



STANDARD TREATMENT GUIDELINES FOR THE VETERINARY SERVICES IN LIBERIA

(Terrestrial and Aquatic Animal Health Sector)

SUPPORTED BY: ECTAD PROGRAM / FOOD AND AGRICULTURE ORGANIZATION FOR THE UNITED NATIONS (FAO/UN) LIBERIA

FOREWORD

The Standard Veterinary Treatment Guidelines (SVTG) for terrestrial and aquatic animals is to provide information on causes, epidemiology, clinical symptoms, diagnosis and treatment of terrestrial and aquatic animals namely: poultry, goats and sheep, cattle, equine, camels, honeybee, companion animals and fish. In writing the manual, the utmost effort have been made to review existing documents and guidelines such as the WOAHO/OIE guidelines, the Animal Diseases Surveillance and Response strategy (ADSR), the National strategy for antimicrobial resistance (AMR) surveillance in the Animal Health sector, LMRHA guidelines, National Action Plan on Prevention and Containment of Antimicrobial Resistance (NAP-AMR), Infectious Disease Surveillance and Response strategy (IDSR), and the results of the 2017 WHO Joint External assessment (JEE). Discussions with Veterinary services and One Health AMR TWG for collaboration on the development of the treatment guidelines. Review of the existing guidelines on IPC for preventing transmission of infectious diseases were also undertaken in line with the international treatment guidelines for adaptation and implementation to animal healthcare facilities through active engagement with stakeholders to practice effective IPC and treatment protocols. Documentation of best practices and inputs from the key stakeholders' meetings and debriefing to the VS, One Health AMR TWG and FAO have been incorporated. Hence, the standard veterinary treatment guidelines will be instrumental to strengthen hygiene and therapeutic practices, to prevent transmission of infectious agents or resistant pathogens, promoting the engagement of all stakeholders within the Animal Health value chain, and to safeguard public health and food safety through regular surveillance on the impact of AMR in the Agri-food production system to support the sustainable economic growth of the country.

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This document, **Standard Treatment Guidelines for the Animal Sector in Liberia**, is the **first of its kind in the country**, was prepared by Dr. Etagegnehu D. Belayneh, the FAO consultant in collaboration with the Chief Veterinary Officer (Mr. Joseph Anderson), Dr. Sabenzia Wekesa, Dr. Ibrahim Gashash Ahmed, and the entire FAO-ECTAD team. The entire team would like to express their sincere gratitude to the Chief Veterinary Officer and his staff for their valuable contribution to the team-work and to all the technical working group members from academia, research institutions, regional agricultural offices, private practitioners, veterinary schools and professional associations. The shared knowledge from practical experiences by members of the Technical Working Groups representing National Fisheries and Aquaculture Authority (NaFAA), Liberia Medical and Health Regulatory Authority (LMHRA), Division of Animal Production Department of Technical Services Ministry of Agriculture, Liberia One Health Platform, Private animal health service providers, Commercial Poultry Farm representatives, and Animal Science Unit University of Liberia (UL) are highly appreciated. The technical support from the Emergency Centre for Trans-Boundary Animal Diseases (ECTAD) of Food and Agriculture Organization (FAO/UN) and financial support from the USAID are greatly acknowledged.

ACRONYMS AND LIST OF ABBREVIATION

Ad lib	Without restraint or limit
AH	Animal Health
AHS	African Horse Sickness
Amp	ampule
AMR	Antimicrobial Resistance
Ante	before
b.i.d.	twice a day
BVD	Bovine Viral Diarrhea
CAHW	Community Animal Health Workers
CBPP	Contagious Bovine Pleuropneumonia
CCPP	Contagious Caprine Pleuropneumonia
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot and Mouth Disease
GIT	Gastro- Intestinal Tract
IB	Infectious Bronchitis
IBD	Infectious Bursal Disease
Im	Intramuscularly
IPC	Infection Prevention & Control
IV	intravenously
LMHRA	Liberia Medicines & Health Products Regulatory Authority
MOA	Ministry of Agriculture
OIE	World Organization for Animal Health
PCR	Polymerase Chain Reaction
PO	by mouth
PPR	Peste des Petits Ruminants
Prn	as needed
q.i.d.	4 times per day
RVF	Rift Valley Fever
SC	Subcutaneously
SPP	Species
VS	Veterinary Services
WHO	World Health Organization
WOAH	World Organization for Animal Health

EXECUTIVE SUMMARY

In December 2020, a situational analysis on Antimicrobial Resistance (AMR) was conducted in Liberia which revealed the weak implementation of regulations on the use of antimicrobial agents in the animal and human sectors, lack of data on AMR, lack of control on selling of antimicrobials, the common practice of buying counterfeit drugs from “drug peddlers,” the unrestrained use of antibiotics in the livestock and agriculture industry among other issues.

Methodology for the development of these guidelines was through a thorough review of the existing local and international documents, systems and instruments, situational analysis of the existing treatment protocols and identifying the gaps of the national veterinary services delivery system. Compiling knowledge acquired from experiences in clinical practices, diagnostic and research laboratories, food safety and veterinary – public health events investigations and surveillance systems in line with identifying the major public and economic diseases and events and species of animals targeted at the national level was instrumental to develop the standard treatment guideline for the identified veterinary topics. Details given on the general animal health conditions of major livestock species in Liberia prioritizing poultry, pigs, goats and sheep, cattle, horses and donkeys, camels, honeybees, companion animals (pets) and aquatic animals in sequential manner. The veterinary topics identified specific to species and causative agents and nature of diseases of non-infectious and infectious due to viral, bacterial, fungal, protozoal and parasitic infestation including clinical signs and symptoms, diagnosis, treatments and prevention for each disease in the targeted species of animals discussed in detail.

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PART ONE

BACKGROUND INFORMATION

1. Introduction

In December 2020, a situational analysis on Antimicrobial Resistance (AMR) was conducted in Liberia which revealed the weak implementation of regulations on the use of antimicrobial agents in the animal and human sectors, lack of data on AMR, lack of control on selling of antimicrobials, the common practice of buying counterfeit drugs from “drug peddlers,” the unrestrained use of antibiotics in the livestock and agriculture industry among other issues. Moreover, inadequate treatment guidelines and infection prevention and control (IPC) measures at animal farms level, slaughterhouses, and veterinary clinics necessitates the need for well-coordinated efforts by all sectors through a multi-sectoral approach to combat and prevent the threats posed by AMR as well as improve therapeutics and IPC practices. AMR which occurs by means of various factors such as natural selective pressure, has a direct consequence of human actions, such as overuse and misuse of antimicrobial agents in various sectors pertaining to human and animal health, animal production, agriculture, aquaculture and environment. The AMR National Action Plan (NAP) that the Antimicrobial Resistance Technical Working Group of the One Health Platform, in collaboration with the animal health sector and support from the United Nations Food and Agriculture Organization (FAO) has embarked on the development of treatment guidelines for the animal sector of the country. Despite the fact that many diseases affect different species of animals, an account of each disease is described separately. A complete description of some of the identified diseases in each animal species was given only whenever there is a significant difference in the epidemiology or clinical signs and symptoms in different species of animals including human being in case of diseases of zoonotic importance. Although there is no sufficient data on the status of fish diseases in Liberia, a comprehensive review of diseases affecting freshwater fish and aquaculture was revised and included. Much emphasis was given to the treatment and prevention part for the selection of the most effective and economical veterinary medicines to promote prudent use of antimicrobials in the animal health sector. The types and dosage of the veterinary medicines is according to the most recent and updated WOAHA standards, guidelines and resolutions on antimicrobial resistance and the antimicrobial agents for animal use. Since prevention of epizootic disease of domestic animals is more economical than clinical treatment of sick animals; appropriate preventive

measures in each section are described accordingly. In addition, a summary of vaccines and their management, normal body parameters of domestic animals and anesthetics, analgesics and tranquilizers described for the development of comprehensive and simplified guidelines for the users. A veterinary medicines of choice depends on individual animal patient and disease condition, species of animal, age, frequency of use and the duration of treatment. In food animals, a genuine consideration was given to the withdrawal period of veterinary medicines in case of a planned or an emergency slaughter of animals on medication. The major focus of the animal health for the country are;

A. The animal health priorities (AH): Consist of updating relevant veterinary and sanitary legislation and regulations, improving infrastructure and strengthening inspection in border inspection posts to better prevent the entry of pathogens, implementing routine (passive) surveillance of key diseases of small ruminants, pigs and poultry and developing preparedness and response capacity for transboundary animal diseases emergencies and roll-out prophylactic programs.

B. Veterinary Public Health (VPH): The national priorities to update relevant veterinary and sanitary legislation and regulations, to improve infrastructure and strengthen inspection (for meat inspection), to phase-out the provision of free medicines to livestock owners, limit the distribution of veterinary medicines to veterinarians and licensed pharmacies linked to veterinarians, and increase the supply/distribution of high quality vaccines, to control rabies in the dog population, and (v) to implement control of residues in imported and local foods of animal origin, based on the results of risk analysis.

C. International Trade-related issues: The proposed strategy focuses primarily on the strengthening and broadening of the quarantine and border security system to enable improved import regulation and inspection at 12 terrestrial border crossings (with Côte d'Ivoire, Guinea and Sierra Leone) and the refurbishment of one internal check-point and several airport and seaports inspection points. The key issue here is to get a control on the imports of – currentl/y- massive amounts of food of animal products, for which there is no inspection system in place, in particular with respect to the microbiological quality of these food stuffs and possible presence of antimicrobial and other chemical residues. The priorities are to enhance the overall impact of the veterinary services on the control of livestock diseases and establishing a dedicated veterinary services to support the development of both Public and private veterinary services.

2. Objectives of developing the Standard Veterinary Treatment Guidelines

- Provision of information on epidemiology, clinical symptoms, diagnosis and treatment of terrestrial and aquatic animals namely cattle, pigs, goats, sheep, poultry, honeybee and fish.
- Provision of standardized guidance to practitioners for animal health service providers to concentrate on making the correct diagnosis, treatment, prevention and control protocols.
- Promotion of high quality of care by directing practitioners to the most appropriate drugs for specific conditions.

3. Methodology for the development of the guidelines

- Review of the existing local and international documents, systems and instruments. Situational analysis of the existing treatment protocols (informant discussion with the animal health service providers) and identifying the gaps of the national veterinary services delivery system in Liberia.
- Compiling knowledge acquired from experiences in clinical practices, diagnostic and research laboratories, food safety and veterinary – public health events investigations and surveillances systems.
- Identifying the major public and economic diseases and events and species of animals targeted at the national level.
- Stakeholders' engagement through group discussions, interviews and meetings with relevant professionals and leaders within the country.

PART TWO
STANDARD TREATMENT GUIDELINES FOR MAJOR VETERINARY TOPICS IDENTIFIED
SECTION ONE: DISEASES OF POULTRY

A. VIRAL DISEASES OF POULTRY

1. Avian Influenza

Cause

Influenza in chicken is caused by an orthomyxovirus type A influenza virus.

Clinical Symptoms and Lesions

Signs range from only a slight decrease in egg production or fertility to a high infection with CNS involvement, respiratory signs, greenish diarrhea, cyanosis and edema of the head, comb, and wattle, discoloration of the shanks and feet and blood-tinged oral and nasal discharges.

Diagnosis

Isolation of the virus in chicken embryo.

Treatment and Prevention

There is no specific treatment. Broad-spectrum antibiotics may be used to control secondary bacterial infections. Vaccination with autogenous virus or a virus of the same hemagglutinin type.

The virus could change its antigenic characteristic and infect humans.

2. Egg Drop Syndrome

Cause

Egg Drop Syndrome (EDS) of egg laying chickens caused by Egg Drop Syndrome Virus (EDSV) transmitted vertically through eggs or via fecal-oral route.

Clinical Symptoms

Loss of eggshell pigmentation, production of thin-shelled, soft-shelled and shell-less eggs, reduced egg production (up to 40%), rough or chalky eggshells and mild depression.

Diagnosis

In non-vaccinated flocks, seroconversion can be tested using haemagglutination-inhibition test (fowl red blood cells), ELISAs or serum neutralization tests.

Treatment and Prevention

- No effective treatment is available.
- Obtain chicks from infection free flock and implementation biosecurity.

Prevention

Inactivated vaccines can be given to birds 14-18 weeks of age and prevent clinical disease.

3. Fowl Pox

Cause

Fowl pox is a slow-spreading viral infection of chickens and other poultry characterized by proliferative skin lesions. The disease is transmitted by direct contact between infected and susceptible birds or by mosquitoes.

Clinical Symptoms

Fowl pox is manifested in two forms:

- Dry form (cutaneous form) characterized by proliferative nodular wart like lesions on unfeathered areas such as comb, wattles, angle of the beak, feet, vent and other areas of the skin.
- Wet form (diphtheritic form) yellowish lesions on mucosa of mouth, pharynx, larynx and trachea and causing respiratory distress. Cutaneous lesions on the eyelids may cause complete closure of one or both eyes and drop in egg production in laying hens.

Diagnosis

Cutaneous lesions are indicative; hematoxylin-eosin staining reveals eosinophilic cytoplasmic inclusion bodies; virus isolation is confirmatory.

Treatment and Prevention

There is no specific treatment.

Vaccinate the remaining flocks with an attenuated fowl pox virus of high immunogenicity and low pathogenicity.

4. Infectious Bronchitis (IBV)

Cause

“Infectious bronchitis” (IBV) is an acute and a highly contagious viral disease caused by coronaviruses affecting the respiratory, urogenital and intestinal tracts poultry. The airborne spread of IBV is the most common and most significant mode of transmission in areas with a dense chicken population.

Clinical Symptoms and Lesions

Young chicks manifest respiratory form characterized by coughing, gasping, sneezing, nasal discharge, exudate in the eyes, huddling near heat source, reduced weight gain, reduced feed efficiency.

Diagnosis

Based on identification viral genome, viral antigens or antibodies against the virus.

Treatment and Prevention

- No specific treatment is available.
- Mortality can be reduced by supportive treatment and elimination of overcrowding, strict biosecurity and prevention of stress (cold stress).
- Broader protection can be achieved by combining different vaccine strains.

5. Infectious Bursal Disease

Cause

Infectious Bursal Disease (IBD) also known as Gumboro disease is an acute, contagious, viral disease of young chickens (3-6 weeks' age). The virus replicates in the bursa of Fabricius and destroys B lymphocytes.

Clinical Symptoms and Lesions

Vent picking, whitish or watery diarrhea, soiled vent feathers, anorexia, depression, ruffled feathers, trembling and severe protrusion. At Necropsy, the bursa may be swollen, edematous, necrotic, hemorrhagic and atrophied.

Diagnosis

Isolation of virus from cloacal bursa and spleen and subsequent identification.

Treatment and Prevention

- No specific treatment available only drugs to protect from secondary bacterial infections.
- Depopulation and rigorous disinfection of contaminated farms.
- Strict hygienic measures including control of personal and material movement. Application of all-in/all-out procedures.

6. Marek's Disease (MD)

Cause

It is a viral induced-neoplastic and immunosuppressive disease of chickens caused by herpes virus (Gallid herpesvirus 2 or GaHV-2, genus Mardivirus).

Clinical Symptoms and Lesions

Clinical symptoms of MD usually appear at about 3 weeks of age and peak between 2 and 7 months. Multifocal lymphoid proliferation in a variety of tissues. Wing paralysis, blindness, ataxia and wasting away.

Diagnosis

Case history, clinical symptoms, gross lesions and histopathology.

Treatment and Prevention

- There is no specific treatment.
- Severely affected flocks should be culled regularly and sick birds euthanized.
- Appropriate vaccine and good biosecurity.

7. Newcastle Disease

Cause

Newcastle Disease (ND) or pseudo-plague is a contagious viral disease of poultry caused by a Paramyxovirus.

Clinical Symptoms and Lesions

- High mortality (up to 100%) associated with characteristic intestinal damage, associated with respiratory and nervous disorders.
- Drooping wings, dragging legs, twisting of the head and neck, circling, depression, inappetence and complete paralysis)
- Respiratory signs gasping, coughing, sneezing and rales.
- Watery-greenish diarrhea and swelling of the tissues of the head and neck).

Diagnosis

Tentative diagnosis is based on clinical symptoms, lesions and the general epidemic context of the disease diagnosis should be confirmed by isolation and identification of the virus.

Treatment and Prevention

- No specific treatment. Only bacterial complications can be treated with antibiotics.
- Control of insects and rodents, Control of water and quality, Use of good litter quality, Use of adequate sanitation and disinfection protocols.
- Vaccination to reduce the number of infected birds and the amount of virus shed into the environment. Inactivated vaccines can be used in birds after priming with a live virus.

Public health Significant: Newcastle disease virus can produce a transitory conjunctivitis in human.

B. BACTERIAL DISEASES OF POULTRY

1. Campylobacteriosis

Cause

Environmental contamination with bird feces is probably the most common source of infection for dissemination of both *C. jejuni* and *C. hepaticus*; however, some species of *Campylobacter* can be transmitted vertically, either on the surface of eggs or by transovarial transmission. Insects, fomites, and contaminated water and feed can transmit *Campylobacter* to young birds.

Clinical signs and symptoms

Infected flocks seldom exhibit these lesions, increased mortality rates, or decreased feed conversion. Death can occur rapidly, suggesting the involvement of acute septicemia and toxemia.

Diagnosis

Campylobacter spp can be identified by biochemical testing, matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry, or PCR assay.

Treatment and prevention

- Spotty liver disease outbreaks caused by *C. hepaticus* may be treated with antibiotics such as chlortetracycline and lincomycin; however, development of resistance and egg withholding time for layers are important concerns.
- Preharvest prevention of *Campylobacter* infection in commercial poultry is based on strict biosecurity, decontamination of housing between successive flocks, exclusion of rodents and wild birds, and insect eradication.

- Because of the zoonotic risk associated with *C. jejuni* and its ability to rapidly develop antibiotic resistance, antibiotics should be administered with caution in companion birds.

Control and Prevention

- Improved biosecurity and hygiene.
- *Campylobacter jejuni* is a major source of foodborne enteritis in human being. It can be decreased through cooking poultry to achieve a core temperature of 74°C for 1 minute.

2. Avian Chlamydiosis (Psittacosis, Ornithosis, Parrot Fever)

Cause

Bacterial infection caused by *Chlamydia psittaci*. It is a zoonosis referred to as psittacosis, parrot fever, or ornithosis, which can cause serious health problems in humans (eg, pneumonia). Avian chlamydiosis can be an inapparent subclinical infection or acute, subacute, or chronic disease of wild and domestic birds characterized by respiratory, digestive, or systemic infection.

Clinical Findings and Lesions

Nasal and ocular discharge, conjunctivitis, sinusitis green to yellow-green droppings, fever, ruffled feathers, weakness, inappetence, weight loss, drop in egg production.

Diagnosis

For flocks, serologic testing, necropsy, and PCR and for individuals, demonstration of shedding of the organism by PCR or culture, a rise in antibody titers, or a combination of serologic test and PCR test or culture.

Treatment and Prevention

- Tetracyclines (chlortetracycline, oxytetracycline, doxycycline) are the antibiotics of choice. When tetracyclines are administered orally, additional sources of dietary calcium (eg, mineral block, supplement, cattle bone) should be reduced to minimize interference with drug absorption.
- Treating infected flocks with chlortetracycline at 400–750 g/ton of feed for a minimum of 2 weeks has effectively decreased potential risk of infection for poultry farm workers.
- Quarantine and examination of all new birds, prevention of exposure to wild birds and traffic control to minimize cross-contamination

3. Avian Spirochetosis (Avian Borreliosis)

Cause

The causal organism of avian spirochetosis, *Borrelia anserina*, is an actively motile spirochete, ~0.2–0.3 μm $\times$ 8–20 μm , and consists of 5–8 loosely arranged coils. Vectors (lice, mosquitoes, some species of ticks, inanimate objects) can transmit the spirochete mechanically to a susceptible host whenever the piercing apparatus becomes contaminated with blood that contains *Borrelia*.

Clinical signs and Findings

Listlessness, depression, somnolence, moderate to marked shivering, and increased thirst but infection may remain asymptomatic. Ruffled feathers, anemia, and pale combs can be noticed as well, and inappetence can lead to reduced weight.

Diagnosis

Demonstration of *Borrelia* in the blood, either as actively motile during dark field microscopy, as stained spirochetes in Giemsa-stained blood smears, or by PCR.

