Thesis Ref no____

ADDIS ABABA UNIVERSITY

COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE

DEPARTMENT OF CLINICAL STUDIES

CLINICAL CASE STUDIES ON SELECTED DISEASES OF VETERINARY IMPORTANCE AND EVALUATING SMARTPHONE BASED MOBILE APP ‘ EDDiE’ AS A DIAGNOSTIC TOOL IN AND AROUND BISHOFTU, CENTERAL OROMIA, ETHIOPIA

MVSc THESIS

BY:

TOLESA EBISA

MVSc PROGRAM IN VETERINARY CLINICAL MEDICINE

AUGUST, 2021

BISHOFTU, ETHIOPIA

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A thesis submitted to College of Veterinary Medicine and Agriculture of Addis Ababa University for partial fulfillment of the requirements for the degree of master of Veterinary Science in Veterinary Clinical Medicine

By:

Tolesa Ebisa

Advisors: Dr. Sisay Girma (Assist.Prof; MSc, Boimedical Sciences)

Takele Beyene (Associate Professor; MSc Pharmacology)

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Submitted by: Tolesa Ebisa Ayana _____ _____

Name of Student Signature Date

Approved for submittal to Msc thesis research assessment committee:

1. Dr Sisay Girma (MSc, Assistant Professor) _____ _____

Major advisor

2. Mr Takele Beyene (MSc, Associate Professor) _____ _____

Co-advisor Signature Date

3. Dr Hailelul Niguse (DVM, MVSc, PHD, Associate Professor)

Department chairperson _____ _____

Signature Date

APPROVAL

Addis Ababa University

College of Veterinary Medicine and Agriculture

As members of the Examining Board of the final MVSc open defence, we certify that

We have read and evaluated the Thesis prepared by: Tolesa Ebisa Ayana entitled

CLINICAL CASE STUDIES ON SELECTED DISEASES OF VETERINARY IMPORTANCE AND EVALUATING SMARTPHONE BASED MOBILE APP ' EDDiE' AS A DIAGNOSTIC TOOL IN AND AROUND BISHOFTU, CENTRAL OROMIA, ETHIOPIA and recommend that it be accepted as fulfilling the thesis requirement for the degree of: Masters of Science in Veterinary clinical Medicine

Dr. _____ _____ _____

Chairman signature Date

Dr._____ _____ _____

External examiner signature Date

Dr._____ _____ _____

Internal examiner signature Date

1. Dr Sisay Girma (MSc, Assistant Professor) _____ _____

Major advisor signature Date

2. Mr Takele Beyene (MSc, Associate Professor) _____ _____

Co-advisor Signature Date

3. Dr Hailelul Niguse (DVM, MVSc, PHD, Associate Professor)

Department chairperson _____ _____

Signature Date

DEDICATION

I dedicated this thesis manuscript to all my families particularly my wife for her continuous love, appreciation, encouragement, moral, and financial support during my studies. Thank you my love (Gaadduu) for you all can never be quantified. God bless you

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my own original work and all sources of materials used for this thesis have been properly acknowledged. I strongly declare that this thesis has not been presented or submitted for any academic degree in any University or research inistitution. This thesis has been submitted in partial fulfilment of the requirements for an advanced (MVSc) degree at the Addis Ababa University and is deposited at the University Library to be made available to borrowers under rules of the Library.

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Name: Tolesa Ebisa Ayana Signature: _____

College of Veterinary Medicine and Agriculture, Bishoftu

Date of submission August, 2021

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ACKNOWLEDGEMENTS

First and foremost, praises and thanks to the God, the Almighty, for His showers of blessings throughout my research work to complete the research successfully.

Besides my advisor (Dr Sisay Girma), I would like to express my deep and sincere gratitude to my research Co-advisor Takele Beyene Tufa |MSc, Associate Professor| for providing invaluable guidance throughout this research. His dynamism, vision, sincerity and motivation have deeply inspired me. He has taught me the methodology to carry out the research and to present the research works as clearly as possible.

I am extending my heartfelt thanks to my wife (Gaadduu) for her love, prayers, caring and sacrifices to educating and preparing me for our future. I am very much thankful to my parents for their love, understanding, prayers and continuing support to complete this research work.

I would also like to thank the research team members of EDDiE mobile app developers. This research was supported both financially and supplying a mobile app "EDDiE" by the project entitled "*Investigation of major transboundary animal diseases affecting export trade and improvement of healthcare decision-making and veterinary medicinal products usage reporting system in Ethiopia"('**TAD-HCS')** and VetEDDiE App Development*" funded by the Addis Ababa University, Ethiopian Biotechnology Institute, and Brooke-Ethiopia.

Finally, my thanks go to all CVMA staff particularly, Veterinary Teaching Hospital colleagues, Spana workers, biomedical, microbiology and parastilogy laboratory workers who have supported me to complete the research work directly or indirectly.

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LIST OF ABBREVIATIONS

AGID	Agar gel immuno diffusion test
ARC	agricultural research center
CCPP	Contagious caprine pleura pneumonia
CLA	caseous lymphadenitis
CMT	California mastitis test
CPV	Canine parvo virus
CSA	Centeral statistical agency
CVMA,AAU	College of veterinary medicine Addis Ababa University
DS	Donkey Sancuatary
EDDIE	Ethiopia differential diagnosis and investigation center
EFSA	European Food Safety Authority
EFSA	European food safety authorities
EHEC	Entero hemorrhagic e-coli
EIEC	Enteroinvasive e-coli
EPEC	Enteropathogenic e-coli
ETEC	Eterotoxigenic e-coli
FAO	Food and agricultural organization
FMD	Foot and mouth disease
FSPH	Food security and public health
GDP	Growth domestic product
HCF	Histoplasma capsulatum var farciminosum
IMI	Intra Mammary Infusion
LSD	Lumpy skin disease
NB	Nutrient broth
NCD	new castle disease
NMSA	National Meterological Service Agency
NVI	National veterinary inistitute
OIE	Office International des E´pizooties
PCR	Polymerase chain reaction
PPR	Petides petiti ruminants
SCC	somatic cell count
SGP	sheep and goat pox
SPANA	Society for the Protection of Animal Abroad
TSB	Tyrophtan Soyan Broth
VTH	Veterinary teaching hospital
WHO	World health organization
XLD	Xylosine Lysine Deoxycalete

ABSTRACT

Livestock provides crucial contributions to human wellbeing. Ethiopia possesses the largest livestock population in Africa. Despite of having a large number of livestock, Ethiopia is not optimally utilizing the sector due to low productivity and a wide range of disease prevalence. Treatment of ailing animals in Ethiopia had gotten fewer attention years ago because the health policies give more attention to preventive medicine. The present case study was conducted from November 2020 to June 2021 at VTH and SPANA of AAU-CVMA, Bishoftu, and its surroundings to study different clinical cases of various infectious and non-infectious diseases and their therapeutic management in different species of animals of different ages and different physiological status using detailed physical and clinical examinations of animals together with Ethiopia differential diagnosis and investigation center (EDDiE) as a diagnostic tool. Therapeutic management of animals was based on tentative diagnosis using broad-spectrum antimicrobials and supportive drugs based on the manufacturer's instructions. For a definitive diagnosis, following laboratory standards samples were collected from tentatively diagnosed animals and then further processed. To check the recovery status of animals' routine follow-up was continued at the clinic during the successive therapies, through a telephone conversation, or at home with prolonged recovery. A total of 19 different cases, 24 animals were examined of which 70.8% (17/24) were ruminants while 29.2% (7/24) were equine, canine, and poultry. Among these, 36.8 % (7/19), 31.6 % (6/19), 10.5 % (2/19), 5.3% (1/19), 15.8% (3/19), of the diseases were caused by bacteria, virus, parasites, fungal, and metabolic, respectively based on clinical pictures, therapeutic responses, and laboratory results. Among the treated animals 83.3% (20/24) were recovered, 8.3 % (2/24) (dog & donkey) died and 8.3% (2/24) passed for postmortem. From a total of 19 cases, in 13 (68.4%) cases; the EDDiE diagnosis was matched with the laboratory confirmation of the case, but in 6 (31.6%) of cases EDDiE was not matched with laboratory results on confirmation. In conclusion, this case study revealed bacteria and viruses followed by parasites were the most common pathogen causing disease in animals. Appropriate management and rational drug use revealed the highest proportion of animals' recovery and awering community in disease prevention and control method was forwarded.

Keywords: *AAU-CVMA, Animals, Bishoftu, Case Studies, Disease, EDDIE, health, Spana, treatment, VT*

1. INTRODUCTION

Globally the livestock sector is highly dynamic, accounts for 40 percent of the agricultural GDP, nearly 20 percent of total GDP, and 20 percent of national foreign exchange earnings by supporting the livelihoods and food security of almost a billion people according to the estimated made in 2017 (Panel Malabo Montpellier, 2020; Thornton,2010). These estimates highlight the important contribution of livestock to sustainable agricultural development. The contribution of livestock to the world's population plays important economic and socio-cultural roles in the wellbeing of rural households as a source of monetary income, food, and nutritional security, agricultural diversification and sustainable agricultural production (Chilonda and Otte, 2006).

Optimization of livestock's contribution to the livelihoods of developing communities requires an understanding of livestock's multiple and complex roles. The contribution of food from animal origin to the nutritional status of the world population is well documented. They raise the social status of owners and contribute to gender balance by affording women and children the opportunity to own livestock, especially small stock (Freeman *et al*., 2007; Letty and Waters-Bayer, 2010).

Livestock make crucial contributions to the human livelihoods of a large proportion of rural households in most African countries and it is believed to play a paramount role in rural poverty reduction strategies in terms of proteinacious food (Murcia *et al*., 2009), income generation to millions of households, an asset of wealth for savings, transportation and draught service, manure for crop production and soil fertility (Shapiro *et al*., 2017), and skin and fur for further processing (Andersson, 2016). In agricultural development, Livestock production has been considered a multi functional activity and plays a crucial role both in national economies and the livelihood of rural communities in most parts of Sub-Saharan Africa (Gelan *et al*., 2012; FAO, 2009).

Ethiopia is endowed with the most abundant livestock population in Africa (Getachew *et al*., 2018), with approximately sixty-three million cattle, thirty-one million sheep and thirty-three million goats, and sixty-one million chickens in 2018 (MOARD, 2018). Despite of having a large number of livestock, Ethiopia is not optimally utilizing the sector due to low productivity and,

consequently, income generated from this sector could not bring meaningful improvements in the development of the country's economy. High disease incidence and parasite burden, poor reproductive performance (Gebremedhin, 2007), reduced genetic potential of indigenous cattle, shortage of feed in quantity and quality, inadequate health care and management measures are the main factors contributing to low productivity (Getachew *et al*., 2018). Among these constraints, diseases have numerous influences on the productivity and fertility of herds. The effect of livestock diseases could be expressed in terms of losses due to mortality, loss of weight, minimal outputs, poor fertility and decrease physical power (Haftu *et al*., 2014).

Direct economic losses in livestock are caused by the widespread prevalence of a wide range of diseases and parasites in all agro-ecological zones through high mortality and poor productive and reproductive performance of the animals. The annual mortality of livestock is estimated to be 8-10%, 14-16%, and 11-13%, for cattle, sheep, and goats respectively under Ethiopian conditions (Asresie and Zemedu, 2015). Various bacterial, viral, protozoal, and parasites are frequently encountered livestock diseases all over the country and account for the momentous economic losses (Abdeta *et al*., 2015).

To assist in the development of animal health strategies and the selections of possible interventions that will ultimately assist in poverty alleviation, identifying the type of common and major health problems is very important. The veterinary clinic is an ideal and reliable source of information about animal diseases and their treatment. People residing within the catchment areas of the clinics often bring their animals to the clinics to seek diagnosis, treatment, and advice on the management of various diseases. In addition to the catalog of the diseases obtained from the clinics, knowledge on disease occurrence patterns can retrieve from such data. When sufficient information is gathered on important diseases the knowledge stored can be used to resolve animal health problems in areas where they occur. Clinical records of the Veterinary Teaching Hospitals are one rich source of data on disease occurrence particularly if they use appropriate techniques and technologies for disease diagnosis and recording (Haftu *et al*., 2014).

