioxide gas pressure regulators. Special medical equipment will be used if it is being used to inflate parts of the body during keyhole surgery or gynecological procedures.

Health Hazard Information: Carbon dioxide regulates the rate of breathing. The occupational exposure limit is 5000 ppm. As the concentration of carbon dioxide rises it affects the rate of breathing, at 2% the rate is noticeably above normal, at 10% breathing is very rapid and headache, vomiting and death may occur in an unfit person, 15% will cause unconsciousness in a few minutes, 25% leads to rapid circulatory insufficiency and death.

Pregnancy and breast feeding: The use of Medical Carbon Dioxide is not recommended during pregnancy but is unlikely to influence lactation.

Contraindications: Carbon dioxide is contraindicated:

- In acidosis
- In respiratory obstruction, the administration of carbon dioxide may be dangerous since any further increase in respiratory effort increases negative intra-thoracic pressure
- During resuscitation, where it can be dangerous and should be avoided.

Color code of cylinders: Grey body, grey shoulder.

3. NITROUS OXIDE (N_2O)

Uses: Nitrous oxide is a non-irritating anaesthetic gas, used as a carrier for the volatile anesthetics, it may be used to insufflate body cavities and in cryosurgery as a refrigerant. It can also be used as an analgesic and in dental work to provide short-term analgesia for tooth extraction and other brief procedures, administered with 50% oxygen.

Administration: Nitrous oxide should only be administered by medical personnel trained in the appropriate techniques. Cylinders should only be used in conjunction with medical nitrous oxide gas pressure regulators. Nitrous oxide should not be used for more than a total of 24 hours, or more frequently than every 4 days, without close clinical supervision and hematological monitoring.

Health Hazard Information: Nitrous oxide does not support life and when used for anesthesia an adequate oxygen concentration must be ensured. Because it is much more soluble than nitrogen, nitrous oxide will diffuse into air filled body cavities much faster than nitrogen will diffuse out, increasing the pressure within them. Administration of nitrous oxide will, if continued for some hours, result in some inactivation of vitamin B_{12}, which is a co-factor of methionine synthase. Folate metabolism is consequently interfered with and DNA synthesis is impaired following prolonged administration of nitrous oxide. If administration is frequent, say every 2 days, this can result in megaloblastic changes in bone marrow, myeloneuropathy and sub acute combined degeneration of the spinal cord. Addiction can also occur. After a substantial period of time signs similar to those of sub acute combined degeneration of the spinal chord may develop. The suggested limits for continuous exposure range between 25-400 ppm. Nitrous oxide should never be given with less than 21% oxygen, but a maximum of 30% oxygen should be used during anesthesia (except when used in combination with a volatile anesthetic agent) and more at altitude and in the presence of disorders affecting oxygenation.

Absolute Contraindications:

- High and low atmospheric pressures.
- Unconsciousness.
- The first sixteen weeks of pregnancy.
- Artificial, traumatic or spontaneous pneumothorax.
- Gross abdominal distension
- During myringoplasty
- Air embolism

Care is required in the following conditions:

- Sedated patients.
- The very young and old due to mask fitting difficulties.
- Bowel obstruction.
- Having Vitamin B12 deficiency.

Color code of cylinders: Blue body, blue shoulder

4. HELIUM (He)

Uses: Helium is used in physiological investigations. The low density of helium compared to nitrogen enables it to provide a substitute for air when mixed with oxygen which is easier to breath in obstructive or dystrophic chest disease. It is indicated to assist flow of oxygen into the alveoli and to reduce the work of breathing in patients with severe airway obstruction. It is also used in some cryogenic applications.

Administration: By mask or endotracheal tube; cylinders should only be used in conjunction with medical oxygen gas pressure regulators. It may also be administered via nasal prongs if sufficiently high flow rate is employed to prevent air entrainment. It can be administered to spontaneously breathing patients or in combination with various forms of invasive and non-invasive ventilatory modes.

Health Hazard Information: Helium is an inert gas and will not support life. An adequate concentration of oxygen must be ensured when helium is administered. The risk for cooling should be considered, especially in smaller children. When using devices not designed for helium-oxygen mixtures, set ventilator tidal volumes and measured flow rates may not be accurate due to the physical properties of helium.

Contraindications: Not reported.