Treatment and prevention

- The most widely used are penicillin derivatives, but streptomycins, tetracyclines, and tylosin are also effective. The antibiotics can be completely effective if begun when the number of spirochetes per oil-immersion field is low or moderate; however, if large numbers of spirochetes are present in the bloodstream, the sudden liberation of large quantities of spirochetal degradation products can result in higher mortality than with no treatment.
- A combination of tick eradication and immunization is the most effective means of control.

4. Colibacillosis (Colisepticemia, Escherichia Coli Infection)

Cause

Colibacillosis is a localized or systemic infection caused by avian pathogenic *Escherichia coli* (APEC). The bacterial portal of entry into birds varies but can include the respiratory tract, skin trauma, cloaca, damaged intestinal mucosa, and navel.

Clinical Findings and Lesions

Young birds dying of acute septicemia have few lesions except for an enlarged, hyperemic liver and spleen with increased fluid in body cavities. Birds that survive septicemia develop subacute fibrinopurulent airsacculitis, pericarditis, perihepatitis, and lymphocytic depletion of the bursa and thymus.

Diagnosis of Colibacillosis in Poultry

Isolation of a pure culture of *E coli* from heart blood, liver, or typical visceral lesions in a fresh carcass indicates primary or secondary colibacillosis.

Treatment and Control of Colibacillosis in Poultry

- Treatment of colibacillosis with antimicrobial agents is problematic due to widespread multidrug resistance and restrictions on antimicrobial use in poultry imposed by regulation and public concern.
- Good management to decrease exposure of birds and reduce the impact of stress and predisposing infections on the susceptibility of birds to infection.

5. Enterococcosis in Poultry

Cause

Enterococcus spp isolated from birds with clinical disease include *E avium*, *E cecorum*, *E durans*, *E faecalis*, *E faecium*, and *E hirae*. *E faecalis* affects birds of all ages. Transmission of enterococcosis is via the oral and/or aerosol routes as well as from skin wounds.

Clinical signs and symptoms

Depression, lethargy, ruffled feathers, diarrhea, and a decrease in egg production.

Diagnosis

History, clinical signs, lesions, and demonstration of enterococci in blood or on impression smears are suggestive of enterococcosis.

Treatment and Prevention

- Antibiotics, including erythromycin and chlortetracycline, have been used to treat acute and subacute infections of enterococcosis.
- Antimicrobial susceptibility testing should be performed to ensure that the most efficacious antibiotic is used.

- Water sanitation helps to reduce the incidence. Enterococcal species are resistant to drying, so they can survive for prolonged periods in the environment.

6. Fowl Cholera

Cause

A contagious, bacterial disease of birds caused by *Pasteurella multocida* that affects domestic and wild birds worldwide. Wild birds may introduce the organism into a poultry flock, but mammals (including rodents, pigs, dogs, and cats) may also carry the infection.

Clinical signs and symptoms

In acute fowl cholera, finding a large number of dead birds without previous signs is usually the first indication of disease. In more prolonged cases, depression, anorexia, mucoid discharge from the mouth, ruffled feathers, diarrhea, and increased respiratory rate. Torticollis may result when the meninges, middle ear, or cranial bones are infected.

Diagnosis

P. multocida isolation can be accomplished using media such as blood agar, dextrose starch agar, or trypticase soy agar.

Treatment and prevention

- Early treatment and adequate dosages are important. Sensitivity testing often aids in drug selection and is important because of the emergence of multiresistant strains.

7. Infectious Coryza in Chickens

Cause

Infectious coryza is an acute respiratory disease of chickens caused by the bacterium *Avibacterium paragallinarum*. Transmission is by direct contact, airborne droplets, and contamination of drinking water.

Clinical signs and symptoms

Affected birds may have diarrhea and feed and water consumption usually is decreased during acute stages of the disease. Egg production may be delayed in young pullets and severely reduced in producing hens. Nasal discharge and occasionally slight facial swelling in the mildest form of infectious coryza.

Diagnosis

A catalase specific test is essential as nonpathogenic hemophilic organisms, which are catalase-positive, are present in both healthy and diseased chickens. Histopathologic features include edema, hyperplasia and erosion of respiratory mucosal and glandular epithelia and edema with infiltration of heterophils, macrophages, and mast cells.

Treatment and prevention

Prompt antimicrobial treatment with supportive care of infected birds to aid recovery. Early treatment with immediate administration of medication via drinking water is recommended until medicated feed is available.

- Erythromycin and oxytetracycline are usually effective.
- Sound farm management and biosecurity practices and vaccination.

8. Pullorum Disease in Poultry

Cause

Pullorum disease is caused by *Salmonella enterica Pullorum* and is characterized by very high mortality in young chickens. Transmission can be vertical (transovarian) but also occurs via direct or indirect contact with infected birds (respiratory or fecal) or contaminated feed, water, or litter.

Clinical signs and symptoms

Affected birds cluster near the heat source, are anorectic, weak, depressed, and have white fecal material pasted to the vent area. In addition, the birds may have respiratory disease, blindness, or swollen joints.

Diagnosis

Lesions in young birds usually include unabsorbed yolk sacs and classic gray nodules in the liver, spleen, lungs, heart, gizzard, and intestine. Firm, cheesy material in the ceca (cecal cores) and raised plaques in the mucosa of the lower intestine.

Treatment and prevention

- Treatment of infected flocks will not alleviate the continuation of the carrier state of the disease. Hence, treatment is not recommended.
- Control is based on routine serologic testing of breeding stock to assure freedom from infection.
- Management and biosecurity measures to reduce the introduction of *S enterica Pullorum*.

9. Salmonellosis

Cause

Salmonellosis in poultry is caused by host adapted serotypes including *Salmonella pullorum* and *S. gallinarum*, causing fowl typhoid or other non-host adapted serotypes such as *S. typhimurium* and *S. arizonae* causing paratyphoid infections.

Treatment and Prevention

See treatment for Pullorum disease.

10. Listeriosis in Poultry

Cause

L. monocytogenes is a gram-positive, non-spore forming, facultative intracellular, facultative anaerobic, rod-shaped bacterium. Transmission occurs via ingestion, inhalation, or wound contamination. Contamination of poultry farms with fecal material from nearby food animal farms (eg, cattle or swine farms) is an important source of infection, especially after a rain or flooding. Wounds from beak trimming and vaccine injection are possible sites of entry for the organism.

Clinical signs and symptoms

Sudden death may occur without premonitory clinical signs. In the encephalitic form, ataxia, lateral recumbency with leg paddling, twisting and backward retraction of the neck, and paralysis occur in affected birds. Outbreaks of listeriosis usually follow exposure to raw or uncooked poultry products but have also occurred after consumption of contaminated, ready-to-eat poultry meat products.

Diagnosis

Immunohistochemical staining to demonstrate *L. monocytogenes* in the tissues or by isolation of the organism.

Treatment and Prevention

- Penicillin, tetracycline, erythromycin, gentamicin, and trimethoprim-sulfamethoxazole.
- Prevention should focus on identifying and eliminating potential sources of infection.

Public Health Significant: Foodborne pathogen to the public and poultry industry.

C. FUNGAL DISEASES OF POULTRY

1. Aspergillosis

Cause

Aspergillosis is a mycotic disease caused by the fungus *Aspergillus fumigatus* that affects all species of birds. The organism is found in litter and feed. Infection occurs predominantly by inhalation of spore.

Clinical Symptoms

The most frequent clinical symptoms are dyspnea, gasping, hyperpnoea, cyanosis and usually without rales. The mortality rate varies between 5 and 50% in the first one to three weeks of age.

Diagnosis

Culture or microscopic examination of the fungus are confirmatory.

Treatment and Prevention

Treatment of affected birds is not effective neither economical.

- Strict adherence to sanitation procedures in the hatchery and fumigation of contaminated hatcheries with formaldehyde or thiabendazole (120-360 g/m³).
- Avoid moldy litter or collections.

Public health significant: Aspergillosis is zoonotic, it is transmitted via inhalation or ingestion. Use protective clothings and masks to avoid human exposure.

D. PROTOZOAL DISEASES OF POULTRY

1. Coccidiosis

Cause

Caused by *Eimeria* spp affecting usually young growing birds which is frequently characterized by diarrhea and enteritis. Coccidial oocysts are present in litter and can be transmitted by feed, water or soil ingestion. Severity of infection is dependent on *Eimeria* species, number of ingested sporulated oocyst, age and immune status of the bird.

Clinical signs and symptoms

Decreased growth rate, severe diarrhea and high mortality, low feed and water consumption followed by weight loss, decreased egg production and increased mortality.

Diagnosis

Demonstration of oocysts in feces or intestinal scrapings coupled with the presence of clinical symptoms should be considered during diagnosis.

Treatment and Prevention

Treatment is recommended only if it is commenced at early stage of the disease.

- Sulfachlorpyrazine sodium monohydrate, 300mg/kg (0.03%) or 100 gm. per 100 liters in drinking water for 3 days.
- Amprolium HCl 200 mg + Sulphaquinoxaline base 200 mg + Vitamin K3 2 mg, 100 g per 150 liter of drinking water for 5-7 days.

F. PARASITIC DISEASES OF POULTRY

1. Gastrointestinal parasites

Cause

Poultry could be infected with nematode and cestode parasites. *Heterakis gallinarum*, *Syngamus trachea*, *Ascarids* and *Capillarids* are economically important.

Clinical signs and symptoms

Reduced appetite, reduced growth rate, diarrhea, anemia, gasping, loss of condition and anorexia.

Diagnosis

Based on clinical symptoms, post-mortem examination and identification of the parasite itself and eggs

Treatment and Prevention

- Piperazines (diethylenediamine) 582-970 mg per Kg body weight with drinking water or 195-390g per 100 liters of drinking water.
- Strict sanitation and disinfection measures of bedding as well as feeders and drinkers, control of secondary hosts such as beetle, roaches, grasshoppers and earth worms.

2. Chicken Mite

Cause

Dermanyssus gallinae (Red mite) infestation. Chicken mites are nocturnal feeders that hide during the day under manure, on roosts, and in cracks and cavities of the chicken house, where they deposit eggs.

Clinical Symptoms and Lesions

Change in bird behavior (nervousness, pecking, stress and aggression), decline in production. Economic losses are associated with production losses and treatment costs.

Treatment and Prevention

- Tetrachlorinfos 50 WP, 6.5 gallon, 1 gallon/100 birds or 1-2gallon/1000 sq. ft of litter.
- Prevent new infestations by cleaning and disinfection with effective acaricides.

SECTION TWO: DISEASES OF PIGS

A. VIRAL DISEASES OF PIGS

1. African Swine Fever (ASF)

Cause

African swine fever (ASF) is a highly infectious and severe hemorrhagic disease of pigs that produces a wide range of clinical signs and lesions that can closely resemble those of classical swine fever. African swine fever virus (ASFV) has a case fatality rate of up to 100% in domestic and wild pigs. The spread of virus from the wildlife reservoirs to domestic pigs can be by the bite of an infected soft tick, oral -nasal route by direct contact with infected pigs or by ingestion of waste food containing unprocessed pig meat or pig meat products. Pigs that survive infection may be persistently infected.

Clinical Signs and symptoms

Peracute, acute, subacute, and chronic forms of ASF occur, and mortality rates vary from 0% to 100%, depending on the virulence of the virus with which pigs are infected. The acute and peracute forms of the disease are characterized by a severe hemorrhagic disease with close to 100% mortality. After a short incubation period of 3 –7 days, swine develop high fever (up to 42°C).

Diagnosis

Virus isolation from swine bone marrow or peripheral blood leukocyte cultures. Antigen detection by immunofluorescence staining of tissue smears, immunodiffusion using tissue suspensions as the source of antigen, or antigen-detection ELISA. In acute cases of ASF, the pigs may die before antibodies are produced.

Treatment, Control, and Prevention

- There is no treatment for ASF, and attempts to develop a vaccine are ongoing.
- The prevention and control of ASF is complicated by several factors, including the transmission of virus in fresh meat and some cured pork products, the possible persistent infection in some pigs, the presence of wildlife reservoirs of virus including wild pigs and soft ticks in some parts of the world.

B. BACTERIAL DISEASES OF PIGS

1. Swine Dysentery

Cause

Infection with *Brachyspira* (*B. hyodysenteriae*, *B. hampsonii* and *B. suanatina*). Transmission is fecal-oral from infected pigs, contaminated water and feed.

Clinical Symptoms

The first clinical signs of swine dysentery are often fever, anorexia and passage of soft feces. Mucohemorrhagic diarrhea with copious mucus and blood in severe cases.

Diagnosis

Bacterial culture for hemolytic isolates of *B. hyodysenteriae*.

Treatment and Prevention

Antimicrobials are an effective treatment for swine dysentery if started early. Administration of antimicrobials based on results of minimum inhibitory concentration testing.

- Lincomycin hydrochloride 10-15 mg/kg, IM, @12 hr. for 3 days.
- Biosecurity and rodent control.
- Swine dysentery is strongly influenced by diet and can be reduced through alteration of dietary fiber where feeds containing more soluble fiber.

2. Swine Erysipelas

Cause

An acute septicaemic disease of swine caused by *Erysipelothrix rhusiopathiae*. Recovered pigs and those chronically infected remain carriers.

Clinical Symptoms

Acutely infected pigs are febrile (40-42°C), walk stiffly on their toes and lie on their sternum separately rather than piling in groups. Skin discoloration may vary from widespread erythema and purplish discoloration of the ears, snout and abdomen to diamond-shaped skin lesions almost anywhere on the body. Chronic arthritis, the most common form of chronic infection, produces mild to severe lameness; the affected joints may be difficult to detect but tend to become visibly enlarged and firm.

Diagnosis

The typical diamond-shaped skin lesions, organism in stained smears or cultures confirms the diagnosis.

Treatment and Prevention:

- Penicillin 10,000-20,000 IU/kg, IM, @ 6 hr for 3 days for acute cases.
- Tetracyclines 5-6 mg/kg, IM @12 hr for 3 days.
- Culling of chronically ill pigs.

C. PARASITIC DISEASES OF PIGS**1. Ascariasis****Cause**

Pigs are infected by *Ascaris suum*. The parasites are found principally in the small intestine but may migrate into the stomach or bile ducts. The migration of larvae in the body damages tissues.

Clinical signs and symptoms

Poor growth rate of young pigs, mechanical obstruction of the intestine, migration into liver may obstruct the bile ducts, producing icterus. Affected pigs show abdominal breathing, unthriftiness and weight loss are common.

Diagnosis

Standard fecal flotation methods diagnosis of *A. suum* in pigs can be made by demonstrating the typical eggs.

Treatment and Prevention

- Fenbendazole; 5-7 mg/kg, PO for 3 days.
- Flubendazole 5mg/kg twice per year can be used for prevention.

2. Cysticercosis**Cause**

Taenia solium is a tapeworm found in the small intestine of man. Its metacestode (larval) stage, a cysticercus is a large fluid-filled cavity or vesicle or bladder found in the musculature of pigs.

Clinical Symptoms

Infection causes pain, paralysis, epileptiform seizures, locomotor disturbances and possibly death. The coenuri commonly localize on the meninges and in the neuropil.

Diagnosis

Diagnosis relies on the detection of cysts in the muscle tissue of animals during carcass inspection.

- Suspected lesions must be submitted to a laboratory in order to confirm diagnosis. 50g of tissue each from brain, tongue, liver and skeletal muscles of infected pig carcasses in ice-box to the laboratory.
- Extraction of DNA from cyst samples suspected lesion using a commercially available QIAamp tissue kit (QIAGEN, Hilden, Germany) according to the manufacturer's instructions.

Treatment and Prevention

It has no specific treatment in pigs.

Prevention

- Prevention of access to human feces by pigs with total confinement of pigs and strict meat inspection and control.
- Humans are final hosts from consumption undercooked pork.

SECTION THREE: DISEASES OF GOATS AND SHEEP

A. VIRAL DISEASES OF GOATS AND SHEEP

1. Bluetongue

Cause

Bluetongue is an arthropod-borne, noncontagious viral disease of sheep, wild ruminants and rarely cattle, goats and carnivores.

Clinical Symptoms

Dyspnea with panting hyperemia of the lips, muzzle and ears, pyrexia [42°C], depression, and inflammation, erosions and ulceration of the oral mucous membranes, particularly the dental pad are observed, other signs include swollen cyanotic tongue, lameness due to coronitis and widespread muscle necrosis, torticollis, vomiting, pneumonia, conjunctivitis, and alopecia.

Diagnosis

Clinical signs are presumptive. Confirmation is based on identification of the virus by isolation in embryonated chicken eggs, susceptible sheep or cell cultures. Serologic tests include ELISA, agar gel immunodiffusion, complement fixation and virus neutralization tests.

Treatment and Prevention

There is no specific treatment.

Monovalent vaccine is available in some countries.

2. Contagious Ecthyma (Orf)

Cause

Contagious ecthyma (orf, contagious pustular dermatitis, sore mouth) is an extremely infectious dermatitis of sheep and goats. Young animals are more susceptible to the disease. The disease is usually more severe in goats than in sheep.

Clinical Symptoms

The lesions develop as papules and progress through vesicular and pustular stages before encrusting. Discrete large scabs, a verrucose mass underneath which are distributed primarily on the skin of lips extending to the

mouth, inter-digital region, around the coronet and udder. Lambs fail to eat normally and lose condition, shows lameness and mastitis may occur in ewes.

Diagnosis

A diagnosis is based on characteristics and location of lesions, as well as flock history of previous outbreaks. A definitive diagnosis is based on viral isolation and an immunologic test.

Treatment and Prevention

Animals are cured spontaneously in most cases with supportive care. Lesions can be treated with a single application of 3 % iodine solution. Antibiotics may help combat secondary infection. In endemic areas, appropriate repellents and larvicides should be applied to the lesions.

Public health significance: The virus is zoonotic; use protective gloves during handling of clinical cases.

3. Peste des Petits Ruminants (PPR)

Cause

Peste des Petits Ruminants (PPR) is an acute or sub-acute highly contagious viral disease of goats and sheep. The disease is caused Peste des petits ruminants' virus (PPRV) which is closely related to rinderpest virus. The virus is transmitted by contact with nasal discharge, tears and secretions from coughing of infected animals.

Clinical Symptoms

Fever (40-41°C), depressed appetite, dull coat, dry muzzle, congested mucous membrane, congested conjunctiva, necrotic stomatitis, gastroenteritis and pneumonia. Hypothermia and death follows, usually after 5-10 days. In goats the major clinical signs are stomatitis, enteritis and pneumonia.

Diagnosis

A presumptive diagnosis is based on epidemiology, clinical signs and pathologic features. Laboratory confirmation is by isolation of the virus, serological tests and molecular diagnostic tests for identification.

Treatment and Prevention

No specific treatment. Fluid therapy is recommended to improve the effects of diarrhea/dysentery.

Vaccination with an attenuated PPR vaccine.

B. BACTERIAL DISEASES IN SHEEP AND GOATS

1. Bacillary Haemoglobinuria

Cause

It is an acute, toxemic and highly fatal clostridial disease, with the liver being the main targeted organ. It is caused by *C. haemolyticum* (*C. novyi* type D). The incubation period is extremely variable and onset depends on the presence of a locus of anaerobiosis in the liver. Such a nidus for germination is most often caused by liver fluke (*Fasciola hepatica*) infection.

Clinical Symptoms

Animals may be found dead without predictive signs. Usually, there is sudden onset of severe depression, fever, abdominal pain, dyspnea, dysentery and haemoglobinuria (red urine). Anemia and jaundice are present in varying degrees. Edema of the chest area may occur. Hemoglobin and RBC levels are quite low.

Diagnosis

- The tentative diagnosis can be done by presence of typical “port-wine-colored urine”, which foams freely during urination or on agitation.
- Diagnosis can be confirmed by isolating *C. haemolyticum* from the liver infarct.
- Rapid and accurate diagnosis can be made by demonstrating the organism in the liver tissue by a fluorescent antibody or immunohistochemical test.

Treatment and Prevention

- Antitoxin 500-1000 ml per adult animal.
- Procaine penicillin G, 22,000 IU/kg, IM or SC. @24 hr. for 3 to 5 days

2. Brucellosis

Cause

This is a disease caused by infection with bacteria of the genus *Brucella* and it is characterized by abortion in late pregnancy and subsequent high rate of infertility. Brucellosis in Goat and sheep normally caused by *B. melitensis* although *B. abortus* may also cause clinical brucellosis. The disease is zoonotic and occupational causing undulant or Malta fever in man. *Brucella ovis* causes epididymitis and orchitis that impair fertility in rams.