Among important technologies; diagnosis through Smartphone-based mobile applications is a common one. The application and use of Smartphone technology have been explored in the field

of public health care and community-based reporting within low resource settings. Such tools and services namely disease diagnosis, treatment and surveillance have been proposed as a means to substantially improve animal health recording, reporting, and surveillance in developing countries, but few detailed field-based trials have been reported in the literature. The use of a previously developed Smartphone application, whose main aim is to assist cattle disease diagnosis, was assessed in terms of its utility for disease reporting, with the outcomes for its use in the field being compared with the traditional manual disease reporting system (Beyene *et al*., 2018).

To detect disease outbreaks and implementing appropriate measures for their control accurate disease diagnosis and reporting is a prerequisite. Protecting animal health requires adequate disease reporting and surveillance to allow appropriate action to be taken to mitigate potential risks quickly and effectively. Timely planned and accurate diagnosis at the animal health center is critical to support continuous improvements in animal health and in detecting outbreaks of diseases. More information is required to describe the pattern of occurrence of clinical diseases for the provision of appropriate veterinary care and an effective disease control program. However, the current approach taken to animal health services in Ethiopia at different animal health centers is based on paper-based reports often prepared monthly that depends on tentative diagnosis which lacks accurateness on a diagnosis of the disease due to lack of laboratory facilities and financial constraints leads to misdiagnosis of the disease and inappropriate managements (Beyene *et al*., 2018). To improve constraints of livestock health surveillances, Ethiopian differential diagnosis and information environment 'EDDiE' was launched and funded by Addis Ababa University, Ethiopian Biotechnology Institute, and Brooke-Ethiopia to diagnose and describe diseases appropriately.

Therefore the objectives of this research were:

General objective

- ✓ To study disease of major veterinary importance at animal health facilities assisted with a mobile app 'EDDiE' in and around Bishoftu, Central Oromia, Ethiopia assisted

Specific objectives

- ✓ To describe clinical manifestations, diagnosis, differential diagnosis, treatment, treatment with the outcome, control, and prevention of each clinical cases
- ✓ To evaluate the accuracy of the smartphone-based mobile app "EDDiE" as a tool in assisting the diagnosis of livestock diseases.
- ✓ To give evidence-based therapy and recommendation based on the finding
- ✓ To confirm the cause of each disease, provide suitable therapy and recommendations in response to the findings.

2. MATERIAL AND METHODS

2.1. Study Area

The study was conducted from November 2020 to June 2021 on Clinical Case Studies on Selected Diseases of Veterinary importance and evaluating smartphone-based mobile app 'EDDiE' as a diagnostic tool in and around Bishoftu, Central Oromia Ethiopia. Bishoftu is located 47 km southeast of the capital of Ethiopia, Addis Ababa. Geographically it is situated at 8° 44' 4.7400" N latitude and 39° 0' 30.7188" E longitude and an altitude of 1870 meters above sea level in the central highlands of Ethiopia. The average maximum and minimum temperature of the area are 34.7 °C and 8.5 °C respectively, and the average relative humidity is 61.3%. The rainfall is bimodal. The town receives an annual rainfall of 1151.6 mm of which 84% is received during the long rainy season covering June to September and the rest in the short rainy season extending from March to May. Farmers in the vicinity of Bishoftu town use a mixed crop and livestock farming system. Moreover, Bishoftu and its surroundings have variable and yet representative agro-ecologies of the country (NMSA, 2020).

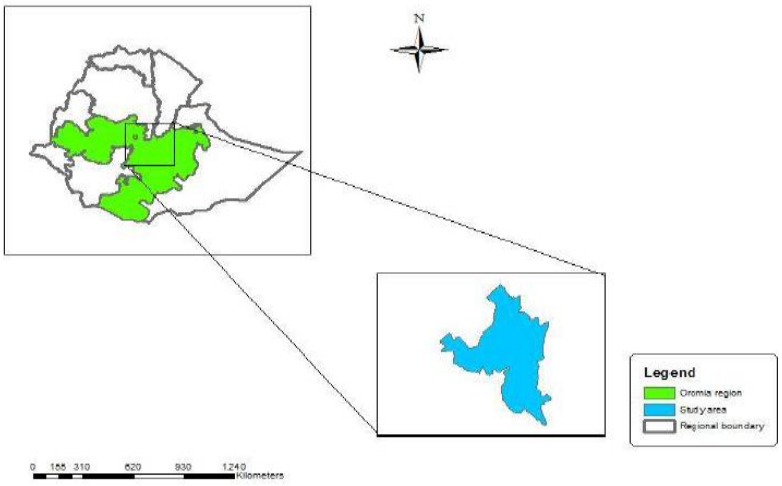


Figure 1: Geographical location of the study area (Yonas *et al*., 2020).

2.2. Study Design and Study Population

A descriptive Case study was conducted to study different clinical case reports and its outcome from November 2020 to June 2021. The purposive sampling technique was used on animals coming to the clinics. The study animals were domestic animals of different species, breeds and ages with sex categories originated from different management systems and admitted to animal health facilities in and around Bishoftu, central Ethiopia. To report important encountered clinical diseases and disorders in animals during the study period, a detailed description of species, parameters, the symptoms, diagnosis, differential diagnosis, treatment, and follow-up of an individual patient animal was recorded.

2.3. Study method

Various domestic animals were admitted to Veterinary Teaching Hospital and other animal health facilities in and around Bishoftu town with various clinical cases were and recorded. The client's name, address, phone number, patient signalment (species, breed, sex, age, weight, and body condition) were recorded before the clinical examination. Available past and present history of every case of domestic animals were chronologically inquired by using formal languages. Furthermore, vital signs: respiratory rate, heart rate, pulse rate, rectal temperature, the color of the visible mucus membrane, rumen motility, and palpation of accessible superficial lymph nodes were recorded. The exploratory puncture was also performed to inspect the nature of the existed contents in the examined mass to support a differential diagnosis. General medical examination and specific clinical findings were examined to help determine a diagnosis and devise the management plan. Based on the availability of reagents and facilities, laboratory examinations of tentatively suspected cases of bacterial, viral, parasitological, and protozoal were conducted. Finally, all relevant information to every case was arranged and interpreted then appropriate therapeutic management continued.

2.4. Case Handling Protocols

Clinical case recording format (Addis Ababa University) and clinical case handling protocol (Jana and Ghosh, 2013) was used in this case study as indicated in Annex part (Annex 1 and Annex 2) respectively.

2.4.1. History taking/anamnesis

Disease problems in veterinary medicine are invariably presented to the clinician through the medium of the owner's complaint, which is a request for professional assistance. The owner is the best link between clinician and patient animals, so appropriate anamnesis are very important in disease diagnosis. For completeness and accuracy of history taking, the following points should be well considered (Patient data, Immediate/present history, past history, management, and Environment history) and the history of each case was carefully taken which gave a guideline for examination of the animals (Duguma, 2016).

2.4.2. Physical and General Examination

Visual examination of the patient revealed the following: physical condition, behavior, posture, gait, superficial skin wound, prolapsed uterus and vagina, salivation, nasal discharge, abdominal distension, and locomotive disruption. Palpation, percussion, auscultation, and needling were used to investigate various sections and systems of the bodies of each of the sick animals. Palpation, percussion, auscultation, and needling were used to evaluate different sections and systems of the body of each of the sick animals. The temperature, pulse, and respiratory rates of each sick animal were recorded. Clinical examinations of all livestock of different ages were conducted based on diseases history, owner complaint, symptoms, to diagnose diseases and disorders (Kabir *et al*., 2010).

2.4.3. Smartphone-based App 'EDDiE' diagnosis and laboratory investigation

In addition to clinical examination; the application of a smartphone-based mobile app as a diagnostic aid tool was used in this research and laboratory techniques were also performed to confirm the individual cases. In this research, the EDDiE app (Ethiopian differential diagnosis

and information environment) was developed by Tufa *et al.* (2020) http://vet-eddie.com/cases/case.php that supports livestock disease diagnosis, treatment, and surveillance. In this study, we evaluated the accuracy of the app compared with expert's tentative diagnoses and laboratory results. Different data with species of animals excluding pet and poultry, clinical signs, disease, and treatment of each disease were recorded on (EDDIE). Based on the data recorded by the EDDiE the diagnosis of the disease, ranking of differential diseases diagnosis (%) and its treatment was recorded. How EDDiE works were mentioned under annex 5. In the end, clinician's/veterinarian's tentative disease diagnosis was compared with the EDDiE app result.

For confirmation, the appropriate samples were collected from tentatively diagnosed cases (by a clinician) from the study sites and transported to Addis Ababa University College of Veterinary Medicine and Agriculture laboratories (Biomedical, Parasitological, and Pathology), National veterinary institute, and NAHDIC. From this result, the use of the app in animal disease diagnosis was evaluated and compared with the gold standard laboratory finding and used to confirm the underlying causes for each disease.

2.4. Ethical Consideration

Before starting the research a nine pages request that explained the purpose of this study and the possibility management planned to reduce pain and suffering of animals during sampling was submitted to Addis Ababa University College of veterinary medicine and agriculture minutes of the animal research ethics and review committee. After the committee evaluated the importance of this study through different aspects, the approval committee was informed us ethical clearance was not mandatory for the discipline.

3. VARIOUS COMPILED AND REPORTED CLINICAL CASES

3.1. Foot and Mouth Disease: A case in Exotic Bull

Abstract

Foot-and-Mouth Disease (FMD) is the most important viral disease and is considered as a constraint to international trade. A current clinical case report was conducted at Veterinary Teaching Hospital (VTH) of AAU-CVMA on December 22, 2020by presenting a-five year's old exotic bull with complaints of excessive drooling of saliva, depression, reluctance to move, and inappetence with difficulty in the mastication. Physical examination revealed, febrile rectal temperature of 40.5^0C, shivering, drooling of saliva, and the formation of blisters or vesicles with an erosion of the tongue and the gum. The EDDiE App assisting diagnosis revealed the case as FMD. The active vesicular lesion was aseptically taken from the tongue using sterile transport media (VTM) and sent to NAHDIC for further confirmation and the result of PCR was positive to FMD. As differential diagnosis Rinderpest and Bovine papular stomatitis were listed. The case was managed by Oxytetracycline 20%; 20mg/kg/day with Flunixin meglumine 2.2mg/kg. After a follow-up of treatment, the bull was completely recovered. Foot and mouth disease is a highly contagious and economically important trans-boundary animal disease. Therefore, isolation and quarantine of infected animals and vaccination of apparently healthy herds were measures to be taken for control and prevention of animals from FMD virus infection.

Key words: Exotic bull, FMD, NAHDIC, treatment

3.1.1. Introduction

Among the livestock diseases hampering the productivity of the sector foot mouth disease is considered as a bottleneck to livestock production and its prompting trade embargos for livestock and livestock products (Anonymous, 1998b). Foot-and-Mouth Disease virus (FMDV) is the most extremely contagious viral disease of animals or humans trans-boundary animal disease affecting all cloven-hoofed animals artiodactylae, mostly cattle, swine, sheep, goats, and many species of wild ungulates, and FMDV rapidly replicates and spreads within the infected animal, among in-

contact susceptible animals, and by aerosol (Brooksby, 1982). It is considered as the most important constraint to international trade in animals and animal products; hence it's recognized as list A of infectious diseases of animals of the Office International des E´pizooties/OIE (Leforban Y, 1999).

It is caused by genus *Aphthous virus* known as foot and mouth disease virus, which is an RNA virus, a positive sense, single-stranded, a small non-enveloped belongs to family Picornaviridae and the first filterable viral agent to cause animal disease (Alshawkamy A *et al*., 2012) and have seven antigenically different serotypes such as A, O, C, and Southern African Territeries (SAT) 1, SAT2, SAT3 and Asia1 as well as over 60 subtypes. Except for Japan, New Zealand, Australia, and some other countries FMDV are distributed in Africa, Asia, South America, and parts of Europe (FAO, 2004). New virus strains can emerge and evolve regularly and give rise to successive waves of infection, which sometimes spill over into FMD- free regions. Vaccination with killed vaccines is used on a large scale but the immunity induced is short-lived and is serotype and sometimes strain-specific (de Los Santos *et al*., 2017).

The major means of transmission are aerosol in which animal-to-animal spread within premises. The disease is characterized by fever, loss of appetite, salivation, vesicular eruptions in the mouth, on the feet and teats, and sudden death of young stock (Quinn PJ *et al*., 2005). The recovered animals remain in poor physical condition over long periods leading to economic losses for livestock industries (Barecha B *et al*., 2011). Four of the seven serotypes of FMDV (O, A, SAT 1, SAT 2) are currently endemic in Ethiopia, while serotype C was last diagnosed in (Mekonen H *et al*., 2011). Studies undertaken on FMD so far revealed the existence of the disease in different parts of the country, with seroprevalence varying from 8.18% in south Omo to 44.2% selected districts of Afar Pastoral Area (Desissa F *et al*., 2014).

