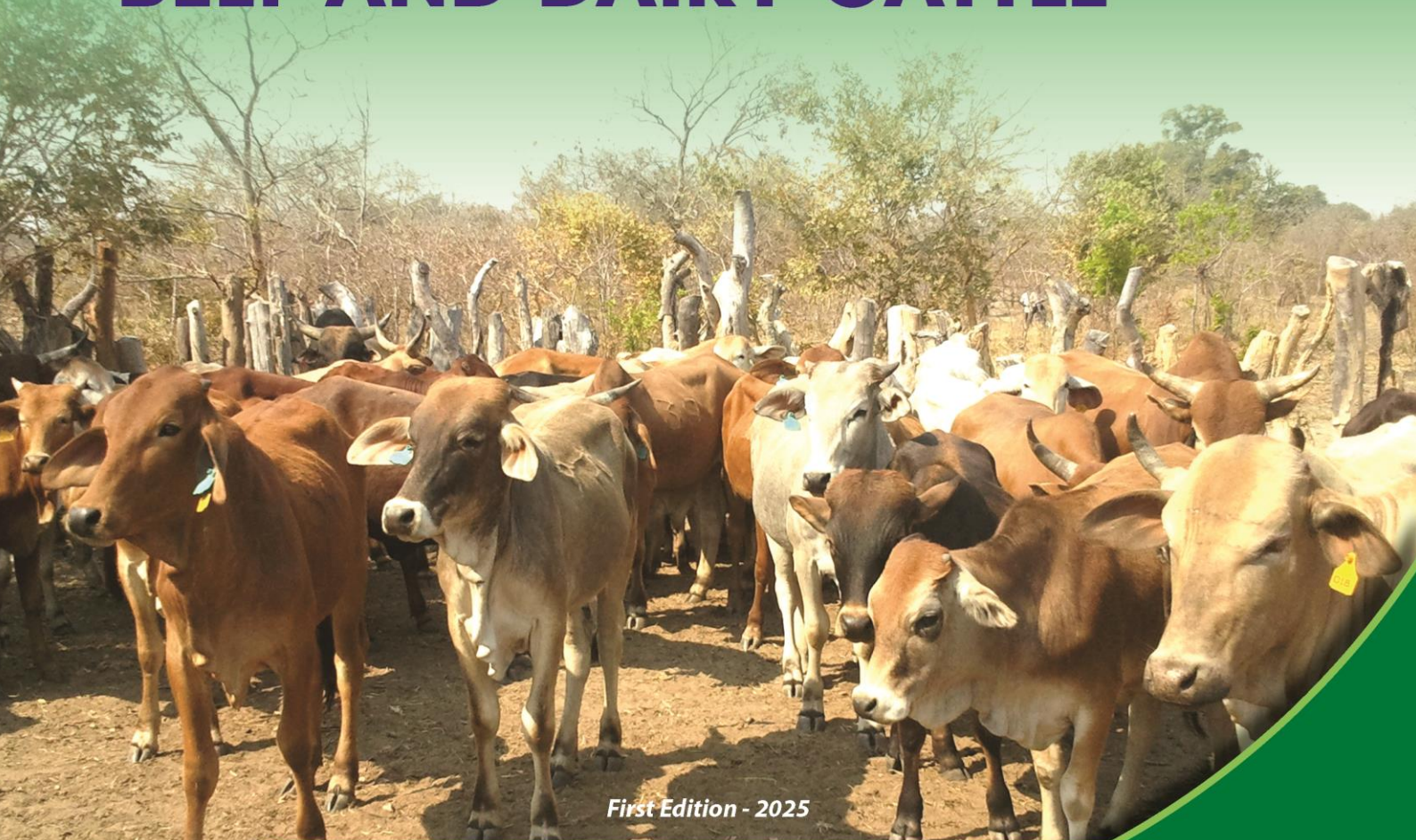




REPUBLIC OF ZAMBIA

MINISTRY OF FISHERIES AND LIVESTOCK
DEPARTMENT OF VETERINARY SERVICES

STANDARD TREATMENT GUIDELINES FOR BEEF AND DAIRY CATTLE



First Edition - 2025



ZNPHI
ZAMBIA NATIONAL
PUBLIC HEALTH INSTITUTE



The
Fleming Fund

BROOKE
ACTION FOR WORKING
HORSES AND DONKEYS



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DISCLAIMER

These treatment guidelines conform to the current evidence-based practice in Zambia. Contributors, reviewers and editors cannot be held responsible for omissions and other consequences. The guidelines are intended solely as a reference and should be used as a general guide for veterinarians and veterinary paraprofessionals. The veterinarian is responsible for the selection and implementation of the appropriate treatment based on their professional judgment. All efforts shall be taken in the best interest of the animal's health and welfare, taking into consideration the specific circumstances of each case.

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ABBREVIATIONS

AMR	Antimicrobial Resistance
ASF	African Swine Fever
CBPP	Contagious Bovine Pleuropneumonia
CIDRZ	Centre for Infectious Disease Research in Zambia
CVRI	Central Veterinary Research Institute
DNEIs	Diseases of National Economic Importance
DVS	Department of Veterinary Services
ECF	East Coast Fever
FMD	Foot and Mouth Disease
GAP	Global Action Plan
GDP	Gross Domestic Product
LS	Livestock Services
LSD	Lumpy Skin Disease
MDs	Management Diseases
MFL	Ministry of Fisheries and Livestock
NAP	National Action Plan
STGs	Standard Treatment Guidelines
UNZAVET	University of Zambia School of Veterinary Medicine

FOREWORD

The livestock industry in Zambia accounts for 42% contribution to the agricultural sector's Gross Domestic Product (GDP) and 50% in employment for rural areas. It plays an important role as a provider of food; nutrition security; manure; raw materials for industries; employment; and income generation. As of January 2018, cattle, which constitutes the majority of the livestock population, accounted for 3,714,667. Despite its importance to the development and sustainability of the Zambian economy, the sector continues to face many challenges among which are the frequent outbreaks of livestock diseases which tend to have a poor response from the DVS. Livestock diseases have a devastating impact on animal productivity; trade in live animals; meat and other animal products; human health; and consequently, on the overall process of economic development. Coupled with the growing consumer demand for beef and dairy products, this has led to farmers in general resorting to use of antimicrobials for treating any diseases, non-therapeutic use including prevention of diseases and for growth promotion in an attempt to maximise profits. Unfortunately, veterinary practitioners have equally been implicated in these practices as they sometimes over prescribe antibiotics even for viral diseases where they are totally ineffectual. This non-prudent use of antimicrobials contributes to their developing resistance and is therefore of concern and remains a serious threat to both the human and animal population. Although Zambia has made progress against antimicrobial resistance (AMR) through implementing the 2017-2027 Multi-sectoral National Action Plan on Antimicrobial Resistance (NAP), there still remains a lot of challenges that require to be addressed under the adopted five strategic objectives from the Global Action Plan (GAP) which was adopted at the World Health Assembly in May 2015. For example, limited progress has been made to improve awareness and understanding of AMR through effective communication, education and training among farmers and veterinary practitioners. The development of standard treatment guidelines for Beef and Dairy Cattle diseases in Zambia would form part of the education and training of veterinary practitioners on prudent use of antimicrobials in a disease situation.

It is my sincere hope that these Standard Treatment Guidelines (STGs) for common beef and dairy cattle diseases in Zambia will improve the quality and uniformity of veterinary care and treatment, and promote appropriate prescribing and dispensing of antimicrobials.



Dr. Max M. Choombe
PERMANENT SECRETARY
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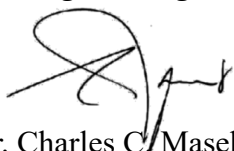
ACKNOWLEDGMENTS

The development of the Standard Treatment Guidelines (STGs) for Beef and Dairy Cattle was made possible through the support of the Government of Zambia through the Ministry of Fisheries and Livestock (MFL), Department of Veterinary Services (DVS), Brooke under the Fleming Fund and collaborative efforts of numerous field experts from key public and private sectors. I would like to acknowledge the significant contributions by the technical working group (TWG) of experts from public, private, academia and regulators on their expert opinions, valuable inputs and essential comments on the initial drafts that preceded the final document.

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On behalf of the Government of Zambia, I would like to appreciate and thank Brooke under the Fleming Funding for availing financial and technical assistance in the development of the STGs.



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INTRODUCTION

The development and implementation of STGs for livestock diseases is a crucial tool for veterinary and veterinary para-professionals in Zambia. Zambia, through the Ministry of Fisheries and Livestock (MFL) Department of Veterinary Services (DVS), in collaboration with the Brooke under the Fleming Funding, has developed comprehensive STGs for Beef and Dairy Cattle for common diseases. This guideline aims to provide a dynamic framework for veterinary practitioners, ensuring uniformity of veterinary care and treatment by promoting prudent antimicrobial use, prescription practices and dispensing of antimicrobials.

The guidelines cover treatment protocols in beef and dairy cattle for prioritized common diseases including some listed under “The Animal Health (Notifiable Diseases) Regulations of 2019 (Statutory Instrument No. 81 of 2019)”. In 2012, the Government of Zambia divided animal diseases into two categories, namely, Diseases of National Economic Importance (DNEI) and Management Diseases (MDs) as mitigation to streamline interventions in animal disease control. DNEI are defined as those diseases that are highly contagious and whose death rates can reach up to 100%. These diseases affect trade and include diseases such as Foot and Mouth Disease (FMD), Contagious Bovine Pleuropneumonia (CBPP) and African Swine Fever (ASF). Furthermore, the cost of controlling DNEI is beyond an individual farmer’s reach and requires government involvement to control the disease. On the other hand, MDs are diseases whose effect is not so drastic, their spread is slow and can be controlled by individual farmers through standard prevention control measures like regular vaccinations, deworming and dipping e.g. Lumpy Skin Disease (LSD) and East Coast Fever (ECF). Although LSD is classified under MDs, the government has in the past outbreaks of the disease been involved in the control of the disease by purchasing antibiotics to treat severe cases against secondary infections. There is also a proposal to re-classify ECF under DNEI due to its high mortality especially in naïve cattle populations.

The livestock sector in Zambia continues to face numerous challenges which have prevented it from realising its full potential with one of the major challenges being the frequent outbreaks of diseases. The Committee on Agriculture on the Auditor General’s Report on the Management and Control of Livestock Diseases for the fifth session of the eleventh National Assembly appointed on 24th September, 2015 highlighted some major weaknesses in the management of livestock diseases which included the following;

- Lack of a livestock development policy
- Out-dated livestock statistics
- Untimely procurement and supply of vaccines and poor vaccination coverage and timing
- Inadequate staffing levels and lack of both basic and advanced diagnostic equipment at Regional Laboratories
- Inadequate/deplorable dip tanks and other supporting infrastructure in each respective agriculture camp to effectively service the total number of animals
- Unavailability of veterinary drugs, inputs and services near farming communities
- Understaffed DVS and lack of transportation to respond to disease outbreaks

- Lack of vaccination and management schedules for farmers for both DNEI and MDs in all the districts in relation to the disease situation in that area.
- Failure to establish the Animal Diseases Control Fund for rapid response to disease outbreaks
- Lack of collaboration between DVS and Livestock Development, and abattoirs and other slaughter facilities.
- Lack of extension services at farm community level
- Lack of an electronic reporting system to ensure quick submission of reports from the camp/district/province leading to delayed response to disease situation

These highlighted challenges in the livestock sector in Zambia present a more complex situation that requires a multi-sectoral approach in order to effectively and sustainably manage and prevent diseases. Inevitably, management of some viral disease outbreaks such as LSD with severe secondary bacterial infection and diseases of bacteria origin requires the use of antibiotics to reduce morbidity and mortality. Consequently, antimicrobial use by veterinary professionals and para-professional continues to be an integral part of treatment of many diseases in cattle in Zambia. However, with the existing evidence of antimicrobial resistant microorganisms in Zambia in human and animal health, the Country has recognised the Public Health threat of AMR and its impact on morbidity and mortality.