Clinical Symptoms

Abortions usually occur in late pregnancy in sheep and during fourth month of pregnancy in goats. In goats, mastitis and lameness may be seen.

Diagnosis

Confirmation is by isolation and identification of bacteria and serological tests.

Treatment and Prevention

- Treatment is not economical except in especially valuable rams and even if infection is eliminated, fertility may remain impaired.
- Oxytetracycline 10%, 5-10 mg/kg, @24 h, for 4-5 days. Oxytetracycline 20% 200mg/ml, 1ml per 10kg bodyweight, IM. Repeat after 3 to 5 days.

Prevention

Test animals before introduction to a flock and vaccinate against the disease, proper disposal of aborted materials, culling of infected sheep/goat.

3. Foot Rot

Cause

Foot rot is a contagious disease of sheep and goats caused mainly by the coexistence of two gram-negative, anaerobic bacteria, *Fusobacterium necrophorum* and *Bacteroides nodosus*.

Clinical Symptoms

Moist inflammation of the skin-horn junction and macerated interdigital skin, ulceration and necrosis of the sensitive laminae of the foot and severe lameness. Affected animals often carry the affected leg or lay down for extended periods, rubbing off the wool/hair on their flanks, brisket and knees.

Diagnosis

Demonstration of *B. nodosus* in smears taken from pus and scraping from the lesion.

Treatment and Prevention

- Footbaths containing 5% copper sulphate, 10% Zinc sulphate, 5-10% Formalin.
- Topical antimicrobial sprays including oxytetracycline sprays. Chlortetracycline hydrochloride + sulfanilamide Spray 2.850gm + 50gm.
- Erythromycin Injectable; 10mg/kg body weight, IM@24 hr. 3-5 days.

- Thiamphenicol for external use on the affected area once a day depending on the healing process for 3 to 5 consecutive days.
- Regular hoof trimming and foot bath and keep the floor dry.

4. Infectious Keratoconjunctivitis

Cause

keratoconjunctivitis associated with *Chlamydia psittaci*, *Chlamydia pecorum*, *Mycoplasma* spp (notably *M. conjunctivae*) and *Moraxella ovis*.

Clinical Symptoms

The earliest clinical signs are photophobia, blepharospasm and epiphora, later, ocular discharge may become mucopurulent. Conjunctivitis, with or without varying degrees of keratitis, is usually present.

Diagnosis

Microbial culture of eye swabs on special media for *Chlamydia* and *Mycoplasma* spp.

Treatment and Prevention

- Tetracycline ointment 10 mg/g, qid, for 3-4 days. Oxytetracycline HCL-Polymixin B sulphate, 5 mg-10000 U/g, qid 3- 4 days.
- Good management practices are of paramount importance to reduce or prevent spread of infectious keratoconjunctivitis infection.

C. PARASITIC DISEASES OF GOATS & SHEEP

1. Coenurosis

Cause

Coenurosis is a parasitic disease caused by the larval stage (*Coenurus cerebralis*) *Taenia multiceps*. *Taenia multiceps* is an intestinal parasite of canids and occasionally human being. *Taenia* eggs expelled in the feces of infected dogs or other canids are the source of infestation for intermediate hosts (sheep and goats). *C. cerebralis*, affects the CNS, particularly the brain of sheep and gives rise to neurological signs of coenurosis (gid or stagger).

Clinical Symptoms

Dullness, circling, torticollis, loss of appetite, frequent bleating, remaining behind the main the flock, visual impairment, muscle tremors and pain response on pressure over the cystic area

Diagnosis

The disease can be diagnosed on the basis of history, clinical signs and on postmortem examinations

Treatment and Prevention

- Treatment is based on surgical removal of the coenurus cyst after general anesthesia of the animal.
- Deworm the Dogs with anthelmintic at 6–8 week intervals and careful disposal of the carcasses/brain of affected sheep.

2. Fasciolosis

Cause

Fasciolosis is a parasitic disease of ruminant caused by the ingestion of metacercariae of *Fasciola hepatica* or *F. gigantica*. It is common in water logged areas which favor the breeding of the snail which is the intermediate host.

Clinical Symptoms

In the acute form; sudden death is common. In subacute form rapid and severe hemorrhagic anemia, rapid loss of condition, a marked paleness of the mucous membranes and an enlarged and palpable liver, submandibular or facial edema and ascites. In chronic form; there is progressive loss of condition, anemia, resulting in submandibular edema and ascites.

Diagnosis

Fecal microscopic examination reveals the oval, operculated, golden brown eggs.

Treatment and Prevention

- Triclabendazole (10 mg/kg PO stat dose or, for severe infections, twice @12 to 24 hr. interval.
- Draining of habitat for the intermediate host snail control and grazing management.

3. Gastrointestinal Parasitism

Cause

Gastro intestinal parasites cause disease due high infestation, weak host animal conditions by other diseases or poor feed and nutrition.

Clinical Symptoms

Gastrointestinal worm infestations are characterized by anorexia, loss in body weight, dehydration, profuse and watery diarrhea which is usually persistent. Haemonchus infections are characterized by severe anemia accompanied by generalized edema and progressive weight loss, which is caused by chronic infection.

Diagnosis

Laboratory confirmatory diagnosis is by demonstrating nematode eggs or tapeworm segments on fecal examination.

Treatment and prevention

Table 1: Antiparasitic treatment for goats and sheep

Parasite genera	Treatment	Dosage
Bunostomum plebotomum Chabertia ovina spp Oesophagostomum spp.	Fenbendazole	Sheep and Goat 5 mg/kg
Haemonchus spp. Nematodiurus spp.	Oxfenbendazole	Sheep 5 mg/kg; Goats 7.5 mg/kg
Cooperia spp. Trichostrongylus spp	Albendazole	Goats & Sheep: 7.5 mg/kg and for adult liver fluke 15 mg/kg
	Tetramisole	15 mg/kg PO or SC for goats & sheep
	Levamisole	8 mg/kg SC for goats & Sheep
	Pyrantel pamoate	25 mg/kg for goats & sheep
	Ivermectin	200mcg/kg, SC for goats & sheep

D. RESPIRATORY DISEASES OF GOATS & SHEEP

1. Aspiration Pneumonia

Cause

Pulmonary inflammation and necrosis due to inhalation of foreign material mostly due to inappropriate oral drenching. The severity of the inflammatory response depends on the material aspirated and the distribution of aspirated material in the lungs. Poor dipping technique with repeated immersion of the animal's head may cause aspiration of fluid. Bacteria in aspirated material may initiate acute infection or secondary infection.

Clinical Signs

Affected animals separate from the rest of the flock and present with pyrexia (40°C–40.5°C), a painful expression, arched back, inappetence, depression and increased respiratory rate (>40–60 breaths/ min) with a shallow abdominal component. Purulent nasal discharge that sometimes is tinged reddish brown or green. Thoracic auscultation reveals reduced lung sounds over affected lung.

Diagnosis

A history suggesting recent foreign body aspiration within the past 1–2 days. Auscultation and clinical signs are indicative.

Treatment and Prevention

- Ampicillin 15 mg/kg @12 hr. IM or 25 mg/kg PO (calves) for 3-5 days.
- Procaine penicillin G, 44,000 IU/kg, IM or SC @12 hr. for 7-14 days.
- Tetracycline; 10-15 mg/kg, IM, @12 hr. for 3-5 days.

2. Contagious Caprine Pleuropneumonia (CCPP)

Cause

Contagious Caprine Pleuropneumonia (CCPP) is one of the most severe diseases of goats caused by *Mycoplasma capricolum* sub species *capripneumoniae*. Highly contagious and frequently fatal; the morbidity rate may reach 100% and the mortality rate can be as high as 80%.

Clinical Symptoms

- Peracute case: affected goats can die within 1 to 3 days with minimal clinical signs.
- In acute disease, high fever, lethargy and anorexia, coughing and labored respiration.

- Subacute or chronic cases tend to be milder with coughing mainly following activity.
- Chronic CCPP is characterized by a chronic cough, nasal discharge and debilitation.

Diagnosis

- Culture of the causative organism from lung tissue samples and/or pleural fluid taken at post-mortem.
- Serologic tests such as complement fixation, passive hemagglutination, ELISA and latex slide agglutination may be used.

Treatment and Prevention

- Tylosin 11mg/kg body weight, @24 hr. for 3-5 days.
- Oxytetracycline 10%, 5-10mg/kg, IM, @ 24 hr. for 3-5 days.
- Annual vaccination for prevention of the disease.

3. Enzootic Pneumonia

Cause

The aetiology is complex. The main causes of the disease are Chlamydia psittaci, Parainfluenza 3 virus and Pasteurella Spp. Thus 'enzootic pneumonia' is more of a clinical term describing a range of respiratory diseases in sheep. Transmitted by direct contact between infected and susceptible sheep due to overcrowding where the micro-organisms contaminate the air, feed, water and equipment and are transmitted from carrier sheep to susceptible sheep by inhalation and ingestion.

Clinical Symptoms

Fever, anorexia, depression, loss of condition, mucopurulent nasal discharge, ocular discharge, dyspnea often accompanied by dry hacking coughing.

Diagnosis

Isolation and identification of the causative agents from affected tissues. It may be supported by ELISA from acute and convalescent sera samples.

Treatment and Prevention

- Oxytetracycline 10%, 5-10 mg/kg, IM@ 24 hr. for 5-7 days.
- Tylosin 11mg/kg body weight, IM2 24 hr. for 3-5 days.

- Penicillin G Procaine + Streptomycin sulfate, 200000 IU + 200 mg, 1 ml per 10 kg bodyweight, IM, 24 hr. for 3 – 4 days.

E. DISEASES OF REPRODUCTIVE SYSTEM OF GOATS & SHEEP

1. Abortion

Cause

Abortion in the ewe is caused by infectious or non-infectious causes. The major infectious agents causing abortions are *Campylobacter*, *Chlamydia*, *Toxoplasma*, *Listeria*, *Brucella* and *Salmonella*.

Table 2: Major infectious causes of abortion in goats and sheep

Disease	Period of abortion	Clinical signs or lesions	Diagnosis	Control
Bovine Viral Diarrhea (BVD Mucosal disease)	42 - 125 days of gestation.	Fetal death and abortion or resorption or fetal immunotolerance and persistent infection, fetal mummification or deformity.	Diagnosis is difficult because BVD does not cause specific fetal lesions. Samples: from placenta, fetal spleen or dam serum. Isolation, immunologic staining, PCR or detection of precolostral antibodies in aborted calves.	Vaccination (Booster vaccination may be desirable).
Infectious Bovine Rhinotracheitis (IBR, Bovine Herpes virus 1)	≥4 months (Second half of gestation)	Infected fetus dies within 24 hr., placentitis with blanched, necrotic cotyledons and edematous, yellow intercotyledonary areas; autolysed fetus.	Fluorescent antibody on kidney, histopathology of liver and adrenal, and serology, PCR.	Vaccination (Booster vaccination may be desirable).
Leptospirosis	Last trimester, 2-6 wk. after an outbreak occurred or 7-10 days after onset of the disease.	Infertility, weak calves, fever and bloody urine; Placentitis with avascular, light tan cotyledons and edematous, yellowish intercotyledonary areas, autolysed fetus	Isolation and identification; Dark field or phase-contrast microscopy and indirect fluorescent antibody, Serum agglutination test using tube or plate procedure; Microbiological culture of the dam's Urine; PCR.	Sanitation, Vaccination, Ceftriaxone Sodium 1ml/50kg (1mg/kg), IM q 24 h for 3-5 days.
Brucellosis	Last trimester (usually around 6-9 th month), premature birth or weak calves.	Cotyledons may be normal to necrotic and red or yellow: The intercotyledonary area is focally thickened with a wet, leathery fetus may be autolysed with	Maternal serology (serum agglutination test plus CFT); Brucellosis ring test (BRT) used as screening for dairy herd.	AI and maternity hygiene to prevent exposure, calf hood vaccination; test and slaughter. Moldy feed should be avoided

		broncho-pneumonia; retention of fetal membrane.		
Mycotic Abortion	≥ 4 months	Cotyledons are enlarged and necrotic with turned-in margins. The intercotyledonary area is thickened and leathery. Adventitious placentation fetus seldom is autolysed. Hyphae associated with fetal dermatitis (especially eyelids), bronchopneumonia, abomasal contents and placental lesions.		
Campylobacteriosis	Embryonic mortality and early abortion (2-3months)	Venereal transmission and repeat breeding, mild fibrinous pleuritis and peritonitis, bronchopneumonia, mild placentitis with hemorrhagic cotyledons and an edematous intercotyledonary area, Infertility.	Dark field microscopy of abomasal contents or culture of placenta or abomasal contents, histopathology is also helpful.	Abortion is sporadic. AI and vaccination 2 months before breeding; Uterine infusion with 0.5-1gm of streptomycin 24 hrs. after AI to restore fertility.
Trichomoniasis	Early abortion	Symptoms similar to Campylobacteriosis, Pyometra, sterility discharge containing pus, placentitis, with hemorrhagic intercotyledonary areas.	Direct microscopy of vaginal/uterine discharge, detection in abomasal content.	Suspend breeding for extra 2 to 3 months, breed through AI, slaughter infected bulls, vaccination in herds using natural mating.
Toxoplasmosis	Late abortion, still birth	premature birth, weak young; Necrotic areas of the Placentomes	Isolation of the organism or serologic test, SabinFeldman dye test for serology.	Prevent ingestion of contaminated placenta (break the infection cycle
Neosporosis	All stages of gestation	Congenital infection, paralysis, stunting, infected calves may be symptom free.	Histologic and immunohistochemical tests on the brain of aborted fetus, IFAT and ELISA.	Test aborting cows and cull; eliminate exposure.
Chlamydiosis	Sporadic abortion ≥ 4 months	Placentitis, fetal pneumonia and hepatitis	Stained smears of cotyledons tissues, culture in embryonating chicken eggs.	Ovine chlamydial vaccine

Listeriosis	Late abortion (4-7th month)	Sporadic abortion, metritis, keratoconjunctivitis and encephalitis. The fetal liver is shrunken and gray and contains pinpoint micro abscesses. Necrosis of the cotyledons and intercotyledonary area.	Culture of Listeria from fetus or placenta.	Sanitation, antibiotic therapy.
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2. Mastitis in Goats

Cause

The organisms infecting the udder of goats are similar to those in cows. It's a multi factorial disease caused by a range of etiological agents. Coagulase-negative staphylococci are prevalent and appear to cause persistent infections and cause subclinical mastitis. The level of infection and incidence of mastitis due to *Staphylococcus aureus* and *Streptococcus agalactiae* and other streptococci tend to be low.

Clinical Symptoms

Inflammation of the udder and often accompanied by severe swelling, drop in milk production and abnormal milk secretions with clots. The signs depend on the organisms involved. Systemic signs could also be observed. Subclinical mastitis is the most common.

Diagnosis

It is based on clinical signs and identification of the pathogen. Tests to detect subclinical mastitis include California Mastitis Test or direct somatic cell count.

Treatment and Prevention

- Erythromycin sodium intramammary infusion, 300 mg, per quarter, @12hr. for 3 days.
- Lincomycin + Neomycine Intramammary Solution 330mg + 100 mg per quarter @12 hr. for 3 days for per acute and acute mastitis.
- Penicillin G Procaine, 30000 IU per10 kg bodyweight, IM @24 hr. for 3 – 5days.
- Cloxacillin sodium intramammary infusion, 200 mg per quarter, @12hr. for 3 days.

3. Puerperal Metritis

Cause

In all species, acute puerperal metritis occurs within the first 10–14 days postpartum. It results from contamination of reproductive tract at parturition and often, but not invariably, follows complicated parturition. Predisposing factors include prolonged delivery, dystocia and retained fetuses or placentas. It is characterized by fetid, watery uterine discharge.

Clinical Symptoms

Fever, purulent vaginal discharge, depression, lethargy, inappetence and may neglect their offspring. A large, flaccid uterus may be palpable.

Diagnosis

Examination of the uterus with a speculum combined with history, visual inspection of the perineum, examination of the tail for evidence of vaginal discharge and transrectal examination of the reproductive tract.

Treatment and Prevention

- Penicillin G Procaine + Streptomycin sulfate, 200000 IU + 200 mg, 1 ml per 10 kg for 3-5 days.
- Oxytetracycline 10%, 5-10 mg/kg, IM, @24 hr. for 5-7 days.
- Sulfamethoxazole-Trimethoprim, 25mg/ kg bodyweight, @24h, IM 3-5 days.
- Maintain good hygiene in delivery pens and assistance during delivery for prevention and control.

SECTION FOUR: DISEASES OF CATTLE

1. Parturient Paresis (Hypocalcemia, Milk Fever)

Cause

Parturient paresis (Milk fever) is a metabolic disease of mature high producing dairy cows predominantly during the first 48 hours of parturition. The disease is associated with low level of ionized calcium in plasma.

Clinical Symptoms

There are three clinical stages related to the severity of hypocalcaemia.

- Lack of appetite, lethargy (weakness), dullness, cold ears and dilated pupil.
- Muscle tremor particularly of the head and limbs, grinding of teeth and incoordination. Hyperexcitability and hypersensitivity may occur at this stage.
- Trecumbent, drowsy (lethargic), flaccid paralysis. At first the animal lies on the sternum with curvature of the neck and may struggle to stand, then lies on the lateral side. Body temperature becomes subnormal, heart rate increases and irregular breathing.

Diagnosis

Hypocalcaemia can be diagnosed based on history, clinical signs, quick response to calcium borogluconate and by measuring the blood levels of calcium.

Treatment and Prevention

- Calcium borogluconate single IV dose of between 8 and 10 g Ca; 400 ml of 40% solution will give 12 gm of available Ca.
- Maintain low level calcium in feed (<50g Ca/day), supply Mg (>50 g per day) and limit phosphorus intake to less than 45 grams per day (at 0.35 % of the diet).

2. Pregnancy Toxemia (Fat Cow Syndrome)

Cause

Pregnancy toxemia results from fetal carbohydrate or energy demand exceeding maternal supply during the last trimester of pregnancy. It is precipitated by large or multiple fetuses, low energy or protein feeds and health conditions that increase energy demand or decreased ability to take in feed.

Clinical Symptoms

Mild cases: Decreased appetite, rumination, fecal production and nose licking. Severe cases: Depression, weakness, ataxia and recumbency. Opisthotonos, seizures or coma at the terminal stage of the condition.

Diagnosis

The history, stage of pregnancy and nutritional status give tentative diagnosis. Elevated ketone and decreased calcium levels in blood are confirmatory.

Treatment and Prevention

- Supportive treatment: Glucose (dextrose 5%) solution, 500 ml, IV Calcium borogluconate + Magnesium Hypophosphite Hexahydrate and 20% glucose 500 ml, IV. Propylene glycol 125 – 250 g PO @12 hr in severe cases.
- Anabolic steroids like dihydrotestosterone undecyclenate, 200-300 mg/animal, IM, stat.
- Pregnancy toxemia can be prevented by supply of adequate feed to meet energy demand.

3. Traumatic Reticuloperitonitis (Hardware disease)

Cause

Traumatic reticuloperitonitis occurs as a consequence of perforation of the reticulum by sharp foreign objects such as nails or pieces of wire. Perforation of the wall of the reticulum by a sharp foreign body initially produces an acute local peritonitis, which may spread to cause acute diffuse peritonitis. The penetration of the foreign body may proceed beyond the peritoneum into other organs resulting in pericarditis, pleuritis and pneumonia.

Clinical Symptoms

Sudden anorexia and fall in milk yield, ruminal stasis and local pain in the abdomen. The animal will be reluctant to walk and does so slowly, particularly downhill and is often accompanied by grunting. Painful and infrequent defecation and urination usually accompanied with grunting. Muffled heart sounds, jugular vein distention with a pronounced jugular pulsation, marked submandibular and brisket edemas.

Diagnosis

Based on clinical signs. Pinching the back or holding the animal by a wood at the sternum to detect pain reaction.

Treatment and Prevention

Confine cows for 1-2 weeks, placing them on an inclined ground (forequarters raised by 25 cm) to limit further advance of the sharp foreign body to the thoracic cavity.