Color code of cylinders: Brown body, brown shoulder.

5. CYCLOPROPANE (C_3H_6)

Uses: Cyclopropane is a potent anaesthetic producing good muscular relaxation. It is non-irritating and induction and recovery are rapid. Mixtures of 4, 8 and 20 to 25 percent with oxygen produce analgesia, light analgesia and surgical analgesia respectively.

Administration: Cyclopropane should only be administered by anesthetists trained in the use of Cyclopropane. Because of the flammability and expense of cyclopropane, it is usually used in a closed (rebreathing) system, in which an absorbent chemical, such as soda lime, removes exhaled carbon dioxide, and the anesthetic is recirculated.

Health Hazard Information: Cardiac irregularities are possible if atropine or catechelomines are used with cyclopropane, nausea, vomiting and a degree of hypotension are common post-operative symptoms.

Contraindications: Not reported.

Color code of cylinders: Orange body, orange shoulder.

6. OXYGEN + CARBON DIOXIDE

Uses: Oxygen/carbon dioxide mixtures are used as a stimulant to the respiratory centre. **Administration:** Usually by mask or endotracheal tube. Cylinders should only be used in conjunction with medical oxygen gas pressure regulators.

Health Hazard Information: Oxygen/carbon dioxide mixtures have similar toxicity to oxygen, but at normal atmospheric pressures the mixtures will induce a marked increase in breathing rate. The mixture should not be used at pressures above normal atmospheric pressure.

Contraindications: Newly born and premature infants should be given oxygen only if absolutely necessary because of the risk of the development of retinal damage.

Color code of cylinders: Black body, white and green shoulder.

7. HELIUM + OXYGEN

Uses: The low density of helium compared to nitrogen enables it to provide a substitute for air when mixed with oxygen which is easier to breath in obstructive or dystrophic chest diseases.

Administration: By mask or endotracheal tube; cylinders should only be used in conjunction with medical oxygen gas pressure regulators.

Health Hazard Information: Not reported.

Contraindications: Not reported.

Color code of cylinders: Brown and green.

8. Nitric Oxide (NO)

Uses: Nitric oxide is a powerful vasodilator, essential signaling molecule, and also a free radical. Since it dilates blood vessels, it is commonly prescribed to patients who suffer from circulation or heart ailments; however, it is prescribed as nitroglycerin and amyl nitrate pills which are metabolized into NO. In fact, the only instance for a NO gas prescription, which needs to be implemented in equal parts with oxygen, is for neonatal patients who suffer from pulmonary hypertension or post-meconium aspiration.

Administration: Nitric oxide is a gas available in concentrations of only 100 ppm and 800 ppm. The nitric oxide administration apparatus is to be used in conjunction with a ventilator or other breathing gas administration system. The concentration of nitric oxide is maintained approximately constant during the inspiratory flow regardless of the variation in flow rate within the inspiratory portion of the respiratory cycle. The concentration of inspired nitric oxide can be set, typically in the range of 0 to 80 parts per million (ppm). The administration apparatus includes a pressure regulator and connectors with fittings which are specific for nitric oxide gas cylinders, typically containing 400 or 800 ppm nitric oxide in nitrogen

Health Hazard Information: Overdosage with inhaled nitric oxide will be seen by elevations in methemoglobin and pulmonary toxicities associated with inspired nitric oxide. Elevated NO may cause acute lung injury.

Contraindications: Inhaled nitric oxide is contraindicated in the treatment of neonates known to be dependent on right-to-left shunting of blood.

Color code of cylinders: Nitric oxide lines and cylinders are frequently labeled with teal and black labels.

9. Medical air

Medical air cylinders are supplied to the following specification:

- oxygen content 20.9% Oxygen ± 0.5%

- nitrogen balance.

Uses: Medical air is used: as a replacement for atmospheric air when the atmosphere is contaminated by noxious fumes, vapours or gases, in anaesthesia as a carrier gas for volatile anaesthetic agents, as a power source for pneumatic equipment in ventilators and incubators to provide uncontaminated and controlled air flows.

Administration: For breathing purposes medical air is administered by various means, commonly by self contained or compressed air line breathing apparatus. In anaesthesia, medical air is administered via a cylinder and valve assembly through a face mask or endotracheal tube.

