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Review on Commonly used Veterinary Antibacterial and Anthelmintic Drugs in Ethiopia

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Abstract: Veterinarians are essential professional person of the efficient health care, and their tasks carry out is administrations of drugs to animals on the order of a veterinarian. Commonly used drugs in Ethiopia are penstrip, oxytetracycline, sulphamidine, ivermectine, albendazole 2500mg, fenbendazole, albendazole 300mg, tetraclozash 3400mg, tetramisol 900mg, tetramisol 600mg and diminazine aceturate are used for treatment of live stocks in the country.

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1. Introduction

Veterinary technicians are essential components of the efficient health care delivery tem in veterinary medicine. One of the important tasks that veterinary technicians carry out is administrations of drugs to animals on the order of a veterinarian. Because this task may have a serious consequence in the terms of the outcome of a case, it is mandatory that technicians have a thorough knowledge of the type and action of drugs used in veterinary medicine. They should have an understanding of the reasons for using drugs called indications and the reason for not using drugs called contraindications (pharmacotherapeutics). They also should know what happens to drug once they enter the body (pharmacokinetics) how drugs exert their effects (pharmacodynamics) and how adverse drug reactions manifest themselves (toxicity). Because veterinarians dispense a large number of drugs technicians also must be well versed in components of a valid veterinarian-client-patient relationship, the importance of proper labeling of dispensed products and methods of client education on the proper use of products to avoid toxic effects or residue. Finally technicians should have a basic understanding of the laws that apply to drug use in a veterinary medicine and the concept of the marketing of veterinary drugs. In short veterinary technicians must have a working knowledge of science of veterinary pharmacology.

Rational use of drugs is based on the use of right drug, right dosage and right cost which is well reflected in the world health organization (WHO) definition: "Rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community".

Now, in the clinical practice of human and veterinary medicine throughout the world large amount of antibiotics are used. Equally, many scientists intensively work on discovery and synthesis of new drugs with broader antimicrobial spectrum, stronger action and more satisfactory safety profile. Most failures during antimicrobial therapy may occur when the pathogenic microorganism is unknown and combination of two or more drugs administered empirically. To avoid these mistakes, clinically confirmed, effective antimicrobial combinations should be used. Globally, more than half of all medicines are prescribed, dispensed or sold improperly, and 50 % of human patients fail to take them correctly. This is more wasteful, expensive and dangerous, both to the health of the individual patient and to the population as a whole that magnifies the problem of misuse of antimicrobial agents.

Irrational use of drugs in veterinary medicine as well as the need for control of their use becomes even bigger problem when used on food producing animals. In this case, there is the possibility that minimal quantities of drugs and their metabolites (residues) which remain in edible tissues or in animal products (meat, milk, eggs, honey) induce certain harmful effects in humans as potential consumers of such food. When drugs are used to improve the productivity of food animals that are intended for human consumption, then there is possibility for producing adverse effects on humans. To prevent this risk, it is necessary to use drugs rationally,

i.e., to use them only when they are really indicated, in the right way, at the right time, in the right dose and respecting withdrawal period. Also, it is necessary to regularly control sensitivity to antimicrobial agents and regulate residue of antimicrobial agents commonly used in veterinary practice.

2. Definition of chemotherapy: Treatment of diseases by chemical substances (drugs). **Selective toxicity:** kills or inhibits the growth of microbes while causing minimal or no harm to the host. It happens by contacting with targets. The target must be a structure or physiological process (s) which is essential for the agent however absent or less important for the host's Cell wall, size of the ribosome (process of protein synthesis), folic acid synthesis and Cholesterol/ergosterol.

3. Broad and Narrow Spectrum Antibiotics

Antibiotics that are limited to treat specific infections are known as narrow spectrum while those that can treat a wide range of infections are called broad spectrum and narrow-spectrum drugs are sometimes preferred because they target a specific pathogen without disturbing the normal flora of the gut or respiratory tract. Broad spectrum drugs are sometimes preferred for the initial treatment of an infection when the causative pathogen is not yet identified.

4. Antimicrobial resistance

Antimicrobial resistance (AMR) is the ability of a microbe to resist the effects of medication. Important points in drug resistance are:- Resistance can be natural in certain types of microbes or acquired in another, the WHO defines antimicrobial resistance as a microorganism's resistance to an antimicrobial drug that was once able to treat an infection by that microorganism, a person cannot become resistant to antibiotics and resistance is a property of the microbe, not a person or other organism infected by a microbe.