- Administer antibacterial drugs for 3-5 days; Oxytetracycline (10%) 5–10 mg/kg/day, IM or slow IV. Procaine penicillin G 22,000 IU/Kg, aqueous suspension, IM or SC, @24 hr. for 3 to 5 days or repository preparations @48-72 hr.
- Left side laparotomy, exploratory rumenotomy with manual removal of the foreign body from the reticulum.
- Oral or occasionally IV fluids and SC calcium borogluconate or Calcium gluconate should be administered as needed. As a post-operative management.

B. VIRAL DISEASES OF CATTLE

1. Foot and Mouth Disease (FMD)

Cause

Foot-and-Mouth Disease (FMD) is a highly communicable viral infection of cattle, pigs, goats, and sheep. It is caused by an Aphthovirus that is transmitted by contact. Recovered animals remain carriers for up to 2 and a half years.

Clinical Symptoms

The disease is characterized by fever, anorexia, vesicles in the mouth on the muzzle, gums, pharynx, teats and interdigital cleft. Dullness, inappetence, fever and shivering followed by smacking of lips, drooling saliva and shaking or kicking of the feet are primary signs. Pregnant animals may abort.

Diagnosis

Clinical signs are indicative and confirmed by serology and isolation of the virus.

Treatment and Prevention

Supportive treatments against secondary bacterial infection. Vaccination, test and quarantine of infected herds and movement control.

2. Lumpy Skin Disease

Cause

Lumpy Skin Disease (LSD) is a highly infectious viral disease of cattle characterized by pox like intracutaneous firm nodules, edema of the limbs, superficial lymph nodes swelling and lymphangitis.

Clinical Symptoms

Painful swelling, fever, lacrimation, nasal discharge and hyper salivation followed by characteristic nodules on the skin and other parts of the body. The nodules are circumscribed, round, slightly raised, firm and painful and involve the entire cutis and mucosa of the gastrointestinal, respiratory and genital tract. The regional lymph nodes are swollen and edema develops in the udder, brisket and legs.

Diagnosis

The widespread nodular lesions of the skin and mucous membranes and biphasic fever are indicative.

Treatment and Prevention

There is no effective treatment but secondary bacterial infections are prevented by administration of broad-spectrum antibiotics.

Prevention

Vaccination with sheep/goat poxvirus or LSD strain.

3. Rinderpest

Cause

Rinderpest or cattle plague, is a highly contagious, usually fatal, acute or subacute viral disease of ruminants caused by morbilli virus. Countries declared free of infection, but under surveillance to avoid any re-emergency.

Clinical Symptoms

Fever, lacrimation, nasal discharge, profuse diarrhea and necrotic erosions of the epithelium of the mouth and other mucosa of the digestive tract.

Diagnosis

Provisional diagnosis is based on history, clinical signs and pathological lesions. Infection is confirmed by serological tests and culture.

Treatment and Prevention

There is no specific treatment available. However, it can be prevented by maintaining disease free status by importation of animals from Rinderpest -free countries.

C. BACTERIAL DISEASES OF CATTLE

1. Anthrax

Cause

Anthrax is a zoonotic bacterial disease caused by *Bacillus anthracis*. Anthrax is most common in wild and domestic herbivores (e.g. cattle, sheep, goats, camels, antelopes). It is primarily a disease of herbivores. However, it can also affect carnivores and scavengers but large outbreaks in these groups are very rare. Cattle are highly susceptible.

Clinical Symptoms

Peracute and acute forms are the common clinical forms of anthrax in cattle. Peracute form is characterized by sudden death. Acute illness is characterized by fever and excitement followed by depression, stupor, anorexia muscle tremors and dyspnea. Pregnant cows may abort. All natural orifices usually exude dark blood that does not clot.

Diagnosis

Anthrax should be suspected if an animal dies suddenly and further investigated by methylene blue stained blood smears.

Treatment and Prevention

- Penicillin 22,000 IU/kg, IM, @12hr. for 2 days, then daily for 3 days or Benzathine penicillin or other repository preparations, @48-72hr. the initial dose should be administered IV.
- Vaccination using Stern a virulent live spore vaccine and proper burial and burning of carcass.
- Necropsy of affected carcasses is not advised.
- Care should be taken not to contaminate water sources, residential areas, livestock facilities, pastures and other establishments in the area.

2. Blackleg

Cause

Black leg is an acute, febrile disease of cattle caused by *Clostridium chauvoei* characterized by emphysematous swelling of the heavy muscles and severe toxemia.

Clinical signs and symptoms

Depression, anorexia, rumen stasis, high fever (41-42°C) and tachycardia, marked lameness with pronounced muscle swelling of the upper limb with crepitation sound.

Diagnosis

The clinical signs, epidemiology and postmortem findings are indicative and bacterial isolation is confirmatory.

Treatment and Prevention

- Procaine penicillin G, 22,000 IU/kg, IM or SC @24 hr. for 3 to 5 days
- Annual vaccination of all cattle with *C. chauvoei* bacterin is used to prevent the disease.

3. Calf Diphtheria**Cause**

Calf diphtheria (Necrotic laryngitis, Laryngeal necrobacillosis) is a disease of young cattle caused by invasion of *Fusobacterium necrophorum* into laryngeal mucosa and cartilage. Primarily affects cattle between 3 and 18 months of age.

Clinical Symptoms

Severe inspiratory dyspnea, salivation, painful swallowing movements, complete anorexia and severe depression are the characteristic signs. High temperature (41°C; 106°F), the pharyngeal region may be swollen and painful on external palpation and there is salivation and nasal discharge.

Diagnosis

Clinical signs are usually sufficient to establish a diagnosis.

Treatment and Prevention

- Procaine penicillin, G, 22,000 IU/kg, IM or SC @ 24 hr. for 3 to 5 days
- Dexamethasone (0.2–0.5 mg/kg, IV or IM) may be used to decrease laryngeal edema in animals with severe respiratory distress.

- Good hygiene in calf pens or feeding and drinking places together with avoidance of rough feed should prevent the spread of the disease.

4. Dermatophilosis

Cause

Dermatophilosis is a skin disease of cattle and other domestic livestock caused by the bacteria *Dermatophilus congolensis*. It is clinically characterized by superficial, pustular, crusting, and/or ulcerative dermatitis.

Clinical Symptoms

Papules, serous exudates causing matting of hair to form a tufted appearance, scab formation may be severe and generalized.

Diagnosis

Clinical appearance, microscopic examination of geimsa or gram stained smear and culture.

Treatment and Prevention

- Amoxicillin 10 –15 mg/kg@24hr. IM; and Topical ointments: Iodophores: 2-5% lime sulfur, 0.5% zinc sulfate 0.2% copper sulfate and 1% potassium aluminum sulfate (alum) as sprays or wash for 3 to 5 days, then weekly until the lesion heals.

5. Hemorrhagic Septicemia

Cause

Hemorrhagic septicemia is a highly fatal bacterial disease seen mainly in cattle and water buffalo. Hemorrhagic septicemia results from infection by *Pasteurella multocida* subsp. *multocida*.

Clinical Symptoms

Initial fever and inappetence followed by respiratory distress with profuse salivation and nasal discharge. A characteristic swelling of the head, throat and brisket, swollen hemorrhagic lymph nodes and numerous mucosal and subserosal petechial hemorrhages.

Diagnosis

Definitive diagnosis depends on identifying *Pasteurella multocida* serotypes. Hemagglutination could be confirmatory.

Treatment and Prevention

- Oxytetracycline 5-10 mg/kg IM or IV, @ 12-24 hr. Long-acting 20 mg/kg SC, IM or IV, @ 2-4 days
- Penicillin-streptomycin; 200,000 IU + 250 mg, 1ml/25kg, IM.
- Amoxicillin + Clavulanic Acid 8.75 mg/kg bodyweight [7 mg/kg bw.

Table 3: Differential diagnosis of diseases of calves characterized by diarrhea

Cause	Age	Clinical signs	Prognosis
Enterotoxigenic <i>E. coli</i>	<3-5 months old, rarely up to 3 weeks.	Sudden onset, profuse amount of liquid faeces (pale yellow to white), cold clammy skin, pale mucosa, wet mouth.	Poor
Salmonella spp.	At least 4 days old.	Foul smelling feces that contain blood, fibrin and copious amounts of feces, septicemia, high fever (40.5-41.5°C), depression and coma.	
Hemorrhagic enterotoxemia due to <i>C. perfringens</i> type B and C	Few days' old	Acute onset of depression, weakness, bloody diarrhea and abdominal pain.	The calf dies within hours if not detected early.
Rota & corona virus and other viral infection	5-15 days' old and even several months old calves. 5-35 days old calves, commonly 2 nd weeks.	Large volume of feces containing mucus. Persistent diarrhea that does not respond to therapy. Dietary diarrhea <3 weeks old. Voluminous feces of pasty gelatinous consistency, emaciation at later stages.	

D. PARASITIC DISEASES OF CATTLE

1. Echinococcosis

Cause

Echinococcus granulosus is a tapeworm found in the small intestine of the canine definitive host. The cyst in the intermediate host, for example in cattle, localizes in various organs (the liver and lungs) and occupies a large portion of functional tissue.

Clinical Symptoms

Clinical signs depend on the organs involved but usually no visible clinical symptoms are observed.

Treatment and Prevention

There is no specific treatment of hydatid cyst. Deworm dogs regularly.

Public health significance: It can be transmitted to humans and cause serious problems.

2. Fasciolosis

Cause

Fasciolosis is a parasitic disease of cattle caused by the liver parasites *Fasciola hepatica* and *F. gigantica*.

Clinical Symptoms

Anaemia, hypoalbuminaemia and submandibular edema are characteristic. Diarrhea may occur if complicated by the presence of other bacteria.

Diagnosis

Diagnosis can be based on clinical findings, seasonality and weather conditions and previous history of the presence of the parasite in the area. Laboratory demonstration of the egg with fecal examination technique is confirmatory.

Treatment and Prevention

- Triclabendazole 9-12 mg/kg, PO stat (all stages of *Fasciola*).
- Albendazole 10 mg/kg, PO, stat repeat after two weeks.

3. Gastrointestinal Parasitism (GI)

Cause

These are infestations of the gastrointestinal tract with nematodes, cestodes and trematodes. The common stomach worms of cattle are *Haemonchus placei*, *Ostertagia ostertagi* and *Trichostrongylus axei*.

Clinical Symptoms

Ostertagia and *Trichostrongylus* infections are characterized by profuse, watery diarrhea that is usually persistent. Signs of anemia, hypoproteinemia and edema, particularly the lower jaw and sometimes along the ventral abdomen manifest these infections together with *Haemonchus* infection.

Diagnosis

In animals with poor body condition anemia and diarrhea are suggestive; confirmed by fecal examination.

Treatment

Fenbendazole Cattle 7.5 mg/kg, Oxfendazole Cattle 4.5 mg/kg, Albendazole Cattle 7.5 mg/kg and for adult liver fluke 15 mg/kg.

4. Ticks infestation

Cause

Ticks are obligatory parasites that feed on blood. They transmit a large number of pathogens while others may directly cause disease due to the salivary toxins and fluids (tick paralysis).

Clinical signs and symptoms

Seasonal skin infestation and associated symptoms of sickness.

Diagnosis

Skin infestation of the animal and identification of the ticks.

Treatment and Prevention

- Chlorfenvinphos spray 10% w/v Emulcifiable Concentrate (EC).
- Diazinon spray or dip or ear tag. 15% w/v, 16.2%, 20% and 60% w/v.
- Cypermethrin spray or dip. EC, 5%, 10% w/v; Powder, 25% or Pour-on solution.

Table 4: Tick vectors and associated livestock diseases

Tick genus (Vector)	Livestock Diseases
Amblyoma	Heart water.
Boophilus	Babesia, Anaplasma marginale.
Hyalomma	Tick toxicosis, many other babesial, theilerial and rickettsial infections.
Rhipicephalus	Babesia infections in domestic animals; East Coast Fever in cattle; Nairobi Sheep Disease, Tick toxicosis and many other babesial, theilerial and rickettsial infections of domestic animals.
Dermacentor	Babesia infections in horses, cattle and sheep; Anaplasma marginale in cattle; tick paralysis.
Ornithodoros	African Swine Fever, Relapsing fever.
Amblyoma	Heart water.

E. PROTOZOAL AND RICKETTSIAL DISEASES OF CATTLE

1. Anaplasmosis

Cause

Anaplasmosis is a tick-borne protozoal disease of ruminants. Clinical bovine anaplasmosis is usually caused by *Anaplasma marginale*. Cattle are also infected with *Anaplasma caudatum* and *Anaplasma centrale*. The tick vectors of anaplasmosis include *Boophilus*, *Dermacentor*, *Rhipicephalus*, *Ixodes*, *Hyalomma*, *Argas* and *Ornithodoros* genera.

Clinical Symptoms

Clinical signs of Anaplasmosis include fever, progressive anemia and inappetence. Loss of coordination, breathlessness when exerted and a rapid bounding pulse are usually evident in the late stages. Pregnant cows may abort. In animals <1 yr. old anaplasmosis is usually subclinical, in yearlings and 2-yr-olds it is moderately severe and in older cattle it is severe and often fatal.

Diagnosis

Microscopic examination of Giemsa-stained thin and thick blood films. Other tests include complement fixation or card agglutination tests.

Treatment and Prevention

- Oxytetracycline 20 mg/kg, IM, two doses with a 1-wk interval.
- Imidocarb dihydrochloride 1.5mg/kg SC stat.
- Tick control strategy.

2. Babesiosis

Cause

Babesiosis is a tick-borne disease of cattle caused by intra-erythrocytic protozoan parasites of the genus *Babesia*. The major vectors for *B. bigemina* and *B. bovis* are *Rhipicephalus microplus* (formerly *Boophilus microplus*) and in some areas, *R. annulatus* (formerly *Boophilus annulatus*).

Clinical Symptoms

High fever (41°C) that lasts 4-12 days, icterus and sunken eyes, accompanied by anorexia, weakness, trembling, dyspnea and tachycardia are the major symptoms of babesiosis. In the terminal stages, severe jaundice and dark red urine.

Diagnosis

History and clinical signs of jaundice with hemoglobinuria and fever are suggestive. Thick and thin Giemsa-stained blood smears is confirmatory. Serological diagnosis (CFT, indirect haemagglutination test, Agar gel diffusion test, rapid card or tube or latex agglutination tests)

Treatment and prevention

- Imidocarb (3mg/kg bw) is the drug of choice for bovine babesiosis.

3. Heartwater

Cause

Heartwater (cowdriosis) is an infectious, noncontagious tick-borne disease of ruminants caused by the rickettsiae spp. *Ehrlichia ruminantium* formerly called *Cowdria ruminantium*. Acute case occurs in young cattle (3 to 18 months of ages)

Clinical Symptoms

Fever (40°C), cessation of rumination, inappetence, petechiae on the mucous membrane of the conjunctiva, lacrimation, convulsion, sudden death and/ or nervous symptoms such as depression, a high-stepping stiff gait, exaggerated blinking of eyes and chewing movement and terminate in convulsions and prostration.

Diagnosis

History or epidemiology, presence of Amblyoma ticks and clinical signs are suggestive.

Giemsa stained brain impression smears are confirmatory.

Treatment and Prevention

- Oxytetracycline 10 mg/kg IV @12-24 hr. long acting formulation, @48-72 hr. interval.
- Doxycycline 2 mg/kg @24 hr. IV.
- Treatment is effective only in early febrile stages before neurological signs develop.
- Affected animals must be kept quiet in a cool area with soft bedding.
- Tick control but maintain enzootic stability.

4. Trypanosomosis

Cause

Trypanosomosis is a chronic disease of cattle caused by protozoa of the genus Trypanosoma. Depending on the species of parasite, the organisms are transmitted cyclically by Tsetse flies of the genus Glossina or mechanically by tsetse or other biting flies.

Clinical Symptoms

Intermittent fever, anemia and weight loss; high mortality, especially if there is poor nutrition or other stress factors.

Diagnosis

In an endemic area, anemic animal in poor condition is suggestive. Confirmation depends on demonstration of trypanosomes in stained blood smears or wet mount.

Treatment and Prevention

Table 5: Trypanosome species and choice of veterinary medicines

Trypanosome SPP	Drug	Preparation	Main action
<i>T. vivax</i> , <i>T. congolense</i> , <i>T. brucei</i> .	Diminazene aceturate	1.05 g sachet dissolved in 10 ml of sterile distilled water.	Curative (with the possible exception of brucei).
<i>T. vivax</i> , <i>T. congolense</i> , <i>T. brucei</i> .	Homidium bromide (Ethidium bromide)	250 mg tablets.	Curative.
<i>T. vivax</i> , <i>T. congolense</i> , <i>T. brucei</i> .	Homidium chloride (Novidium chloride)	250 mg tablets	Curative

Tsetse flies control strategy (e.g. frequent spraying and dipping of animals, pouron external ointment etc.

F. DISEASES OF THE RESPIRATORY SYSTEM OF CATTLE

1. Aspiration Pneumonia

Cause

Aspiration pneumonia is a common type of pneumonia caused by aspiration of foreign material into the lungs. The most common causes of aspiration pneumonia are faulty administration of medicines or other supplement and especially if the tongue is pulled out, and the head is held high.

Clinical Symptoms

Occasionally, evidence of aspirated material, e.g. oil droplets, green herbs or expectorated material can be seen in the nasal discharge. Fluid sounds over one or both sides of the chest, followed by wheezing sounds, pleuritic friction rubs and sometimes crackling sounds of subcutaneous emphysema.

Diagnosis

History of the animal within the last 2-3 days, auscultation and clinical signs are indicative.

Treatment and Prevention

- Saline nebulization (aerosolization) and coupage may assist with generating a productive cough to facilitate clearance of the aspirated material.
- Ampicillin 15 mg/kg @12 hr. IM or 25 mg/kg PO (calves) for 3-5 days.

- Procaine penicillin G, initially 44,000 IU/kg, IM or SC @ 12 hr. for 7-14 days, then 22,000 IU/kg for 7 to 14 days.

2. Bovine Respiratory Disease Complex

Cause

Bovine Respiratory Disease Complex (BRD) is a multifactorial disease. The most common viruses involved in BRD include Bovine Viral Diarrhea (BVD), Infectious Bovine Rhinotracheitis (IBR), Bovine Respiratory Syncytial Virus (BRSV) and Parainfluenza Type-3 Virus (PI-3). The common bacteria found in the lungs of cattle with BRD include Mannheimia haemolytica and Pasteurella multocida.

Clinical Symptoms

High fever (42.2°C), nasal discharge and as the disease progresses inappetence, dyspnea with extended head and open mouth breathing are observed. The distribution of the lesion is usually anteroventral.

Treatment and Prevention

- Oxytetracycline hydrochloride 11 mg/kg, SC @ 24hr. for 3 days; LA formulations, 20 mg/kg, IM, 48 hr. interval for at least 2 days after the rectal temperature has returned to the normal range.
- Procaine penicillin G, 22,000 IU/kg, IM or SC @24 hr. for 3 to 5 days.
- Amoxicillin trihydrate 11 mg/kg, IM, SC @24 hr. for 5 days

3. Contagious Bovine Pleuropneumonia (CBPP)

Cause

Contagious Bovine Pleuropneumonia (CBPP) is a highly contagious pneumonia of cattle is caused by Mycoplasma mycoides subspecies mycoides (small colony type) and transmitted to susceptible cattle by aerosol.

Clinical Symptoms

Fever (41.5°C), anorexia, difficult breathing, grunt at expiration, cough when forced to move, standing with the elbows apart, arched back and extended head. Mortality reach up to 50% and recovered animal and subclinical cases are important source of infection.

Diagnosis

Clinical signs, complement fixation test and characteristic marble appearance of the lung in dead animals.

Treatment and Prevention

Treatment could be attempted only in highly valuable animals, since animals remain carriers after treatment. Tylosin 10 mg/kg, IM, @12 hr. for 3-5 day. Oxytetracycline 10 mg/kg, IM, for 5 days.

4. Tuberculosis

Cause

Tuberculosis (TB) is an infectious, granulomatous disease of animals and human caused by acid-fast bacilli of the genus *Mycobacterium*. The main tubercle bacillus in cattle is *M. bovis*, though *M. tuberculosis* and *M. avium* are also involved. *Mycobacterium bovis* can cause progressive disease in most warm-blooded vertebrates including human being.