Health Hazard Information: Medical air should never be administered to a patient if, when it is mixed with other gases, the oxygen content is less than 21%. Care is needed in the handling and use of medical air cylinders.

Contraindications: Medical air is contraindicated where oxygen or other gaseous combinations would be indicated (airways obstruction, pneumonia, and a myriad of cardio-respiratory conditions).

Color code of cylinders: Yellow

Appendix-xv

Side Effect of Some Common Drugs

Common Drugs	Side effects
Analgesics & Antipyretics	
Non-opioid Analgesics-	
Aspirin	Nausea, dyspepsia, gastrointestinal ulceration & bronchospasm, Prolong bleeding time, urticaria.
Ibuprofen	Epigastria pain, Edema, Nausea, Constipation.
Paracetamol	Thrombocytopenia, leukopenia, and neutropenia.
Tolfenamic Acid	Tremor, constipation, confusion, dysuria specially in male.
Opioid Analgesics-	
Morphine sulphate	Urinary Retention, constipation, vomiting, purities, headache, depression, dyspnea, insomnia.
Tramadol Hydrochloride	Sweating, dizziness, constipation, GI bleeding, vomiting, nausea, dry mouth and fatigue.
Anti-bacterials	
Aminoglycosides	Nephrotoxicity, Ototoxicity, Neurotoxicity
Carbapenems	Constipation
Cephalosporins	Nephrotoxicity, Stevens j. syndrome, Toxic epidermal dermatitis, A.A. diarrhea
Clindamycin	Thrombocytopenia, Renal dysfunction
Colistimethate sodium	Nephrotoxicity, Neurotoxicity
Isoniazide	Elevated liver function. Tests, Loss of apetite, Weakness, Lethargy, Thrombocytopenia, peripheral neuropathy (dose related).
Linezolid, Tedizolid	Thrombocytopenia, Elevated blood pressure, Serotonin syndrome, Diarrhea in children, Headache, Nausea.
Nitrofurantoin	Urine discoloration, Anemia
Penicillins	Thrombocytopenia, Abdominal discomfort, Nephrotoxicity, Hypersensitivity reaction- fever, joint pain, rash.
Polymyxin B	Nephrotoxicity, Neurotoxicity
Rifampicin	Ataxia, Elevated liver function. Tests, Flu like syndrome.
Teicoplanin	Nephrotoxicity, Thrombocytopenia
Tigecycline	Systemic acidosis, Vit. K deficiency, Hepatotoxicity
Vancomycin	Nephrotoxicity, Ototoxicity, Thrombocytopenia
Macrolides (Azithromycin/Clarithromycin/ Erythromycin)	Diarrhea, nausea, abdominal pain, loose stool in high single dose therapy, Taste disturbance, Paresthesia, Pruritis, Cramping, Flatulence.
Fluoroquinolones (Ciprofloxacin/ Levofloxacin/ Gatifloxacin)	Nausea, Headache, Diarrhea, Dizziness, Dyspepsia, Photo sensitivity.
Tetracycline	Children may develop permanent brown discoloration of teeth (>10%), Diarrhea, nausea, Antibiotic associated pseudomembranous colitis (1-2%)
Chloramphenicol	Leucopenia, Thrombocytopenia, Suppression of red cell production, Aplastic Anemia, Peripheral neuritis, Grey baby syndrome.