Pathogens often become resistant by: i) By preventing entrance of the drug into the envelope's membrane, ii) by pumping the drug out of the membrane after it has entered (translocases), iii) by inactivating drugs through chemical modification (hydrolysis), iv) by modification of target enzyme or organelle so that is no longer susceptible to the drug and v) they may either use an alternate pathway to bypass the sequence inhibited by the agent or increase the production of target metabolite.

Factors promoting drug resistance are:- Exposure to sub-optimal levels of antimicrobial, exposure to microbes carrying resistance genes, inappropriate drug use, lack of quality control in manufacture or outdated antimicrobial, inadequate surveillance or defective susceptibility assays, poverty or war, use of antibiotics in foods and antibiotics are used in animal feeds and sprayed on plants to prevent infection.

Mechanism to Reduce Bacterial Resistance are:- Appropriate diagnosis and proper selection of antibiotics**,** rational use of antibiotics**,** proper hygienic and other disease prevention practices and cycling the usage of antibiotic.

5. Clinical use of antibiotics

To understand clinical use of antibiotics the following principles should be observed: Antibiotics should not be given for trivial infections, they should be used for prophylaxis in special conditions, treatment should be based on a clear clinical and bacteriological diagnosis, antibiotics for systemic treatment must be given in full therapeutic doses for adequate period and combined therapy with two or more antibiotics is required for some conditions like when there are serious resistant infections, severe mixed infections and to achieve synergism.

6. Antibacterial drugs and their formulation

To treat problems coming from bacteria, different antibacterial drugs are utilized, the most common in our country are: - A) Preparation containing single antibacterial agent are oxytetracycline, penicillin, sulphadimidine and tylosin, B) Preparation containing two or more / combined / antibacterial agents are Penicillin/streptomycin (pen-strept), Trimethoprim / sulfamethoxazole (co-trimoxazole or Bactrim®) and C) Other special preparations with antibacterial effect are eye Ointments, wound sprays, intrauterine bolus, intramammary infusions, powders, emerging preparations, enrofloxacin 10%, florfenicol 10% (analogue of chloramphenicol, but it is more potent) and gentamycin injection.

7. Preparation containing single antibacterial agent

1) Oxytetracycline

Formulation of Oxytetracycline can be:- Injection: oxytetracycline HCl in 100 ml vial 5%, 10%, 20%, Powder: 5%, 10%, 20%, 25%, 50% alone or in combination with vitamins, Spray 5% oxytetracycline alone or oxytetracycline 25mg and 5mg/ml with or without Gentian Violet (GV) and intrauterine bolus 50mg, 100mg, 250mg, 500mg, 1gm.

Storage /Stability/ of oxytetracycline:-Products should not be stored in tight and light resistant containers, at temperatures of less than 40^{o}C (104^{o}F) and preferably at room temperature (15-30^{o}C) and avoid freezing.

Compatibility of oxytetracycline: - Oxytetracycline compatible with most commonly used IV infusion solutions, including dextrose, sodium chloride 0.9%, and lactated ringers.

Drugs that are reportedly incompatible with oxytetracycline are:- Penicillin groups, pentobarbital sodium, aminophylline, amphotericin B, calcium chloride / gluconate, heparin sodium, hydrocortisone

sodium, iron dextran, phenobarbital sodiumand sodium bicarbonate.

Dose and route of administration, Follow manufacturers instruction		
Species	Dose and route of administration oxytetracycline	Remark
Cattle	_5 -10 mg/kg IM/IV q24h of 10 % – 20 mg/kg q48-72h IM of 20 % (repeat if needed)	Give 10% IV and increase the dose for cowdriosis, Anaplasmosis
Horses	– 5 -20 mg/kg IM q24h of 10 %	– IV is not well recommended Dose and route of administration, Follow manufacturers instruction – 20 % should not also be used at all
Sheep & Goats	– 5 -10 mg/kg IM/IV q24h of 10 % – 20 mg/kg q48-72h IM of 20 % (repeat if needed)	– Give IV and increase the dose for cowdriosis,
Dogs/cats	– 20 mg/kg PO tid (q8h) of tablet – 7.5 - 10 mg/kg IV/IM of 10%	
Swine	– 5 - 10 mg/kg IM/IV q24h of 10%	

Mechanism of Action of oxytetracycline: - Oxytetracycline inhibit the growth and multiplication of bacteria:- by inhibitors of bacterial protein synthesis and by bind with 30s unit of the ribosome.

Clinical use of oxytetracycline:-Oxytetracycline is effective against all gram positive and negative bacteria**,** first choice for diseases caused by rickettsia, Chlamydia **and** effective for some protozoal diseases like coccidiosis and toxoplasmosis.