Amongst some of the recognized drivers of AMR worldwide from the veterinary profession and para-profession perspective includes:

- Veterinary professionals over prescribing of antibiotics even for viral diseases,
- Inappropriate prescription and dispensing of antimicrobials leading to misuse and overuse,
- Veterinary professionals and para-professionals lack diagnostic knowledge and tools, etc.

Therefore, the development and implementation of STGs in all animal health facilities, veterinary districts and camps in Zambia would aid capacitate veterinary professions and para-professions with knowledge and an onsite tool for management of diseases thereby promote prudent use of antimicrobials and hopefully reduce AMR.

The guidelines promote the rational use of veterinary drugs, reducing the risks associated with non-prudent use of antimicrobials, including the development of AMR. These guidelines are designed to merely provide standardized treatment options for ten (10) prioritized common diseases of beef and dairy cattle and **DO NOT** in any way substitute sound professional decision-making supported by current scientific knowledge and awareness of potential consequences including the development of resistant strains. Therefore, veterinary professionals and para-professionals should use their clinical judgment, scientific knowledge and available statutes i.e. Animal Health Act No. 27 of 2010 to decide whether or not to adhere to the guidelines in relation to the disease situation in their area.

PROCESS OF DEVELOPMENT

These STGs were developed by a TWG of field experts from public, private, and academia. Key stakeholders reviewed and agreed on the development processes, based on those outlined in literature including the WHO Handbook for Guideline Development. From this, the process and roadmap was assembled that included the associated activities, outlined below.

1. Plan
 - a) Identify key stakeholders
 - b) Form TWG to do research and draft document
 - c) Mobilise financial resources
 - d) Establish timelines and set targets
2. Research
 - a) Prioritise diseases/conditions
 - b) Review of existing cattle guidelines
 - c) Systematic review for any gaps (e.g. first line drugs in Zambia)
 - d) Survey of frontline veterinary practitioners to understand realities on the ground
3. Draft
 - a) Writing of first draft prioritised guidelines
 - b) Regular meetings of TWG to refine the drafts
4. Review (internal)
 - a) In person workshop of TWG
 - b) Produce final draft
5. Review (external)
 - a) Share final draft with key external stakeholders and end-users
 - b) Consider in person workshop
 - c) Consider piloting the guidelines with a small group of practitioners
6. Endorsement
 - a) Meeting with veterinary department for their approval of guidelines
7. Roll out
 - a) Grand workshop/launch event
 - b) Media briefed
 - c) Consider both printed and digital dissemination

- d) Consider both national and regional engagement
- e) Consider a pilot first

8. Evaluation

- a) Consider using research survey as a baseline, then conducting a follow up.

The following documents and guidelines were reviewed; WHO Aware human medical guideline for Bronchitis, UK NICE human medical guideline for leg ulcer infection; Tanzania veterinary guideline for Infectious Bovine Rhinotracheitis (IBR); India veterinary guideline for Downer Cow Syndrome; FirstLine (University of Guelph) veterinary antimicrobial use guideline for canine mastitis to guide the scope of these STGs. The layout of the guidelines was adapted to as outlined under the scope below based on the reviewed treatment guidelines.

The relevant cattle diseases in Zambia were reviewed and a priority list of conditions for the treatment guidelines was developed. The priority list was developed based on the conditions that most commonly occur and are likely to be associated with the most misuse of antimicrobials in beef and dairy cattle in Zambia. Initially, 21 key conditions were identified and after considerations, 10 key conditions/categories were selected for guideline development.

OBJECTIVES

These guidelines serve as a reference practical guide for veterinary professionals and para-professionals to identify clinical signs, diagnose, and treat ten prioritized diseases in Beef and Dairy Cattle in Zambia. The specific objectives of the STGs are to:

- Harmonize treatment of beef and dairy cattle diseases to ensure veterinary workers follow best practice according to evidence
- Improve disease management and treatment outcomes in cattle, improving animal welfare and giving farmers better value for money from veterinary services
- To promote prudent, safe and rational use of antimicrobial molecules to reduce the risk of antimicrobial resistance

TARGET AUDIENCE

These STGs can be used by any veterinary professionals and para-professionals that see most clinical cases in the field and are therefore considered as the frontline in animal health care. However, a key target audience for the STGs are the frontline veterinary para-professionals who are legally under the supervision of registered veterinary surgeons as prescribed by The Veterinary and Veterinary Para-Professional Act No. 45 of 2010.

SCOPE

These STGs covers a wide range of topics related to management of ten prioritized common diseases in beef and dairy cattle in Zambia, including:

- a) Definition

b) Diagnosis

- History (including predisposing factors)
- Clinical signs
- Specific tests (to cover microbiology, blood testing etc.)
- Differential diagnosis

c) Treatment

- Supportive treatment (non-antimicrobial medicines and husbandry management)
- Antimicrobial treatment (including making it clear when antimicrobials are not needed and will not offer any benefit for the case.)
- Include a “CAUTION” box, reminding practitioners to consider withdrawal time

d) Prevention and Control

- Prevention and control measures (herd management, vaccination etc.)
- Client education (what you need to explain to the farmer)

SELECTION AND PRUDENT USE OF ANTIBIOTICS

Antimicrobial resistance is a threat to global public health and development and is estimated to contribute to more than five million deaths globally each year. The inappropriate use and overuse of antibiotics are driving a global increase in AMR and have a pernicious impact on the effectiveness of these critical medicines. Through the Global Action Plan on AMR, WHO is working to support effective antimicrobial stewardship programmes, improve the surveillance of AMR and reduce inappropriate antibiotic consumption. To assist in the development of tools for antibiotic stewardship at local, national and global levels and to reduce antimicrobial resistance, the AWARe classification of antibiotics was developed by WHO in which antibiotics are classified into three different groups - Access, Watch and Reserve - based on their clinical importance and the risk of their use promoting resistance to emphasize the importance of their appropriate use.

In developing the guidelines, the AWARe classification was considered to be used as a tool to guide veterinary professionals and para-professional in the selection and use of antimicrobials to better support antibiotic prescribing, monitoring and stewardship activities. While the application may be different in veterinary medicine and practice, it is recommended that all attending veterinary professions and para-professions in both the private and public sector be familiar with and maintain an updated WHO AWARe classification of antibiotics for evaluation and monitoring of use. In this edition of the STGs, antibiotics have been categorized using the WHO AWARe classification of Antibiotics as follows:

- Access
- Watch
- Reserve

RECOMMENDED APPROACH TO RESPONSIBLE USE OF ANTIMICROBIALS

In any disease situation, the veterinary profession and para-profession must make a decision based on a rigorous decision process, which is supported by current scientific knowledge, evidence and awareness of potential consequences before administering antimicrobials to any animal. The decision to administer any antimicrobial should take into account the signalment, a thorough history taking into account age of affected animal(s), nature and duration of clinical signs, clinical examination findings, and results from diagnostics aids where applicable such isolation and antibiogram profile tests. Figure 1 below provides a recommended decision tree on the use of antimicrobials in livestock in Zambia in a disease situation. It is the responsibility of the attending veterinary profession and para-profession in both the private and public sector to be familiar with and maintain an updated List of Notifiable Diseases in Zambia.

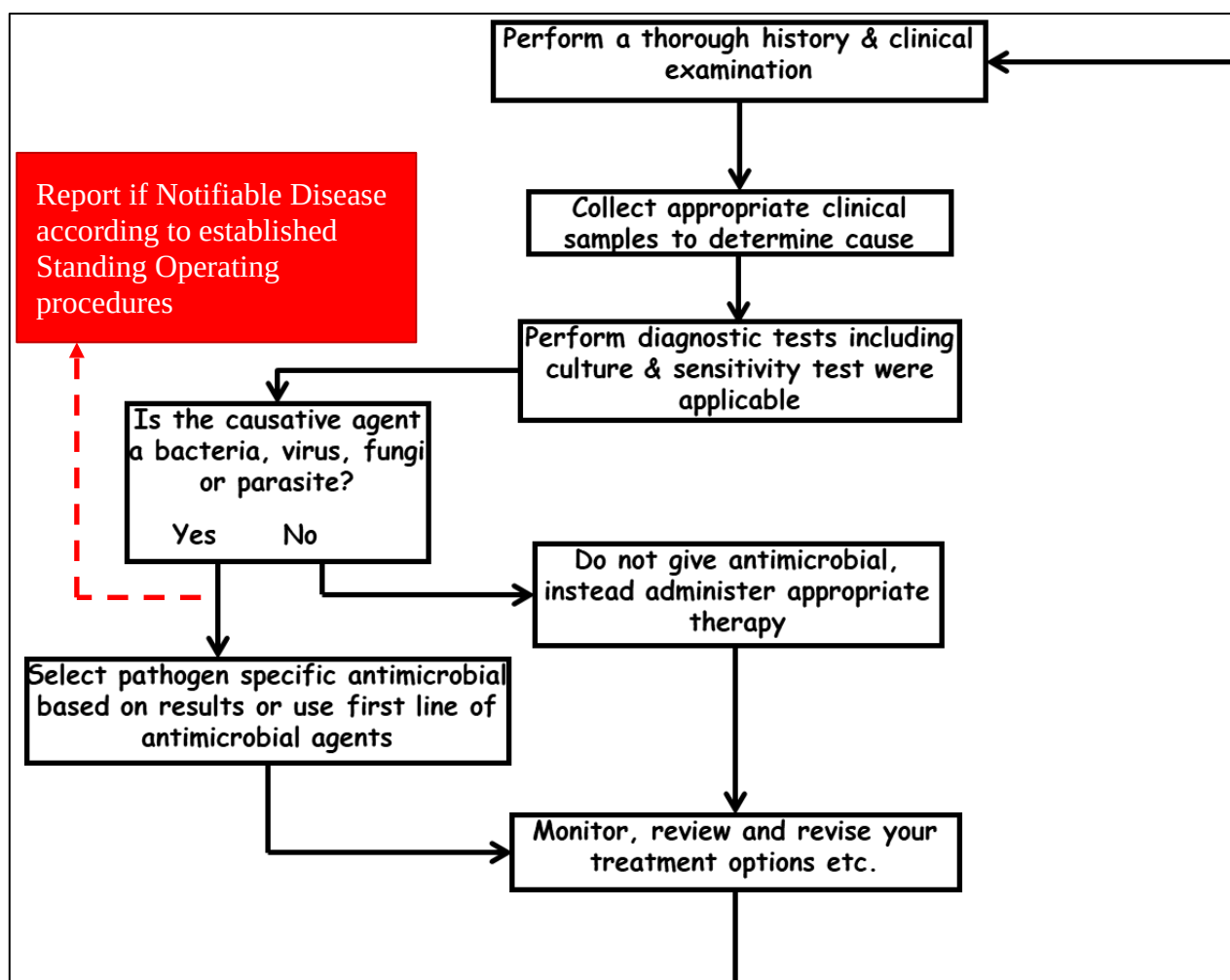


Figure 1: Approach to Prudent Use of Antimicrobials in Livestock in Zambia

INFECTIOUS DISEASES OF CATTLE IN ZAMBIA

Infectious diseases are those diseases that are caused by pathogenic microorganisms such as bacteria, viruses, protozoa and fungi that invade an animal's body and can spread from one animal to another directly or indirectly.