Common Drugs	Side effects
Anti-coagulants	
Enoxaparin	Anemia, Blood thin, hemorrhage, Fever.
Rivaroxaban	Abdominal pain, Back pain, Headache, Dizziness, Fatigue, peripheral edema.
Warfarin	Taste perversion, Rash, Diarrhea, Jaundice, and Fever, Hemorrhage.
Anti-fungals	
Azoles	Q-T prolongation, Hypokalemia, Increased ALT/AST, Thrombocytopenia, SJS, TEN, Spontaneous hypoglycemia
Echinocandins (Anidulafungin, Caspofungin)	Hepatotoxicity
Anti-hypertensive	
Acetazolamide	Thirst, Confusion, Malaise, Polyuria, Anorexia.
Alfuzosin	Abdominal pain, Headache, constipation
Amlodipine	Edema, Headache, palpitation, abdominal pain,
Atenolol	Tiredness, Depression, Leg pain, Hypotension, Bradycardia, Cold extremities.
Bisoprolol	Dizziness. Upper Respiratory infection, Bradyarrythmia.
Captopril	Hyperkalemia, Skin Rash
Carvedilol	Hypotension, Diarrhea, Vomiting, Weight gain, Dizziness, Fatigue, Hyperglycemia.
Eplerenone	Hypercalamia, Abdominal pain, Cough
Frusemide	Hypokalemia, Hyperuricemia
Hydrochlorothiazide	Weakness, vertigo, gastric irritation, Electrolyte disturbance, Hypotension.
Irbesartan	Dizziness, Diarrhea, Fatigue, Hyperkalemia.
Labetalol	Dizziness, Fatigue, Nausea
Losartan Potassium	Hypoglycemia, Weakness, Chest pain
Nifedipine	Heart Burn, Peripheral edema, Headache
Olmesartan Midoxomil	Back pain, Headache, Dizziness, Diarrhea, Fatigue
Prazosin	Palpitation, Weakness, Headache, Dizziness.
Ramipril	Cough, Hypotension, Headache
Telmisartan	Headache, Dizziness, Diarrhea, Fatigue
Terazosin	Dizziness, Hypotension, Impotence, edema
Valsartan	Vertigo, Dizziness, Upper abdominal pain
Verapamil HCl	Headache, Constipation, Sleep disturbance
Anti-viral	
Acyclovir	Elevated transaminase level, Abdomina pain, Anemia, Fatigue, Oral malaise
Oseltamivir	Nephrotoxicity, Arrhythmia, Delirium, Abnornal liver function. Tests, Abnormal pain.

Common Drugs	Side effects
Drugs for Cancer Therapy	
Bevacizumab	Dry mouth, cough, voice changes, and loss of appetite, diarrhea, nausea, vomiting, constipation, mouth sores, and headache, Weakness.
Bleomycin	Skin reaction, Pulmonary toxicity, Hypersensitivity reaction, Myelosuppression.
Carboplatin	Nausea& vomiting, Anemia, Elevation of ALT, AST, Blood urea & bilirubin level, Cardiac failure etc.
Cisplatin	Nausea &vomiting, Hair loss, Diarrhea, loss of appetite, Hiccup etc.
Cyclophosphamide	Anorexia, Nausea & vomiting, Anemia, Alopecia, Skin & nail pigmentation.
Dacarbazine	Myelosuppression, nausea and vomiting, Flu -like syndrome, CNS Toxicity, photosensitivity.
Docetaxel	Myelosuppression, Hypersensitivity reaction, Fluid retention, Alopecia, Mucositis, Peripheral neuropathy.
Doxorubicin	GI toxicity, Blurred vision, Headache, Seizure, Skin pigmentation, Myelosuppression, Cardiac toxicity.
Epirubicin	Alopecia, Diarrhea, Nausea & vomiting, Cardio toxicity, Skin rash, Leukopenia or Neutropenia.
Etoposide	Nausea &vomiting, Anorexia, Diarrhea, Stomatitis, CNS effects, Peripheral neuropathy, Thrombocytopenia, Leukopenia.
Folinic Acid (Leucovorin)	GI disturbances, Hypersensitivity reactions, Bronchospasm.
5-Flurouracil	Myelosuppression, Hand-foot syndrome, Neurologic toxicity, Dry skin, Metallic taste.
Gemcitabine	Leukopenia, Thrombocytopenia, Anemia, Mild GI effects, Rashes, Renal impairment, Pulmonary toxicity & edema, Proteinuria, Hematuria etc.
Irinotican	Nausea & vomiting, skin reactions, Diarrhea, Cardiovascular toxicity, Neutropenia, Anemia, Abdominal Cramps etc.
Ifosphophamide	Nausea & vomiting, Depression, Hallucinations, Wound healing impairment, Nephrotoxicity, Cardiac toxicity etc.
Methotrexate	Myelosuppression, Mucositis, Uric acid nephropathy, Acute cerebral dysfunction, Skin rash, Arachnoiditis with intrathecal administration.
Oxaliplatin	Myelosuppression, Neurotoxicity, Nausea and vomiting, Diarrhea, Allergic reaction, Hepatotoxicity
Paclitaxel	Neutropenia, Anemia, Chest Pain, Neurotoxicity, Skin Discoloration, Alopecia.
Pemetrexed	Myelosuppression, Skin rash, Mucositis, Fatigue.
Rituximab	Headache, fever, chills, stomach pain, nausea, diarrhea, heartburn, flushing, night sweats, weakness, muscle or joint pain, back pain, dizziness.
Topotecan	Myelosuppression, Nausea, Vomiting, Headache, Fever, Myalgias, Alopecia.
Trastuzumab	Fever, Chills, Muscle aches, Nausea.
Vinblastin	Neurotoxicity, Constipation, Alopecia, Myelosuppression, Hypertension, Mucositis.
Vincristine	Neurotoxicity, Constipation, Alopecia, Myelosuppression, Azoospermia, Mucositis.