Clinical Symptoms

Tuberculosis has two clinical forms: pulmonary or extrapulmonary. In the latter form, generalized signs including progressive emaciation, lethargy, weakness, anorexia and a low-grade, fluctuating fever is observed. The respiratory form of the disease causes a chronic, intermittent, moist cough with gradual signs of dyspnea and tachypnea.

Diagnosis

Single or comparative intradermal tuberculin test. Confirmation of diagnosis requires isolation and identification of the organism.

Treatment and Prevention

- Treatment of bovine tuberculosis is not economical and not recommended. However, in valuable animals: Isonicotinic acid hydrazine/isoniazid (INH), 20 mg/kg, PO @24 hr. for 8 weeks.
- Test and slaughter of reactors to keep herds free of infection.

5. Verminous Pneumonia

Cause

Verminous pneumonia (lungworm infection, parasitic pneumonia) is an infestation of the lower respiratory tract of cattle by a nematode parasite, *Dictyocaulus viviparus*. It is characterized by bronchitis or pneumonia, which may be aggravated by secondary bacterial pneumonia.

Clinical Symptoms

In acute verminous pneumonia, frequent bronchial cough that may be persistent, slight nasal discharge, fever (40-41°C), increased vesicular murmur and bronchial tones, dyspnea, expiratory grunt, abnormal lung sound, cyanosis and death are common signs.

Diagnosis

Clinical signs, epidemiology, identification of first-stage larvae in feces using the Baerman technique.

Treatment and Prevention

- Levamisole 15mg/kg, PO, stat. Fenbendazole 5-15 mg/kg @24 hr. PO for 3 days.
- Oxfendazole 4.5 mg/kg, PO stat. Albendazole 7.5 mg/kg, PO, stat.

Prevention

Strategic deworming and grazing management for prevention of Verminous Pneumonia.

G. DISEASES OF THE REPRODUCTIVE SYSTEM OF CATTLE

1. Abortion

Cause

The causes of abortion could be infectious or non-infectious. In additions, any disease causing high fever may also induce abortion.

Table 6: Infectious causes of abortion in cow

Disease	Period of abortion	Clinical signs or lesions	Diagnosis	Control
Bovine Viral Diarrhea (BVD Mucosal disease)	42 - 125 days of gestation.	Fetal death and abortion or resorption or fetal immunotolerance and persistent infection, fetal mummification or deformity.	Diagnosis is difficult because BVD does not cause specific fetal lesions. Samples: from placenta, fetal spleen or dam serum. Isolation, immunologic staining, PCR or detection of precolostral antibodies in aborted calves.	Vaccination (Booster vaccination may be desirable).
Infectious Bovine Rhinotracheitis (IBR, Bovine Herpes virus 1)	≥4 months (Second half of gestation)	Infected fetus dies within 24 hr., placentitis with blanched, necrotic cotyledons and edematous, yellow intercotyledonary areas and autolysed fetus.	Fluorescent antibody on kidney, histopathology of liver and adrenal, and serology, PCR.	Vaccination (Booster vaccination may be desirable).
Leptospirosis	Last trimester, 2-6 wk. after an outbreak occurred or 7-10 days after onset of the disease.	Infertility, weak calves, fever and bloody urine; Placentitis with avascular, light tan cotyledons and edematous, yellowish intercotyledonary areas & autolysed fetus	Isolation and identification; Dark field or phase-contrast microscopy and indirect fluorescent antibody, Serum agglutination test using tube or plate procedure. Microbiological culture of the dam's Urine; PCR.	Sanitation, Vaccination, Ceftiofur Sodium 1ml/50kg (1mg/kg), IM @24 h for 3-5 days.
Brucellosis	Last trimester (usually around 6-9th month), premature birth or weak calves.	Cotyledons may be normal to necrotic and red or yellow. The intercotyledonary area is focally thickened with a wet, leathery fetus may be autolysed with broncho-pneumonia; retention of fetal membrane.	Maternal serology (serum agglutination test plus CFT). Brucellosis ring test (BRT) used as screening for dairy herd.	AI and maternity hygiene to prevent exposure, calf hood vaccination; test & slaughter. Moldy feed should be avoided
Campylobacteriosis	Embryonic mortality and early abortion (2-3 months)	Venereal transmission and repeat breeding, mild fibrinous pleuritis and peritonitis, bronchopneumonia, mild placentitis with hemorrhagic cotyledons and an edematous intercotyledonary area, Infertility.	Dark field microscopy of abomasal contents or culture of placenta or abomasal contents, histopathology is also helpful.	Abortion is sporadic. AI and vaccination 2 months before breeding; Uterine infusion with 0.5-1gm of streptomycin 24 hrs. after AI to restore fertility.
Trichomoniasis	Early abortion	Symptoms similar to Campylobacteriosis, Pyometra, sterility discharge containing pus, placentitis, with hemorrhagic intercotyledonary areas.	Direct microscopy of vaginal/uterine discharge, detection in abomasal content.	Suspend breeding for extra 2 to 3 months, breed through AI, slaughter infected bulls, vaccination in herds using natural mating.

Toxoplasmosis	Late abortion, still birth	premature birth, weak young; Necrotic areas of the placentomes	Isolation of the organism or serologic test, SabinFeldman dye test for serology.	Prevent ingestion of contaminated placenta (break the infection cycle)
Neosporosis	All stages of gestation	Congenital infection, paralysis, stunting, infected calves may be symptom free.	Histologic and immunohistochemical tests on the brain of aborted fetus, IFAT and ELISA.	Test aborting cows and cull; eliminate exposure.
Chlamydiosis	Sporadic abortion $\geq$ 4 months	Placentitis, fetal pneumonia and hepatitis	Stained smears of cotyledons tissues, culture in embryonating chicken eggs.	Ovine chlamydial Vaccine

Diagnosis

Diagnosis requires isolation and identification of the causative agent from uterine swab, biopsy, examination of fetus and placenta, urine and serological tests.

Treatment and Prevention

- A balanced nutritional feeding program. Good animal husbandry practices - Adequate housing facilities, handling, hygiene and environmental control.
- Regular immunizations against diseases that cause abortion.

2. Bovine Mastitis

Cause

It is caused by bacterial or mycotic pathogens. Staphylococcus aureus, Streptococcus agalactiae, Str. uberis, Str. dysgalactiae, other streptococci, Arcanobacterium pyogenes, Mycoplasma spp, Nocardia asteroides, asteroids and coliforms are the most common agents.

Clinical Symptoms

Clinical mastitis is manifested by inflammation of the udder and often accompanied by abnormal milk secretions. Subclinical mastitis is the most common form.

3. Dystocia

Cause

Dystocia refers to difficult birth. It may result from maternal or fetal causes. Maternal causes include myometrial defects such as uterine atony, metabolic abnormalities such as hypocalcemia, inadequate pelvic diameter, insufficient dilation of the birth canal, while fetal causes include fetal hormone (corticosteroid) deficiency, fetal oversize, fetal death or abnormal fetal presentation and posture.

Clinical signs and symptoms

Dystocia is considered if the animal had previous history of the condition and parturition does not occur within 24 hours after onset of labor and drop in rectal temperature (to $<37.7^{\circ}\text{C}$) or if gestation is prolonged.

Treatment and Prevention

- Determine the cause of dystocia and the condition of the animal before management commences. Manual correction of abnormal position of the fetus. Surgical removal (Caesarian operation).
- Cull heifers with very small pelvic size.
- Maintain proper feeding and good nutritional condition of pregnant animals.

4. Follicular Cystic Ovary Disease

Cause

Cystic ovary disease (Follicular cysts, Cystic follicles, Nymphomania “Bulling”) primarily affects dairy cattle. It occurs within 3-8 weeks of parturition most often.

Clinical signs and Symptoms

Regular ovulation fails in a cow developing cystic ovary condition and the dominant follicle continues to enlarge. The cow may show signs ranging from constant estrus activity to nearly complete estrus. Behavioral change ranges from frequent, intermittent estrus with exaggerated estrus signs including mounting, pawing the ground and bellowing. Relaxation of the vulva, perineum and the large pelvic ligaments. Elevated tail head is a common sign in chronic cases.

Diagnosis

Rectal palpation and history, conformation and uterine changes.

Treatment and Prevention

Manual rupture with moderate pressure on the ovary with fingers of the hand, but the potential danger of traumatizing the ovary and causing hemorrhage with subsequent local adhesions should not be overlooked. Estrus is expected after 4-7 or 15-25 days.

- Gonadotropin-Releasing Hormone (Gn-RH) 100mcg, IM; Cows come back on estrus within 15-30 days (peak 19-23 days). Repeat the treatment for the second or even third times, if required.
- PGF2 α products can be given 7 days after GnRH or hCG Luteinizing hormone (LH) 500 mcg/animal IM.

5. Metritis and Endometritis

Cause

It is the inflammation of the muscular and endometrial layers of the uterus. Retained fetal membranes, dystocia, trauma to the reproductive tract, abortion, concurrent systemic disease and emphysematous fetus. Unsanitary conditions at parturition can all predispose to metritis.

Clinical Symptoms

Fetid uterine discharge is common; systemic signs include fever, anorexia, depression and swollen and soft uterus. The mucus character (0=clear translucent; 1= mucus containing flecks of white pus; 2= exudate containing 50% white or cream pus; 3= exudate containing >50% white, cream or bloody pus) and odour scores are summed to give an endometritis clinical score ranging from 0 to 6 (vaginal mucus odour: 0 for no odor; 6 for a fetid odor).

Diagnosis

Examination of the uterus with a speculum combined with history, visual inspection of the perineum, examination of the tail for evidence of vaginal discharge and manual or ultrasonic transrectal examination of the reproductive tract. The examination of the contents of the vagina for the presence of pus is the most useful procedure for diagnosis of uterine infection.

Treatment and Prevention

- Procaine penicillin G 22,000 IU/kg, aqueous suspension, IM or SC @24 hr. for 3 to 5 days
- benzathine penicillin G or a similar repository preparation, @ 48-72 hr.

- Sodium Penicillin G, 10 million IU, intrauterine infusion stat during the postovulatory period. Ceftiofur Sodium 1ml/50kg (1mg/kg), IM @ 24hr. for 3-5 days.
- Tetracycline 2 to 6 g, intrauterine pessaries daily for 3 days. Prostaglandin PGF2 α or its analogs like cloprostenol, at usual luteolytic doses, for the management of endometritis.
- If the disease progresses to puerperal metritis, with the presence of systemic signs such as dehydration and pyrexia, fluid therapy (4-5ml/4-5minute) to restore normal hydration level and antipyretic (flunixin meglumine at a rate of 2.2mg/kg) drugs for 1 to 3 days. Infusion of the uterus with saline (1 L) at early postpartum.

SECTION FIVE: DISEASES OF EQUIDAE (HORSES AND DONKEYS)

1. Colic in Equines

Cause

Colic or abdominal pain occurs when the wall of the intestine is stretched excessively either by gas, fluid or ingesta. it is caused by excessive tension on the mesentery, as a result of incarceration or severe twisting of the intestine or inflammation of the intestine (peritonitis).

Common causes of colic in horses;

- In young Horses: Small-intestinal intussusception, non-strangulating infarction and foreign body obstruction.
- In the middle-aged horses: epiploic foramen, cecal impaction, enteroliths and large-colon volvulus.
- In the aged horses: pedunculated lipoma and mesocolic rupture. Migratory larvae of blood worms of *Strongylus vulgaris*, are common causes of colic.

Clinical Symptoms

Pawing repeatedly with a front foot, looking back at the flank region, curling the upper lip and arching the neck, repeatedly raising a rear leg or kicking at the abdomen, lying down, rolling from side to side, sweating, stretching out as if to urinate, straining to defecate, distention of the abdomen, loss of appetite, and decreased number of bowel movements.

Diagnosis

Rectal examination, nasogastric intubation and fecal sample test for parasite and bacterial are useful techniques.

Treatment and Prevention

- Phenylbutazone 4.4 mg/kg PO or IV @24 hr. for 10 days.
- Ketoprofen 2.2 mg/Kg PO or IV once or repeat after 24hr. for abdominal pain.
- Regular access to water and feed; avoid access to moldy feed and foreign body such as polythene bags, avoid overworking.

2. Lameness in Equines

Cause

Lameness is a deviation from a normal stance or gait. It is an indicator of a structural or functional disorder of the musculoskeletal system that is noted while the animal is either moving or stationary.

Clinical Symptoms

Pain, increased digital pulse, abnormal gait, incoordination, shifting of weight from lame foot, nodding of head, exhaustion, sweating, tendency to lie down, abnormal wear of hoof, discharge or bad smell swellings of joints.

Diagnosis

Diagnostic imaging techniques such as radiography, ultrasonography, MRI, CT, nuclear imaging and thermography can be used to evaluate the soft-tissue structures and bones.

Treatment and Prevention

- Dexamethasone 0.05-2.0 mg/ kg @24hr. I/V, I/M or PO.
- Identifying and eliminating the underlying cause.
- Regular hoof trimming and proper shoeing.

B. VIRAL DISEASES OF EQUIDAE

1. African Horse Sickness

Cause

African Horse Sickness (AHS) is an acute or subacute, arthropod-borne viral disease of Equidae caused by virus of the genus Orbivirus and outbreaks occur after heavy rains. Transmission is by *Culicoides* biting midges. Other potential vectors include mosquitoes, flies and ticks.

Clinical Signs

Four forms exist: Respiratory, cardiac, mixed and “horse sickness fever”. The conjunctiva is congested and the supraorbital fossa swollen. Swelling usually extends to the eyelids, facial tissues, neck, thorax, brisket and shoulders in cardiac form.

Diagnosis

In endemic areas, clinical signs and lesions may lead to a tentative diagnosis. Serology and culture are confirmatory.

Treatment and prevention

Vaccination with polyvalent or specific serotype based vaccine before outbreak season. Reduce exposure to biting insects using repellents.

2. Equine Infectious Anemia (EIA)

Cause

It is a mild viral disease caused by a Lentivirus affecting equine species. The virus is transmitted by hematophagous insects.

Clinical Signs

Fever, depression and petechiae on mucous membranes and conjunctiva. Recovered animals may show chronic form of the disease characterized by weight loss, anaemia, ventral oedema and debilitation leading to death.

Diagnosis

Agar gel diffusion test and ELISA.

Treatment and Prevention

Prevention and control include Test and cull of animals before introduction to an EIA free farm and insect control.

C. BACTERIAL DISEASES OF EQUIDAE

1. Actinobacillosis

Cause

Actinobacillosis in horses is caused by *Actinobacillus equuli*. It almost always involves soft tissue, including lymph nodes through which the organisms frequently spread, but also may involve adjacent bony tissues. Infection occurs through a contaminated umbilicus, inhalation or ingestion.

Clinical Signs

In young foals; diarrhea, which may be followed by meningitis, pneumonia, purulent nephritis, or septic polyarthritis (sleepy foal disease or joint ill) are common symptoms. Clinical features in adult horses include abortion, septicemia, nephritis and endocarditis.

Diagnosis

Clinical findings are suggestive and confirmed by microscopic examination from the exudates and by culture.

Treatment and Prevention

Oxytetracycline 5%, 5 mg/kg, @12 hr. IV or IM for 3-7 days. Procaine Penicillin G, 20,000 IU/kg, @12hr. IM for 3-7days. Potassium iodide 10% PO with Iodine tincture (Iodine 2%) applied topically.

2. Conjunctivitis (Pink Eye)

Cause

Moraxella is the common cause of conjunctivitis. Pseudomonas aeruginosa and Streptococcus equi subsp. zooepidermicus are also known to infect and cause corneal ulcers and lead to keratitis.

Clinical Signs

There are variable degrees of swelling of the eyelids, painful discomfort, purulent exudate, inflammation and hyperaemia of the conjunctiva and photophobia.

Diagnosis

Corneal ulceration and recurrent uveitis (periodic ophthalmia) and biopsy.

Treatment and Prevention

- Gentamycin eye drops, 10 drops @6hr. for 5 days.
- Chlorotetracycline hydrochloride eye ointment

3. Glanders

Cause

Glanders is a contagious, short- or long-term, usually fatal disease of the horse family caused by the bacterium *Burkholderia mallei*. The transmission through the consumption of contaminated.

Clinical signs and symptoms

In the skin form the lymph vessels degenerate and form ulcers that discharge highly infectious, sticky pus.

Diagnosis

Typical signs raise suspicion for this disease, but culture of the organisms is needed for confirmation.

Treatment and prevention

Rigorous disinfection of the area involved. Early detection and elimination of affected animals, quarantine.

4. Strangles

Cause

The causative organism, *Streptococcus equi* is highly host-adapted and produces clinical disease only in horses, donkeys, and mules. Transmission is via direct contact with infected horses or with any number of contaminated fomites. *S. equi* bacteria via inhalation or ingestion and colonize regional lymph nodes within a few hours of infection.

Clinical signs

Horses with retropharyngeal lymph node involvement have difficulty swallowing, inspiratory respiratory noise, and extended head and neck. Rupture of retropharyngeal lymph node abscesses internally within the guttural pouch results in empyema and coincides with the presence of mucopurulent nasal discharge as exudate drains from the pouches.

Diagnosis

Diagnosis of strangles relies on culture of exudate from an abscessed lymph node or PCR array of guttural pouch or nasopharyngeal washes.

Treatment and prevention

- Procaine penicillin (22,000 IU/kg, IM @12 hr.) is the choice of drug.
- Supportive treatment should include provision of a warm, dry, and dust-free environment with palatable feed, warm compresses applied to sites of lymphadenopathy to facilitate maturation of abscesses.
- Ruptured abscesses should be flushed with dilute (3%–5%) povidone-iodine solution for several days until discharge ceases.
- Vaccines are available for administration to healthy animals.

5. Tetanus

Cause

Tetanus toxemia is caused by a specific neurotoxin produced by *Clostridium tetani*. Infection most commonly occurs after an injury and wound punctures including improper post-surgical wound management.

Clinical signs and Symptoms

Stiffness, often involving masseter muscles and muscles of neck, hind limbs and erected ears, stiff and extended tail, anterior nares dilated, difficulty in walking and turning, Sweating and prolapse of the third eyelid. Increased heart rate, rapid breathing and congestion of mucous membranes due to interference of general spasms with circulation and respiration.

Diagnosis

Confirmation by tetanus toxin in the serum, and gram-stained smears and anaerobic culture of samples from suspected wounds.

Treatment and Prevention

The horse should be placed in a quiet, darkened box stall and sufficient bedding with feeding and watering devices to avoid lowering of the head.

- Urinary catheterization for bladder emptying, enemas and manual rectal evacuation of feces.
- Debriding and cleaning the wounds with Hydrogen peroxide.
- Tetanus antitoxin, 15,000 IU (15ml), IV and 8,000 IU (8ml),

D. PROTOZOAL PARASITES OF EQUIDAE

1. Equine Piroplasmosis

Cause

Infection caused by *Babesia caballi* and *Theileria equi*. The pathogens are transmitted by ixodid tick species.

Clinical Symptoms

Fever, petechial hemorrhages of mucus membrane, anemia, hemoglobinuria, icterus and ecchymosis of the third eye lid. Extensive subcutaneous edema of the eyelids, ventral abdomen, genital organs and legs. Higher rate of fatality rate for *T. equi* than *B. caballi* (4)

Diagnosis

Microscopic examination of Giemsa stained blood smears and presence of vector in the environment.

Treatment and Prevention

- Diminazene aceturate *B. cabali* 5mg/kg IM, twice @24 hr.
- Imidocarb dipropionate 2.2 mg/Kg @24hr. for *B. caballi* and 4 mg/Kg @72hr. x 4 for *B. equi* IM.
- Seasonal tick control strategy.

2. *Trypanosoma evansi* Infection (Surra)

Cause

Acute diseases in horses, and chronic in donkeys and mules caused by *T. evansi*.

Clinical Symptoms

Emaciation, anemia and oedematous plaques on the ventral surface of the body. Invasion of the central nervous system leads to meningitis. Hind limb paralysis and difficulty to get up.

Diagnosis

Thin blood film for *T. evansi*.

Treatment and Prevention

- Suramin 10 mg/kg IM stat. Diminazene aceturate 3.5 mg/kg IM stat.
- Isometamidium 0.5 mg/kg, IM stat (curative treatment).