1.0 VIRAL DISEASES

There are many viral diseases that affect cattle in Zambia and cause a negative impact on dairy and beef operations.

1.1 Calf Scours

Calf scours is a condition where young calves develop diarrhoea and become dehydrated. It is characterized by loose manure that persists for two or more days and can be accompanied by a decrease in appetite, lethargy, dehydration, and fever.

1.1.1 Viral Scours

Definition

Rotavirus is the most common viral cause of diarrhoea in calves. Groups A and B rotavirus are involved, but group A is most prevalent and clinically important and contains several serotypes of differing virulence. *Rotavirus* is present in most cattle herds and typically causes diarrhoea in calves 5 to 14 days old. *Rotavirus* infections are self-limiting because once the epithelial cells are dead, the virus does not have anywhere to replicate. Transmission generally occurs as a result of oral contact with infected faeces. One of the major sources of rotavirus infection is carrier cows showing no symptoms and shedding the virus around the time of calving. Coronavirus is also commonly associated with diarrhoea in calves. It replicates in the epithelium of the upper respiratory tract and in the enterocytes of the intestine, where it produces similar lesions to rotavirus but also infects the epithelial cells of the large intestine to produce atrophy of the colonic ridges.

Diagnosis

- History and predisposing factors
 - Diarrhoea in calves aged 5 to 14 days' old
- Clinical signs
 - Affected calves are only moderately depressed and often continue to suck or drink milk.
 - The faeces are voluminous, soft to liquid, and often contain large amounts of mucus and blood flecks (sometimes).
 - Diarrheal commonly persists for 3 to several days, with some cases of coronaviral diarrhoea becoming chronic.
 - Calves can become dehydrated and pick up secondary infections.
 - Some calves may drool and some may be seen to continually attempt, and fail, to defecate.
 - In calves older than four weeks of age, there are often no signs at all following re-infection.
- Specific tests
 - Antibody-based rapid test (Immunochromatography)
 - ELISA

- Molecular-based RT-PCR and RT-qPCR

NOTE: Fresh faecal samples from untreated scouring calves should be submitted for laboratory diagnosis.

- Differential diagnosis
 - Bovine viral diarrhoea virus (BVDV)
 - *Escherichia coli* (*E. coli*) infection
 - Salmonellosis
 - Cryptosporidiosis
 - Coccidiosis
 - Clostridial infection

Treatment

Treatment focuses primarily on supportive care, as there are no specific antiviral treatments available.

- Supportive treatment
 - Rehydration – oral electrolytes with strong ion difference (SID of 60 mmol). 4 litres a day
 - Cows' whole milk should be given in small quantities several times daily (to the full level of requirement) to optimize digestion and to minimize weight loss
 - Electrolytes should be given at least 30 minutes before a milk feed
 - Anti-inflammatory medications, such as Flunixin meglumine single dose at 2.2mg/kg IV or Ketoprofen 3 mg/kg/day IV or IM for up to 3 days
 - Vitamin B complex 5 - 10 ml IM or SC for up to 3 days
 - Administer IV fluids, such as lactated Ringer's solution, to severely dehydrated calves. 80 to 90 ml/kg at a rate of 30 - 40 ml/kg/hr IV, Severe cases 80 ml/kg/hr.
 - Hypoglycaemic calves should be given 25 – 50g dextrose to the IV fluids
 - Probiotics such as lactobacillus to support growth of beneficial gut flora
- Antimicrobial treatment (AWaRe Classification)

No specific antiviral treatment available. However, in cases where the calf looks septic or has infection complication related to bacteria, antimicrobials may be used.

- **Access:** Trimethoprim-sulphonamide 24mg/kg slow IV or IM once daily for 3 to 5 days – Only to be considered and administered due to the likelihood of a mixed infection

CAUTION: Adhere to the withdrawal period of antibiotics

Prevention and Control

- Prevention and control measures
 - Practice good general hygiene, in particular in maternity and calf-rearing areas
 - Reduce exposure of neonates to pathogens by separating maternity pens, calf-rearing areas, and hospital pens on the premises
 - Practice good colostrum management
 - Avoid mingling older calves with neonates
 - Vaccination of dams late in pregnancy to boost the immunoglobulin content
 - The pregnant dam should be vaccinated at 6 and 2 weeks before parturition to stimulate antibody production to specific pathogens of the neonatal diarrhoea complex
- Client education
 - Ensure calves have adequate colostrum a few hours after birth (4 – 6 litres in 24 hours)
 - Maintain a clean environment and follow proper sanitation procedures.
 - Regularly check calves for signs of scours and seek veterinary attention if symptoms persist.
 - Adhere to the recommended treatment
 - Provide clean fresh water all the time
 - Clean and disinfect all feeding equipment after use
 - Restrict access to the calf rearing area
 - Isolate all scours cases, assign separate feeding equipment and personnel and always feed the healthy calves first to minimise transmission of infection

1.2 Lumpy Skin Disease (LSD)

Definition

Lumpy skin disease (LSD) is a highly contagious viral disease that affects cattle. It's caused by a poxvirus and is spread by biting insects, such as mosquitoes, ticks, and flies.

NOTE: LSD is a notifiable disease in Zambia. Suspected cases should be reported to the nearest veterinary district office.

Diagnosis

- History
 - Previous LSD outbreaks in the area.
 - High rainfall activities leading to increase in biting parasites.
- Clinical signs
 - Fever
 - Nodules on the skin, mucous membranes and internal organs
 - Loss of weight

- Enlarged lymph nodes
- Oedema of the skin
- Death
- Specific tests
 - Skin scrapings
 - PCR
 - ELISA
 - Use specific tests to rule out conditions that show similar clinical signs to LSD.
- Differential diagnoses
 - Pseudo lumpy skin disease
 - Dermatophilosis
 - Ringworm
 - Urticaria
 - Insect bites
 - Bovine Warts.

Treatment

There is no specific treatment for LSD but supportive care. The use of antibiotics is only necessary for cases with secondary bacterial infections.

- Supportive treatment

Non-Steroidal Anti-Inflammatories (NSAIDS) to reduce pain and inflammation and keep the appetite of affected animals

- Flunixin meglumine at 1.1-2.2 mg/kg once daily SC or slow IV for up to 3 days

OR

- Meloxicam at 0.5 mg/kg once daily SC or IV for up to 3 days

- Antimicrobial treatment (AWaRe classification)

Use of antibiotics is not always necessary unless where the nodules have become open wounds and are infected.

- **Access:** Oxytetracycline at 10 mg/kg IM once daily for 5 to 7 days

OR

- **Watch:** Dihydrostreptomycin 10 mg/kg IM) once daily for 5 to 7 days

CAUTION: Whenever antibiotics are used to treat secondary bacterial infections, always adhere to withdrawal periods for milk and meat.

Prevention and Control

- Prevention and control measures
 - Vaccinate animals with LSD vaccine before the start of the rains (November)
 - Use dips with both insecticide and acaricide properties
- Client education
 - Use of antibiotics is not always necessary unless where the nodules have become open wounds and are infected
 - Restrict movement of cattle in infected areas, and practice proper disposal of dead animals by incineration, and cleaning and disinfection of premises and equipment

1.3 Foot and Mouth Disease (FMD)

Definition

Foot and mouth disease (FMD) is a highly contagious viral infection that primarily affects cloven-hoofed animals, such as cattle, pigs, sheep, goats and deer. The disease is caused by foot-and-mouth disease virus (FMDV) and can lead to severe health issues in livestock, including high fever and painful blisters in the mouth and on the feet.

NOTE: FMD is a notifiable disease in Zambia. Suspected cases should be reported to the nearest veterinary district office.

Diagnosis

- History
 - Recent exposure to other animals or outbreak
 - Overcrowding
- Clinical signs
 - Fever lasting two or six days
 - Blisters in the mouth and on the feet, which can cause significant discomfort and lead to difficulty in eating and drinking
- Specific tests

Samples such as throat swabs, fluid from blisters or faecal samples may be collected

 - PCR to detect the viral RNA
 - Serological tests - ELISA
 - Virus isolation – culture the virus from the samples
- Differentials diagnoses
 - Bovine popular stomatitis
 - BVD
 - Mycotic stomatitis

Treatment

There is no specific antiviral treatment for FMD but supportive care focussing on alleviating symptoms and preventing complications. The use of antibiotics is only necessary for cases with secondary bacterial infections.

- Supportive treatment

Non-Steroidal Anti-Inflammatories (NSAIDS) to reduce pain and inflammation and keep the appetite of affected animals

- Flunixin meglumine at 1.1-2.2 mg/kg once daily SC or slow IV for up to 3 days

OR

- Meloxicam at 0.5 mg/kg once daily SC or IV for up to 3 days

- Treating secondary bacterial infections - Antimicrobial treatment (AWaRe classification)

Use of antibiotics is not always necessary unless where the vesicles/blisters have become open wounds and are infected.

- **Access:** Oxytetracycline at 10 mg/kg IM once daily for 3 to 5 days

OR

- **Access:** Trimethoprim-sulphonamide 30 mg/kg IM once daily for 3 to 5 days

CAUTION: Whenever antibiotics are used to treat secondary bacterial infections, always adhere to withdrawal periods for milk and meat.

- Preventing secondary infections
 - In some cases, topical treatments may be used to prevent secondary bacterial infections in the blisters.

Prevention and Control

- Prevention and control measures
 - Infected animals should be isolated to prevent the spread of the virus to healthy animals
 - The government regulates vaccines and regions where vaccination should be done in compliance with WOAHA guidelines
 - Limiting the movement of animals, people, and vehicles in and out of farms can significantly reduce the risk of transmission
 - Implement strict disinfection protocols for equipment, clothing, and vehicles at the farm
- Client education
 - Use of antibiotics is not always necessary unless where the veterinarian has prescribed
 - Restrict movement of cattle in infected areas, and practice proper disposal of dead animals by incineration, and cleaning and disinfection of premises and equipment

2.0 BACTERIAL DISEASES

Bacterial diseases are infections caused by harmful bacteria that invade the body of an animal. These pathogens can multiply rapidly and cause various health problems.