Common Drugs	Side effects
Drugs for Depression	
Amitriptyline HCL	Dry mouth, weight, vision problem, Sweating, Postural hypotension, Tachycardia.
Escitalopram	Somnolence, Insomnia, Headache, Nausea, Menstrual Disorder.
Flupenthixol Melitracen	Insomnia, Restlessness.
Mirtazepine	Weight gain, appetite, somnolence.
Nortiptyline	Anxiety, Palpation, Arrhythmias, panic.
Diazepam	Diarrhea, Euphoria, Rash, Incoordination.
Phenobarbitone	Drowsiness, Excitement, Vomiting, confusion.
Drugs for Heart Failure (Inotropic-Sympathomimetic)	
Dopamine HCL	Angina pain, atrial fibrillation, ventricular arrhythmia, Ectopic beats, Tachycardia.
Dobutamine HCl	Angina, dyspnea, fever, nausea, Tachyarrhythmia.
Digoxin	Dizziness, Mental disturbance, Diarrhea, Headache, Nausea.
Drugs for Lipid Regulation	
Atorvastatin	Diarrhea, Nasopharyngitis, Arthralgia.
Fenofibrate	Abdominal Pain, Back Pain, Headache, constipation.
Omega -3 fatty Acid	Taste perversion, Rash, Infection, pain.
Rosuvastatin	Myalgia, Headache, pharyngitis.
Simvastatin	Myalgia, Headache, pharyngitis, abdominal pain, constipation.
Drugs for Respiratory System	
Aminophylline	Convulsion, vomiting, insomnia, Abdominal pain.
Glycopyronium Bromide	Dry mouth, dehydration, immune system disorder.
Ipratropium Bromide	Dry mouth, Headache, Urinary retention, Buccal ulceration.
Ipratropium bromide + Salbutamol	Bronchitis, chest pain, nausea, URTI, Headache.
Rofumilast	Diarrhea, Weight loss, Back pain.
Salbutamol +Theophylline	Bronchitis, chest pain, nausea.
Drugs Used in the Alimentary Disease/Disorder	
Antacids & other Anti-Dyspeptics drugs	Diarrhea, Stomach cramps, milk-alkali syndrome, Chalky taste, Vomiting.
Domperidone	Dry mouth, nervousness, drowsiness, skin rash and itching.
Diosmin + Hesperidin	Routine gastric disorders and neurovegetative disorders (feeling of discomfort).
H_2 -Receptor antagonists	Nausea, headache, dizziness and diarrhea, skin rashes.
Hydrocortisone + Aesculin + Cinchocaine + Framycetin/ Neomycin	Local atrophic changes in the skin.
Proton pump inhibitors	Diarrhea, headache (both may be severe); also nausea,

Common Drugs	Side effects
	constipation, flatulence, dizziness, somnolence, malaise, Abdominal pain.
Drug Used in Respiratory Diseases	
Adrenaline	Anxiety, tremor, tachycardia, cardiac arrhythmias, Dizziness, Dyspnea, Flushing.
Aminophylline	Gastric irritation, nausea, vomiting, epigastric pain and tremor.
Ephedrine	Tremor, tachycardia, insomnia, urinary retention, dry mouth, Palpitation, Restlessness.
Ipratropium Bromide	Dryness of the mouth, nausea, dizziness, blurred vision.
Ketotifen	Dry mouth, sedation, Weight gain, Rash.
Montelukast	Dizziness, headache, diarrhea, restlessness, abdominal pain.
Pizotifen	Weight gain, Dry mouth, muscle pain, Hepatic injury.
Salbutamol	Tremor, Palpitations, muscle cramps, and tachycardia.