Transmission Susceptible animals are infected through direct or indirect contact with infected animals or other objects exposed to live viruses. The most common route of infection of susceptible animals is by direct contact, either by mechanical transfer or by aerosol infection. Oral transmission is also possible especially when the animal has damaged skin in and around the mouth as well as on pre-existing abrasions on animals (Alexanderson S *et al*., 2003b). Some

cases of airborne transmission as far as 300km from the source of infection have been described (Sorenson J *et al*., 2000, Sorenson J *et al*., 2001). Pigs are more likely to get infected by eating contaminated food (Alexanderson S *et al*., 2002).

Pathogenesis: FMD virus Infection of cattle generally occurs via the respiratory route by an aerosolized virus, and can also occur through abrasions on the skin or mucous membranes, but is very inefficient, requiring almost 10,000 times more virus (Donaldson, 1987), then virus excreted into milk of dairy as well as in urine, semen and feces of animals as a result calves can acquire a virus via inhalation of infected the milk of virus (Burrows, 1968; Hyde *et al*., 1975). Aerosol infection is also due to the excretion of large amounts of the virus by infected cattle which can infect other cattle in addition to other species (Sorensen *et al*., 2000). The lung or pharyngeal areas are suggested by several studies as the sites of initial virus replication, with the highly rapid dissemination of the virus to oral and pedal epithelial areas, probably mediated by cells of monocyte/macrophage origin (Brown *et al*., 1992). Following the dissemination of the virus to the replication area, Vesicles start to develop at multiple sites, generally on the feet and tongue, and are usually preceded by fever. Areas subjected to trauma or physical stress, and most animals that develop viremia were characterized by Severe lesions often occur. Depending on the infecting dose and route of infection, the incubation period can be between 2 and 14 days (Gailiunas and Cottral, 1966).

Clinical sign: FMD is characterized by fever, shivering, drooling of saliva, and the formation of blisters or vesicles on the epithelium of the tongue, nose, coronary bands, and teats as a result of the replication of FMDV (Donaldson and Sellers, 2000). The vesicles are packed with virus particles, as many as 108 per ml. Loss of epithelium are most pronounced on the upper dorsal surface of the tongue, and its desquamation leaves a raw red surface that bleeds easily. Most affected animals will recover within 2 weeks of the onset of symptoms. Secondary bacterial infections of desquamated tissues may delay recovery. The mortality rate for mature animals seldom exceeds 5%, but young animals may have mortality rates as high as 50%. The disease varies somewhat with the species of animals but in general is similar to that of cattle and swine (Geering, 1967).

Diagnosis and differential diagnosis: FMD case was diagnosed based on the chief complaints of the owner and clinical signs observed at the time are considered as a major suggestive option for the diagnosis. Additionally based on diagnostic assisting tools of the disease EDDiE aids FMD was diagnosed. FMD was confused with vesicular stomatitis (VS) and swine vesicular disease (SVD), additionally other infectious agents can cause stomatitis, e.g. the viruses of mucosal disease (MD), malignant catarrhal fever (MCF), rinderpest, peste des petits ruminants (PPR), papular stomatitis, Orf, blue tongue (BT) and epizootic haemorrhagic disease (EHD) were listed as differential diagnosis (Quinn PJ *et al*., 2005).

3.1.2. Case description on FMD

A-five years old exotic Bull was presented to the VTH of AAU-CVMA on December 22, 2020 with the history following heavy rainfall the bull shows excessive drooling of saliva, depression reluctance to move, and inappetence with difficulty in the mastication. The owner complains that the bull has no history of vaccination before a year and the disease condition occurred in the surrounding area before two weeks even there was communal grazing and watering points with infected herds of cattle extensively managed at the field. After routine physical examination, it revealed temp of 40.5^{0}C (Figure 2A), RR-67bts/min, HR- 36beats/min, fever, shivering, drooling of saliva (Figure 2B), and the formation of blisters or vesicles on the epithelium with an erosion of the tongue (Figure 2C) and the gum (Figure 2D), nose, coronary bands as indicated from the figure below was examined. The EDDiE aids App reveals the diagnosis of the case as FMD virus. Based on the chief complaints of the owner, clinical signs of the case were presented and the EDDiE aids App the case was tentatively diagnosed as FMD virus. For confirmatory diagnosis, epithelial tissue samples were collected from unruptured and freshly ruptured vesicles and sent to NAHDIC by viral transport media. Infectious bovine rhinotracheitis, Rinderpest, Bluetongue, Bovine papular stomatitis, and malignant catarrhal fever (MCF) were listed as differential diagnoses.

Figure 2: Pictorial presentations of the clinical findings during clinical examination of bull infected by FMD: A) The febrile reaction; B) excessive drooling of saliva, vesicular erosoin of the tongue (figure2C) and D) the gums

3.1.3. Laboratory investigation and its findings

Epithelial tissue samples were collected from unruptured and freshly ruptured vesicles and kept in 0.04 M phosphate buffer with 50% glycerol (VTM). Then, the samples were labeled and kept on the cold chain during transportation to NAHDIC, Sebeta, where they were kept at -80 °C until processed. Cell cultures were examined for evidence of cytopathic effect (CPE) and PCR for molecular identification of FMDv was conducted and the result of PCR showed the presence of positive FMD virus at CT value of 21 (Figure 3).

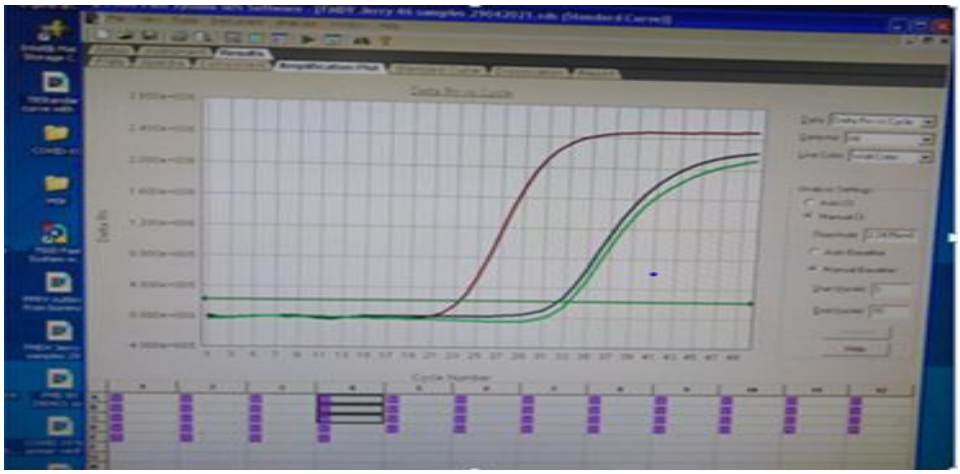
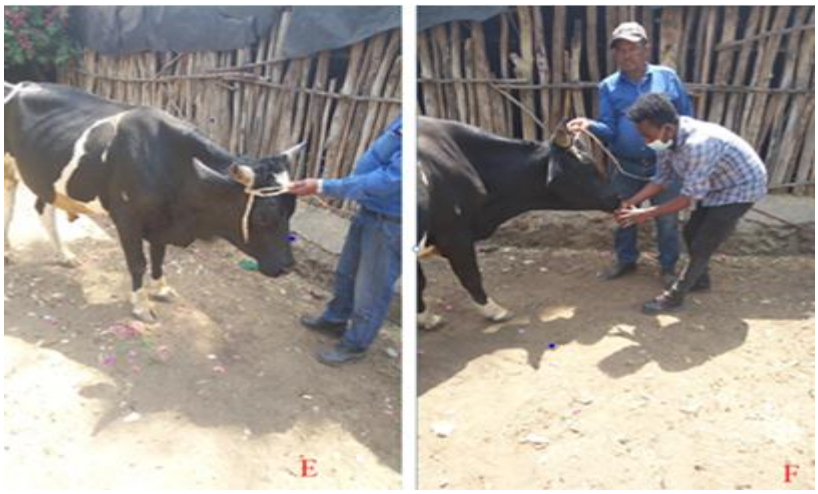


Figure 3: PCR positive of FMD suspected case at CT value of 21 and bull fully recovered from FMD after treatment & management of two weeks below.



3.1.4. Treatment outcome and follow up

Specifically, there is no antibiotic-based treatment for viral disease particularly for FMD virus; however, using iodine tincture we disinfect the erosion of the tongue and the gum to minimize viral load and formation of blisters or vesicles. Flunixin meglumine (Bimeda-MTC Animal Health Inc.Cambridge, Canada) 2.2mg/Kg/day, IM 3days for the control of pyrexia and inflammation associated with FMDV infection and Oxytetracycline 20%; 20mg/kg (Shanghai Thongren Pharmaceutical Co., Ltd, China), IM for prevention of secondary bacterial

complication were administered. After therapeutic management, the bull was fully recovered from the previous problem as indicated in (Figure 3 (E&F)) after follow-up of two weeks.

3.1.5. Discussion

Globally Foot and Mouth Disease (FMD) is a highly contagious transboundary viral disease that affects all cloven-hoofed animals particularly cattle, caused by a virus that belongs to the genus Aphthovirus of the family Picornaviridae with seven standard serotypes: A, O, C, and South African Territories (SAT) 1, SAT 2, SAT 3, and Asia1 (Dabasa and Abunna, 2021). Since the introduction of FMD virus restrict or ban imports of livestock products and sometimes other products, its considered as a potential threat of economic impact to Ethiopia's live animal export trade as a restriction to international trade (Abdela, 2017). The disease is characterized by fever, shivering, drooling of saliva, and the formation of blisters or vesicles on the epithelium of the tongue, a nose which is in agreement with the report of Donaldson and Sellers, (2000) in which infected cattle with FMD shows similar clinical manifestation with this current case report.

The main route for transmissions of the virus follows direct or indirect contact with infected animals or other objects exposed to live viruses, either by mechanical transfer or by aerosol infection. Oral transmission is also possible especially when the animal has damaged skin in and around the mouth as well as on pre-existing abrasions on animals as Alexanderson S et al. (2003b) reported. As a report of Sorenson J *et al*. (2001), airborne transmissions by far 300km from the source of infection, have been described and Alexanderson S *et al*. (2003b), discussed inhalation of an aerosolized virus is also a common mode of transmission for cattle.

The current clinical case report was finally diagnosed based on the clinical findings; EDDiE App diagnostic tools and laboratory findings in which the case report was in agreement with Rahman *et al*. (2012) in which diagnosis of each of the clinical cases was made on physical examination, clinical examination, and using common laboratory techniques. Clinical specimens from ruptured and unruptured vesicles were collected and sent for confirmation to NAHDIC and the result of molecular PCR assay was indicated positive result in line with the report of (Tesfaye *et al*., 2020) that FMDVs were isolated and characterized by using reverse transcription-polymerase chain reaction (RT-PCR).

For the management and prevention of the disease, vaccination is the only solution that is in agreement with the report of Admassu *et al*. (2015) that quarantine, isolation of infected animals, vaccination programs, and proper disposal of infected carcass practiced for FMD control in Ethiopia context. General vaccination should be modified including ring vaccination to produce a buffer area along the border and the clinically critical need for improved diagnostic tests to detect virally infected cattle. The treatment option is washing and disinfecting with iodine tincture as an option with acetone to minimize viral load and antibiotic use for control of bacterial complications as OIE, (2019) and broad-spectrum antibiotic with Flunixin meglumine was administerd to prevent complication inflammatory associated with the problem.

In conclusion, Foot and mouth disease is a highly contagious and economically important trans-boundary animal disease that affects all cloven-hoofed animals and is distributed worldwide. Therefore, vaccination of animals before the seasonal occurrence of the disease was the only option for the control and prevention.