Adverse reaction of oxytetracycline include:- a) Diarrhea and opportunistic infection b) discoloration of bone and teeth c) antianabolic effect in mammals, d) Photosensitization e) may affect the function of kidney or liver.

Precautions of oxytetracycline:- Preferably don't give oxytetracycline to pregnant animals unless absolutely essential, animals with known hypersensitivity, young animals and should not be given with drugs that are incompatible with oxytetracycline.

Other type of tetracycline include: - Chlortetracycline, doxycycline, minocycline all the above three tetracyclines have Similar chemotherapeutic effect and different in Pharmacokinetics property.

2. Penicillins

Dosage				
Species	Dose and route of administration of Different salts of Pen-G			
	Penicillin G potassium	Penicillin G sodium:	Penicillin G procaine	Penicillin G benzathine
Cattle			44,000-66,000 Units/kg IM, once daily	44,000 -66,000 Units/kg IM, q2days
Horses		10,000-50,000 Units/kg IM q6h	20,000 - 100,000 Units/kg IM q12h	50,000 Units/kg IM q2 days
Dogs/cats	20,000- 40,000 Units/kg IM q6-8h	20,000-40,000 Units/kg IM q6-8h	20,000-40,000 Units/kg IM q12-24h	50,000 Units/kg IM, q5 days
Swine			40,000 IU/kg IM once daily	

Several preparations of penicillins are used in veterinary medicine, of these, penicillin G is quite commonly utilized and it is available in several different salt forms such as:- a) Penicillin G potassium (benzylpenicillin potassium) b) Penicillin G sodium (benzylpenicillin sodium) c) Penicillin G procaine (also known as Aqueous Procaine Penicillin G, Fortified Procaine Penicillin G, Benzylpenicillin Procaine, Procaine Benzylpenicillin) d) Penicillin G Benzathine (also known as Benzathine

Benzylpenicillin, Benzathine Penicillin G, Benzylpenicillin Benzathineit, it is a long-acting form of penicillin G and they differ in solubility and duration of action).

Storage/Stability/Compatibility of Penicillins:- Penicillin G sodium and potassium should be protected from moisture to prevent hydrolysis of the compounds and Penicillin G sodium and potassium powder for injection can be stored at room temperature (15-30^{o}C). After reconstituting, the injectable solution is stable for 7 days when kept refrigerated (2-8^{o}C) and for 24 hours at room temperature. Penicillin G procaine and Benzathine penicillin G should be stored at 2-8^{o}C; avoid freezing Penicillin G salts in single or combined form may be available in intrammary infusion, intrauterine bolus, and other preparations, their utilization may vary based on formulation and composition so follow the manufacturer's instruction.

Penicillin V Potassium:-Penicillin V is slightly less active than penicillin G, the only advantage is it can be given orally. Other penicillins include:- narrow spectrum antibiotics, betalactamase resistant (Methicillin, Oxacillin, nafcillin, cloxacillin) and extended spectrum (Ampicillin and Amoxicillin).

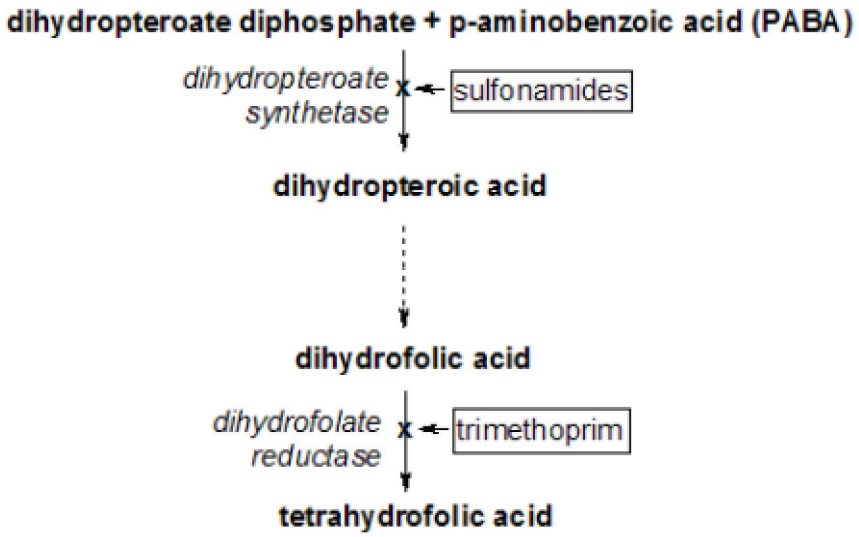
Mechanism Action of Penicillins:-Penicillin's are beta-lactam antibiotics act by interfere synthesis of bacterial cell wall. Penicillin's attached with penicillin binding protein to act on the bacteria. Bacteria must be in a growing stage to be susceptible and organism at rest and without cell wall is not susceptible to penicillin.