Appendix-xvi

Index of Veterinary Manufacturers and Importers

	Name of the Manufacturers and Importers	Address and License No.	MFG. License No. Biological	MFG. License No. Non-Biological
1.	Adova Pharmaceuticals Ltd.	Savar, Dhaka 105, Boro Rangamatia, Durgapur, Ashulia.	325	528
2.	Advanced Chemical Industries Limited	Godnail, Narayangonj 7, Haziganj Road	051	213
3.	Advent Pharma Ltd.	Dhamrai, Dhaka Plot No. B 50-54, BSCIC I/A	289	493
4.	Albion Laboratories Ltd.	Sitakundu Rahmatnagar, Sitakundu	191	109
5.	Alkad Laboratories	Alamnagar, Rangpur	218	372
6.	Al-Madina Pharmaceuticals Ltd.	I-22 Bank Colony, Savar, Dhaka	272	037
7.	Aristopharma Limited	Gachha, Gazipur Sadar, Gazipur	304	
8.	Bengal Remedies Ltd.	A-114, BSCIC I/A, Tongi, Gazipur	300	502
9.	Beximco Pharmaceuticals Ltd.	Tongi I/A, Gazipur	119	379
10.	Biopharma Ltd.	A-116, BSCIC I/A, Tongi, Gazipur.	081	322
11.	Bridge Pharmaceuticals Ltd.	West Tangra, Sarulia, Demra, Dhaka	292	54
12.	Chemist Laboratories Ltd.	College Road, Barisal	063	135
13.	Desh Pharmaceuticals Ltd.	Rupnagar, Mirpur Dhaka	175	417
14.	EDCL (Dhaka)	395-397, Tajgoan I/A, Dhaka.	99	365
15.	Edruc Ltd.	Pabna	018	018
16.	Eon Pharmaceuticals Ltd.	217/5, Chandana, Joydebpur, Gazipur	282	57
17.	Eskayef Pharmaceuticals Ltd. Mirpur.	9/C, North East, Darus Salam, Mirpur, Dhaka.	130	385
18.	Eskayef Pharmaceuticals Ltd., Narayanganj	Murapara, Rupganj, Narayanganj	306	509
19.	Eskayef Pharmaceuticals Ltd., Tongi, Gazipur	400 Tongi/ I/A. Squibb Road, Gazipur.	215	449
20.	Ethical Drug Ltd.	Godnail Siddergonj, Narayangonj.	185	425
21.	FnF Pharmaceuticals Ltd.	Rautoli, Nagarbathan, Jhenaidah.	240	463
22.	Gentry Pharmaceuticals Ltd.	Vangnahati, Sreepur, Gazipur	26	27
23.	Globe Pharmaceuticals Ltd.	Begumganj, Noakhali.	182	50
24.	Gonoshasthaya Pharmaceuticals Ltd.	Nayarhat, Savar, Dhaka	117	381
25.	Guardian Healthcare Ltd.	Amtola, Khatghora, Zirabo, Ashulia, Savar, Dhaka	490	286
26.	Incepta Pharmaceuticals Ltd. (Dhamrai Unit)	Krishnapura, Sahabelishor, Dhamrai, Dhaka	290	494
27.	Jayson Pharmaceuticals Ltd.	231, Tejgoan I/A, Dhaka.	003	082
28.	Kemiko Pharmaceuticals Ltd.	Ticapara, Rajshahi.	152	403
29.	Medicon Pharmaceuticals Ltd.	Plot # 17/A-1, Block-D, Section l0, Mirpur. Plot # 17/A-1	148	402
30.	Medimet Pharmaceuticals Ltd.	Rupatali, Barisal	159	341
31.	MedRx Life Science Ltd.	Brahmanbaria Plot No. A-88, & A-89, BSCIC I/E, Nandanpur	241	465
32.	Naafco Pharma Ltd.	Bandia, Bhalluka, Mymensingh	295	464
33.	Navana Pharmaceuticals Ltd.	Rupshi, Rupganj, Narayanganj.	194	431