3.2. Lumpy Skin Disease: A case of Ox

Abstract:

A clinical case report was conducted at Dire Veterinary Clinic, Bishoftu, Ethiopia in November 2020 with the complaints of depression, skin nodules appeared first on the skin of the head and neck followed by the eruption on the entire bodies of the Ox. Physical clinical examinations were revealed a rectal temperature of 39.9^0C; with generalized skin nodules and lameness. Prescapular and femoral lymph nodes were swollen. The case was tentatively diagnosed as a Lumpy skin disease (LSD). The EDDiE has also confirmed the case as LSD. Hence definitive diagnosis based on the above examination was LSD. For therapeutic management, the Ox was treated by 20% Oxytetracycline (Shanghai Thongren Pharmaceutical Co., Ltd, China) at 20mg/kg/day to reduce the risk of secondary bacterial complications and Flunixin meglumine (Bimeda-MTC Animal Health Inc.Cambridge, ON Canada) 2.2mg/Kg/day IM, 3days to control pyrexia and inflammation associated with LSDv infection were administered. Following follow-up, the Ox was recovered gradually, and however, the nodular lesion was not completely absent. LSD is a vector-borne viral disease, which causes dramatic economic impacts with significant production

losses. Therefore, based on the above results we recommend district livestock health office should provide vaccination of LSD before its seasonal outbreak occurred.

Keywords: *Lumpy skin disease, Ox, PCR, Vaccination*

3.2.1. Introduction

Lumpy skin disease (LSD) is a high-impact transboundary viral disease characterized by pyrexia, confined firm skin and visceral nodules covering all areas of the body, lesions in the mouth, pharynx, and respiratory system, and swollen lymph nodes in cattle (Zewdie, 2021). It is a cattle pox disease (LSD) (OIE, 2014; ESFA, 2015). The disease is caused by the same-named pox virus, which belongs to the genus Capripoxvirus and the family Poxviridae (Buller *et al*., 2005). Antigenically, LSDV is similar to SGPV, and serologically, CaPVs are difficult to distinguish. The Neethling strain is the LSD virus's prototype. The virus restricts affected countries from accessing lucrative export markets, exacerbating the financial consequences of an LSD epidemic (Alexander, *et al*., 1957). LSD is categorized as a modifiable disease by the World Organization for Animal Health, due to its rapid spread of the virus in susceptible cattle populations and its economic consequences on the global cattle industry (Tuppurainen, 2012).

Clinical signs: The incubation period under field conditions has not been reported, but following inoculation, it takes 6–9 days until the onset of fever. In the infected animal, there is initial pyrexia, which may exceed 41°C and persist for 1 week. The presence of fever, nodules on the skin, mucous membranes and internal organs, emaciation, enlarged lymph nodes, edema of the skin, and sometimes pneumonia and death are typical characteristics of the virus (LSD). All the superficial lymph nodes become enlarged and, there is a marked reduction in milk yield of lactated Cows. Between 7 and 19 days following virus inoculation, nodules of 2-5 cm in diameter appear all over the body, mainly on the head, neck, udder, and perineum in severe instances (OIE, 2010).

Mechanically biting and blood-feeding arthropods are believed to be the principal means of transmission for LSD. *Aedes aegypti* female mosquitoes have been also involved in the transmission of LSDV under experimental conditions recovered from *Stomoxys, Biomyia, Musca,*

Culicoides, and *Glossina* species that may have the potential to transmit LSD (Chihota *et al*., 2001). In the transmission and epidemiology of LSD common African hard tick species, such as, brown tick (*Rhipicephalus appendiculatus*), the bont tick (*Amblyomma hebraeum*) and the African blue tick (*Rhipicephalus (Boophilus) decoloratus*) have been recorded (Lubinga *et al*., 2013). Most LSD virus infections are thought to be transmitted through insects. The severity of the disease will be affected by host susceptibility, dose and route of virus inoculation in which the incubation period is ranged between 2-5 weeks (OIE, 2010). The severity of LSD (clinical symptoms) is determined by the capripoxvirus strain, the affected host (cattle breed), and the host immune status. There is significant variation in susceptibility of the same breed to LSD due to variation in virulence of the virus, immunological status of the host, and availability of the insect (Haig, 1957).

Pathogenesis: Few studies have been conducted on the pathogenesis of LSD in cattle, viremia and fever formed after localization in the skin and development of inflammatory nodules. The virus enters the body of the animal, through abraded tissues, it starts to replicate locally and will result in local swelling at the site of inoculation developed. After a week the local swelling will be followed by enlargement of the regional lymph nodes, while the generalized eruption of skin nodules usually occurs 7-19 days after injection (Barnard *et al.,* 1994). After the development of fever, there is also LSDV demonstrated in saliva, semen and skin nodules. During infection, multiple virus-encoded factors are produced which influence pathogenesis and disease (Lubinga *et al*., 2014). The main symptoms of LSD infection in most animals are about 0.5-5 cm skin nodules in diameter in whole skin or subcutaneous tissue and swollen superficial lymph nodes especially subscapular and precrural lymph nodes. Nasal, oral, ocular, and vaginal mucosa can all be affected by these nodules. Their number may range from a few to several hundred (Barnard *et al.,* 1994).

Cutaneous lesions can heal quickly, indurate and become hard lumps, or become sequestered; leaving deep ulcers partially filled with granulation tissue, which frequently suppurates (Wainwright *et al.,* 2013). Presence of papules mostly in hairless areas of the perineum, udder, inner ear, muzzle and eyelids leads to the development of ulcerative lesions with excessive salivation, lacrimation and nasal discharge that may contain LSD virus. Some of the infected

cattle may develop edematous swelling of one or more legs and show lameness (Babiuk *et al.*, 2008). There are currently no commercial diagnostic test kits available for the diagnosis of the LSD virus (Tuppurainen and Oura, 2012). Thus, the tentative diagnosis of LSD is usually based on the characteristic clinical signs of fever, nodular lesions in the skin that leads to necrosis, and its differential diagnosis. The confirmatory diagnosis is by laboratory tests using conventional polymerase chain reaction (PCR) techniques (OIE, 2011).

There is no specific antiviral treatment, particularly for LSDv. Sick animals should be isolated and quarantined from the herd and follow supportive treatment such as antibiotics, anti-inflammatory drugs, and supportive therapeutics. These therapies are usually given to avoid chances for the development of secondary bacterial infections, inflammation and fever, and thus improving the appetite of the animal (Capstick *et al.*, 1959).

Because biting flies and some tick species are the most common vectors of disease transmission, quarantine and movement restrictions are ineffective in most cases. In endemic areas, like Ethiopia, control is therefore essentially confined to immunoprophylaxis (Coetzer and Tuppurainen, 2004; OIE, 2011).

Therefore, the objective of this case report is to describe the disease, treat and follow up the patient on the outcomes.

3.2.2. Case description of lumpy skin disease

About 7 years old Ox, was presented to Dire Veterinary Clinic, Bishoftu in November 2020 with complaints of depression skin nodules appeared first in the skin of the head and neck following all the entire body parts. The Ox was reared with other two Cows and a bull under a semi-extensive farming system. The first Cow was suffered from a similar case and was treated before a month, as a result, the lesions become recurred and the Cow recovered (figure5A). There is a regular follow-up of vaccination against lumpy skin disease every year and the last year's vaccination was missed. The history of the Ox was depression, inappetence, the generalized appearance of skin nodules (figure5B), swelling in leg, and lameness. The tentative diagnosis was suggested as LSD based on the EDDiE, history, clinical findings, and presence of similar cases in

the areas. On clinical examination, the Ox was having a temperature of 39.9^{o}C, respiratory rate of 24 breaths/min, and pulse rate of 72 beats/min. Skin nodules with unmeasured diameters were seen all over the skin(figure5B). The Ox was febrile with depression, prescapular and femoral lymph nodes were swollen and pit on palpation.

Figure 4: Photograph of the Ox suffered from LSD: Cow on recovering from LSD with scars formation from ruptured nodules (A) and Ox suffered from LSD with skin nodules and scabs (B)

3.2.3. Laboratory investigation and findings

A Biopsy sample of the skin nodules was planned to be collected aseptically and processed for confirmatory diagnosis, however due to scarcity of Viral transport media it's not collected, and the diagnosis of the case was made on the basis of clinical signs observed, seasonal occurrence of disease, and IEDDiE' result.

Limitation

Laboratory confirmation was not made for this disease due to scarcity of viral transport media facilities and hence treatment was done based on the clinical picture only (symptomatic therapy).

3.2.4. Management of the case and treatment outcome

Treatment of LSDv was targeted to reducing pyrexia and inflammation to the animal and preventing secondary bacterial complications using 20% Oxytetracycline (Shanghai Thongren Pharmaceutical Co., Ltd, China) at 20mg/kg/day and Flunixin meglumine (Bimeda-MTC Animal Health Inc.Cambridge, ON Canada) 2.2mg/Kg/day IM, 3days to control pyrexia and inflammation associated with LSDv infection were administered. Gradually the rectal temperature of Ox becomes lowered and dropped to 38.2^0C. During therapeutic management, the nodules were not completely disappeared. But two months later the Ox was fully recovered and nodules were disappeared with prominent scars as seen from (figure 5A&B).

Figure 5: Photograph of the Ox fully recovered from LSD infection after follow up of a month: nodules were ruptured and disappeared left with scar formation around the face and neck figure (A&B).

3.2.5. Discussion

Lumpy skin disease is economically significant an infectious viral disease of domestic ruminants affecting the livestock industry of most developing countries like Ethiopia (Abera *et al*., 2015). The current clinical case report was confirmed as LSD based on the history, clinical findings, and laboratory confirmation which agrees with the report of Elhaig *et al*.,(2017); Tuppuraine *et al*., (2011). They stated that manifestations of LSD from infected cattle were observed by continuous high pyrexia (40-41.5°C), serious depression, lacrimation, nasal discharge, anorexia, dysgalactia,

and painful and hyperemic nodules slightly raised above the surrounding normal skin from which they are often separated by a narrow ring and firm by the involvement of head, neck, the perineum, the genitalia, udder, and the limbs. According to the report of Constable *et al*., (2017) other features of LSD is enlargement of superficial lymph nodes and lymphadenopathy, in lactating cows decreased production of milk with possibilities of abortion in pregnant cows even swelling of the testicles and orchitis are also probable occur in bulls. The morbidity rate is higher which ranges from 3% - 85% with fewer associated mortalities ranging 1-3% and associated economic losses due to decreased feed intake, milk production, weight conversion, abortion and infertility, and damaged hides. Based on the report of EFSA, (2015) the disease is important and notifiable as it hampers international trade.

This current case report was managed by administration of broad-spectrum antibiotic (20% Oxytetracycline) with Flunixin meglumine to control pyrexia and inflammation associated with LSDv which revealed gradual recovery of the Ox with a gradual decrement of fever, anorexia, nodular lesions, and other abnormalities until the nodular lesion left as a scar which is in line with Capstick *et al*., (1959) protection of cattle against LSD. The report of Al-Salihi K (2014) indicated isolation of sick animals from the herd and managing with supportive treatment such as antibiotics, anti-inflammatory drugs, and vitamin injections to treat secondary bacterial infections or to improve the animal's appetites and this report has similarity with the current case management. To enhance immunity against CaPV Brenner *et al*., (2009) indicate that regular vaccination of apparently healthy animals is more important than treating infected animals.

In conclusion, LSD is a vector-borne disease and is prevalent in almost all the regions and agro-ecological zones of Ethiopia and the disease poses considerable economic losses to the cattle population. Therefore to create sufficient herd immunity, regular Vaccination campaigns should be implemented by an effective and potent vaccine.

3.3. Salmonellosis: A case in Ox

Abstract

A current clinical case report was conducted at Veterinary Teaching Hospital of AAU-CVMA by presenting about 300kg local breed of Ox on December 30, 2020, with the complaints of inappetence, diarrhea, Ox kept in the house, fed over atela with concentrate and fed leftover of bread and enjera which is left over from the family. Physical examination revealed, the Ox was experienced severe depression and febrile rectal temperature of 39.7 ^{0}C, moderate dehydration, and watery feces with mucous, fetid and profuse diarrhea. EDDiE diagnosis revealed the case as salmonellosis. Tentatively the case was diagnosed as salmonellosis based on the history, EDDiE results, and clinical signs observed. Bacteriological examination of specimen taken for suspected case revealed positive result for salmonella and confirmed as salmonellosis. Colibacillosis, coccidiosis, and gastrointestinal parasitisim were listed as differential diagnosis. For therapeutic management best medical, Trimethoprim Sulfadiazine 30 mg/kg was administered as initial dose and maintenance dose. Following treatment of three days, the Ox was well responded to the therapy. Salmonellosis is a highly contagious bacterial disease of animals and human beings with significant economic impact. Therefore, to mitigate associated risk and occurrence, maintaining hygiene measures was recommended.