2.1 Infectious Bovine Keratoconjunctivitis (IBK) ‘Pink Eye’

Definition

IBK, commonly known as pinkeye, is a highly contagious ocular disease. It is a common, highly contagious ocular disease affecting primarily calves. Primarily caused by *Moraxella bovis*, which has an incubation period of 2 to 3 days. *Mycoplasma bovis* can cause a similar lesion and is recognized as a co-infective pathogen in cases of pink eye.

Diagnosis

- History and Predisposing factors
 - Animals with IBK will sometimes have a history of ocular irritation, which predisposes animals to bacterial colonization
 - Entropion and malformation of eye lids may cause primary irritation that leads to keratoconjunctivitis
 - Animal exposure to flies, UV light and grass, as well as dust causes primary insult to the ocular mucosa barriers and thus predispose to infection
 - *Mycoplasma* spp., *Acholeplasma*, *Chlamydia*, *Bovine herpesvirus I* (IBR) and *Bovine Adenovirus* are among the microbial agents suspected to predispose cattle to *Moraxella* colonization
 - Owners may have observed signs of blindness as well as poor vision
- Clinical Signs
 - A small opaque area appears on the cornea within two days. Corneal lesions are typically central in location
 - Conjunctiva hyperaemia
 - Tear-staining of the face
 - Pus matting the lashes and hair of the face
 - Blepharospasms
 - Sensitivity to light
 - Whitish discoloration of the cornea
 - Blindness and hitting into objects
 - In severe cases, ulceration may progress to corneal perforation but this is uncommon
- Specific Tests
 - Bacterial culture and sensitivity culture (where applicable)
 - PCR can be used for aetiological diagnosis

- Differential diagnoses
 - Foreign Bodies (FB) within conjunctival sac
 - IBR)
 - Bovine Iritis

Treatment

- Specific treatment
 - Iodine 10% as an ocular spray – once or twice a day for 7 to 14 days, depending on severity
 - Antibiotics (AWaRe Classification) - for more severe cases
 - **Access:** Florfenicol at 20mg/kg IM every 48 hours. 2 doses total
 - **Access:** LA Oxytetracycline at 10-20mg/kg IM single systemic dose is effective when subconjunctival or topical treatment is not practical
 - OR
 - **Access:** Oxytetracycline Eye powder applied at least every 8–12 hours to be effective for 10-14 days; thus they may not be practical in typical herd settings but is effective in cases with secondary Mycoplasma infection
- Supportive treatment
 - Should include basic provision of food and water to the animals especially in bilateral cases which have progressed to visual impairment stages
 - Eye patches may be used to provide protection to the eye from environmental conditions and help recovery rate

CAUTION: Whenever antibiotics are used, always follow withdrawal periods for milk and meat. Do not use florfenicol in lactating dairy cows older than 20 months.

NOTE: Topical use of oxytetracycline has zero withdrawal periods for both milk and meat.

Prevention and Control

- Prevention and control measures
 - Vaccines may be used when available
 - Fly control using pyrethroid dip spray
 - Dust control by introducing windbreakers where applicable
 - Pasture management – mainly preventing animals from grazing on pasture that has residual abrasive stumps that may scratch the eyes
 - All new stock at the farm should be quarantined and managed separately before being introduced to the herd
- Client education
 - IBK is contagious and can be spread within the herd from animal to animal

- Fly control is essential in preventing this spread of the disease especially through proper management of animal waste

2.2 Clostridial Diseases

Clostridial diseases in cattle are acute, often fatal infections caused by *Clostridium* species, including *C. chauvoei* (Blackleg), *C. septicum* (Malignant Oedema), *C. perfringens* (Enterotoxaemia), *C. tetani* (Tetanus), and *C. botulinum* (Botulism). These infections are characterized by sudden death, muscle necrosis, systemic toxæmia, or neurological signs.

2.2.1 Tetanus

Definition

Tetanus is a serious infectious disease caused by the exotoxin produced by the bacterium *C. tetani*. The condition primarily affects the central nervous system and can lead to severe muscle spasms.

Diagnosis

- History and predisposing factors
 - Stress and potential injuries during calving can create an environment for infection
 - Trauma, surgical wounds, or castration especially if proper hygiene is not maintained
- Clinical signs
 - Stiffness and reluctance to move
 - Anxiety and excitability
 - Muscle spasms which may lead to severe complications and death
- Specific tests
 - Detection of tetanus toxin
 - Culture and isolation from wounds if present
 - PCR can be used for aetiological diagnosis
- Differential diagnoses
 - Strychnine poisoning
 - Spinal injury
 - Hypocalcaemia

Treatment

Treating tetanus in cattle requires a multifaceted approach, focusing on supportive care, wound management, and pharmacological interventions.

- Supportive treatment
 - Isolation of affected animal in a quiet, calm environment to minimize the stress and prevent exacerbation of symptoms

- Wound management
 - Thorough flushing and debriding of the wound to remove any debris and to reduce the bacterial load
- Antimicrobial treatment (AWaRE Classification)
 - **Access:** Penicillin (Procaine Penicillin G) at high doses of 22,000-44,000 IU/kg IM every 12 hours for 3-5 days

CAUTION: Adhere to the withdrawal period. Avoid slaughtering animals within withdrawal periods to prevent drug residues

- Other pharmacological interventions
 - **Tetanus antitoxin:** Administering tetanus antitoxin can be effective, particularly if given in the early stages of the disease (include dosage)

Prevention and Control

- Prevention and control measures
 - Vaccination is available and is important for livestock
 - Proper management by prompt cleaning and treating any wounds to reduce risk of infection
 - Maintain strict hygiene during surgical procedures like castration and calving to minimize introduction of bacteria
- Client education
 - Emphasize routine vaccination as the most effective preventive measure
 - Encourage proper disposal of carcasses to prevent environmental contamination
 - Keep cattle in clean, dry environment to minimize exposure to contaminated soil

2.2.2 Black Quarter (Blackleg)

Definition

Black quarter, also known as blackleg, is an acute infectious disease in cattle caused by the bacterium *C. chauvoei*. It is characterized by severe swelling in the muscles, particularly in young cattle aged between six months and two years, and can lead to high mortality rates if not treated promptly. In cattle, blackleg infection is endogenous and lesions may develop without any history of wounds. The case fatality rate approaches 100%.

Diagnosis

- History and predisposing factors
 - Most cases occur in cattle aged between six months to two years, although it can also affect animals as young as two months
 - Cattle that are well-conditioned and have high feed intake are more susceptible
 - Exposure to contaminated soil or feed with clostridial spores

- Trauma and stress - surgical wounds, or castration
- Clinical signs
 - Usually, onset is sudden, and a few cattle may be found dead without premonitory signs
 - Acute, severe lameness and marked depression are common
 - Initially, there is a fever but, by the time clinical signs are obvious, body temperature may be normal or subnormal
 - General signs include prostration and tremors
 - Death occurs within 12-48 hours
 - Characteristic oedematous and crepitant swellings develop in the hip, shoulder, chest, back, neck, or elsewhere. At first, the swelling is small, hot, and painful. As the disease rapidly progresses, the swelling enlarges, there is crepitation on palpation, and the skin becomes cold and insensitive with decreased blood supply to affected areas.
 - Most cases are seen in cattle from 6-24 months old, but thrifty calves as young as 6 weeks and cattle as old as 10-12 years may be affected
- Specific tests
 - Fluorescent antibody tests (FAT) on affected tissues
 - Culture and isolation from lesions particularly when the carcass is examined ≥ 24 hrs after death
 - PCR for species confirmation
 - **Post-mortem findings:** The lesions are restricted to the myocardium and the diaphragm. The affected muscles are dark red to black and dry and spongy, have a sweetish odour, and are infiltrated with small bubbles but little oedema
- Differentials diagnoses
 - Other acute clostridial infections
 - Lightning strike
 - Anthrax
 - Lactation tetany
 - Extensive haemorrhage
 - Acute lead poisoning

Treatment

Blackleg is a rapidly progressing disease and treatment options are limited. Treatment may be effective in initial stages of infection although the success rate is generally low.

- Antimicrobial treatment (AWaRE Classification)
 - **Access:** Penicillin (Procaine Penicillin G) at high doses of 22,000-44,000 IU/kg IM every 12 hours for 3-5 days. In an outbreak situation, cattle at risk should be treated prophylactically with penicillin given at 10,000 IU/kg IM once daily for as long as 14 days.

OR

- **Access:** Oxytetracycline at high doses of 20mg/kg IM every 12 hours for 3-5 days. In an outbreak, all susceptible cattle should be treated prophylactically with administration of oxytetracycline at 10mg/kg IM to prevent new cases for as long as 14 days

CAUTION: Adhere to the withdrawal period. Avoid slaughtering animals within withdrawal periods to prevent drug residues

- Supportive treatment
 - Fluid therapy to prevent dehydration (Lingers lactate)
 - Anti-inflammatory drugs (NSAIDs) to reduce pain and inflammation
 - Flunixin meglumine at 1.1-2.2 mg/kg IV once daily for up to 3 days
 - OR
 - Meloxicam at 0.5 mg/kg SC or IV once daily for up to 3 days

Prevention and Control

- Prevention and control measures
 - In an outbreak, all susceptible cattle should be vaccinated to prevent new cases. A multivalent vaccine containing *C. chauvoei*, *C. septicum*, and, where needed, *C. novyi* antigens is safe and reliable for cattle at 3-6 months of age with annual boosters
 - Cattle should be moved from affected pastures and include rotational grazing and avoidance of contaminated pastures
 - Carcasses should be destroyed by burning or buried deeply with lime in a fenced-off area to limit heavy spore contamination of the soil
- Client education
 - Emphasize routine vaccination as the most effective preventive measure
 - Educate farmers on early recognition of signs and immediate reporting for early intervention
 - Encourage proper disposal of carcasses to prevent environmental contamination

2.2.3 Malignant Oedema

Definition

Malignant oedema is an acute and often infection primarily caused by *C. septicum*. The condition is characterized by rapid onset and is typically associated with contaminated wounds, particularly in the head and neck regions of cattle, although it can occur in any superficial part of the body.

Diagnosis

- History and predisposing factors
 - Trauma or injury, particularly in areas where the swelling is observed
- Clinical signs
 - Localized swelling

- Fever
- Systemic signs of illness
- Clinical signs typically develop within a few couple of days following contamination of wound or injury
- Specific tests
 - Culture and isolation from affected tissue sample(s) provides a definitive diagnosis
 - FAT to detect presence of the bacteria in affected tissue sample(s)
 - PCR for species confirmation
 - **Post-mortem findings:** The lesions often reveal significant oedema and fluid accumulation in the affected areas can further support the diagnosis
- Differentials diagnoses
 - Blackleg
 - FMD
 - BVD
 - Anthrax

Treatment

Malignant oedema treatment in cattle can be challenging due to rapid progression of the disease.