	Name of the Manufacturers and Importers	Address and License No.	MFG. License No. Biological	MFG. License No. Non-Biological
34.	Newtec Pharmaceuticals Ltd.	Boro Dhormopur, Comilla	301	503
35.	Novartis (Bangladesh) Ltd.	Squibb Road, Tongi, Gazipur.	188	427
36.	One Pharma Ltd.	Plot No. C-23-24, BSCIC I/A, Bogra	062	244
37.	Opsonin Pharma Limited	Rupatali, Barisal	012	080
38.	Orion Infusion Ltd.	Maikali Rupgong, Narayangong.	198	
39.	Orion Pharma Ltd.	D/28/2, Sumilpara, Siddhirganj, Narayanganj-1431	46	179
40.	Popular Pharmaceuticals Ltd.	164, Tongi Industrial Aria, Tongi, Gazipur.	250	473
41.	Rampart-Power Bangladesh Ltd.	Konabari, Gazipur	209	445
42.	Renata Limited	Plot No. 1, Sec-7, Milk Vita Road, Mirpur, Dhaka.	045	197
43.	Renata Limited, Gazipur	Rajendrapur, Gazipur	273	501
44.	Rephco Pharmaceuticals Ltd.	Mathuranath Public School Road, Nutan Bazar, Barisal	058	229
45.	RN Pharmaceuticals	Eidgah Compound, Kanchijuli, Mymensingh.		
46.	Shinil Pharma Limited	BK Bari, Mirzapur, Gazipur	317	525
47.	Square Cephalosporins Ltd.	Kaliakoir, Gazipur Kaliakoir	259	
48.	Square Formulations Ltd.	Momin Nagar, Gorai, Mirzapur, Tangail	296	497
49.	Square Pharmaceuticals Ltd. (Chemical Division)	Pabna Salgaria, Pabna	202	438
50.	Square Pharmaceuticals Ltd. Gazipur	Kaliakair, Gazipur	235	460
51.	Square Pharmaceuticals Ltd. Pabna	Salgaria, Pabna Salgaria, Pabna	033	114
52.	Super Power Pharmaceuticals Ltd.	Belabo, Narsingdi, Bangladesh	269	443
53.	Techno Drugs Ltd.	Satipara, Narshingdi	211	446
54.	Techno Drugs Ltd., Gazipur	B. K. Bari, Mirzapur, Gazipur	274	482
55.	The ACME Laboratories Ltd.	Dhamrai, Savar	115	250
56.	Vion Pharmaceuticals (Veterinary)	Matidali, 2nd Bypass, Manikchock, Bogura	328	532
57.	Vision Drugs Limited (Veterinary)	Ichakhada, Magura Sadar, Magura	329	533
58.	Ziska Pharmaceuticals Ltd.	Karol Surichala, Shafipur, Kaliakoir, Gazipur	183	424

Appendix-xvii

Veterinary Related Acts/Rules/Ordinance in Bangladesh

SL NO	Act/Rules/Ordinance	Year of Publication
1	Animal Slaughter and Meat Quality Control Rules	2021
2	Bangladesh Veterinary Council Act	2019
3	Animal Welfare Act	2019
4	Animal Feed Rules	2013
5	Animal Slaughter and Meat Quality Control Act	2011
6	Fisheries and Fodder Act	2010
7	Veterinary Disease Regulations	2008
8	Bangladesh Animal and Animal Products Prevention Act	2005
9	Animal Diseases Act	2005
10	The society for Prevention of Cruelty to Animals Ordinance	1962

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Pharmaceutical Abbreviations

Communication of dosage instructions to patients

Veterinarian, Physicians and Pharmacists have to devote considerable time and effort to the development and utilization of safe and cost-effective drug therapy. In order to gain maximum benefit from the use of drugs while minimizing their side effects, prescribers and pharmacists must maintain effective communications not only among themselves, but with their animal/bird owners as well. The directions for drug use and other information which prescribers indicate on prescription orders must be transferred on the labels and explained by the pharmacists to the animal/bird owners for safe and effective drug therapy. In order to assure that this information is conveyed clearly and effectively to the animal/birds, the following guidelines have to be followed by the professionals.