Keywords: *Ox, Salmonellosis, Sulfadiazine*

3.3.1. Introduction

Salmonellosis is an infectious disease caused by gram-negative bacteria of the genus *Salmonella*, belonging to the family *Enterobacteriaceae*. *Salmonella* was named after its discovered Salmon by an American Scantest Daniel Salmon in 1885 isolated the first time *Salmonella choleraesuis* in pig intestine (Rao, 2004). Salmonellosis is an important disease of livestock mostly common in cattle causing high morbidity and mortality of affected animals as well as a high cost of treatment. The most common serovars *typhimurium* and *Dublin* are associated with disease outbreaks. *S. typhimurium* is commonly isolated in cases of enteritis in calves less than 2 months

old, while *S. Dublin* is often present in cases of septicemia, meningoencephalitis, and septic arthritis associated or not with enteritis (Costa *et al*., 2012).

It is considered to be the major economic and animal welfare problem in the cattle industry worldwide. In cattle, salmonellosis is manifested in two main clinical patterns. *Salmonella typhimurium* in young animals is the predominant etiological agent of salmonellosis, causing acute enteritis, which results in severe dehydration and high mortality if left untreated. On the other hand *Salmonella Dublin* is predominant in older animals, causing both enteric and systemic infections, including septicemia and abortion. The most common type of infection is the carrier state, in which infected animals carry the pathogen for a variable period of time without showing any clinical signs (Wray *et al*., 1991).

Etiology and clinical sign: Salmonellosis in warm-blooded vertebrates, associated with serovars of *Salmonella enterica* i.e. only a few serotypes produce clinical Salmonellosis in healthy animals and typically have a narrow range of host species as serovar-host specificity. There are host-specific and non host-specific salmonella serotypes. Host-specific serotypes are *Salmonella Paratyphi* (man), *Salmonella Gallinarum* (fowl), *Salmonella Pullorum*, *Salmonella Abortus* equi (horse), *Salmonella Abortus ovis* (sheep), *Salmonella Abortus suis* (pig), and *Salmonella Dublin* (mainly in cattle). Non host-specific salmonella is *Salmonella Typhimurium* (man, cattle, sheep, pig, horse, fowl and rodents) (Kemal, 2014). Enteritis and septicemia are considered major syndrome in livestock. The clinical disease of acute enteritis occurs in adult animals and in young animals is characterized by (i.e. the most common symptoms of the disease) are fever followed by severe watery diarrhea to pasty, sometimes dysentery, often tenesmus, abdominal cramps and other less common clinical presentations include abortion, arthritis, and necrosis of extremities. In dairy cows, milk production drops acutely. Intestinal salmonellosis usually lasts from several days to a week. Death can occur as the result of dehydration and toxemia (Pender, 2003).

The most obvious symptoms of subacute enteritis which may be seen in adult animals of cattle and sheep are persistent soft feces or diarrhea, weight loss and sometimes mild fever, inappetence, and some dehydration can occur. Chronic enteritis is mainly seen in older calves, adult cattle and growing pigs. The clinical signs can include progressive emaciation, low-grade

intermittent fever and inappetence. Enteritis with septicemia is the most common syndrome in newborn calves, lambs, foals, fowl, and piglets. It may also be seen in pigs up to 6 months of age and occurs in adult animals (Molla *et al*., 2003).

Transmission and source of infection: The usual route of infection in enteritis is fecal-oral, although infection through the upper respiratory tract has also been reported. Most Salmonella infections in farm animals are likely to acquire from animals of the same species, especially in the case of the host-adapted serovars. In adult cattle there are important differences in the behavior of *S. Dublin* and *S. typhimurium*. Pasture contamination is also an important source of salmonellosis; results when flooding occurs and there are many reports of a clinical case in adult cattle arising from grazing recently flooded pasture (Wray, 1994). Infected animals are the source of the organisms (i.e. the principal sources of infection are carrier animals); they excrete bacteria and infect other animals, directly or indirectly, by contamination of the environment, primarily feed and water supplies. Feces of infected animals can contaminate feed and water, milk, fresh and processed meats from abattoirs. Bacteria may also be disseminated during the transport of infected animals and during the holding of animals in a lairage before slaughter. In these situations, the excretion of salmonellas is exacerbated by the stress imposed (Barrow *et al*., 2010).

Pathogenesis: Salmonella infects animals and humans by the oral route (i.e. the usual route of infection is fecal-oral), Following ingestion, (i.e. after ingestion), the proportion of the organisms resists the low pH of the stomach, and reach the distal ileum and the cecum, (i.e. the organism colonizes the digestive tract) and invades and multiplies in enterocytes and tonsillar lymphoid tissue (i.e. invade the mucosa, and replicate in the submucosa and Peyer's patches). Cell destruction follows, and the bacteria are ingested by phagocytic cells such as macrophages and neutrophils, and multiply in young animals, and in adults whose resistance has been lowered and starts to be spread beyond the mesenteric lymph nodes occurs, and the infection is established in the reticuloendothelial cells of the liver, and from there it invades the bloodstream (i.e. true septicemia is developed), with subsequent localization in brain and meninges, pregnant uterus, joints and distal aspects of the limbs, and tips of the ears and tails (Kemal, 2014).

Diagnosis and its differential diagnosis: A definitive etiologic diagnosis of salmonellosis depends on the isolation of the organism from feces, blood, milk, and other body fluids and from tissue aseptically collected at necropsy. About 90% of isolates are obtained from routine feces culture, but isolates are also obtained from blood, urine and materials from site of infection in which feed, water, and environmental samples may be cultured to confirm the presence of the pathogen in a herd or flock or to determine the source of the organism. Campylobacteriosis, parasitic diarrhea, shigellosis, vibriosis, viral gastroenteritis and yersiniosis are listed as a differential diagnoses to salmonellosis (Kemal, 2014).

Treatment and prevention; Antimicrobial therapy is necessary in cases of suspected/confirmed bacteremia (septicemia) animals. But not recommended for enteric disease (i.e. the use of antimicrobials for the treatment of enteritis or healthy shedders is highly controversial, due it may affect ruminal /intestinal flora and increase the emergence of resistant strains. The treatment of non-typhoidal salmonella infection is different from treatment typhoidal infection. Antibiotics should not be used routinely in the treatment of non-typhoidal Salmonella infection as used in typhoid infection since antibiotic therapy can increase relapse of infection and also prolong the duration of gastrointestinal carrier states. The main treatment should be aimed at correcting dehydration by Oral and parenteral fluid therapy to substitute water and correct acid-base and electrolyte imbalances (Jones *et al*., 2007).

Therefore, the objective of this clinical case report was to describe, identify causative agents and provide appropriate treatments.

3.3.2. Case description of salmonellosis

About 300kg weighted local breed Ox kept for fattening purpose was presented to Veterinary Teaching Hospital of AAU-CVMA on December 30, 2020, with the complaints of inappetence, diarrhea, the Ox kept in house and fed over residues of local alcohol “atela” with concentrate feed and food leftover of bread and enjera from the family past history. On physical examination, the Ox experienced severe depression and revealed a temperature of 39.7^0C, heart rate of 73 beats/min, respiratory rate of 22 breath/min, and moderate dehydration with 3 seconds capillary refill time and watery feces with mucous, fetid, and profuse diarrhea which is prominent as

indicated in the following (figure 6B). The EDDiE was diagnosis the case as salmonellosis. Based on past history clinical findings, and diagnosis assisting tools the case was tentatively diagnosed as salmonellosis. Gastrointestinal parasitisim, colibacillosis, coccidiosis, and shigellosis were listed as differential diagnoses. For confirmatory diagnosis, fecal sample was taken from the Ox and sent to the microbiology, and parasitology laboratory of AAU-CVMA for further investigation and confirmation.

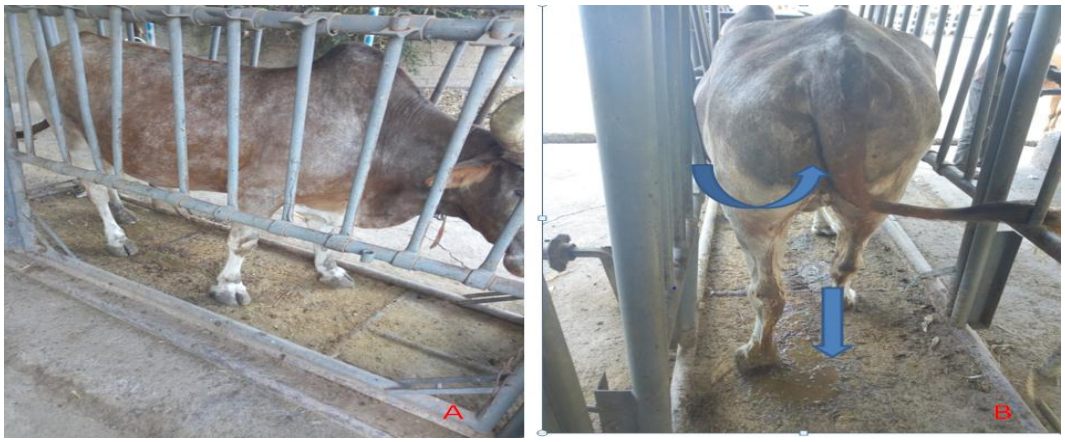


Figure 6: Pictorial presentation of Ox suffered by diarrhea due to salmonellosis (A) and visible watery and profuse diarrhea observed on the ground (B)

3.3.3. Laboratory findings and their investigation

A fecal sample was taken from the Ox and sent to the microbiology and parasitology laboratory of AAU-CVMA for further investigation and confirmation. Fecal floatation technique was conducted to detect the presence of gastrointestinal parasitism like Emeria/Coccidian oocytes and the test result was negative. The same sample was also enriched in buffered peptone water for 24hrs. Sample containing enriched media was transferred to Rappaport Vassiliadis broth media for 24hrs and one loopful of each enriched broth was streaked aseptically onto XLD media which is selective media for salmonella organism. As a result, the bacteria salmonella growth was observed on XLD media. A typical colony of salmonella grown on XLD was, small red translucent and/or dome-shaped colonies and have central black spot due to hydrogen sulfide production was inspected on XLD (Figure 7A). To get pure colonies again one loopful colony

from XLD was streaked aseptically onto new XLD plating media and typical colonies of salmonella were observed (Figure 7B), then gram staining revealed gram-negative rod and for further identification passed for biochemical tests.

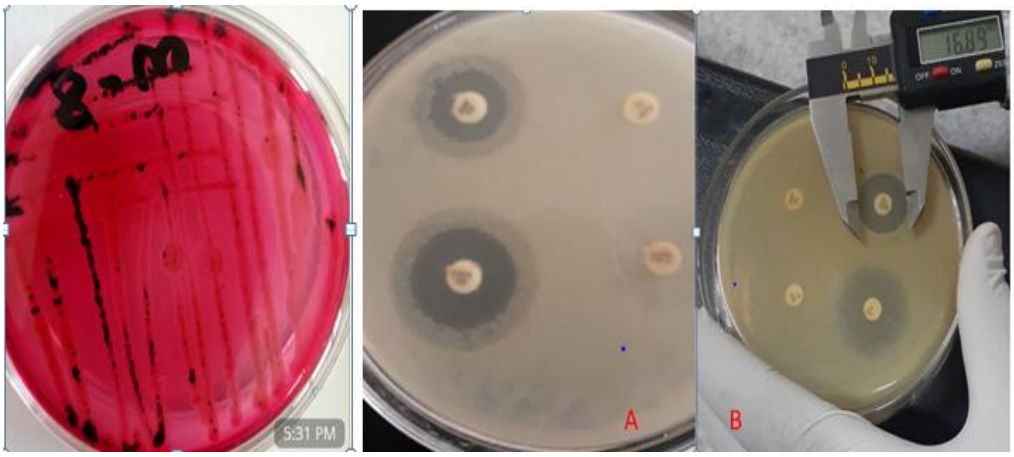


Figure 7: Result of laboratory examination of salmonella colony growth on XLD and antimicrobial susceptibility test for salmonellosis

Antimicrobial susceptibility test

An antimicrobial susceptibility test was carried out in the veterinary microbiology laboratory of the AAU-CVMA. Fresh Salmonella colonies were grown on a nutrient agar plate then four to five colonies were transferred with the sterile loop into tubes containing 4ml of saline water and incubated at 37°C for 6 hours until it achieved 0.5 McFarland turbidity standards. The smooth suspension was inoculated uniformly on the entire surface of Mueller-Hinton agar by using sterile cotton swabs. Inoculated Muller Hinton agar was allowed to air dry and antibiotic disks from each selected antibiotic were placed. Antimicrobial zone of inhibition results were interpreted based on the standard guidelines. Based on a zone of inhibition, Salmonella isolates from Ox feces were susceptible to ciprofloxacin, chloramphenicol, and sulfamethoxazole and resistant to oxytetracycline and gentamycin (Figure 7A and B).