- Antimicrobial treatment (AWaRE Classification)
 - **Access:** Penicillin (Procaine Penicillin G) at high doses of 22,000-44,000 IU/kg IM every 12 hours for 3-5 days.
 - OR
 - **Access:** Oxytetracycline at high doses of 20mg/kg IM every 12 hours for 3-5 days.

CAUTION: Adhere to the withdrawal period. Avoid slaughtering animals within withdrawal periods to prevent drug residues
- Supportive treatment
 - Fluid therapy to prevent dehydration (Ringers lactate)
 - Anti-inflammatory drugs (NSAIDs) to reduce pain and inflammation
 - Flunixin meglumine at 1.1-2.2 mg/kg IV once daily for up to 3 days
 - OR
 - Meloxicam at 0.5 mg/kg SC or IV once daily for up to 3 days
- Wound management
 - If there are visible wounds or areas of swelling, local treatment may be necessary which may include surgical draining and thorough flushing of abscesses or necrotic tissue to alleviate pressure and promote healing

Prevention and Control

- Prevention and control measures
 - A multivalent vaccine containing *C. chauvoei*, *C. septicum*, and, where needed, *C. novyi* antigens is safe and reliable for cattle at 3-6 months of age with annual boosters. To prevent outbreaks, cattle should be vaccinated 2-6 weeks before calving.
 - Cattle should be moved from affected pastures and include rotational grazing and avoidance of contaminated pastures
 - Carcasses should be destroyed by burning or buried deeply with lime in a fenced-off area to limit heavy spore contamination of the soil
- Client education
 - Emphasize routine vaccination as the most effective preventive measure
 - Educate farmers on early recognition of signs and immediate reporting for early intervention
 - Encourage proper disposal of carcasses to prevent environmental contamination

2.2.4 Enterotoxaemia ‘Overeating Disease or Purple Gut’

Definition

Enterotoxaemia is a serious condition primarily affecting young cattle, particularly calves. It is caused by the abnormal proliferation of certain strains of *C. perfringens*, which are normally found in the gastrointestinal tract of livestock. The most common type of enterotoxaemia in calves is associated with *C. perfringens* type A, accounting for up to 20% of total mortality in affected veal calves.

Diagnosis

- History and predisposing factors
 - Cattle consuming a high-carbohydrate diet
- Clinical signs
 - Clinical signs develop rapidly, often within 12 hours and may not be detectable until it is too late for effective intervention
 - Sudden death
 - Lethargy
 - Abdominal distension
 - Neurological signs such as seizures
- Specific tests
 - Culture and isolation from a segment of small intestine and its contents
 - FAT to detect presence of the bacteria in affected tissue sample(s)
 - PCR for species confirmation
 - **Post-mortem findings:** Characteristic lesions in the intestine and other organs but rapid autolysis can complicate the diagnosis

- **Histological findings:** For cases suspected to be caused by *C. perfringens* type D, examination of the brain may be necessary.
- Differentials diagnoses
 - Blackleg
 - Bacterial enteritis such as salmonellosis or colibacillosis
 - BVD
 - Grain overload or acidosis

Treatment

Treatment of enterotoxaemia in cattle can be challenging due to rapid progression of the disease.

- Antimicrobial treatment
 - Not indicated for treatment of enterotoxaemia
- Supportive treatment
 - Fluid therapy to combat dehydration (Ringers lactate) and electrolyte imbalances
- Antitoxins
 - In some cases, administering antitoxins early in the course of the disease may help neutralize the toxin

Prevention and Control

- Prevention and control measures
 - Vaccination is recommended for herds at risk
 - Dietary management by adjusting feeding practices to prevent overeating.
- Client education
 - Emphasize routine vaccination as the most effective preventive measure especially in herds are risk
 - Gradual changes to diet, particularly when introducing high-carbohydrate feeds to help minimize the risk

2.2.5 Botulism

Definition

Botulism is a rapid onset, usually fatal disease caused by the botulinum toxin produced by the bacterium *C. botulinum*. The development of the signs and disease progression depends on the amount of toxin ingested but the disease also occurs due to infection of wound with the organisms and the formation of potent exotoxins.

Diagnosis

- History and predisposing factors
 - Ingestion of poorly prepared silage, decomposing animals or rotting organic material

- Clinical signs
 - Rapid onset of signs characterized by progressive paralysis
 - Hindlimb weakness
 - Protrusion of the tongue is a characteristic sign observed in some cases
 - Weakness
 - Staggering
 - Collapse
 - Death
- Specific tests
 - Detection of toxin by ELISA
 - Culture and isolation from tissues of affected animals in cases of toxin-coinfectious botulism
 - PCR for species confirmation
- Differential diagnoses
 - Hypocalcaemia
 - Paralytic rabies
 - Other clostridial diseases

Treatment

Treatment of botulism is rarely attempted due to rapid progression of the disease and the difficulty in reversing the effects of the toxin.

- Antimicrobial treatment
 - Not indicated for treatment of botulism

Prevention and Control

- Prevention and control measures
 - Vaccination is recommended for herds at risk
- Client education
 - Emphasize routine vaccination as the most effective preventive measure especially in herds at risk

2.3 Calf Scours

2.3.1 Bacterial Scours

Definition

Enterotoxigenic *E. coli* is an important bacterial pathogen associated with neonatal diarrhoea in calves during the first week of life. *Salmonella* spp., especially *S. typhimurium* and *S. dublin*, but occasionally other serovars, cause diarrhoea in calves 2–12 weeks old. *Salmonellae* produce

enterotoxins but are also invasive and produce inflammatory change within the intestine and infection commonly progresses to a bacteraemia. Neonatal diarrhoea has also been associated with *C. perfringens* type A characterized by peracute haemorrhagic abomasitis and enteritis is seen sporadically, although outbreaks can occur.

Diagnosis

- History and predisposing factors
 - Failure of transfer of passive immunity is an important predisposing factor.
- Clinical signs

For Enterotoxigenic *E. coli*;

- Sudden onset of profuse amounts of liquid faeces and the calves rapidly become depressed and recumbent
- Calves may lose >12% of body weight in fluid within hours and hypovolemic shock and death may occur in 12–24 hours

For *Salmonella* spp.;

- Foul smelling faeces containing blood, fibrin and copious amounts of mucus
- Septicaemia, with high fever and depression progressing to prostration and coma
- Rapid deterioration and death despite vigorous therapy

For haemorrhagic enterotoxaemia due to *C. perfringens* type A, B, or C;

- Acute onset of depression and weakness
- Bloody diarrhoea
- Abdominal pain and death within a few hours
- Specific tests
 - Faecal samples can be tested with calf-side test kits using immune chromatography to identify antigens of common pathogens of neonatal diarrhoea or
 - Submit faecal sample to a diagnostic laboratory for isolation and characterization of enteropathogens

NOTE: Samples should be taken from several untreated calves in the early stages of diarrhoea.

- Differential diagnoses
 - Rotavirus and Coronavirus
 - Cryptosporidiosis
 - Coccidiosis
 - Nutritional scours

Treatment

- Supportive treatment
 - Rehydration – oral electrolytes with strong ion difference (SID) of 60 mmol. 4 litres a day
 - Cows' whole milk should be given in small quantities several times daily (to the full level of requirement) to optimize digestion and to minimize weight loss
 - Electrolytes should be given at least 30 minutes before a milk feed
 - Anti-inflammatory medications, such as Flunixin meglumine single dose at 2.2mg/kg IV or Ketoprofen 3 mg/kg/day IV or IM once daily for up to 3 days
 - Vitamin B complex 5-10 ml IM or SC once daily for up to 3 to 5 days
 - Administer IV fluids, such as lactated Ringer's solution, to severely dehydrated calves. 80 - 90 ml/kg at a rate of 30 - 40 ml/kg/hour IV, Severe cases 80 ml/kg/hour rapidly
 - Hypoglycaemic calves should be given 25 – 50g dextrose to the IV fluids
- Antimicrobial treatment options (AWaRe Classification)

Consider antimicrobial treatment in systematically ill calves

- **Access:** Amoxicillin at 10 mg/kg every after 12 hours for 3 to 5 days
- **Access:** Trimethoprim and Sulfadoxine at 24 mg/kg slow IV or IM once daily for 3 to 5 days
- OR
- **Access:** Tetracycline (oral powder) 11 mg/kg every 12 hours administered in water or as a bolus for 3 to 5 days
- OR
- **Reserve:** Ceftiofur at 1.0 - 2.2 mg/kg IM once daily for 3 to 5 days

CAUTION: Adhere to the withdrawal period

Prevention and Control

- Prevention and control measures
 - Practice good general hygiene, in particular in maternity and calf-rearing areas
 - Reduce exposure of neonates to pathogens by separating maternity pens, calf-rearing areas and hospital pens on the premises
 - Practice good colostrum management
 - Avoid mingling older calves with neonates
 - Vaccination of dams late in pregnancy to boost the immunoglobulin content
 - The pregnant dam should be vaccinated at 6 and 2 weeks before parturition to stimulate antibody production to specific pathogens of the neonatal diarrhoea complex
- Client education
 - Ensure calves have adequate colostrum a few hours after birth (4 – 6 litres in 24 hours)

- Maintain a clean environment and follow proper sanitation procedures.
- Regularly check calves for signs of scours and seek veterinary attention if symptoms persist.
- Adhere to the recommended treatment
- Provide clean fresh water all the time
- Clean and disinfect all feeding equipment after use
- Restrict access to the calf rearing area
- Isolate all scours cases, assign separate feeding equipment and personnel and always feed the healthy calves first to minimise transmission of infection

2.4 Interdigital Necrobacillosis “Infectious Foot Rot”

Definition

Foot rot is a bacterial infection of the soft tissues of the foot in dairy and beef cattle, creating a sudden onset of mild to severe lameness. The most common bacteria associated with foot rot are *Fusobacterium necrophorum*, *Dichelobacter nodosus*, *Trueperella pyogenes*, *Porphyromonas levii* and *Prevotella intermedia*.

Diagnosis

- History and predisposing factors
 - Trauma to the hoof
 - Wet and humid conditions
- Clinical signs
 - Sudden onset of lameness, accompanied by symmetrical swelling of the lower leg above the hoof
 - Splitting open of interdigital skin and a foul-smelling discharge is noticeable
 - In more severe cases, loose pieces of necrotic tissue can be easily removed from the interdigital space
- Specific tests
 - Bacteriological culture of tissue or swab samples from the affected foot
- Differential diagnoses
 - Interdigital dermatitis
 - Sole ulcers
 - Sole abscesses
 - Sole abrasions
 - Infected corns
 - Fractures
 - Septic arthritis
 - Inflammation or infection of tendons and tendon sheaths

Treatment

- Supportive Treatment
 - NSAIDs
 - Ketoprofen at 3 mg/kg/day IV or IM for up to 3 days
OR
 - Tolfenamic acid at 2 mg/kg slow IV or IM and treatment may be repeated once after 2 days
OR
 - Flunixin meglumine 2.2 mg/kg slow IV once a day for up to 3 days
 - Copper sulphate footbath twice a day for 3 days at 50 g/L
 - Hoof trimming and topical medication (wound spray and ointment) applied liberally
 - Apply antibacterial disinfectants to the affected area such as povidone iodine liberally twice a day for at least 14 days
 - Bandaging to protect the affected area
- Antimicrobial treatment options (AWaRe Classification)
 - **Access:** Procaine penicillin G 22,000 - 66,000 IU/kg IM once a day for 3 to 5 days
OR
 - **Access:** Amoxicillin + Clavulanate Potassium at 8.75 mg/kg IM or SC once a day for 3 to 5 days
OR
 - **Access:** LA tetracycline at 20 mg/kg deep IM as a single injection - the dose can be repeated after 48 hours

NOTE: Treated animals should visually improve within 2–3 days. If animals do not respond, the diagnosis should be re-evaluated.