3. *Trypanosoma equiperdum* Infection (Dourine)

Cause

Infection with *T. equiperdum* due to vertical is transmission during gestation period from mare to foal. Trypanosomes penetrate the genital mucosa and develop at the site of entry.

Clinical signs and Symptoms

Skin plaques, often containing trypanosomes are considered to be a pathognomonic feature of dourine. Intermittent and development of nervous signs (Pyrexia). Animals with pyrexia become emaciated and paralysis of the hind limb and muscles of the head region may follow.

Diagnosis

Clinical signs and confirmation is by complement fixation test.

Treatment and Prevention

- Suramin 10 mg/kg IM stat. Diminazene aceturate 3.5 mg/kg IM stat.
- Isometamidium 0.5 mg/kg, IM stat (curative treatment).
- Testing and culling for the establishment of freedom from infection.

2. FUNGAL DISEASES OF EQUIDAE

1. Candidiasis

Cause

Candidiasis is a localized muco-cutaneous disease caused by fungus, *Candida albicans*. It is an opportunistic pathogen. Factors associated with candidal infections are disruption of mucosal integrity, indwelling intravenous or urinary catheters, long term administration of antibiotics and immunosuppressive drugs or diseases.

Clinical Symptoms

Lesion may be single or multiple, raised, circular, white masses covered with scabs. Marked keratinous thickening of the mucosae of the tongue, esophagus and rumen may be observed. *Candida* species also causes arthritis in horses.

Diagnosis

Microscopic examination or culture of scrapings or biopsy specimens from mucocutaneous lesions.

Treatment and Prevention

- Ketoconazole 10 mg/kg@24 hr. PO for 5-7days.
- Itraconazole, 3 mg/kg@12 hr. PO for 84-120 days.
- Fluconazole, 4mg/ kg @12hr. PO for 4-8 Weeks.

2. Dermatophytosis

Cause

Trichophyton equinum and *T. mentagrophytes* are the primary causes of ringworm in horses. Transmission is by direct contact or by grooming implements. Most lesions are seen in the saddle and girth areas known as “girth itch.”

Clinical Symptoms

Patches of alopecia and erythema, scaling and crusting; early lesions may resemble typical urticaria.

Diagnosis

Examination of skin scraping and culture is confirmatory.

Treatment and Prevention

- Miconazole 1% cream or lotion @24 hr. for 2-4weeks topically.
- Chlorhexidine Gluconate (0.2%)+ Miconazole nitrate (0.2%) shampoo.
- Disinfecting grooming or harnessing equipment and isolation of infected animals.

3. Epizootic Lymphangitis

Cause

Infection is acquired by wound infection or by blood-sucking insects. Transmssion through harness and horse handling materials.

Clinical signs and Symptoms

Affected lymph nodes are enlarged and hard. The skin covering the nodules may become thick, indurated and fused to the underlying tissues.

Diagnosis

Microscopic examination of exudates using giemsa or gram stain.

Treatment and Prevention

- Early treatment with sodium iodide 10% and potassium iodide 10%, IV for at least one week combined with surgical incision of wounds.

3. PARASITIC DISEASES OF EQUIDAE

1. Lungworm Infection (Verminous Pneumonia)

Cause

Pneumonia or bronchitis Infection of lower respiratory tract of horses and donkeys with the parasite nematode *Dictyocaulus arnfieldi*.

Clinical signs and Symptoms

Moderate to severe and persistent coughing, tachypnea and unthriftiness in older horses, and but few of such signs and symptoms in foals or donkeys.

Diagnosis

Microscopic identification of first-stage *D. arnfieldi* larvae from fecal samples.

Treatment and Prevention

For Treatment see under disease of cattle.

2. Onchocerciasis

Cause

Onchocerca cervicalis localizes in the ligamentum nuchae and possibly other sites in Equidae. The microfilariae are found in the dermis and rarely in circulating peripheral blood.

Clinical signs and Symptoms

Dermatitis and marked fibrosis and mineralization induced by ligamentum nuchae inflammatory reactions. Larger numbers of microfilariae may be found in the skin without causing dermatitis. Scales, crusts, ulceration, alopecia and depigmentation skin lesions and pruritis.

Diagnosis

Microscopic examination of filarial worms from skin biopsy.

Treatment and Prevention

Ivermectin 0.2-0.3mg/kg I/M or S/C. Moxidectin 0.4 mg/kg kills the larvae. Plus, Dexamethasone 2.5 to 5 mg/450kg, I/M.

3. Gastrointestinal Helminthiasis

Cause

Gastrointestinal parasites affecting horses include oxyuris species, *Parascaris equorum*, large strongyles including *S. vulgaris*, *S. edentatus* and *S. equinus*; small strongyles like *S. tenuicollis*, *Strongyloides* species and *Trichostrongylus* species. The migratory larval stages of most of these parasites cause severe damage in vital organs of thoracic and abdominal cavity.

Clinical Symptoms

Large strongyles cause anemia, weakness, emaciation and diarrhea. *Strongylus vulgaris* causes colic, gangrenous enteritis or intestinal stasis, torsion or intussusception and possibly rupture. In heavy *P. equorum* infestation, unthriftiness, loss of energy and colic. *T. tenuicollis* produces severe ulcers in the wall of the colon. Digestive and absorptive function disturbance resulting in catarrhal enteritis of the large intestine.

Diagnosis

Microscopic examination of feces for egg and there are also serological tests.

Treatment and Prevention

- Ivermectin 200µg/kg, PO or SC stat. Moxidectin 0.4 mg/kg, PO or SC stat. Albendazole 7.5mg/kg PO stat. Fenbendazole at 10 mg/kg @24hr.PO for 5 days stat.
- Pyrantel pamoate 6.6 mg/kg, PO stat.
- Strategic treatment; at the beginning of rainy season and at the end of rainy season.

4. RESPIRATORY DISEASES OF EQUIDAE

1. Acute Bronchointerstitial Pneumonia in Foals

Cause

Acute bronchointerstitial pneumonia is a sporadic, rapidly progressive, disease of characterized by acute respiratory distress and high mortality caused by gram negative bacteria or infection with *Rhodococcus equi*.

Clinical Signs

Acute or peracute onset accompanied by a marked fever. Foals are unable or reluctant to eat or move and become cyanotic followed by severe respiratory distress.

Diagnosis

Clinical examination

Treatment and Prevention

Immediate and aggressive treatment with Dexamethasone 0.1-0.2 mg/kg, @12 hr. for 1-2 days followed by once a day for next 3-5 days. Plus, Erythromycine, 20-25mg/kg PO@ 8hr.

SECTION SEVEN: DISEASES OF HONEYBEES

1. American Foulbrood

Cause

American Foulbrood (AFB) is the most virulent infectious brood disease caused by the spore-forming bacterium *Paenibacillus larvae* sub-spp. *larvae* [*Bacillus larvae*]. The spore is resistant to heat and drought, capable of germinating in an unfavorable environment. The vegetative form of the bacteria is infectious. The spores germinate into vegetative form in the larval and early young bee pupae gut, which digests them with enzymes secreted by the bacterium.

Clinical signs

The symptoms of AFB include: characteristic sour odor, perforated or sunken capping, darker in color than healthy brood capping and resultant black scales that are difficult to remove from the cell because of their stickiness.

Diagnosis

Indicative characteristic signs include glue-like consistency of dead larvae and Ropy test (Stir in the cell with a match stick. The affected larvae stick tenaciously forming long string or rope when it is drawn) or Holst Milk Test (Swirl the affected individual with 1% skim milk; if the milk clears, it is indicative of AFB). Confirmatory laboratory tests include culture or transmission experiment.

Treatment and Prevention

Oxytetracycline 200 mg/colony in 1.6 g powdered sugar, apply at the top bars as dust, three times at 4-5 days interval;

Caution: commence one month before the first major nectar flow and repeat after the honey crop removal and treat all the colonies.

2. Chalkbrood

Cause

Chalkbrood, a fungal brood disease of honey bees, is caused by the spore-forming fungus, *Ascosphaera apis*. Worker, drone and queen larvae are all susceptible. Spores of the fungus are ingested with the larval food and germinate in the hindgut of the bee larva. A change in brood nest temperature can trigger chalkbrood disease by enhancing growth of *A. apis* in the honey bee. Common causes of stress are high and low temperatures, too moist or dry air conditions, poor nutrition, failing queen, poor hive management and moving hives. Transmission occurs by contaminated pollen, infected foraging bees leaving spores, by queens, drifting bees and drones. The spores remain viable for up to 15 years or more in equipment and soil.

Clinical Symptoms

Dead larvae are usually chalky white and covered with fungus filaments (mycelia) that have a fluffy, cotton-like appearance. Sometimes the color may be mottled or blue-gray or black, which dries out and adheres to the cell wall. A slight non-objectionable odor may be present.

Diagnosis

Brood inspection and microscopic examination of samples.

Treatment and Prevention

No specific treatment is available. Keep strong colonies, re-queen severely affected colonies.

3. European Foulbrood (EFB)

Cause

European foulbrood is a bacterial brood disease caused by the bacterium *Melissococcus pluton* [*Streptococcus pluton*]. It kills larvae that are two to four days old while they are still C-shaped in the bottom of cells. Unlike American foulbrood, most of the larvae die before their cells are capped. A spotty pattern of capped and uncapped cells develops only when EFB becomes serious.

Clinical Symptoms and Lesions

The color changes are non-uniform ranging from a normal pearly-white to yellowish, then brown and finally grayish-black, blotchy or mottled. Infected larvae lose their plump appearance and look under-nourished. Their breathing tubes or trachea are visible as distinct white lines. The dead larvae form a thin, brown or blackish-brown scale which can be easily removed. EFB usually does not kill colonies, but a heavy infection will seriously affect population growth.

Diagnosis

The diagnosis of EFB is almost the same as that of AFB. The rosy test shows less stringiness or ropyness and the Holst Milk test does not result in a clearing of the solution.

Treatment and Prevention

Similar to American foulbrood. Requeening colonies with a young queen eliminates infection; it gives the colony a more prolific queen and it provides a time lag between brood cycles that allows the house bees to remove diseased larvae.

4. Wax Moth

Cause

Larvae of the greater wax moth, *Galleria melonella* cause considerable damage to beeswax combs left unattended by bees particularly in weak or dead colonies and those placed in storage are subject to attack.

Clinical signs and symptoms

Wax moth larvae damage or destroy the combs by chewing through the beeswax cells as they feed on cocoons, cast skins and pollen. They spin silken galleries for protection from bees that will remove the wax moth larvae if they get the chance. Beeswax combs are often reduced.

Treatment and Prevention

Paradichlorobenzene crystals, in a small piece of paper between every fifth super in a stack repels wax moths, prohibit egg laying and kill young larvae. Maintain strong, healthy colonies, which can defend themselves against wax moths. Stored equipment and comb honey off colonies.

SECTION EIGHT: DISEASES OF COMPANION ANIMALS (DOGS & CATS)

1. Tick Paralysis

Cause

Tick paralysis is a toxin-induced, febrile, ascending, symmetrical condition in which there is flaccid tetraplegia and functional impediment to the reflexes of the superficial and deep tendons of the limbs and abdomen. Dogs are affected most frequently, but cats also suffer from the condition. Ticks genera of *Rhipicephalus*, *Haemaphysalis*, *Otobius*, and *Argas* are associated with paralysis in dogs and cats.

Clinical Symptoms

Early signs include change or loss of voice, lack of coordination of the hind legs, change in breathing rate and effort, gagging or coughing, vomiting and dilated pupils. Signs occur 3-9 days after the tick infestations. Difficulties in breathing, chewing and swallowing. Death can occur within several hours from respiratory paralysis. Temperature remains normal; blood and humoral values are unchanged.

Diagnosis

Signs of tick infestations, sudden appearance of paralysis.

Treatment and Prevention

- Medicated collar (Diazinon 15%). Amitraz to be diluted as per the label on the container.
- Ivermectin 400-600mg/kg

2. Canine Distemper

Cause

Canine distemper is a highly contagious, systemic, viral disease of dogs. Infection occurs via aerosol. Some infected dogs may shed virus for several months.

Clinical Symptoms

Transient fever, 3-6 days after infection and leukopenia (especially lymphopenia). The fever subsides several days and second fever accompanied by serous nasal discharge, mucopurulent ocular discharge and anorexia.

Diagnosis

Serologic demonstration of virus-specific IgM or an increased ratio of CSF to serum virus-specific IgG.

Treatment and Prevention

- Procaine Penicillin + Dihydrostreptomycin Sulfate 200,000IU: 200mg/ml, 1-2ml/20kg, IM, @24 hr. for 3-5days.
- Vaccination of young dogs with canine distemper start vaccinations at 6 weeks old and repeat at 3 to 4 weeks' interval until 16 weeks' old.

3. Canine Parvovirus

Cause

Canine parvo virus is a highly contagious in young dogs. The virus is resistance to many common detergents and disinfectants, as well as changes in temperature and pH the virus can persist for many months and possibly years in the environment.

Clinical Symptoms

Lethargy, anorexia and fever with progression to vomiting and bloody diarrhea.

Diagnosis

ELISA test or hemagglutination test.

Treatment and Prevention

- Gentamicin 4-6 mg/kg, SC or IM, @ 24 hr. for a maximum of 5 days.
- IV fluid therapy with a balanced electrolyte solution (Lactated Ringer's and 5% dextrose with additional potassium chloride 10-20mEq/L
- Vaccination at 5-8 weeks of age and annual vaccination thereafter.

4. Rabies

Cause

Rabies is an acute viral encephalomyelitis caused by Rhabdoviridae that principally affects carnivores and insectivorous bats, although it can affect any mammal. It is almost invariably fatal once clinical symptoms appear. Transmission is by the bite of a rabid animal. The virus in the saliva spreads into the tissues. Virus contact with fresh wound or even intact mucous membrane may also transmit the disease.

Clinical Symptoms

Clinical symptoms of rabies are rarely definitive. The most reliable signs are behavioral changes and unexplained paralysis. Behavioral changes may include anorexia, signs of apprehension or nervousness,

irritability and hyper excitability. At early stages loneliness, ataxia, altered phonation and changes in temperament. A normally docile animal may suddenly become vicious and vice versa. Two types of clinical manifestation; **Prodromal Form - Lasts 1-3 days**; animals show only vague CNS signs, which intensify rapidly. **Furious Form: This is the classical “mad-dog syndrome,”** the animal becomes irrational and with the slightest provocation, may viciously and aggressively use its teeth and claws, anxiety with pupils dilated. Noise invites attack. Such animals lose all caution and fear of natural enemies. Carnivores with this form of rabies frequently roam extensively attacking other animals and people. Puppies usually become harsh in a few hours. Rabid domestic cats attack suddenly, biting and scratching aggressively. As the disease progresses, muscular incoordination and seizures are common. Paralytic Form: Paralysis of the throat and masseter muscles, often with profuse salivation and inability to swallow. Dropping of the lower jaw is common in dogs. At this stage the animals are not vicious and rarely attempt to bite. The paralysis progresses rapidly to all parts of the body, coma and death follow in a few hours.

Diagnosis

Care must be taken as early stages of rabies can be easily confused with other diseases or normal aggressive tendencies. A rabies diagnosis must be verified with laboratory tests. Immunofluorescence microscopy on fresh brain tissue culture techniques using mouse neuroblastoma cells or both are confirmatory tests.

Treatment and Control

No treatment for rabies. Notification of suspected cases and reduction of contact between susceptible dogs by leash laws, dog movement control, and quarantine. Mass immunization of dogs (and cats) by campaigns using modified live virus and inactivated types with booster dose once a year.

- Unvaccinated and freely roaming dogs control. Dog registration and continuous vaccination of dogs and cats. Management of Suspected Rabies Cases and Exposed Pets.
- Any healthy dog or cat, whether vaccinated against rabies or not, that exposes (bites or deposits saliva in a fresh wound or on a mucous membrane) to a person should be confined for 10 days
- Pre-exposure immunization is strongly recommended for all people in high-risk groups.

B. BACTERIAL DISEASES OF DOGS AND CATS

1. Brucellosis

Cause

Brucellosis in dogs is caused by *Brucella canis*.

Clinical symptoms

Abortions, decreased fertility, reduced litter sizes and neonatal mortality. In male dogs: orchitis and epididymitis.

Diagnosis

Tube agglutination test, ELISA and agar gel immunodiffusion test.

Treatment and Prevention

Treat animals that are not intended for breeding and during early course of infection. Serological detection and culling of infected animals from breeding.

2. Canine Monocytic Ehrlichiosis

Cause

Ehrlichiosis is a generalized disease of Canidae caused by the rickettsiae *Ehrlichia canis*. It is transmitted by ticks especially *Rhipicephalus sanguineus*.

Clinical Symptoms

The disease may progress through an acute, subclinical to chronic phases. The acute phase is characterized by fever, thrombocytopenia, leucopenia and anemia. Persistent bone marrow depression, along with hemorrhages, neurological disturbance, peripheral edema and emaciation are characteristic. The disease may progress to chronic phase.

Diagnosis

Clinical and hematological features; detection of *E. canis* in mononuclear cells in Giemsa stained smears of the buffy coat.

Treatment and Prevention

Doxycycline or any Tetracycline 2-10 mg/kg, I/M, PO, @ 24 hr. for ten days.

3. Leptospirosis

Cause

Dogs are the primary host of leptospira serovar canicola. The most common serovars infecting dogs are Leptospira canicola and L. icterohaemorrhagiae.

Clinical Symptoms

Early findings are non-specific and include fever, depression, anorexia and generalized pain, vasculitis, thrombocytopenia and a coagulopathy may develop followed by uremia, dehydration, vomiting and oral ulceration. Icterus often reflects the severity of the disease, meningitis, uveitis and abortion have been reported in rare circumstances.

Diagnosis

Dark field microscopy, fluorescent antibody, PCR and culture. Demonstration of leptospira in tissues with silver staining or fluorescent antibody test.

Treatment and Prevention

- Doxycycline 5mg/kg/day, IV or PO @ 24 hr. for three weeks to eliminate renal carrier phase.
- Recently infected dogs can be treated with Amoxicillin or Doxycycline with dose as above for 7-10days.
- Rodent control and vaccination

Public health significance: Leptospira are pathogenic to humans and could be transmitted from dogs.

4. Hemorrhagic Gastroenteritis

Cause

Hemorrhagic Gastroenteritis (HGE) is a disease of dogs characterized by an acute onset of bloody diarrhea in dogs caused by bacterial endotoxins or diet.

Clinical Symptoms

Dogs 2-4 years old: vomiting and bloody diarrhea, anorexia and depression;

Diagnosis

The clinical sign of acute, bloody diarrhea accompanied by an increased PCV, which is often >60%.

Treatment and Prevention

- Lactated Ringer's 40-50ml/kg, PO, IV, with Potassium chloride. Gentamicin Sulfate 2-4 mg/kg @ 8 hr. IV (with IV fluid), IM, or SC.
- Sulfamethazine-Trimethoprim 200/40mg, 5- 30 mg/kg, IM, @24 hr. for 3-5 days for mild cases.
- Food and water should be withdrawn for 2-3 days.

C. FUNGAL DISEASES OF DOGS AND CATS

1. Dermatophytosis

Cause

Dermatophytosis is an infection of keratinized tissue (skin, hair and claws) by one of the three genera of fungi Epidermophyton, Microsporum and Trichophyton. Microsporum canis is the most common infection.

Clinical Symptoms

Kittens are most commonly affected. Lesions consist of focal alopecia, scaling and crusting; most infections occur around ears and face or on extremities. The hair becomes brittle. Feline miliary dermatitis with pruritis is occasionally observed. In dogs the lesions include alopecia, scaly patches with broken hairs and regional or generalized folliculitis with papules and pustules.

Diagnosis

Direct smear, culture and clinical symptoms are sufficient; the Wood's lamp is useful in establishing a tentative diagnosis.

Treatment and Prevention

Miconazole 1% solution, @1-2 hr. then @3-4 hr. after 3-4 days. In chronic case: Griseofulvin in dogs 25-100 mg/kg once daily or divided in two doses; in cats 25-50 mg/kg daily in divided doses for 2-4 wk after the clinical cure. Ketoconazole 10 mg/kg, for 2-4 wk. after clinical cure. Itraconazole at 5 mg/kg, daily for 2-4 wk. past clinical cure. Dermatophytosis in dogs and shorthaired cats is usually self-limiting, but clinical cure can be accelerated by treatment.