3.3.4. Management and treatment outcome of salmonellosis

As the treatment option, the best medical therapy we used for this case was Sulfadiazine + Trimethoprim Injection 50mg/kg (Advacare Yuanheng Pharmaceutical Co., Ltd, China) was given slowly IV and IM for successive five days. The owner of the Ox was advised to keep the hygienic status of the feed and feed with good management care during fattening. Following consecutive therapy, the Ox was well responded to the treatment and totally recovered as indicated below after two weeks follow up (Figure 10A&B).

Figure 8: Photograph of Ox recovered from salmonellosis after two weeks follow up (A) and with normal feces after therapeutic management (B)

3.3.5. Discussion

Infections with Salmonellae are of great zoonotic and public health importance and remain as a global problem. They are often in great concern due to the disease of cattle and the potential to harm people via consumption of dairy and meat products and also sometimes in contact with cattle (OIE, 2000). These infections can cause highly significant morbidity and mortality both in humans and animal production as well as considerable huge economic losses. Salmonella infections are endemic in some developing countries, including Ethiopia, and represent a serious public health hazard. The organisms have maintained an infection in carrier animals and lead to

continuing in contributing shedding of the organisms in furher exposure to sick and apparently healthy animal's repeatedly (Helmy YA *et al*., 2017).

Based on the microbiological laboratory result, history, clinical signs observed and report of EDDiE application the case was finally diagnosed as salmonellosis. The laboratory finding was in agreement with the report of the clinician and EDDiE report. This indicates that the laboratory result is in agreement with the clinician tentative diagnosis, and EDDiE disease ranking. This current clinical case study was diagnosed as a salmonella infection in Ox/Salmonellosis based on the history, clinical signs observed and also the EDDiE app report as it was salmonellosis. Again the isolation and identification of the organism and confirmatory laboratory test of the microbiological culture of the feces aseptically collected from the Ox indicate that the growth of salmonella organisms on XLD media which is in agreement with the above diagnosis. The clinical sign is vary but typical changes seen in the current case report were depression/lethargy, fever, lack of appetite followed by fetid diarrhea which was agreed with the clinical signs observed in the report of Marques *et al*., (2013).

The treatment option given to salmonella infection was Trimethoprim sulfadiazine 50mg/kg for five days which gives good response to the problem and this response was in agreement with treatment recommended by Radostits *et al*., (2006) that treatment of salmonella species consists of controlling the infection with effective antibiotics, and maintaining fluid balance with electrolytes. An antimicrobial susceptibility test was conducted to choose the best drug for the prevention and treatment of the Ox. Salmonella isolated organism was susceptible to ciprofloxacin, gentamycin, chloramphenicol, and sulfamethoxazole and resistant to oxytetracycline and gentamycin which is inconsistent with the studies of (Kemal, 2014; Alemu and Zewdu, 2012).

In conclusion, Salmonellosis is a highly contagious bacterial disease of animals and human beings with significant economic impact. Prevention of salmonellosis achieved by the implementation of hygiene measures and the use of antibiotics may give rise to the emergence of resistance problems. Reducing Salmonella prevalence requires a multi-hurdle approach at all stages of breeding, hatching, grow-out, transportation, and processing. The owner is advised

hygiene of feed and water is the best option for prevention and management of salmonellosis during fattening to mitigate associated risk factors. Therefore, to mitigate associated risk and occurrence, maintaining hygiene measures was recommended.

3.4. Clinical mastitis: A Case in lactated Cow

Abstract

Mastitis is an inflammation of the udder tissue in cows and is always caused by harmful bacteria, entering through the teat end and set up an infection. A 300 kg early lactated exotic Cow was presented to the Veterinary Teaching Hospital of AAU-CVMA with chief complains of swelling of an udder and changes in the consistency of the milk with the history of four parity stages. The initial physical examination of the Cow revealed, a rectal temperature of 39.8^0C and hard to touch, response to pain, and redness of udder. Diagnosis by EDDiE app included mastitis under **zz**-other disease. Bacteriological cultures of fresh milk showed that mastitis was due to *S. aureus.* The case was thoroughly treated by intra-mammary infusion. Mastitis is one of the most challenging economic and health problems of the dairy industry and small-scale dairy holders worldwide. Therefore, provision of maintaining a clean environment, prevent teat injuries, and pre and post milking teat dipping of the dairy cow are promising for prevention of the disease rather than therapeutic management was forwarded.

Keywords: *Cow, intra-mammary infusion, mastitis, S. aureus*

3.4.1. Introduction

Mastitis is the most widespread and costly disease in dairy cattle occurring throughout the world which needs particular concern for farmers in developing countries including Ethiopia (Seegers H *et al*., 2003). Mastitis is the most common and economically costly disease in dairy farming and it's an inflammatory reaction of the mammary gland caused by a bacterial infection or tissue trauma in which management practices, exposure to pathogens and efficiency of the udder defense mechanisms and also the interaction between these factors can be affected (Nielsen C, 2009). Mastitis is an inflammation of the udder in cows and inflammation of the udder is almost

always caused by harmful bacteria, which enter through the teat end and set up an infection. The words ‘mastitis’ and ‘infection’ use interchangeably since preventing mastitis involves preventing bacterial infections (Livestock improvement/LI, 2001). Mastitis is defined as an inflammatory reaction of the mammary gland and induced when pathogenic microorganisms enter the udder through the teat canal, overcome the cow’s defense mechanisms, begin to multiply in the udder, and produce toxins that are harmful to the mammary gland. This causes damage in mammary tissue then, which results increased vascular permeability. As a result of this, milk composition is altered: there is leakage of blood constituents, serum proteins, enzymes, and salts into the milk; decreased synthesis of caseins and lactose; and decreased fat quality (Christa P, 2008).

Etiology and clinical mastitis: A wide range of pathogens including bacteria, viruses, fungi, and the toxins of these pathogens can cause the disease. Mastitis may be caused by contagious or environmental pathogens. Contagious pathogens live and multiply on and in the cow’s mammary gland and are transmitted from cow to cow primarily during the milking process. Major contagious mastitis pathogens include Staphylococcus aureus and Streptococcus agalactiae. Environmental pathogens reside in the environment where cows live. Major environmental mastitis pathogens include streptococci other than S. agalactiae and coliforms, or Gram-negative bacteria (Oliver *et al*., 2004).

Staphylococcus spp. is the most frequently diagnosed causal microorganism of intramammary infection in lactated cows. Some pathogens such as *Streptococcus spp., Enterobacteriaceae, Pseudomonas aeruginosa, Mannheimia haemolytica*, *Corynebacteria*, and fungi can produce intramammary infection in lactated cows, but occurrence rates are lower (Contreras *et al*., 2007). Bovine mastitis is associated with many different infectious agents, commonly those causing contagious mastitis, which is spread from infected quarters to other quarters and cows, those that are normal teat skin inhabitants and cause opportunistic mastitis, and those causing environmental mastitis, which are usually present in the cow’s environment (Radostits OM *et al*., 2006). The most common route for pathogenic microorganisms to enter the udder is through the teat canal. The subsequent damage to the tissue of the mammary gland increases the vascular permeability and results in an increased number of somatic leukocyte cells in the milk. The report says that suckling improves udder health in suckled compared to non-suckled cows, probably due to

improved udder emptying and minimizes dirty bedding constitutes a hygiene risk to udder health (Fröberg S, 2008), amount of somatic cells present in milk of various types, and their relative proportion depends on the health status of the cow (Harmon RJ, 1994).

Source of infection: The source of mastitis infection may be regarded as contagious or environmental. Contagious pathogens are spread during milking except some microorganisms invade the cow's udder after bacteremia and most other species are opportunistic invaders from the cow's environment. Mammary gland; transmission occurs at milking is considered as the primary reservoir of infection. Early-stage of lactation is more prone to mastitis occurrence than the remaining stage of lactation (Rahmeto *et al*., 2016).

Clinical mastitis in most dairy herds is commonly known to be caused by environmental pathogens. Clinical mastitis does, including redness, heat, pain and impaired function with other symptoms such as anorexia, fever, or agalactia, where toxaemia and gangrenous necrosis of the udder are considered as a consequence of clinical mastitis (Marshall RT *et al*., 1993). Cow-level factors associated with the development of Clinical mastitis were carried out as fewer studies have investigated. The risk of developing Clinical mastitis is greatest in early lactation and increases with parity and level of milk production (Berry DP & Meaney WJ, 2005). The primary source of environmental pathogens in addition to other contaminated fomites as well as skin and teat lesions and vector parasites is the bedding used for housing cattle (Erskine, 2020).

In subclinical mastitis, the udder and milk show no visible signs of inflammation and are known as the most prevalent form of mastitis. Gross changes in milk are not observable and milk production will be lowered, hence can only be detected with individual cow somatic cell count (SCC) or microbiological culture. Infected cows serve as reservoirs and can infect other cows (Chassagne *et al*., 2005).

Prevalence of infected quarter's increases with age, peaking at 7 years and also is a result of a greater cellular response to infection or of a greater amount of permanent udder damage after infection in older cows. Especially older cows after four lactations were submitted to more lactation, increasing the risk for mastitis and udder tissue damage. The report says the first month of lactation is the most sensitive period for the risk of mastitis in the cow, even in well-managed

herds (Christa P, 2008). Poor management and hygiene, teat injuries and faulty milking machines are known to hasten the entry of infectious agents and the course of the disease. These predisposing factors present the organisms able to pass through the teat canal and enter udder to set-up infection (Islam MA *et al*., 2011).

Diagnosis: Clinical observation of gross abnormalities indicated the clinical form of the disease was detected by physical examination of the udder for the presence of swelling, pain, hotness, disproportional symmetry, fibrosis, visible injury, tick infestation, atrophy, and teat blindness and organoleptic tests like an abnormality in color, tastes, and odors are detected by olfactory system. (Asrat A *et al*., 2014).

California mastitis test (CMT): After physical examination, milk samples were tested by the CMT (Kit Lot number 67467, ImmuCell, USA). CMT was carried out to screen both clinical and sub-clinical mastitis for the selection of samples for bacterial culture and its simple, inexpensive, rapid screening test for mastitis. Based on gel reaction between the nucleic acid of the cells & reagent the presence and severity of the infection was diagnosed. A squirt of milk from each quarter of the udder was placed in each of four shallow cups in the CMT paddle and an equal amount of the reagent was added. Gentle circular motion in the horizontal plane was applied. Positive samples show gel formation within a few seconds (Radostits *et al*., 2007).

Treatment and prevention: Appropriate Therapeutic management of mastitis during lactation with antibiotics and udder health management will set goals for udder health status. Today, about 60%-70% of all antimicrobial drugs administered in dairy farms are for preventing and treating mastitis (Stevens M *et al*., 2016). Animal producers can practice several techniques to successfully manage mastitis in their herd/flock. Some of the strategies are using proper milking management methods, Proper installation, function, and maintenance of milking equipment, Dry cow management (Ahmed M *et al*., 2004; Asrat A *et al*., 2014). Proper therapy of mastitis during lactation, Maintenance of an appropriate environment, Monitoring udder health status, Culling chronically infected cows, Good record keeping, Periodic review of the udder health management program, and Setting goals for udder health status (ketema & Tsehay, 2014).

3.4.2. Case description on mastitis in cows

About 300 kg adult early lactated exotic Cow was presented to Veterinary Teaching Hospital of AAU-CVMA with a complaint of swelling of the udder, pain upon palpation, and redness of udder. The chief complaint of the owner was swelling of an udder and changes in the consistency of the milk. The cow has a history of four parity stages and due the udder was extended more. Physical clinical examination of the Cow's revealed a rectal temperature of 39.8^0C, HR 64 beat/min, and respiratory rate of 24breath/min. Then Udders of the Cow's were physically examined by visual inspection and palpation for the presence of any lesion, pain, heat, and swelling (Figure 9A). Following examination, no gross abnormalities except swelling of an udder mostly left rear teat was firm on palpation and hard to touch, response to pain and redness of udder with extended more udder was observed (Figure 9B). Diagnosis by EDDiE had a limitation on mastitis and was not included in the list of major cattle diseases. The case was diagnosed as bovine mastitis based on the history and clinical signs observed and its differential diagnosis is mammary edema, breast cancer, and ruptured breast cyst. For confirmatory diagnosis milk sample was aseptically collected and sent for microbiological cultures (Figure 9C). California mastitis tests (CMT) was conducted to screen infected teat and selection of samples for bacteriological cultures in which gel formation was observed as indicated below (Figure 9D).