CAUTION: Adhere to withdrawal period for antibiotics.

Prevention and Control

- Prevention and control measures
 - Keep paddocks/pens free of hard objects and mud. Removing all offending objects such as rocks, nails, wires, sharp edges, cables and other hazardous objects from water troughs, feed pads and gateways to reduce the risk of infection
 - Regularly trim hooves to prevent overgrown hooves, which can contribute to foot rot
 - Copper sulphate and formalin routine footbaths. Dilution at 2 - 4 % for formalin and 4 - 5 % for non-acidified and 1 - 2 % for buffered acidified solution copper sulphate once weekly
- Client education
 - Regular monitoring for new cases and prompt reporting for immediate treatment/intervention

- Routine hoof health program implementation such as footbath and hoof trimming
- Identify and address areas contributing to foot rot
- Adherence to recommended treatment
- Prognosis - If left untreated, foot rot can lead to chronic disease and a poor recovery prognosis
- Severely affected animals may need to be culled from the herd

2.5 Pneumonic Pasteurellosis “Transit Fever/Shipping Fever”

Definition

Pasteurella pneumonia is a respiratory disease of calves and adult animals that causes a haemorrhagic fibrinonecrotic bronchopneumonia. *Mannheimia haemolytica*, *Pasteurella multocida* and *Mycoplasma bovis* often presents co-infections in cattle lung, with *P. multocida* being part of normal flora. *M. haemolytica* is the primary pathogen and has 3 recognised serotypes causing disease; types A1, A2 and A6. It is found in the nasal passages of a number of healthy carrier animals, with outbreaks of disease precipitated by multiple stress factors including transit, social and weaning stress.

Diagnosis

- Clinical signs
 - Coughing
 - Frothing from both nose and mouth
 - Rapid breathing
 - Weakness
 - Off-food
 - Listlessness and fever (40-41°C)
 - Death may occur acutely in severe cases
- Specific tests
 - Bacterial culture (Rib sample or long bones are preferred to lung tissue).
 - Immunohistochemical testing
 - PCR assay
 - **Post-mortem findings:** Lesions are not pathognomonic, but are highly suggestive in the case of haemorrhagic fibrinonecrotic bronchopneumonia. Grossly, there are extensive reddish-black to greyish-brown consolidated regions cranioventrally in the lungs with gelatinous thickening of interlobular septa and fibrinous pleuritis; extensive thromboses, necrotic pulmonary foci and limited evidence of bronchitis and bronchiolitis.
- Differential diagnoses
 - Lungworm infection
 - Bovine parainfluenza virus infection
 - Bovine respiratory syncytial virus

- Other bacterial infections of the respiratory system

Treatment

- Supportive treatment
 - NSAIDs are beneficial in speeding recovery and reducing residual lung damage as they reduce pain and inflammation
 - Flunixin meglumine at 1.1–2.2 mg/kg IV once daily for up to 3 days
 - OR
 - Meloxicam at 0.5 mg/kg SC or IV once daily for up to 3 days
 - Reduce stress and exhaustion during treatment. Less handling of animals is preferred as pulmonary distress may lead to early death.
- Antimicrobial treatment options (Aware Classification)
 - **Watch:** Tulathromycin in non-lactating cows at 2.5 mg/kg SC single dose
 - OR
 - **Watch:** Gamithromycin in beef and non-lactating cattle at 6 mg/kg SC single dose
 - OR
 - **Watch:** Tilmicosin at 10–20 mg/kg SC as a single dose
 - OR
 - **Watch:** Florfenicol at 20 mg/kg IM repeated in 48 hours; or 40 mg/kg SC as a single dose
 - **Reserve:** Enrofloxacin at 2.5–5 mg/kg SC once a day for up to 5 days; or 7.5–12.5 mg/kg SC as a single dose

CAUTION: Adhere to withdrawal period for antibiotics

Prevention and Control

- Prevention and control measures
 - Vaccination is the most efficient control
 - Good management practices aimed at reducing stress on animal's groups
 - Metaphylaxis may be indicated in highly susceptible population
- Client education
 - Vaccination is the most efficient control
 - Good management practices aimed at reducing stress on animal's groups
 - Because sick animals generally require only 1 administration, the long-acting antimicrobials allow the feedlot producer to return treated animals directly to the home pen, rather than having to maintain sick animals in a separate isolation pen

2.6 Abortions

Abortion in cattle can be a significant concern as it can impact her productivity and overall health. There are several causes of abortion in cattle.

2.6.1 Brucellosis

Definition

Increased rate of abortions and/or stillbirths with the former being in the later stages of gestation caused by *Brucella abortus*. Abortions exceeding 5% of the total number of cows and multiple animals are affected with increased retained placentas, is suggestive of brucellosis.

NOTE: Brucellosis is a notifiable disease in Zambia. Suspected cases should be reported to the nearest veterinary district office.

Diagnosis

- History and predisposing factors
 - Abortions and/or stillbirths with new animals introduced to a herd without proper quarantine and testing is suggestive of brucellosis infection
 - Calves be born weak and usually die within a few days
 - Bulls tend to be carriers of infection and may infect naive cows
- Clinical signs

Brucella spp. cause chronic disease that, if not treated, persists for life.

- Abortion is the most obvious manifestation
- Infections may also cause stillborn or weak calves
- Retained placentas
- Reduced milk yield
- Usually, general health is not impaired in uncomplicated abortions
- Specific tests
 - Culture and isolation of *B. abortus* from foetuses (stomach and lungs), placental tissues or milk
 - Serum agglutination tests – Rose Bengal Test
 - Milk ring test (for screening purposes)
 - Complement fixation test
 - Indirect and competitive ELISA
- Differentials diagnoses
 - Trichomoniasis
 - Vibriosis
 - Leptospirosis

- IBR
- Treatment
 - No practical treatment is available. It's a notifiable disease, therefore report accordingly

Prevention and Control

- Prevention and control measures
 - Vaccination of calves increases resistance to infection. Calves are vaccinated between 3 and 8 months of age. Resistance may not be complete and some vaccinated calves may become infected, depending on severity of exposure.
 - Eventual eradication depends on testing and eliminating reactors. The disease has been eradicated from many individual herds and areas by this method. Herds must be tested at regular intervals until two or three successive tests are negative.
- Client education
 - There is no treatment for the brucellosis and all infected or reactive animals should be culled from the herd
 - Careful selection and screening of bulls sourced externally is important to prevent the introduction and spread of the disease in the herd as they act as carrier
 - Maintain good hygienic farm practices including proper disposal of afterbirth from cows
 - The disease is zoonotic and therefore all suspected tissues or afterbirths should be handled with care

2.6.2 Campylobacteriosis (Vibriosis)

Definition

It is a venereal disease of cattle caused by *Campylobacter* spp. and transmission occurs by coitus, ingestion and other means. *C. fetus* subspp *venerealis* is the main cause of venereal disease of cattle. Healthy bulls become infected during coitus with diseased cows. Abortions usually occur between the fifth and eighth month of pregnancy.

Diagnosis

- History and predisposing factors
 - Sporadic abortions usually in the last half of gestation.
- Clinical signs
 - The disease is insidious and often unrecognized in herds causing production losses such as abortions
 - Poor conception rates
 - Long calving intervals
 - Uterine infections and gastroenteritis
 - Abortions usually occur between fifth and eighth month of pregnancy
 - Infected bulls show no symptoms and their semen is normal

- Specific tests
 - The disease is confirmed by measuring antibodies against *C. fetus* in the cervicovaginal mucus of an infected cow or heifer by using an agglutination test or ELISA
 - Culture and isolation
- Differential diagnoses
 - Bovine viral diarrhoea
 - IBR
 - Leptospirosis
 - Brucellosis
 - Trichomoniasis

Treatment

Treatment of campylobacteriosis is not necessary in mild cases. For practical reasons, cows are not usually treated for genital campylobacteriosis.

- Supportive treatment
 - Fluid therapy is recommended to replace fluid lost through diarrhoea
 - Breeding rest and application of uterine infusions are essential
 - Infected bulls may be treated utilizing repeated irrigations of the prepuce along with antibiotic suspensions but with variable results

Prevention and Control

- Prevention and control measures
 - Where practical, artificial insemination is an excellent way to prevent or control genital campylobacteriosis
 - Because *C. fetus* has been isolated from cows for >6 months after the end of pregnancy, it has been suggested that artificial insemination should continue until all the cows in a herd have been through at least two pregnancies
 - Vaccination should be done annually where applicable
 - Adopting good hygienic measures and bull screening sourced externally can help control the disease
- Client education
 - Ensure that all bulls sourced externally are screened
 - Encourage farmers to practice artificial insemination and good hygiene

3.0 PARASITIC DISEASES - HELMINTHIC AND PROTOZOAN INFECTIONS

3.1 *Trichostrongylus* spp. and *Dictyocaulus viviparus*

Definition

The gastrointestinal tract (GIT) is infected with hairworms, also called stomach worms and intestinal worms with a faecal egg count of at least 20 eggs per gram (EPG). Disease is secondary to inadequate nutrition.

Diagnosis

- History and predisposing factors
 - Poor nutrition
 - Intensive operation with no rotational grazing and no record of administration of worm remedy
- Clinical signs

Usually non-specific and includes;

- Pale mucous membranes
- Submandibular oedema (Bottle jaw)
- Ascites (Potbelly)
- Diarrhoea
- Not grazing
- Not chewing cud
- Rough and dry hair coat
- Thinness
- Weakness and inability to stand
- Specific tests
 - Faecal egg count by floatation method
- Differential diagnoses
 - Malnutrition
 - Liver fluke infection

Treatment options

- Ivermectin at 0.2mg/kg SC single dose
OR
- Albendazole at 10mg/kg PO single dose
OR
- Doramectin at 0.2mg/kg SC single dose

Prevention and Control

- Prevention and control measures
 - The most important way to control hairworms is to maintain good nutrition by rotating pastures, preventing overcrowding and overgrazing and providing good quality pasture, hay and supplements. This may not be practical on communally grazed pastures. When cattle have a diet with enough protein, vitamins and minerals, fewer worms are normally established and the cattle are able to withstand their effects
 - Faecal egg count would be a good guide for determining the treatment interval or a minimum of 3-4 months' interval can be used to control the level of infection
- Client education
 - Routine deworming of animals especially at the beginning and end of the rain season helps to reduce the worm burden
 - Ensure that the animals are on a good nutritional plane especially during the dry season

3.2 Fascioliasis “*Fasciola Gigantica* (Liver Fluke)”

Definition

Fascioliasis is a trematode zoonotic snail-borne disease of public health and economic importance that is caused by infection with *Fasciola gigantica* and *Fasciola hepatica*. It leads to digestive inefficiency with liver disease in young animals and chronic liver disease in adult cattle leading to mortalities, growth retardation, drop in livestock production and condemnation of the infected livers during meat inspection.