Side effect of Penicillins:-Mostly penicillin's are the safest drug but its side effect is hypersensitivity and broad spectrum penicillin can disturb gastrointestinal flora.

3. Sulfonamides

Are group of drugs with similar structure and mechanism of action sulfonamides act as competitive inhibitors of the enzyme dihydropteroate synthase. Bacteriostatic:- sulfonamides are a drug that inhibit the growth and multiplication of bacteria. Selective toxicity of sulfonamides depends on the fact that mammalian cells take up folate supplied in the diet, but susceptible bacteria lack this ability and must synthesize folate.

Mechanism action of Sulfonamides



A. Sulphadimidine:- It is also called sulfamethazine and has a spectrum of antimicrobial action similar to other sulfonamides.

Dosage

Species	Initial dose	Maintenance dose
dogs and cats	100mg/kg bwt	50mg/kg q12h
cattle, sheep, Goatand swine	200 mg/kg bwt	100mg/kg bwt q24h

It can be given either subcutaneously or intravenously

Sulphadimidine has been shown to be effective in vitro against the different bacterial species. It can be employed in the treatment of enteritis, wooden tongue, Pasteurellosis, foot rot, rhinitis and others and has also effective in the treatment of coccidiosis.

Special precautions for use of sulphadimidine: Adequate water must be available during period of treatment, to minimize the risk of injection site tissue reaction following subcutaneous administration, divide the dose in two or more injection sites and massaged well the injection sites

Contraindications:- Contraindicated in animals with known sulphonamide sensitivity, severe liver damages and blood dyscrasias. Therapeutic doses are relatively non-toxic, but agranulocytosis, hemolytic anemia and avitaminosis-K have been reported following prolonged administration. Prolonged treatment with sulphadimidine should be avoided, especially in young stock.

Storage of sulphadimidine:-The following points are important for **Storage of sulphadimidine these are:-** Do not store above 25^{o}C, protect from light**,** following withdrawal of the first dose, use the product within 28 days and discard unused material.

4. Tylosin

Tylosin is a macrolide and bacteriostatic antibiotic. Broad spectrum of activity against gram positive organisms and a limited range of gram negative organisms. Tylosin is used to treat bacterial infections in a wide range of species. Drug of choice for mycoplasmal infection and has a high margin of safety.

Mode of action:-Tylosin act by inhibition of protein synthesis through binding to the 50S subunit of the bacterial ribosome.

Storage of tylosin:-Tylosin stores at room temperature in a tight light resistant and childproof container.

Possible side effects:-Some animals may have vomiting and a slight worsening of the diarrhea at the beginning of treatment, when using the injectable form of tylosin, pain and a local reaction at the injection site may occur.

Available forms:-Tylosin is available in injectable, intramammary, and oral formulations

Precautions and contraindications:- Administration of tylosin should be avoided in animals with a known hypersensitivity to the product, or to other macrolides, oral administration can result in diarrhea and gastrointestinal disturbance and this is particularly true of horses, the injectable formulations of tylosin can cause pain, inflammation, and itchiness around the injection site and has a relatively poor spectrum of activity against Gram negative organisms.

Drug interactions:-Tylosin may increase digitalis blood levels, thus its toxicity, and may be antagonistic to chloramphenicol or lincosamides

8. Preparation containing two or more /combined/ antibacterial agents

1. Penicillin/streptomycin (penstrept)

Contain:- Procaine Penicillin 200,000 IU and Dihydrostreptomycin Sulphate 200 mg/250mg but, The proportion may vary. Dose for Penicillin/streptomycin (penstrept) is 1ml per 20kg-25 kg body weight daily for 3 days by deep intramuscular route. Side effect and contraindication for Penicillin/streptomycin (penstrept) is not recorded at recommended dose. Storage for Penicillin/streptomycin (penstrept) is store below 30^{o}C, Protect from light and following withdrawal of the first dose, uses the product within 28 days.

9. Anthelmintics

There are numerous anthelmintics (worm treatments) registered for use with cattle. The active ingredients in these products can be classified into three main categories, depending on their chemical structure and mode of action: - Macrocyclic lactones or 'mectins' – abamectin, doramectin, eprinomectin, ivermectin and moxidectin, benzimidazoles - albendazole, fenbendazole and oxfendazole and levamisole – levamisole.