Figure 9: Photographs taken during diagnosing of mastitis cow case, Cow suffered by mastitis case(A), physical examination of the udder for the presence of swelling and vital sign of mastitis(B), milk sample taking from mastitis suspected teat(C) and conducting CMT to screen gel formation of the milk(D).

3.4.3. Laboratory finding and its investigation

The milk sample was collected after a quarter of the teats have been washed with tap water to remove a considerable amount of dirt and dried. Then milk samples were sent to the Microbiology laboratory of AAU-CVMA. The milk sample was enriched with TSB. After 24 hrs samples were cultured on BA showed golden yellow (beta-hemolysis) colony (A). From BA a loop full colony was picked and striked on MSA. Since MSA was a selective media for Staphylococcus organism and after incubation at 37^0C for 24hrs the organism was grown on MSA media with a typical characteristic of yellow colonies growth (Figure 10B and C). For identification of the bacteria, gram staining was conducted and revealed, gram-positive cocci, violet color resembling bunches of grapes through a light microscope (D) and coagulase-positive test and test-test kits Coagulase positive (E) was also conducted and revealed positive.

Based on the history, clinical signs, and laboratory finding the case was finally diagnosed as mastitis due to *Staphylococcus aureus*.

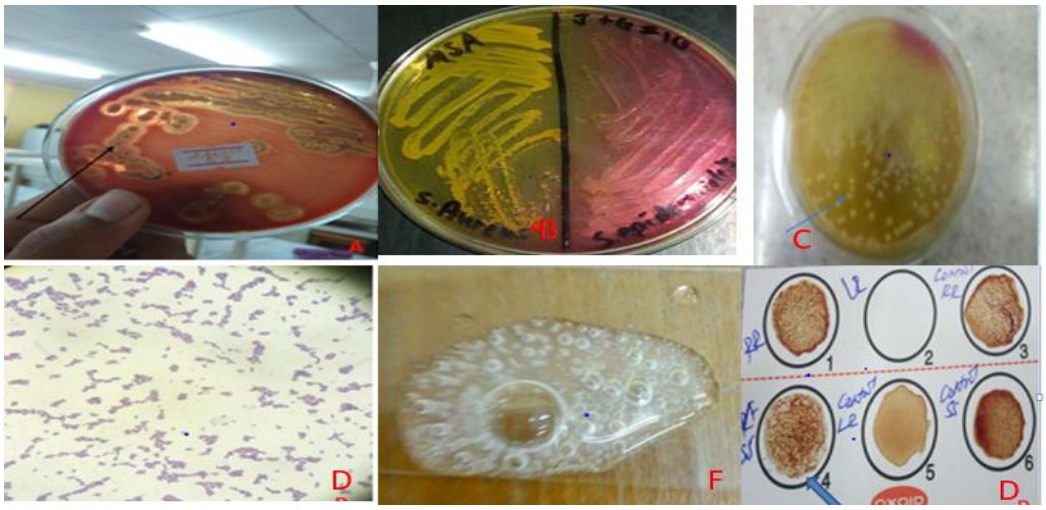


Figure 10: Isolation of *S.aureus*: (A) On Blood agar golden yellow (beta-hemolysis) colony, growth of *Staphylococcus aureus* on MSA yellow colony (B and C), (D) gram-positive cocci, (F) coagulase-positive test and (E) On Coagulase test-test kits Coagulase positive.

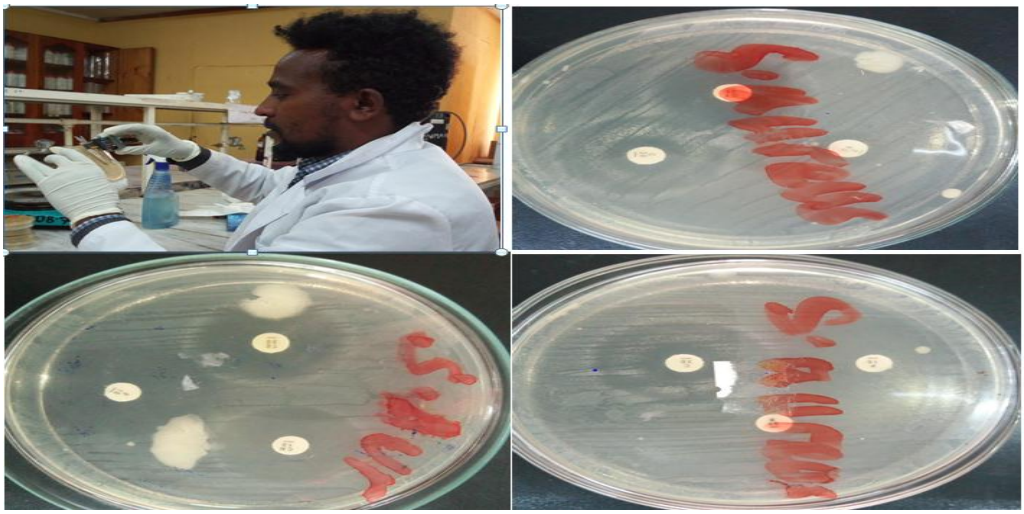


Figure 11: Antimicrobial sensitivity test for *S.aureus*

Gentamycin, streptomycin, chloroamphenicol and trimetoprim sulfamethoxazole are susceptible to *S.aureus.* Clindamycin, bacitracin, penicillin, tetracycline and oxytetracycline are resistant.

3.4.4. Management of mastitis and its treatment outcome

Primary treatment was practiced by removal of foci of infection by drainage of pus from abscesses, cellulitis of the swelling udder. Appropriate therapy of mastitis during lactation with antibiotics and udder health management will set goals for udder health status. In this case report tentatively the Cow was thoroughly treated with intramammary infusion (Cloxacillin benzathine for intramammary infusion, each disposable syringe contains 6-milliliter dose contains cloxacillin benzathine equivalent to 500 milligrams of cloxacillin), 6 ml per infected quarter aseptically for five days to the treatment of mastitis in lactating Cows and dexamethasone (Sokar Healthcare Pvt. Ltd. Gujarat India) at a dose of 0.2mg/kg/day for three days (IM), to alleviate pain and inflammation associated with mastitis were administered, after milking, cleaning, and disinfecting the teat, contents of a single 6-milliliter syringe infused into each infected quarter for five days consecutive infusions. Post-treatment, local heat, and pain associated with mastitis were disappeared while swelling on the udder was not. A week later, the clotty milk from the affected teat was minimized and two weeks later the cow was fully recovered.

3.4.5. Discussion

Bovine mastitis is a serious disease causing considerable economic loss worldwide (Halasa *et al*., 2007), with high prevalence and currently, mastitis is a costly disease, which manifests as inflammation of the mammary gland and affecting dairy cattle. A case in clinical mastitis of cattle was manifested by swelling, inflamed udder, reduction, and change in appearance with the change in the composition of milk which agree with the particular case report dealing currently. Comparatively these gross abnormalities are not prominent in sub-clinical mastitis however an increase in SCC which may develop into chronic mastitis has appeared. Good management practices of Cows' environment and mitigating a wide range of pathogens get access to the udder to have impacts on the prevention and incidence rate of mastitis caused by both the major and minor contagious and environmental mastitis pathogens (Rahmeto *et al*., 2016).

Clinical signs observed in cows in this current case report was swelling of an udder mostly left rear teat was firm on palpation and hard to touch, response to pain and redness of udder with more extended udder observed which is in agreement with (Oliver *et al*., 2004) that mastitis

caused by harmful bacteria, which enter through the teat end and set up an infection. Based on history, clinical findings, and laboratory confirmation the present case report was finally diagnosed as Mastitis; but EEDiE diagnosis revealed under zz- other disease indicating that it has its own limitation to include other very important cattle diseases in the algorithm. In the present case report, a typical case of mastitis is reported which is caused by *S. aureus* and this report agreed with the result reported by Marogna *et al*. (2012); and White and Hinckley, (1999). Infection usually occurs after kidding with the development of enlarging pendulous udder. Milk in the udder provides the site for bacterial multiplication and if remain untreated, may develop into chronic mastitis (Alawa *et al*., 2000).

A confirmatory test was conducted after the milk sample was collected and sent to the microbiology laboratory and cultured on blood agar and mannitol salt agar. The colony grown on MSA manifested with typical characteristics of yellow colonies surrounded by yellow zone and gram staining revealed grape-shaped cocci gram-positive which is a typical characteristic of *S.aureus.*

Appropriate Therapeutic management of mastitis during lactation with antibiotics and udder health management will set goals for udder health status. Today in dairy farms approximately about 60%-70% of all antimicrobial drugs administered are for preventing and treating mastitis (Stevens M *et al*., 2016). Broad-spectrum effective therapeutic agent against the major causal agents of the disease commonly practiced (Sawant *et al*., 2005). In this case report the cow was treated with intramammary infusion (Cloxacillin benzathine for intramammary infusion, each disposable syringe contains 6-milliliter dose contains cloxacillin benzathine equivalent to 500 milligrams of cloxacillin), 6 ml per infected quarter aseptically for five days, and dexamethasone (Sokar Healthcare Pvt. Ltd. Gujarat India) at a dose of 0.2mg/kg/day for three days I.M to alleviate the gross clinical sign of mastitis was also recommended in line with the report of (McKellar, 2006). Administration of the antibiotic, in this case, depends on the identification of the causal agent. Antibiotics are useful to treat bacterial infections; however, they cannot protect the glands from tissue damage.

In conclusion, clinical mastitis is due to environmental and cow factors. Cow factors are increased no. of parity and the increased size of udder which can easily predispose to pathogen and environmental factor is hygiene and their bedding house matters causing a substantial impact on the dairy industry. Therefore, maintaining a clean and good environment, vigorous treatment of affected animals with appropriate drugs was suggested as best control measures.

3.5. Management of abscess in Ox

Abstract

A subcutaneous abscess is an accumulation of pus surrounded by fibrous tissue within the tissues beneath the skin, which is treated by drainage to remove pus and start the healing process. Seven years old local Ox was brought to Veterinary Teaching Hospital of AAU-CVMA with a history of swelling in the neck. Upon palpation, round, large, and tense swelling under the skin of the ventral neck inside dewlap, and the swelling was hot, soft in consistency, and painful to touch. The sample of the swelling was taken and cultured before isolation and identification. Accordingly, the colonies were identified as Staphylococcus aureus by gram staining and mannitol salt agar**.** After sedating, and preparing the incision area, an incision with a disposable sterile scalpel tip was made on the ventral aspect of the abscess. A large quantity of pus was drained and a cavity was irrigated with 0.5% dilute povidone iodine. Then, the cavity was then packed with gauze soaked in 5% povidone-iodine with a Seton protruding out of the incision. The Ox was treated by administration of Procaine penicillin G+ Dihydrostreptomycinsulphate and Flunixin Meglumine. Eventually, the ox was successfully recovered after 2 weeks without any complication.

Keywords: *dewlap, drain, ox, subcutaneous abscess, Staphylococcus aureus*

3.5.1. Introduction

An abscess is a localized collection of pus in a cavity (Dinulos and Pace, 2008), which is formed when the body tries to protect itself from an infection by creating a wall around it (Baiu and Melendez, 2018). The most common causes are pathogenic bacteria although other pathogens can

cause similar signs (Rothstein, 2011). The bacteria that cause abscesses are Staphylococcus *aureus,* Staphylococcus *epidermidis,* Staphylococcus *hycus,* Arcanobacterium *pyogenes,* Corynebacterium *pseudotuberculosis,* Streptococcus *pyogenes,* Streptococcus *milleri,* Streptococcus *intermedius,* Pasteurella *multocida,* Escherichia *coli* and other gram-negative rods in ruminants (AL-Tuffyli and Shekhan, 2012).

The bacteria can enter into the deeper tissues through an injury or puncture wound created due to sharp-pointed material in the forage, then the tissues become colonized by pathogenic bacteria, which leads to abscess formation (Rothstein, 2011) because the immune system sends fighters of white blood cells to the localized area. As the leukocytes attack the bacteria, some adjacent tissue dies, creating a hole that fills with pus to form an abscess. This pus may consist of a combination of dead tissue, leukocytes and bacteria. The abscess may be hot, red, swollen, tender and fluctuant indicating pus ripening. Abscesses can occur in any part of the body, and often take between two to five days to develop but sometimes can develop instantaneously (SAHARA Centre for Residential Care and Rehabilitation, 2012).