Diagnosis

- History and predisposing factors
 - Cattle living in wet areas with alkaline soils which are infested with snails are at high risk of infection.
- Clinical signs
 - Animals will show signs similar to malnutrition
 - Poor weight gain
 - Poor body condition
 - Poor reproductive performance
- Specific tests
 - Faecal egg count
 - ELISA
- Differential diagnoses
 - Malnutrition
 - *Trichostrongylus* spp. infection

Treatment options

- Anthelmintic treatment options
 - Nitroxinil at 13mg/kg SC single dose
 - OR
 - Triclabendazole at 10mg/kg PO single dose
 - OR
 - Closantel at 2.5mg/kg SC single dose
 - OR
 - Albendazole at 10mg/kg PO single dose

Prevention and Control

- Prevention and control measures
 - During wet/rain seasons, where possible, animals should be moved to areas that are not heavily infested with snails (very difficult in communally grazed pastures)
 - Use flukicides like nitroxinil to control the population of flukes
 - Deworm the animals using triclabendazole to control internal parasites at specific intervals guided by faecal egg count e.g. twice a year or at 3-4 months' interval
- Client education
 - Dairy herds require a whole herd strategy for the control of fasciolosis because once the parasite becomes established, there are few opportunities available to treat it in the adult milking herd

3.3 Cestode Infections

Definition

Moniezia is a genus of tapeworms/cestodes that primarily infects ruminants, including cattle. Infected cattle show no significant clinical signs and the presence of the tapeworms does not typically affect their health or performance. Infections of young animals, particularly those up to 18 months of age are often found in pastured cattle and animals with faecal egg count of at ≥ 200 EPG are selected for intervention.

Diagnosis

- History and predisposing factors
 - Exposure to damp grass and unsanitary conditions
- Clinical signs
 - Heavy infection is characterized by anorexia
 - Dullness
 - Weight loss or poor growth
 - Weakness due to moderate anaemia

- Diarrhoea and sometimes constipation
- Specific tests
 - Faecal egg count of at least 200 EPG is diagnostic of infection
 - Presence of worms in stool passed by young animals
- Differential diagnoses
 - Malnutrition

Treatment

- Anthelmintic treatment options
 - Praziquantel at 15mg/kg PO single dose
OR
 - Albendazole at 5mg/kg PO single dose
OR
 - Fenbendazole at 5-10mg/kg PO single dose

CAUTION: Do not use 10mg/kg dose of Fenbendazole in lactating cows.

Prevention and Control

- Prevention and control measures
 - Prevention is difficult, but young animals should be kept away from areas where the mites live and on wet grass
 - Calf houses should be regularly cleared, cleaned and disinfected
- Client education
 - Where possible, practice rotational grazing and prevent young animals from accessing unsanitary and wet grass
 - Practice good farm hygienic practices and proper disposal of waste including manure

3.4 Calf Scours

Calf scours also known as calf diarrhoea, is a prevalent condition affecting young calves, particularly those under three months of age. It can be caused by a variety of factors which are broadly categorized into infectious and non-infectious agents for of which protozoan parasites are also implicated.

3.4.1 Cryptosporidiosis

Definition

Cryptosporidiosis is seen in calves 5-35 days old but most commonly in the second week of life. It is characterized by persistent diarrhoea that does not respond to therapy. Diarrheal due solely to *Cryptosporidium* spp. is often mild and self-limiting, although the severity may be related to the general strength of the calf and to the intensity of challenge with the organism. Combination

infections with cryptosporidium, rotavirus and coronavirus are common and result in persistent diarrhoea often characterized by emaciation and death. Death from hypoglycaemia also occurs as a sequela of cryptosporidiosis in calves 3-4 weeks of age that have recovered from diarrhoea but are still emaciated.

Diagnosis

- History and predisposing factors
 - Poor hygiene and calf management practices
- Clinical signs
 - Mild to moderate diarrhoea that persists for several days regardless of treatment (duration of diarrhoea tends to be a few days longer than are seen in the diarrhoeas caused by rotavirus, coronavirus, or enterotoxigenic *E. coli*)
 - Faeces are yellow or pale, watery and contain mucus
 - Weight loss and emaciation
 - Varying degrees of apathy, anorexia, and dehydration are present
 - Dehydration, weakness, collapse, fatality can occur (rarely)
- Specific tests
 - Detection of oocysts by examination of faecal smears with Ziehl-Neelsen stains
 - Faecal flotation techniques
 - ELISA and PCR
 - Fluorescent-labelled antibodies
 - Rapid immunochromatographic test

NOTE: Submit faecal samples (in sterile containers) from untreated scouring calves.

- Differential diagnoses
 - Coccidiosis (*Eimeria* spp)
 - Bovine viral diarrhoea
 - Salmonellosis
 - Bovine coronavirus
 - Bovine rotavirus
 - *E. coli* infection
 - Nutritional scours

Treatment

- Supportive treatment
 - Rehydration – oral electrolytes with strong ion difference (SID of 60 mmol). 4 litres a day
 - Cows' whole milk should be given in small quantities several times daily (to the full level of requirement) to optimize digestion and to minimize weight loss

- Electrolytes should be given at least 30 minutes before a milk feed
- NSAIDs
 - Flunixin meglumine at 2.2mg/kg IV single dose
 - OR
 - Ketoprofen 3mg/kg/day IV or IM for up to 3 days
- Vitamin-B complex 5 - 10 ml IM or SC for up to 3 to 5 days
- Administer IV fluids, such as lactated Ringer's solution, to severely dehydrated calves 80 - 90 ml/kg at a rate of 30 - 40 ml/kg/hr IV, severe cases 80 ml/kg/hr rapidly
- Hypoglycaemic calves should be given 25 – 50g dextrose to the IV fluids
- Antiprotozoal treatment
 - Halofuginone lactate for oral administration to calves after feeding at 2ml/10kg once a day for 7 days. Treatment should be commenced within 24 hours after the onset of diarrhoea.

Prevention and Control

- Prevention and control measures
 - Calving should take place in a clean environment and adequate amounts of colostrum fed within 24-48
 - Calves should be kept separate without calf-to-calf contact for at least the first 2 weeks of life, with strict hygiene at feeding
 - Diarrheic calves should be isolated from healthy calves during the course of the diarrhoea and for several days after recovery. Great care must be taken to avoid mechanical transmission of infection
 - Calf-rearing houses should be vacated and cleaned out on a regular basis; an “all-in/all-out” management system, with thorough cleaning and several weeks of drying between batches of calves, should be used
 - Rats, mice, and flies should be controlled when possible, and rodents and pets should not have access to calf grain and milk feed storage areas
- Client education
 - *Cryptosporidium parvum* can infect humans. Farm workers should wash their hands, change their clothes and footwear after handling sick calves. Children and immunocompromised adults should not care for sick calves. Farm owners should comply with all the regulations on slurry and run-off water from animal buildings.
 - Strict sanitation and hygiene protocols and access control to the calf rearing area should be fully implemented
 - Screen replacement stock before introducing them to the herd
 - Use personal protective clothing such as gloves and masks when handling infected calves and their environment

4.0 HAEMOPARASITIC AND RICKETTSIAL DISEASES

4.1 Ehrlichiosis/Cowdriosis ‘Heartwater’

Definition

Heartwater (also known as cowdriosis) is an acute, fatal, non-contagious, infectious, tick-borne rickettsial disease of ruminants caused by *Ehrlichia ruminantium* (formerly *Cowdria ruminantium*) and transmitted by *Amblyomma* ticks. The disease can cause high mortality (up to 90%) in susceptible domestic ruminants.

NOTE: Heartwater is a notifiable disease in Zambia. Suspected cases should be reported to the nearest veterinary district office.

Diagnosis

- History and predisposing factors
 - Infestation of areas with ticks of the genus *Amblyomma*
 - Ticks’ infestation 1-3 weeks prior to clinical signs
 - In endemic areas, heartwater should be suspected in susceptible ruminants infested with *Amblyomma* with high mortality rate of up to 90%, and having a fever of unknown origin, especially when accompanied by nervous signs.
- Clinical signs
 - Peracute form
 - High fever which may exceed 41°C within 1–2 days after the onset of fever
 - Prostration and death with terminal convulsions in 1-2 days (100% mortality).
 - Acute form
 - More common, duration of about 6 days
 - 50 to 90% mortality
 - Fever
 - Inappetence
 - Listlessness and rapid breathing followed by the classical nervous syndrome: ataxia, chewing movements, twitching of the eyelids, circling, aggression, apparent blindness, recumbency, convulsions and death.
 - Subacute form
 - Profuse, fetid diarrhoea ending in either death or recovery within 2 weeks
 - Subclinical form
 - Mild and inapparent

- **Post-mortem findings:** Ascites, hydrothorax, hydropericardium and severe pulmonary oedema
- Specific tests
 - PCR - Definitive diagnosis with demonstration of the presence of causative bacteria in the blood of clinically affected animals, and in the organs of dead animals, and in ticks.
 - Histological evaluation - The presence of *E. ruminantium* colonies in the cytoplasm of capillary endothelial cells of the brain is proof of heartwater.
 - Typical colonies of *E. ruminantium* can be observed in brain smears made after death and this represents a definitive diagnosis.
 - Serological testing – ELISA assay
- Differential diagnoses
 - Peracute form: Anthrax
 - **Acute form:** Rabies, Sporadic bovine encephalomyelitis, Tetanus
 - **Nervous/Cerebral form:** Theileriosis, Babesiosis, Trypanosomosis, Meningitis, Listeric or other encephalitis, hypomagnesaemia and poisoning with strychnine, lead and organophosphates

Treatment

- Supportive treatment
 - Corticosteroids
 - Prednisolone at 1 mg/kg IM for 2 to 3 days
 - Diazepam at 0.2–0.5 mg/kg IV; or 0.5–1 mg/kg IM, repeated every 10 minutes for up to 3 doses to control seizures
- Antibiotic treatment options (AWaRe Classification)
 - **Access:** Oxytetracycline at 10-20 mg/kg slow IV or IM every 24 hours for a minimum of 3 days even if the patient's temperature normalizes
 - If fever persists, oxytetracycline treatment should continue for fourth and fifth days
 - If the fever still does not abate, a trimethoprim-sulphonamide at 15 mg/kg IM every 24 hours can be successful however

NOTE: Recovered animals become carriers of infection.

CAUTION: Strictly adhere to withdrawal periods of antibiotics and when using sulphonamides in lactating dairy cattle as its use may be prohibited in lactating dairy cattle

Prevention and Control

- Prevention and control measures
 - **Tick control** - Weekly dipping in acaricides.
 - **Vaccination** - Inactivated or recombinant vaccines, Attenuated vaccines reported.