Public health significance: It is zoonotic handle infected pets with care and avoid direct skin contact with infected pets.

2. Cryptococcosis

Cause

Cryptococcosis is a fungal disease of dogs and cats caused by *Cryptococcus neoformans*. It may be systemic affecting the respiratory tract, Central Nervous System (CNS), eyes and skin (particularly the face and neck of cats). Transmission occurs by inhalation or wound contamination from the environment.

Clinical Symptoms and Lesions

In cats: sneezing, mucopurulent, serous or hemorrhagic unilateral or bilateral chronic nasal discharge, polyp-like mass in the nostril and a firm subcutaneous swelling over the bridge of the nose. Cutaneous papules and nodules that are fluctuant to firm, larger may ulcerate. Neurologic signs like depression, changes in temperament, seizures, circling, paresis and blindness. Dilated unresponsive pupils and blindness due to exudative retinal detachment, granulomatous chorioretinitis, panophthalmitis and optic neuritis.

In dogs: More severely disseminated disease and most have CNS or ocular involvement. Clinical symptoms are usually related to meningoencephalitis, optic neuritis and granulomatous chorioretinitis.

Diagnosis

Cytologic evaluation of nasal exudate, skin exudate and CerebroSpinal Fluid (CSF).

Treatment and Prevention

- Amphotericin B 0.1-0.5 mg/kg (cats) and 0.25-0.5 mg/kg (dogs).
- Itraconazole 5-10mg/kg. @ 12-24 hr PO for 7 days for dogs.
- Fluconazole 5-10 mg, PO, @ 12-24 hr for 7 days for cats.

D. PROTOZOAL PARASITES

1. Canine Babesiosis

Cause

Caused in dogs by *B. gibsoni* and *B. canis* and *B. felis* in cats. The parasite affects host erythrocytes.

Clinical Symptoms

Symptoms may come and go as the disease runs its course and can include lack of energy, lack of appetite, weakness, pale gums and tongue, orange or red colored urine, discolored stool, weight loss, enlarged spleen and jaundice. The severity of the disease depends on species of *Babesia*, presence of concurrent infections and age and immune status of the host.

Diagnosis

Demonstration of the Babesia parasite in erythrocytes of affected animals from blood.

Treatment and Prevention

- Diminazene aceturate 3-5 mg/kg, IM, stat. Imidocarb dipropionate 5-6mg/kg IM or SC stat and repeated in 2 weeks.
- Lactated Ringer's solution 40-50ml/kg, @24 hr. I/V, I/P, or S/C can be given as a supportive treatment until rehydration restored.
- Regular tick control.

2. Giardiasis

Cause

It is enteric disease of dogs and cats caused by parasitic protozoa of the genus Giardia. Transmission among hosts occurs by fecal-oral route. Cysts excreted in feces are immediately infective.

Clinical Symptoms

Chronic diarrhea either continuous or intermittent lasting for weeks, months or in unusual cases years or feces becomes pasty in consistency, pale, with foul odor.

Diagnosis

Microscopic examination feces giardia cyst identification.

Treatment and Prevention

Tinidazole 50 mg/kg PO @24 hr. for 3 days in cats and dogs.

3. Toxoplasmosis

Cause

Toxoplasma gondii is a protozoan parasite that infects most species of warm-blooded animals, including birds and man. Members of the cat family are the only known definitive hosts and thus, serve as the main reservoir. Transmission is by ingestion of raw meat, food, contaminated feces or congenitally.

Clinical Symptoms

Toxoplasmosis is usually a subclinical illness. However, in young animals, interstitial pneumonia, myocarditis, hepatic necrosis, meningoencephalomyelitis, chorioretinitis, lymphadenopathy and myositis are observed.

Diagnosis

Available tests include the Sabin-Feldman dye test, complement fixation, direct and indirect hemagglutination, latex agglutination, modified agglutination, ELISA and indirect fluorescent antibody testing.

Treatment and Prevention

- Clindamycin in dogs, 10-40 mg/kg @12-24 hr. for 2-4 weeks;
- cats, 25-50 mg/kg, @12-24 hr. for 2-4 weeks.
- Sulfadiazine 73 mg/kg and pyrimethamine 0.44 mg/kg act synergistically.

Public health Significance: It can be one of the causes abortion in pregnant women and birth defects.

E. PARASITIC DISEASES OF DOGS AND CATS

1. Dirofilariasis

Cause

Parasitic infection by *Dirofilaria immitis*. Dirofilariasis is infection of particularly the right ventricle and aorta of dogs. infection in cats infrequent. Mosquitoes are intermediate hosts.

Clinical Symptoms

Gradual weight loss, decreased exercise tolerance and cough aggravated by exercise and in advanced cases, dyspnea, increased temperatures, abdominal fluid, cyanotic mucous membranes and periodic collapse.

Diagnosis

Identification of *Dirofilaria* worm in blood samples and serological tests.

Treatment and Prevention

- Acetylsalicylic acid plus prednisolone prevents thromboembolism.
- Ivermectin 6 mcg/kg, I/M, every 30 days.
- Imidacloprid + Moxidectin, Cat, 10 mg/kg BW imidacloprid and 1.0 mg/kg BW moxidectin, equivalent to 0.1 ml/kg BW spoton monthly during the peak season of mosquitoes bites.

2. Ascariasis

Cause

The large roundworms (ascaridoid nematodes) of dogs and cats are common, especially in puppies and kittens. *Toxocara canis* is the most important cause of fatal infections in young pups. *Toxascaris leonina* occurs in adult dogs and in cats.

Clinical Symptoms

Stunted and devastating growth and loss of condition, adult worms discharge during vomiting and defecation. Pulmonary damage due to migrating larvae may be complicated by bacterial pneumonia. Diarrhea with mucus may be evident. In severe infections of puppies, verminous pneumonia, ascites, fatty degeneration of the liver and mucoid enteritis are common.

Diagnosis

Microscopic examination of feces for eggs.

Treatment and Prevention

- Piperazine 50-100 mg/kg, PO stat. for dogs and cats. Mebendazole 22 mg/kg, @24 hr. PO with food for 3 days.
- Pyrantelpamoate, dogs: 5-10 mg/kg; cats 10 mg/kg, both PO, single dose.
- Repeat @ 2- to 3-wk intervals until 3 month of age.

3. Ancylostoma Caninum Infection

Cause

Ancylostoma caninum is the principal cause of canine hookworm disease. Transmission may result from ingestion of infective larvae from the environment or, in A. caninum, ingestion of colostrum or milk of infected bitches or from larval invasion through the skin.

Clinical Symptoms

Acute normocytic, normochromic anemia followed by hypochromic, microcytic anemia in young puppies, and often fatal. Adult dogs may be debilitated and malnourished. Diarrhea with dark, tarry feces accompanies severe infections. Anemia, anorexia, emaciation and weakness in chronic disease.

Diagnosis

Flotation technic for microscopic examination of fresh feces from infected dogs, acute anemia and deaths of other young pups.

Treatment and Prevention

- Mebendazole 22 mg/kg, @ 24 hr. PO with food for 3 days.
- Fenbendazole 50 mg/kg.@ 24 hr. PO with food for 3 days.

- Milbemycin oxime + Praziquantel, Dog, 0.5 mg of milbemycin oxime and 5 mg of praziquantel per kg PO. Plus, Iron dextran 10 mg/kg, @24 h, IM for three days.

4. *Spirocerca Lupi*

Cause

Spirocerca lupi infection is an esophageal worm of dogs. The adult worms localize within nodules in the esophageal, gastric or aortic walls. Infection is acquired when dogs eat dung beetles (the intermediate host) or other animals such as chicken or reptiles which are secondary hosts.

Clinical Findings

Clinical symptoms appear when the nodules become large enough to interfere with swallowing and frequently vomit when trying to eat. Other signs include spondylitis or enlargement of extremities is characteristic of osteopathy. Dogs may die suddenly due to rupture of the aorta.

Diagnosis

Fecal examination, gastroscopic examination and radiologic examination.

Treatment and Prevention

- Levamisole 5mg/kg PO stat. or Albendazole 5mg/kg PO stat.
- Prevent dogs from eating dung beetles or raw chicken scraps, mice, lizard etc.

5. *Strongyloidosis*

Cause

Strongyloides stercoralis is a small, slender nematode when fully mature is buried in the mucosa of the anterior half of the small intestine of dogs. Usually, infections are associated with warm, wet, crowded, unsanitary housing. The species found most often in dogs is identical to the one found in human being. Other species in dogs include *S. planiceps* and *S. fuelleborni*; *S. cati* and *S. tumefaciens* are found in cats.

Clinical Symptoms

Early signs include emaciation and stunted growth. Usually in advanced stages, there is shallow, rapid breathing and pyrexia, and the prognosis is grave.

Diagnosis

Characteristic clinical symptoms and larvae identified by direct microscopical evaluation.

Treatment and Prevention

- Mebendazole 22 mg/kg, @24 hr. PO with food for 3 days. Albendazole 25 mg/kg, @12 hr. PO.
- Ivermectin 200 mcg/kg, PO or SC stat.
- Strongloides stercoralis infection causes severe disease in humans.

6. Tapeworms

Cause

Taenia species including *Dipylidium caninum* and *Taenia taeniaformis* are two important cestodes of pets acquired by ingestion of raw meat and offal. Dogs got infected with *Echinococcus granulosus* (the hydatid tapeworm).

Clinical Symptoms

Clinical symptoms vary from weakness, malaise, irritability, capricious appetite and shaggy coat to colic and mild diarrhea. emaciation.

Diagnosis

Fecal flotation may reveal the eggs of *E. granulosus* from other cestodes.

Treatment and Prevention

- Mebendazole 22 mg/kg, @24 hr. PO with food for 3 days. Albendazole 25 mg/kg, @12 hr. PO for 3 days.
- Praziquantel at 7.5 mg/kg, PO for two consecutive days is effective against *Dipyllobothrium latum* and 20 mg/kg, PO as a single dose against *Spirometra mansonioides*/ *E. granulosus* same dosage for dogs and cats.
- Emodepside + Praziquantel, Cat, 3 mg emodepside / kg and 12 mg praziquantel /kg, equivalent to 0.14 ml Profender / kg, Stat.

Public health significance: Cestodes of dogs and cats are of public health importance.

7. Canine Demodex

Cause

This common skin disease of dogs occurs only when large numbers of *Demodex canis* mites inhabit hair follicles, sebaceous glands or apocrine sweat glands. The mites are transmitted from the mother to puppies during nursing within the first 72 hours after birth. *D. canis* and *D. cati* are normal inhabitants of dogs and cats, respectively but may cause clinical disease if animals suffer from immunosuppression, systemic disease, estrus, and heartworm infection predispose to generalized demodicosis.

Clinical Symptoms

Lesions consist of areas of focal alopecia and erythema. Occasionally, some of the cases will progress to the generalized form

Diagnosis

Deep skin scrapings reveal mites, eggs and larval forms in high numbers.

Treatment and Prevention

- Amitraz dips 0.025%, every 2 weeks after clipping the entire hair coat and a benzoyl peroxide shampoo among those applied for its follicular flushing activity before the dip is applied.
- Ivermectin (400-600 mcg/kg PO, stat. Sarolaner Dog, 2–4 mg/kg PO, at monthly intervals for three consecutive months.
- Treatment should be continued until skin scrapings are negative at least two consecutive occasions on monthly base sampling.

8. Fleas and Flea Allergy Dermatitis (FAD)

Cause

Fleas cause flea allergy dermatitis. They are vectors of typhus-like rickettsiae and intermediate host for filarid and cestode parasites. Species that commonly infest dogs and cats are: *Ctenocephalides felis* (the cat flea), *C. canis* (the dog flea).

Clinical Symptoms

In dogs, papulocrustous lesions distributed on the lower back, tail head and posterior and inner thighs. Dogs may be particularly sensitive in the flanks, caudal and medial thighs, ventral abdomen, lower back, neck and ears. Affected dogs are restless and uncomfortable, scratching, licking, rubbing, chewing and even nibbling at

Cats with FAD can have alopecia, facial dermatitis, exfoliative dermatitis and “racing stripe” or dorsal dermatitis.

Diagnosis

History, clinical symptoms, presence of fleas or flea excrement, results of intradermal testing.

Treatment and Prevention

- Non-encapsulated chlorpyrifos (see accompanying leaflet for application).
- Imidacloprid + Moxidectin, Cat, 10 mg/kg BW imidacloprid and 1.0 mg/kg BW moxidectin, equivalent to 0.1 ml/kg BW spoton monthly.
- Environmental fleas control.

9. Feline Demodex

Cause

Demodex cati is a normal inhabitant of feline skin follicles but causes disease in immunosuppressed animals.

Clinical Symptoms

In localized demodicosis, there are one or several areas of focal alopecia on the head and neck. In generalized disease, alopecia, crusting and secondary pyoderma of the whole body are seen.

Diagnosis

Examination of skin scraping and medical evaluation is indicated in cats with generalized disease.

Treatment and Prevention

Weekly lime sulfur dips (2%) are safe and usually effective.

10. Notoedres

Cause

Highly contagious disease of cats and kittens is caused by *Notoedres cati*, which can opportunistically infest other animals, including man. The mite and its life cycle are similar to the sarcoptic mite.

Clinical Symptoms

Pruritus is severe. Crusts and alopecia are seen, particularly on the ears, head and neck and can become generalized.

Diagnosis

It is based on clinical symptoms and identification of mites in skin scraping.

Treatment and Prevention

Amitraz spray, 0.025% as sarcoptic mange. Imidacloprid + Moxidectin, Cat, 10 mg/kg BW imidacloprid and 1.0 mg/kg BW moxidectin, equivalent to 0.1 ml/kg BW spoton Stat.

11. Sarcoptes

Cause

Sarcoptes scabiei subspecies *canis* infestation is a highly contagious disease of dogs. The mites are fairly host specific, but animals (including human being) which come across in contact with infested dogs can also be infested.

Clinical Symptoms

Asymptomatic carriers may exist. Intense pruritus is characteristic. Primary lesions consist of a papular eruption due to self-trauma, develops thick crusts with secondary bacterial infection. Typically, lesions start on the ventral abdomen, chest, ears, elbows legs and become generalized, if not treated on time. Dogs with chronic, generalized disease develop severe thickening of the skin with fold formation and crust, peripheral lymphadenopathy, and emaciation, with possible death.

Diagnosis

History of severe pruritus of sudden onset, several extensive superficial scrapings at different sites and fecal flotation for microscopic identification of mites or eggs.

Treatment and Prevention

The hair should be clipped, the crusts and dirt removed by soaking with a good antiseborrheic shampoo. Amitraz, 0.025%. PlusPrednisolone 0.5-1mg/kg, PO. Sarolaner, Dog, 2–4 mg/kg BW, PO, a single dose at monthly intervals for two consecutive months. Selamectin, Dog, 6 mg/kg, Spoton, a single dose for two consecutive months. Afoxolaner Dog 2.7–7 mg/kg, PO, Monthly administration of the product for two consecutive months. Fluralaner, Dog, 25 – 56 mg fluralaner/kg BW, PO, Stat.

12. Tick Infestation

Cause

For description, diagnosis, treatment and control see Ticks control in cattle, and for treatment and dosages see the label on the container of acaricides and mite treatment above.

SECTION SIX: DISEASES OF FRESH WATER FISH (AQUATIC ANIMALS)

A. FISH AND ITS ENVIRONMENT

Fishes are poikilothermic aquatic animals and need continuous acclimatization to the environmental changes. Each species has a preferred range of water quality parameters and outside this range will suffer stress, which may lead to disease and even death. Fish can be affected by external environment water contaminants including pollution from agriculture, sewage or industrial sources as well as natural variations in water quality caused by geology, soils and the climate. Water quality may be influenced by farm management, fish husbandry (including stocking density and feeding) as well as excreted wastes of the fish. The physical action of the fish in stirring up sediments can also have an impact on some water parameters. There are several key water quality parameters such as temperature, dissolved oxygen, pH, ammonia and nitrite that should be tested whenever any fish disease is suspected. Organic compounds such as detergents and hydrocarbons, pesticides, herbicides and molluscicides can be extremely toxic to fish and may reach aquaculture water supplies by accidental leakage or contamination and runoff from agricultural and industrial lands. Clinical symptoms vary with the type of compound but tend to include distress, respiratory failure, and death.

1. Heavy Metals poisoning

Cause

Fish are sensitive to dissolved metals. Metals are most toxic in low alkalinity waters in which high concentrations of metals remain dissolved. Metal contamination may occur from the following sources: leaching from lead, copper or galvanized (containing zinc) plumbing fittings, mining activities, petroleum spillage, explosive (dynamite), human waste, groundwater (especially soft, acid water) that may have high concentrations of metals, Rainfall run-off from soils that are poorly buffered or are contaminated (e.g. mine wastes).

Clinical signs & Symptoms

- Metal poisoning varies and depends on the metal and fish species. Effects can be chronic or sub-lethal leading to a gradual decline in fish health, low reproduction and reduced immunity to other diseases. Some clinical signs include:
- Gills damage including inflammation, hyperplasia, and necrosis, Skin lesions, Fin rot and Skin discoloration

Diagnosis

Water and fish samples must be submitted to a laboratory specializing in water analysis and diagnostic labs.

Treatment and Prevention

Test the heavy metal level of the water before establishing fish farming. Avoid using metal fittings (especially those containing, lead, mercury, arsenic, cadmium, etc), water from mining sites for aquaculture systems to reduce the risk of metal poisoning, and isolation of affected fish

2. Ammonia Poisoning

Cause

Ammonia poisoning is one of the most common water quality problems in aquaculture. It is the primary nitrogenous waste product of fish, but also comes from the decay of organic matter such as waste feed and algae. Potential causes of elevated ammonia levels include overcrowding of fish, medication or chemicals added, failure of biological filters, reduced water flow and accumulation of waste feed or other organic matter. Ammonia toxicity also varies with salinity, water hardness and other stress factors.

Clinic Signs Behavioral abnormalities (hyper-excitability), reduced feed intake, retarded growth, weak disease resistance, and high mortality.

Diagnosis

Chemical measurement of total ammonia, pH and temperature using appropriate test kits and meters.

Treatment and Prevention

Dilution using fresh water, stop feeding, decrease stocking density, reduce temperature and reduce PH Improve husbandry practices and take an active approach to managing the health of stock.

3. Carbon Dioxide Poisoning

Cause

Carbon dioxide (CO₂) is essential for plant growth and is usually present as a free gas or bound with other elements to form bicarbonates, carbonates and organic compounds. High levels of free CO₂ can cause problems at low pH levels (pH<7.0). The main sources of CO₂ are respiratory wastes of the fish, decomposition of organic matter, respiration by aerobic bacteria, groundwater and the atmosphere. High levels of CO₂ interfere with oxygen uptake.

Clinical signs and symptoms

Dyspnoea and chronic inflammation and calcium carbonate disposition in the kidneys and epaxial muscles.

Diagnosis

Check content of CO₂ where >12 mg/L CO₂ is indicative.

Treatment and Prevention

Increasing aeration, reducing stocking density, addition of calcium hydroxide.

Use of mechanical aeration and oxygenation systems.

4. Chlorine/ Chloramine Poisoning**Cause**

Chlorine is commonly used to treat water for human consumption. Ammonia added to stabilize the chlorine reacts producing chloramines. Both chlorine and chloramines are extremely toxic to fish and can cause acute or sub-acute toxicity.

Clinical signs and Symptoms

Chlorine/chloramine poisoning includes breathing difficulty, dyspnea and death. Gill tissue of affected fish becomes necrotic. Fish exposed to chlorine poisoning appear to have improved survival if the water is super-saturated with oxygen for several days and the temperature is lowered.

Diagnosis

A reliable water quality spectrophotometer-based test kit can measure chlorine. Chlorine can also be detected by smell. Any detectable amount of chlorine or chloramines is undesirable.

Treatment and Prevention

Chlorine can be removed from water by vigorous aeration. Water may also be filtered through activated carbon/fresh charcoal or natural clays (zeolites)

Treat with a chemical neutralizer such as Sodium Thiosulphate.