Macrocyclic lactones These products are generally very effective against gastrointestinal worms in cattle, killing both mature worms and inhibited larvae. They are also effective against lungworm, biting and sucking lice, mange mites and cattle tick.

The 'mectin' chemicals all act a similar way binding to invertebrate nerve and muscle cells, causing paralysis to the affected parasite. When given as directed, they have a wide safety margin. There are subtle differences between the chemicals in this group, such as their persistence and hence protective period after treatment and their impact on dung beetles and other friendly insects in the environment. However, these differences are relatively minor, with the choice of product within the group based largely on availability and cost.

The 'mectins' can be applied by injection or as a pour-on. The injectable products must be given subcutaneously injection into the muscle causes a severe reaction at the injection site. Ease of application, good efficacy against a broad spectrum of cattle parasites and moderate cost usually makes a 'mectin' chemical the product of choice for worm control in export cattle.

Benzimidazoles The benzimidazole or 'white' drenches are registered for use against gastrointestinal worms and lungworm in cattle, but are not effective against lice, mites or ticks. They are very safe and are generally much cheaper than the 'mectin' products. However, apart from Systemex Rumen Injection Cattle Wormer, they are all oral drenches. Drenching large numbers of cattle with a hook is slow and labour intensive.

Levamisole The levamisole or 'clear' drenches are registered for use against gastrointestinal worms

and lungworm in cattle, but are not effective against lice, mites or ticks. The injectable levamisole products are the cheapest cattle drenches on the market. Levamisole has a small safety margin. It is quite safe when used as directed, but toxicity can occur if cattle are given more than twice the recommended dose, especially if the cattle are stressed.

Trichlorfon There is only one product registered for use in cattle - Neguvon Soluble Powder Anthelmintic, Boticide. It is principally used to treat bots in horses. Trichlorfon has a narrow spectrum of activity against cattle worms, and it has no obvious advantages over other products available.

9.1. Fluke

The drugs registered for treatment of animal fluke can be classified into four groups, based on their active ingredient such as:-triclabendazole, clorsulon, oxyclozanide and nitroxynil, and albendazole.

Triclabendazole If elimination of fluke is the only consideration; triclabendazole is the drug of choice. This is because it kills both immature fluke in the liver tissue and mature fluke in the bile duct. The other products available have little if any effect on early, immature fluke.

Unfortunately, in some areas fluke have developed resistance to triclabendazole, rendering it less effective. Another major drawback is that triclabendazole must be given as an oral drench. Drenching large numbers of cattle with a hook is slow and labour intensive.

Clorsulon is combined with ivermectin in Ivomec plus Antiparasitic injection for Cattle and Virbamax plus. It kills mature fluke in the bile duct, but has limited effect against immature fluke. However, the advantage of these products is that they can be given by injection, with the clorsulon/ivermectin combination effective against a broad spectrum of internal parasites.

Oxyclozanide and nitroxynil: These older chemicals are moderately effective against mature liver fluke and a narrow spectrum of gastrointestinal parasites in cattle. They offer no obvious advantages over products containing triclabendazole or clorsulon, and are unlikely to be the treatment of choice for export cattle.

Albendazole The cattle worm drenches that contain albendazole typically have a secondary claim to 'aid the control of liver fluke'. Few fluke are killed by albendazole. However, there is a reduction in the number of viable fluke eggs passed by infected animals. To achieve this effect cattle must receive a higher dose than is recommended for worm control. Albendazole is vastly inferior to all other registered fluke treatments and it is difficult to imagine a situation where it would be the treatment of choice.

References

1. Gonzalez, R.R., Cheuvront, S.N. and Montain, S.J. (2009). Expanded prediction equations of human sweat loss and water needs. *Journal of Applied Physiology*; 107:379-388.
2. Hanmant, A. and Priyadarshini, K. (2011). Prescription analysis to evaluate rational use of antimicrobials. *International Journal of Pharmacology Biolological Science*; 2(2):314–319.
3. Muir, W.W., Louis, S.T., Mosby, E.R. and Hubbell, J.A. (2007). Hand book of veterinary anesthesia 4th ed.
4. Tony, B.R., Colin, C.H. and Phil, R.E. (2004). Livestock exports Best practice use of veterinary drugs, meat and livestock Australia, *2 January ISBN*: 17(40):36 39-4 9.
5. Vitomir, C., Silva, D., Biljana, A. and Sanja, C. (2011). The significance of rational use of drugs in veterinary medicine for food safety. *Tehnologija mesa*; 52(1):74–79.
6. WHO. (2012). Rational use of medicine http://www.who.int/medicines/areas/rational_use/en/index.html. Accessed, 18 Oct 2013.

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