Notes for prescribers

1. Whenever possible, specific times of the day for drug administration should be indicated (for example, Take one capsule at 7:00 am, 1:00 pm, and 7:00 pm is more preferable as compared Take one capsule three times daily, most preferable once a day or long actionProprietary Preperations).
2. The use of potentially confusing abbreviations, ie, qid, tid, bd, etc, is discouraged.
3. Vague instructions such as “take as necessary” or “take as directed” which are confusing to the animal/bird owners should be avoided.
4. If dosing at specific intervals around-the-clock is therapeutically important, this should specifically be stated on the prescription by indicating appropriate times for drug administration.
5. The symptom, indication, or the intended effect for which the drug is being used should be included in the instructions whenever possible (for example, Take one tablet at 6:00 am and 6.00 pm for high blood pressure, or Take one tablet at 7:00 am, 11:00 am, 4:00 pm, and 8.00 pm for cough).
6. The Metric System of weights and measures should be used.
7. The prescription order should indicate whether or not the prescription should be refilled and, if so, the number of refill(s) and the period of time for such renewal is recommended.
8. The prescriber should print his/her name, telephone number and registration number on the prescription blank.

Notes for Pharmacists

1. Instructions to the patient regarding directions for use of medication should be concise and precise, but readily understandable to the animal/bird owners. The pharmacist should give verbal reinforcement and clarification of instructions to the patient when appropriate.
2. For those dosage forms where confusion may develop as to how the medication is to be administered, the pharmacist should clearly indicate the intended route of administration on the prescription label.
3. Where special storage conditions are required, the pharmacist should indicate appropriate instructions for storage on the prescription label and explain to the animal/bird owners.

TABLE: Common Abbreviations of Prescriptions, Medical and Pharmaceutical orders.

ABBREVIATION	MEANING
a.d.	Right ear
a.s	left ear
Aa	of each
abd	abdomen
ac	before meals
ad lib	At pleasure, freely
ad	To, up to
amp	Ampoule of medication
aq	Water
as	directed
ATC	Around the clock
au	each ear
BCP	birth control pill
bid	Twice a day
BM	Bowel movement.
BP	Blood pressure
BPH	benign prostatic hypertrophy
BS	Blood sugar
BSA	Body surface area
CAD	coronary artery disease
caps	Capsule
cc	cubic centimeter [milliliter]
CHF	congestive heart failure
COPD	chronic obstructive pulmonary
CP	chest pain
DC	discontinue medication
dil	dilute
disp	dispense
div	divide
DJD	degenerative joint disease
DM	diabetes mellitus
dtd	Let such doses be given
DW	distilled water
DX	diagnosis
elix	elixir
Ft	Make,
GI	Gastrointestinal
grGrain	Sx symptom
gtt	A drop

GU	Genitourinary
HA	headache
HBP	High blood pressure
HR	heart rate
HRT	hormone replacement therapy
hs	at bedtime
HTN	Hypertension
ID	Intradermal injection
IM	intramuscular injection
inj	An injection
IU	international units
IV	Intravenous injection
JRA	juvenile rheumatoid arthritis
kg	kilogram
L	liter ud
let	it be made
m or min	Minimum
wk	week
m	Mix
mcg	microgram
mEq	milliecluivalent
mg	milligram
mL	milliliter
mOsmol	milliosmole
N&V	Nausea and vomiting
noct	At night
non rep/NR	Do not repeat
OA	osteoarthritis
od	Right eye
os	Left eye
ou	Each eye
p	pulse
pc	After eating
PEFR	peak expiratory flow rate
po	by mouth
postop	after surgery
pr	rectally
prn	when necessary
pulv	A powder
PVD	peripheral vascular disease
q	every
qd	every day

qh	every hour
qid	four times daily
qod	every other day
qs ad	a sufficient quantity to
qs	as much as is sufficient disease (prepared)
RA	rheumatoid arthritis
Rect	Use rectally
s	without
Sig	write on label
SL	sublingual
SOB	shortness of breath
Sol	Solution
ss	One-half
stat	immediately
supp	Suppository
Susp	Suspension
Syr	Syrup
TB	tuberculosis
tbsp	tablespoon
TED	thromboembolic disease
TIA	transient ischernic attack
tid	three times a day
tiw	three times a week
top	(Use) topically
tsp	teaspoon
Tx	treatment
U	unit
UC	ulcerative colitis
Oint.	ointment
URI	upper respiratory infection
ut dict	as directed
UTI	urinary tract infection
WA	while awake
P.F	prefilled syringe

General Index

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1st Edition

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