5. Gas Supersaturation (Gas Bubble Disease)**Cause**

Gas super-saturation may be caused by excessive plant photosynthesis during daylight hours in ponds with dense algal blooms, inflow water saturated with gases as a result of heating under pressure, water inflow pipes sucking

in air (prior to pumps) and ground waters that are supersaturated with nitrogen and/or carbon dioxide. Most gas emboli are produced by excess nitrogen. Oxygen rarely causes gas bubble disease because it is assimilated metabolically and hence is less likely to form persistent bubbles.

Clinical signs

Fish become listless and float to the surface. Small bubbles can be seen forming in superficial blood vessels typically on gills and fins and behind the eyes.

Diagnosis

Measure water with a satumeter (an oxygen meter will give an indication of oxygen supersaturation only. Small bubbles will immediately form on any object placed in the water.

Treatment and Prevention

Eliminate excess gases from the water source by aerating water in a reservoir to allow gases to equilibrate. Install de-gassing devices on pipelines and systems before the water enters the culture vessels.

6. Hydrogen Sulfide Poisoning

Cause

Hydrogen Sulfide (H_2S) forms from the reduction of sulphate under anaerobic conditions in brackish water/marine systems, and in freshwater systems whenever there is excessive accumulation of organic matters disturbing pond sediments and release Hydrogen Sulfide gas from the mud.

Clinical signs and Symptom

H_2S interferes with respiration causing hypoxia. Concentrations of H_2S between 0.5-1.0 mg/L can cause acute mortality.

Diagnosis

“Rotten egg” characteristic smell detection and can be measured by a reliable water quality spectrophotometer.

Treatment and Prevention

Vigorous aeration or use of a degassing device. Raising pH and lowering temperature also reduce toxicity. Regular addition of fresh water also assists in reducing H_2S concentrations.

7. Nitrite Poisoning (Brown Blood Disease)

Cause

Nitrite is an intermediary product in the oxidation of ammonia to nitrate by bacteria. Circumstances which lead to high concentration of ammonia result in nitrite poisoning. Susceptibility to nitrite toxicity varies among species fish.

Clinical signs and Symptoms

Behavioral changes are similar to characteristics of hypoxia. In acute to chronic cases, dyspnea and gills become light chocolate to brown in color.

Diagnosis

Test for nitrite using a chemical test kit.

Treatment and Prevention

Add of salt (Sodium Chloride) ≤ 50 mg/L. The chloride ion competitively inhibits nitrite uptake across the gills.

B. MAJOR BACTERIAL DISEASES OF FRESH WATER FISH

1. Bacterial Gill Disease (BGD)

Cause

One or more species of filamentous bacteria including *Flavobacterium* spp. *Flavobacterium branchiophilum* Gram-negative bacilli of varying length. Carrier fish in the rearing units or a contaminated water sources are sources of contamination.

Clinical signs

Loss of appetite; swimming at the surface and often upstream (against the current) to obtain efficient water flow over the gill surfaces.

Diagnosis

Clinical signs and test for specific bacteria.

Treatment and Prevention

Erythromycin in feed at a rate of 100 mg/kg/day for 21 days, Chloramin-T dipping at 8.5-10 ppm for 1 hour daily for 3 days. Improve environmental conditions and increase Dissolved Oxygen (DO).

2. Columnaris Infection

Cause

It is caused by Gram – negative *Flavobacterium columnare*, which belongs to the family Flavobacteriaceae and causative agent is *Flexibacter columnaris*. Overcrowding and high temperatures (> 18°C), and physical injury due to rough handling predispose outbreaks of the disease.

Clinical signs

A systemic form characterized by sudden death. Shallow erosions of the skin, and frayed fins and eroded gills. Gills lesions are more necrotic and death more rapid, Yellow coloration of skin lesions due to hemorrhagic ulcers.

Treatment and Prevention

Avoid exposure to the disease by using disease free water or UV disinfected water

Avoid temperature of water above 18°C, crowding and rough handling.

3. Enteric Septicemia of Catfish (ESC)

Cause

It is caused by *Edwardsiella ictaluri* affecting mostly the channel catfish (*Ictalurus punctatus*). Water contamination by the organisms from feces, cannibalism of infected fish and feeding on dead and infected carcasses. The pathogen can enter the host through the gut, nasal openings and possibly the gills. Rough handling, close confinement, improper diet, low water chlorides, poor water quality and water temperature fluctuations lead to increased susceptibility to infection. Diseased or carrier fish are the main source of infection.

Clinical signs

Loss of appetite, swimming in tight circles and chasing their tails. Hang in the water column with the head up and tail down. Red circular spots (2-3 mm diameter) over the entire body, white circular spots (2-3 mm diameter), Rash and bloody plug on the base of fins, raised reddish spot on top of head, ulcerated areas on top of the head (hole-in-the-head), protruding eyes, bloated fluid filled belly (yellowish or bloody), hemorrhages in internal organs and tissue and white pustules in the liver.

Diagnosis:

Causative bacterium Isolation from the internal organs or brain tissue.

Treatment and Prevention

Terramycin 2.5 - 3.75 g/45 kg of fish given daily in feed for 10-14 days and then followed by a 21-day withdrawal period before slaughter. Sulfadimethoxine-ormetoprim 50 mg/kg of fish body weight/day given in feeds for 5 days followed by 10 days' withdrawal period before slaughter. Florfenicol 10 mg/kg/day incorporated into floating catfish feed and administered daily for 10 consecutive days followed by withdrawal period of 12 days before slaughter.

Minimize stress factors, improve proper nutrition and feeding, and vaccination practices.

4. Epitheliocystis

Cause

Chlamydia organisms are the etiological agents, which are intracellular Gram-negative bacteria. Both freshwater and marine fish are affected. Mortalities usually associated in cultured fish and infection spreads very quickly in fingerlings held in overcrowded ponds.

Clinical signs

Epithelial cells grow gradually into a grossly hypertrophic body. Severe erosion of the gill architecture which interferes with the respiratory function.

Treatment and Prevention

Furazolidone given in feed 25-35 mg/kg/day for 20 days. Reduction of stocking densities.

5. Furunculosis

Cause

Caused by *Aeromonas salmonicida* an obligate fish pathogen, Gram-negative, facultative aerobe and non-motile rod bacterium. Contaminated waters and carrier or infected fish with open sores can spread the disease. Horizontal transmission via contaminated water, eggs, carriers, equipment, clothing and surface of aquatic birds. Rapid spread of the disease and devastating losses in high density aquaculture.

Clinical signs

Large boils (sores) on the side of the fish, external and internal hemorrhaging, swelling of the vents and kidneys, ulcers, gastroenteritis and tail rot.

Diagnosis

Isolation and identification of the bacterium from the kidney tissue.

Treatment and Prevention

Sulfamerazine 10gm/45kg of fish/day for 3 weeks. Amoxicillin at a dose rate of 80 mg per kg body weight/day for 10 days. Use of clean fish water overcrowding.

6. Motile Aeromonad Infection (MAI)

Cause

The causative agents include *Aeromonas* (*A.*) *hydrophila*, *A. sobria* and *A. cavia* which are Gram-negative, rod shaped and facultative anaerobic bacteria. Opportunistic pathogens transmitted horizontally from normal flora of healthy or diseased fish, other survivors and carriers (frogs, snails, and shrimps).

Clinical signs

Hemorrhagic and necrotic lesions on the skin/muscles, superficial circular or grayish-red ulcerated lesions around mouth. Swollen and soft kidney, petechiae of musculature, absence of feed in the intestines.

Diagnosis

Symptoms, lesions and isolation of the bacterium from the kidney tissue.

Treatment and Prevention

Oxytetracycline 75mg/kg/day for 10days. Amoxicillin and Ampicillin at a rate of 40-80mg/kg/day for 10days. Improve fish farm management.

Caution: Gastroenteritis in young children and immune- compromised individuals.

7. Mycobacteriosis in Fish/Atypical Mycobacteriosis

Cause

The disease is caused by *Mycobacteriosis* (*M.*) *marinum*, *M. fortuitum* and *M. chelonae*. Infected fish are a constant source and reservoir of infection to other fish.

Clinical Signs and Lesions

Anorexia, weight loss accompanied by scale loss, ulcers or non-specific hemorrhagic lesions, spinal curvature, lethargy, loss of equilibrium, darker skin color, abdominal swelling, low level but chronic mortality, poor reproductive performance and milliary tubercle like lesions on liver, spleen and kidney.

Diagnosis

Chronic mortality, especially if accompanied by poor condition or emaciation and the existence of fish with chronic ulcers or unexplained reproductive problems can be used for presumptive diagnosis. Preliminary diagnosis is usually based on the presence of granulomatous lesions, either grossly visible or microscopic. Definitive diagnosis is based on culture using Lowenstein-Jensen medium.

Treatment and Prevention

The infected system should be depopulated and all equipment disinfected with a mycobacteriocidal agent such as Lysol® or concentrated (50 to 70 percent) ethyl alcohol. Control is usually based on thorough cleaning and disinfection of all surfaces with a mycobacteriocidal agents (e.g. Nitric oxide). Mycobacterial infection of fish are zoonotic which means the organisms can cause diseases in human.

C. FUNGAL INFECTIONS OF FRESH WATER FISH

1. Branchiomycosis/Gill Rot

Cause

Two fungal organisms associated with the occurrence of gill rot are *Branchiomyces sauguins* and *Branchiomyces demigrans*. Infection occurs primarily on the gill filaments, lamellar capillaries and other tissues of the gills, both produce branched and non-septate hyphae. Most species of freshwater fish are susceptible. There is also a strong association between outbreaks of the disease and the presence of environmental stress such as low pH, low dissolved oxygen or a high algal bloom. Fungal spores carried in the water and debris on pond bottom are sources of infection for susceptible fish. Ponds with bottom sediments rich in organic matter increases sporulation.

Clinical signs and Symptoms

Acute course of the disease will be observed during warm months and disease signs include lethargy, bright-red gills due to impaired circulation and some areas of the gills become white to brown depending on the stage of necrosis. The subacute form develops slowly and the symptoms are marbling appearance of the gill on sectioning, ragged and corroded gills. The chronic cases include signs like pale gills, swollen lamellae and slight to moderate necrosis on the gills.

Treatment and Prevention

Treatment with chemicals such as malachite green at a rate of 1.0 ppm at interval of 4-7 days and copper sulphate at 0.1-0.2 ppm are recommended. Strict sanitation and disinfection. Dead fish should be collected regularly and burned or deeply buried. Ponds with enzootic branchiomycosis should be dried and treated with calcium oxide (quicklime). Transport of the infected fish from place to place and stress factors should be avoided.

2. Saprolegniasis (Skin Fungus)

Cause

Saprolegniasis is a fungal disease of fish and fish eggs. Dead fish and fish eggs are a fertile medium for more fungal growth and production of zoospores. The disease will attack an existing injury on the fish and can spread to healthy tissue. Saprolegniasis may be secondary to other infections (like bacterial gill disease) or damage to skin, fins or gills from external parasites. Poor water quality and high organic loads.

Clinical signs and symptoms

Fluffy, cotton-like, white to gray/gray to gray-brown growth manifested on the skin, fins, gills or eyes of fish or on fish eggs. Ulcerative mycoses progress to a deep necrotic muscular lesion.

Diagnosis

Presumptive diagnosis can be achieved based on disease signs. However, identification of the fungi will be used for definitive diagnosis.

Treatment and Prevention

Improve water quality and circulation, avoid overcrowding and remove dead eggs and fish at regular intervals. Malachite Green fungicides @1.0 ppm.

3. Systemic Mycoses

Cause

Ichthyophonus hoferi infection spread by fungal cysts which are released through feces (contact with fecal materials) and by cannibalism of infected fish or consumption of infected carcass.

Clinical signs and Symptoms

Paper like texture of the skin and vertebral column. Swollen heart and brain with gray necrotic foci.

Diagnosis

Clinical signs, lesions observed at autopsy. Isolation and identification of the fungal agent.

Treatment and Prevention

Avoid feeding raw fish or raw fish products to culture fish. Drying and disinfection of ponds.

D. PARASITIC DISEASES OF FRESHWATER FISH

1. Cestode Infection

Cause

Plerocercoids larval cestodes is damaging parasite affecting vital organs such as brain, eyes or heart.

Clinical signs and Symptoms

More commonly, failure to thrive or gain weight is the most frequent sign of infection.

Diagnosis

Internal cestode parasites such as tapeworms are significantly harder to diagnose in fish. Active passing of cestode segments in feces can be very difficult to see. Positive diagnosis of cestode infection can only be made with a fresh fecal microscopic examination (identifying its characteristic egg).

Treatment and Prevention

Niclosamide given in feed at a rate of 40 mg/kg/day for 3 days Diseases.

2. Crustacea Infection

Parasitic crustacea of freshwater fish can be seen with the naked eye as they attach to the gills, body and fins of the host.

3. Leech Infestation

Leeches are members of the annelid having anterior and posterior suckers which to the side of a fish or to the inside of mouths. Secrete an anticoagulant (blood thinner) which significantly affect fish health.

Clinical Symptoms

Chronic anemia and secondary infection at the point of attachment are common.

Diagnosis

Adult leeches easy seen

E. PROTOZOA INFECTIONS OF FISH

1. Ciliates

Cause

Many of the parasites proliferate in organic debris that accumulate at the bottom of a tank or vat. Nets, hoses or caretakers' wet hands easily transmit ciliates from tank to tank.

Clinical signs and symptoms

Skin and gill irritation shown by flashing, rubbing and rapid breathing. The most common ciliates are:

A) White Spot Disease: It is caused by *Ichthyophthirius multifiliis*. It is called 'Itch'. Small blister-like raised lesions develop along the body wall and fins. If the infection is restricted to the gills, the gills will appear swollen and be covered with thick mucus without white spots.

Diagnosis: Identification of the parasite on the gills, skin and/or fins is definitive. Classically *I. multifiliis* is identified by its large horseshoe-shaped macronucleus.

B) Chilodonella: *Chilodonella* is a ciliated protozoan that causes infected fish to secrete excessive mucus. Infected fish may flash and show similar signs of irritation. Many fish die when infestations become moderate (five to nine organisms per low power field on the microscope) to heavy (greater than ten organisms per low power field).

Clinical Symptoms: Excessive mucus secretion, irritation followed by mortality.

Diagnosis: Examine scrapings of skin mucus or gill filaments microscopically.

C) Tetrahymena: *Tetrahymena* is a protozoan commonly found living in organic debris at the bottom of an aquarium or vat.

Clinical Symptoms: Exophthalmia (markedly enlarged eyes) is common symptom.

Diagnosis: Identification of *Tetrahymena*

2. Flagellates

Cause

Flagellated protozoans are small microscopic parasites that can infect fish externally and internally.

A) Hexamita / Spironucleus: *Hexamita* is an intestinal parasite commonly found in the intestinal tract of freshwater fish.

Clinical Symptoms: Thin fish with distended abdomen. The intestines may contain a yellow mucoid (mucus-like) material.

Diagnosis: Make a squash preparation from the intestine and examine it at 200 or 400x magnification. The flagellates move by spiraling.

- B) Ichthyobodo:** Ichthyobodo is a commonly encountered external flagellate. Ichthyobodo can be located on the gills, skin and fins.

Clinical Symptoms: Infected angelfish also produce excessive mucus that can give dark colored fish a gray or blue coloration along the dorsal body wall. Infected fish flash and lose condition, often characterized by a thin, unthrifty appearance.

Diagnosis: Microscopically identify Ichthyobodo by its corkscrew swimming pattern.

- C) Piscinoodinium:** Piscinoodinium is a sedentary flagellate that attaches to the skin, fins and gills of fish. The common name for Piscinoodinium infection is “Gold Dust” or “Velvet” Disease. Piscinoodinium is most pathogenic to young fish. The life cycle of this parasite can be completed in 10-14 days at 73-77°F, but lower temperatures can slow the life cycle.

Clinical Symptoms: The parasite has an amber pigment, visible on heavily infected fish. Affected fish will flash, go off feed and die. There is amber pigment on the skin.

Diagnosis: Identification and signs on the skin.

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ANNEX I: VETERINARY MEDICINES PRESCRIPTION FORM

Prescription Ser. No, 000000

Name and Level of Animal Health _____

Institution _____

Owner's Name _____

Address _____ Tel _____

Species of animal _____ Age: _____ Sex _____

Body weight _____ ID No. _____ Case No. _____

Diagnosis _____ Treatment prescribed

(name, strength, dosage form, dosage and quantity
of drug) _____

Withdrawal period _____

Prescriber's _____

Dispenser's _____

Name _____

Qualification _____

Registration no. _____

Signature _____

Date _____

ANNEX II: RELEVANT DEFINITION

Antimicrobials: Antimicrobials are agents used to prevent, control and treat infectious diseases in humans, animals and plants. They include antibiotics, fungicides, antiviral agents and parasiticides. Disinfectants, antiseptics, other pharmaceuticals and natural products may also have antimicrobial properties.

Antimicrobial resistance (AMR): Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi and parasites no longer respond to antimicrobial agents. As a result of drug resistance, antibiotics and other antimicrobial agents become ineffective and infections become difficult or impossible to treat, increasing the risk of disease spread, severe illness and death.

Active substance or ingredient: Any substance or combination of substances used in a finished pharmaceutical product intended to furnish pharmacological activity or otherwise have direct effect in the diagnosis, cure, mitigation, treatment or prevention of disease, or to have direct effect in restoring, correcting or modifying physiological functions in animals;

Adverse drug reaction: is unfavorable and unintended effect that occurs after the use of or exposure to veterinary drugs.

Biological product: means reagents, sera, attenuated or killed vaccines or microbial genetic material used for the diagnosis, prevention or treatment of animal diseases;

Contraindication: is a condition or factor that serves as a reason to withhold a certain medical treatment. It is a specific situation in which a drug, procedure, or surgery should not be used because it may be harmful to the patient;

Dispenser: Any person who is licensed or authorized by the appropriate body to dispense veterinary drugs and/or medical supplies;

Dispensing: The act of preparing veterinary drugs and/or medical supplies and distributing to users with adequate information, counselling and appropriate follow up;

Dosage interval: is the time interval between successive dosages;

Dosage regimen: is the schedule of doses of a therapeutic agent including name, dose, frequency, duration and route of administration of the drug;

Dose: is the amount of a drug to be administered at one time to bring a desired therapeutic response in a patient;

Drug Interaction: is the modification of the effect of one drug by the prior or concomitant administration of another drugs or feed or herbs.

Excipients: are inert substances added to the pharmaceutical preparations either to add the bulk of the active drug or to mask unpleasant taste (lactose, calcium lactate, starch and so on);

Indication: is a valid reason to use a certain drug for the diagnosis, prophylaxis or treatment of diseases;

Label: Any material which is printed or fixed to a packing material which provides the necessary information about veterinary drugs and includes an insert (leaflet);

Loading dose: is one or a series of doses that may be given at the onset of therapy with the aim of achieving the target concentration rapidly;

Maintenance doses: are series of repetitive doses or as a continuous infusion to maintain a steady-state concentration of a drug;

Over-the-counter veterinary drugs: veterinary drugs that can be dispensed without prescription;

Owner: any person who is responsible for the patient animal and who bring it to the veterinary clinic and purchases the prescribed and/or over-the-counter veterinary drugs from the veterinary pharmacy;

Packing material: means any material that may be used for filling, inserting or wrapping or packing veterinary drug and includes immediate container and other materials for wrapping the product;

Patient animal: An animal presenting to an authorized animal health care provider to prevent or treat disease;

Precautions: are situations in which the drug should be used cautiously because there may be adverse reaction in that situation;

Pre-packaging: Repackaging of veterinary drugs into usable quantities before they are requested by animal owners (users);

Prescriber: Any animal health practitioner who is licensed or authorized by the appropriate body to write a prescription;

Prescription only veterinary drugs: veterinary drugs dispensed only with prescription;

Prescription: Any order for veterinary drug written and signed by a duly licensed or authorized animal health practitioner issued to an animal patient in order to collect medicine from veterinary drugs dispensing outlet;

Repackaging: Packing of any processed or semi -processed medicine by a different manufacturing company in any

Shelf-life: The length of time a veterinary drug may remain on the shelf, in the original package and under usual environmental conditions and retain an acceptable level of its original potency and overall quality.

Side effects: are unwanted but often unavoidable effects that occur at therapeutic dose. Example: Atropine is a pre-anesthetic drug used to reduce secretion but causes dryness of the mouth as side effect;

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent.

The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate changes and contributing to sustainable development.

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