- **The infection** - Treatment method (injection of a dose of live bacteria, followed by treatment before the onset of clinical signs)
- Client education
 - There is no effective vaccine against heartwater; control is based on preventing infestation by the *Amblyomma* tick vector

4.2 Bovine Anaplasmosis (Gall Sickness)

Definition

Bovine anaplasmosis is a rickettsial disease that results from infection with *Anaplasma marginale*, an *intracellular* bacterium that infects red blood cells, causing fever and anaemia.

Diagnosis

- History and predisposing factors
 - Outbreaks of clinical bovine anaplasmosis are mainly due to infection with *Anaplasma marginale*. Clinical outbreaks due to *Anaplasma centrale* are extremely rare but it is capable of producing a moderate degree of anaemia
 - The disease is typically transmitted by tick vectors, but mechanical transmission by biting insects or by needle can occur
 - The disease is usually seasonal
 - Disease severity is age dependent
- Clinical signs
 - Often subclinical in cattle less than one-year-old, but moderately severe to fatal in older animals
 - Incubation period varies from 15-36 days
 - Anaemia
 - Jaundice and sudden death are characteristic signs of anaplasmosis
 - Other signs include rapid loss of milk production and weight
- Specific tests
 - **Blood smears:** Giemsa-stained thin and thick blood films
 - From live cattle, use blood smear from a large vein such as the jugular vein;
 - From dead cattle, use blood smears from internal organs (including liver, kidney, heart and lungs) and from blood retained in peripheral vessels.
 - Serological testing - ELISA, complement fixation, or card agglutination test
- Differential diagnoses
 - Bovine babesiosis
 - Conditions that result in anaemia and jaundice, e.g. leptospirosis and theileriosis

Treatment

- Supportive treatment
 - Blood transfusion is indicated in animals with a PCV less than 15 %
- Antimicrobial treatment options
 - Tetracyclines
 - **Access:** LA Oxytetracycline at 20 mg/kg IM single injection
 - *For carrier state:* LA Oxytetracycline at 20 mg/kg IM, two injections at one-week interval
 - Imidocarb
 - Imidocarb dihydrochloride salt at 1.5 mg/kg SC single injection
OR
 - Imidocarb dipropionate at 3 mg/kg SC single injection
 - *For animals in carrier state:* Imidocarb dipropionate at 5 mg/kg IM or SC, two injections given 2 weeks apart

CAUTION: Adhere to withdrawal period. Imidocarb is a suspected carcinogen with long withholding periods; therefore adhere to manufacturers' recommendation.

Prevention and Control

- Prevention and control measures
 - **Tick control** - Weekly dipping in acaricides
 - **Vaccination** - Vaccination with killed/attenuated *A. marginale* vaccine or live *A. centrale* vaccine used in endemic areas
 - In non-endemic areas, serological identification of carriers and culling or treatment of reactors
 - Prevention of iatrogenic transmission
- Client education
 - Once infected with *Anaplasma*, cattle may remain carriers for life

4.3 East Coast Fever “Corridor Disease ‘Denkete’”

Definition

This is a tick-borne disease transmitted by the brown ear tick called *Rhipicephalus appendiculatus*. The disease is usually characterized by high fever, swelling of the lymph nodes, dyspnoea and high mortality (90-100%) in naive cattle especially in the traditionally kept cattle where tick control measures are inadequate. Recovered animals become carriers and the disease would recur when the animals are in stressful conditions. In other words, there is no treatment that totally eradicates the disease.

Diagnosis

- History and predisposing factors
 - History of ticks' infestation
 - Stressful conditions and ideal period for ticks increased reproduction (rain season and cold season)
 - First clinical signs of ECF are seen 7 to 15 days after attachment of infected ticks
 - High mortalities of sometimes up to 100% in naïve cattle populations with fever
 - In post-mortem examination, the most striking lesions are lymph node enlargement, massive pulmonary oedema and hyperaemia
- Clinical signs
 - Enlarged lymph nodes especially the parotid and prescapular lymph nodes
 - Affected animals are anorexic
 - Pyrexia (above 39.5° C and may reach 42° C)
 - Anaemia - presents as lethargy with pale mucous membranes in some cases
 - Lacrimation and nasal discharge and epistaxis may occur
 - Terminally, dyspnoea is common, a sharp drop in temperature takes place and pulmonary exudate pours from the nostrils
 - Death
- Specific tests

Definitive diagnosis is obtained by laboratory examination.

- Whole blood sample for a blood smear
- Serum for other tests
 - PCR (may be the most specific),
 - IFA and ELISA are the most common tests
- Differential diagnoses
 - Trypanosomosis
 - Cowdriosis
 - Contagious bovine pleuropneumonia (CBPP)
 - Malignant catarrhal fever (MCF)

Treatment

Early treatment within 24 hours of noticing the sickness usually gives the best treatment results. Late treatment is more often than not less effective.

- Supportive Treatment
 - Provide sufficient drinking water
 - Anti-inflammatory drugs

- Flunixin meglumine at 1.1-2.2mg/kg once a day low IV for up to 3 days
OR
- Ketoprofen at 3mg/kg slow IV may be used in cases of fever till fever stops or for up to 3 days
- B-complex vitamins and medicines that help to restore ruminal function must be administered
- Antiprotozoal treatment
 - Buparvaquone at 2.5mg/kg IM single dose is effective but in severe cases treatment can be repeated after 48 hours

NOTE: Due to the immunosuppressive nature of the disease co-infections with other tick-borne diseases and bacterial infections take place thus buparvaquone is often administered with a long acting (LA) oxytetracycline at the dose of 10-20mg/kg IM.

OR

- Parvaquone is also effective at 1ml per 15kg IM. At least two treatments must be administered for it to effectively treat the disease. Parvaquone is also administered together with LA oxytetracycline at the dose of 10-20mg/kg IM.

OR

- Buparvaquone plus furosemide or parvaquone plus furosemide should be used in cases with pulmonary signs. However, even with these drugs combined with furosemide, if treatment is commenced late, the treatment results are unsatisfactory

OR

- Where available, short acting oxytetracycline at 10-20mg/kg IM or IV formulation could be used at first treatment, followed by LA oxytetracycline at the dose of 10-20mg/kg IM after 24 hours. The short acting oxytetracycline could be used in cattle that are easy to handle

CAUTION: Adhere to the withdrawal period for meat and milk for all the drugs used

Prevention and Control

- Prevention and control measures
 - Control ticks by regular dipping, spraying, use of pour-ons and injectable antiparasitics like ivermectin and doramectin used at 1ml/50kg SC.

NOTE: Dipping or spraying must be carried out weekly or as recommended by DVS throughout the year. The injectable antiparasitic agents should be used strategically around times outbreaks are expected, which is during heavy rains and the cold season. The acaricides must be used alternatively within a month to deal with the matters of acaricides resistance that have been observed against most acaricides available. Vaccination where available/possible is used to

provide life-long immunity and currently, Zambia has implemented the infection and treatment method in certain areas.

- Client education
 - It is cheaper to prevent your herd from getting this disease by planning to dip/spray your animals throughout the year than to try to treat
 - Late treatment always gives poor treatment results
 - Inform a veterinarian or para-professional immediately you see one animal sick
 - Once animals recover from this disease, they become carriers, this means they will lead to infection of other animals
 - Do not inject any antibiotic without receiving instructions from the veterinarian or para-profession

4.4 Bovine Babesiosis “Redwater”

Definition

Bovine babesiosis is a tick borne disease of cattle that is caused by protozoan parasites of the genus *Babesia*. The tick responsible for this disease is *Rhipicephalus microplus* or *Boophilus microplus*. The most important species are *Babesia bovis* and *Babesia divergens* although *B. bovis* is generally more pathogenic than *B. divergens*. These two occur singly or together and combined with *Anaplasma* and can produce a fatal “tick fever”. The disease is also referred to as Redwater fever due to the haematuria.

Diagnosis

- History and predisposing factors
 - Presence of ticks and bloody urinate
- Clinical signs
 - Affected cattle are febrile and develop anal sphincter spasm producing coiling of faeces which are voided under pressure
 - Inappetence
 - Increased respiratory rate
 - Muscle tremors
 - Intravascular haemolysis that is shown by anaemia
 - Haemoglobinuria and jaundice
 - Weight loss
 - Haemoglobinaemia and haemoglobinuria in final stages.
 - Diarrhoea or constipation may be present
 - Cattle in late pregnancy may abort
 - Animals that recover from the acute disease remain infected for a number of years with *B. bovis* and a few months with *B. bigemina*. During that carrier state no clinical signs are apparent

The disease has three important features in endemic areas which are:

- a) Firstly, that calves have a degree of immunity from colostrum - derived antibodies and age related factors, this immunity persists up to six months,
- b) Secondly animals that recover from the disease are immune for four (4) years and
- c) Thirdly some breeds are more resistant to the disease than others, for example the *Bos indicus* are generally more resistant to ticks and their clinical effects than others. These three factors are very important in determining the risk of clinical disease.
- Specific tests
 - Definitive diagnosis is obtained by microscopic examination of Giemsa stained blood or organ smears.
 - From a live animal, thick and thin blood smears, preferably from the capillaries of the ear or tail tip.
 - Serology is also used - ELISA and PCR
- Differential diagnoses
 - Anaplasmosis
 - East Coast Fever/Theileriosis
 - Leptospirosis in calves
 - Bacillary haemoglobinuria
 - Bracken poisoning
 - Kale poisoning
 - Nitrate poisoning

Treatment

- Supportive treatment
 - Anti-inflammatory drugs
 - Flunixin meglumine at 1.1-2.2mg/kg once a day low IV for up to 3 days
 - OR
 - Ketoprofen at 3mg/kg slow IV may be used in cases of fever till fever stops or for up to 3 days
 - To very valuable anaemic cattle, blood transfusions may be considered
- Antiprotozoal treatment
 - Imidocarb dipropionate at 2.5 mls per 100kg SC single dose. At a dosage of 3mg/kg imidocarb provides protection from babesiosis for approximately 4 weeks and may eliminate *B. bovis* and *B. bigemina* from carrier animals
 - OR
 - Diaminazene aceturate at the dosage of 3.5mg/kg IM single dose

CAUTION: No antibiotics are required. Milk and meat withdrawal periods for the drugs should be advised to the farmer as per manufacturer's recommendation

Prevention and Control

- Prevention and control measures
 - Prevention is done by dipping/spraying the animals' weekly
 - Where available, vaccines must be used as well and chemo immunization
 - Keeping known resistant breeds of cattle also helps
- Client education
 - This disease like other tick-borne diseases usually occurs when there is an increase in tick populations during the rain and cold season.
 - Work with the veterinarian and veterinary para-professionals so that they help you to design and implement a tick control strategy that will be effective.
 - Always ensure you monitor your animals wellbeing and report any sick animals early so that treatment is started immediately the disease is seen

REVIEW AND RETENTION

These STGs are effective for the period 2025 to 2027 and will be reviewed at the expiration of their validity or whenever deemed necessary by the DVS or relevant authority.

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