An abscess may be differentiated from hernia, tumor, hematoma and cyst. Abscess, tumor, and cyst develop slowly whereas hernia occurs suddenly, and in developing an abscess, there are symptoms of local inflammation and it does not fluctuate under the skin. In hematoma, the blood accumulation may feel free fluid and a slight crepitating sound on palpation. A cyst fluctuates uniformly and has no eye point and pain or functional signs are absent. It is confirmed by exploratory puncture of the swelling and demonstration of intestinal contents or radiography may also be done for confirmation (Dese *et al*., 2019). The abscess is diagnosed by aspirating swelling with a needle to obtain the sample for further confirmatory examination (Hess, 2004). Gram staining is a technique used to classify bacteria into two categories (Gram-positive and Gram-negative) based on coloring their cell wall constituents. Gram-positive bacteria retain the crystal violet during the decoloring process due to the presence of a thick layer of peptidoglycan in their cell walls. On the other hand, Gram-negative bacteria stain red, which is due to a thinner peptidoglycan wall, which does not retain the crystal violet (Becerra *et al*., 2016). Mannitol Salt Agar is a frequently used selective and differential growth medium. It contains a high concentration of salt which is selected for the genus Staphylococcus since they can tolerate high

saline levels. MSA also includes the sugar mannitol and the pH indicator phenol red. Pathogenic staphylococci, such as Staphylococcus aureus can ferment mannitol, thus, a formed acidic byproduct causes the phenol red in the agar to turn yellow (Kateete *et al*., 2010).

Not all abscesses need treatment, but large abscesses and those deep in the tissue, such as subcutaneous abscesses, require lancing, irrigation and antibiotics. The incision should be at ventral area of the abscess to achieve good drainage of the pocket. In addition, Very large or deep abscesses can require more than one access opening to proper irrigation and drainage (McDonald, 2013). In this particular case report, the management of the abscess by drainage was described.

3.5.2. Case description of abscess in Ox:

Seven years old local breed ox weighing 240kg was brought to Veterinary Teaching Hospital of AAU-CVMA, with a history of swelling in the neck. Upon palpation, round, large, and tense swelling under the skin of the ventral neck inside dewlap (Figure 12A), and the swelling was hot, soft in consistency, and painful to touch. Centesis of the swelling with a sterile needle on the dependent part was also conducted to check its content (Figure 12B) and then the contents filled inside cavity were pus (Figure 12C). The animal was feverish while the other vital parameters were within the normal values with a pinkish mucus membrane.

3.5.3. Laboratory investigation and its findings

A thick pus sample was taken by dissecting subcutaneous abscess with sterile surgical blade and taken by the sterile swabs. The sample was placed into sterile tubes containing a Peptone water medium. Then, it was cultured in blood agar plates. Finally, the media were incubated at 37 C° for 24hrs in aerobic and anaerobic conditions. After incubation, the appeared colonies on BA were cultured on MSA. Gram staining revealed, violet color coccus resembling bunches of grapes through a light microscope (Figure 12E), and this bacterial spp showed as gram-positive *Staphylococcus aureus* then fermented mannitol and the medium turned to yellow as shown below (Figure 12D). Then, the case was diagnosed as a subcutaneous abscess caused by Staphylococcus aureus and decided for management by drainage.

Figure 12: Subcutaneous abscess in Ox: Swelling under dewlap of the Ox (A), drainage of subcutaneous abscess (B), drained thick thread like pus from subcutaneous tissue space of dewlap (C), *S.aureus* organism grown on MSA by culturing of pus (D) gram staining revealed gram-positive bacteria(E) and Ox after subcutaneous abscess management and treatment

3.5.4. Management of the case and treatment outcome

Drainage of subcutaneous abscess: after aseptic preparation and control of the animal by infiltrating along incision line with Lidocaine HCL 2% (manufactured by Makcur Laboratory Limited, Gujarat, India), an incision with a disposable sterile scalpel tip was made on the ventral aspect of the abscess. A large quantity of pus was drained and a cavity was irrigated with 0.5% dilute povidone-iodine. Then, the cavity was then packed with gauze soaked in 5% povidone-iodine with a Seton protruding out of the incision to allow pus drainage. The incision site is left unsutured to heal as a scar. Then, gauze soaked in 5% povidone iodine with a Seton protruding out of the incision was regularly changed daily for 2 weeks. The Ox was treated by administration of Procaine penicillin G, 200000 IU/ml + Dihydrostreptomycinsulphate, 200 mg/ml, 1ml/20kg, (IM) for 5 days and Flunixin Meglumine, 2.2mg/kg, intramuscularly (IM), for 3days to prevent

pyrexia and inflammation associated with endotoxaemia. The owner was advised to give rest from any work for a patient until complete healing. Finally, the ox was successfully recovered after 14 days without any complication.

3.5.5. Discussion

A subcutaneous abscess may result from traumatic wounds, oral foreign bodies, upper respiratory tract, urinary tract infections, and bacteremia secondary to a tooth root. An abscess is usually soft to firm swellings that gradually enlarge over several days. Although the abscess commonly develops on the head and limbs, it may be found anywhere in the body. It is usually not frequently immovable and minimally inflamed and often contains thick, caseous exudate. A subcutaneous abscess may be confined to the subcutaneous space, or it may extend to the underlying dermis and bone (Hess, 2004). The subcutaneous abscess may occur at vaccination sites when vaccination is performed under sub-optimal conditions (wet, dirty). Most cattle are vaccinated on the near side; hence most vaccination site abscesses in cattle are on the near side of the neck. In the early stages, abscesses may be accompanied by pain, heat, and swelling, but later they become cold and surrounded by a fibrous capsule (ALEC and MLA, 2021).

Streptococcus pyogenes, *Staphylococcus epidermidis*, and *Escherichia coli* are the most commonly isolated bacteria from subcutaneous abscesses in cattle, sheep, and goats, in addition to the species isolated in this case i.e. *Staphylococcus aureus* (Tavassoli*et al*., 2010). The bacteria can enter into the deeper tissues through an injury or puncture wound created due to sharp-pointed material in the forage, then the tissues become colonized by pathogenic bacteria, which leads to abscess formation (Rothstein, 2011) because the immune system sends fighters of white blood cells to the localized area. As the leukocytes attack the bacteria, some adjacent tissues die and creating a hole that fills with pus to form an abscess. This pus may consist of a combination of dead tissue, leukocytes, and bacteria. The abscess may be hot, red, swollen, tender and fluctuant indicating pus ripening. Abscesses can occur in any part of the body, and often take between two to five days to develop but sometimes can develop instantaneously (SAHARA, 2012).

The abscess is diagnosed by aspirating swelling with a needle to obtain a sample for further confirmatory examination (Hess, 2004). The case was currently diagnosed by culturing of the sample containing abscess on MSA which is used as a selective and differential growth medium. Staphylococcus aureus can ferment mannitol, thus, a formed acidic byproduct causes the phenol red in the agar to turn yellow. Gram staining is a technique used to classify bacteria into two categories (Gram-positive and Gram-negative) based on coloring their cell wall constituents.

3.6. Bovine fasciolosis

Abstract

Both internal and external parasitism is a big challenge in livestock production causing a major economic loss in the tropical and subtropical countries of the world. A 7-years old local Cow was presented to Veterinary Teaching Hospital of AAU-CVMA, with a history of grazing at the field of marshy and mud area of cheleleka and showed gradually decreased milk yield and progressive weakness with the existence of unusual swelling under dewlap and the neck area. General physical examination revealed, temperature of 36.9 ^{0}C and slightly no change with other parameters and “bottle jaw” due to edema under the jaw which is not firm upon palpation and icterus/yellowish mucous membrane was clinically examined. Diagnosis assisted by EDDiE revealed the case as fasciolosis. For confirmatory test fecal sample was taken by sterile caps and sent to Parasitological laboratory AAU-CVMA. After the sedimentation technique was conducted laboratory results revealed the oval operculated golden egg which is positive for fasciolosis. The current case was treated with Triclabendazole 12 mg/kg. From the report of the owner the cow was recovered and returned to its normal yield. Fasciolosis is one of the most economically important helminth diseases hampering the productivity of domestic animals worldwide. Therefore, regular deworming and control of intermediate host snail populations at transmission sites by draining swamps and building sewage systems were recommended.

Keyword: *antihelmentic, cow, fasciolosis,*

3.6.1. Introduction

Fasciolosis is a parasitic disease highly prevalent and affects all domesticated animals with vital morbidity, mortality and economic losses (Dalton, 1999; Scott, 2003). Fascioliasis or liver fluke is a human and an animal parasitic disease caused by endoparasitic trematodes of the genus Fasciola which live in the bile ducts. Fasciolosis is a plant-born trematode zoonosis and is classified as a neglected tropical disease (NTD). However, it affects humans its main host is ruminants such as cattle and sheep. Commonly the occurrence of fasciolosis as a chronic disease and severity depend on the nutrition of the host whereas the susceptibility to this parasite is more in the case of cattle, sheep, and goats compared to other domestic animals (Schoenian, 2003). Infestation of Bovine fasciolosis, both Fasciola *gigantica* and Fasciola *hepatica* is a parasitic disease of cattle caused by trematodes usually in the tropics. The members of this genus are commonly known as liver flukes (Hardi *et al*., 2016).

Etiology: Fasciolosis is mainly caused by the digenean trematode of the genus Fasciola consisting of two species usually implicated in causing the disease namely; *F. hepatica* and *F. gigantica* where *F. gigantica* is larger than *F. hepatica* and can reach up to 7.5cm in length (FAO, 2009). Identification of fasciola eggs from other flukes, especially from the large eggs of paramphistomum; Fasciola eggs have yellowish-brown shell with an indistinct operculum and embryonic cells whereas paramphistomum eggs have transparent shells, distinct operculum with embryonic clear cells, and possess a small knob at their posterior ends (Taylor, M.A *et al*.,2007). Factors that determining the occurrence and severity of fasciolosis are the availability of suitable snail habitat, temperature, moisture, and host ranges are most importantly influencing (Maqbool A *et al*., 2002). *Lymneae truncatula* and *Lymneae natalensis* is considered as principal intermediate hosts of Fasciola *hepatica* and fasciola *gigantic* respectively (Bowmann *et al*., 2003).

Pathogenesis and clinical sign: Depending upon the development of the parasite in the liver and the species of the host involved its pathogenesis has two phases. The former phase occurs during migration in the liver parenchyma and is associated with liver damage and hemorrhage. The second occurs when the parasite is in the bile duct and result from the haematophagous activity of

the adult fluke and from damage to the biliary mucosa by their tegumental spines (Taylor, M.A *et al*., 2007). The first phase is associated with liver tissue damage and causes hemorrhage while the second phase results in the haematophagous activity of adult flukes and damage to the biliary mucosa, which causes cholangitis by their cuticular spines (Radostitis *et al*., 1994).

Clinical signs of fasciolosis are associated with liver fluke infection, depending on the numbers and stages of development of the parasites. However the disease causes a wide range of clinical signs, none of the syndromes is pathognomonic. Ingested number of metacercariae manifests the disease as acute, subacute, or chronic forms. Acute fasciolosis rarely occurs in cattle and is less common than the chronic form whereas hepatitis is caused by simultaneous migration of a large number of immature flukes. It's characterized by weight loss, anemia, and hypoproteinemia (Urquhart *et al*., 1996). Subacute forms of the disease by ingestion of moderate numbers of (500-1500) metacercariae are ingested over a longer period and if reached bile ducts cause cholangitis (Bowmann *et al*., 2003). The most common form of fasciolosis in cattle is chronic form and occurs when the parasites reaches the hepatic bile duct characterized by the classical clinical signs: gradual losses of condition, progressive weakness, anemia, jaw" due to edema under the jaw and hypoproteinemia with development of edematous subcutaneous swelling, especially in the intra-mandibular space and over the abdomen (Hunter, 1994; Michael, 2004).

Diagnosis: Tentatively it was diagnosed based on prior knowledge of the epidemiology of the disease in a given environment, clinical sign observation, grazing history, and seasonal occurrence, examination of feces by laboratory tests, and post mortem examination as tentative and confirmatory diagnosis (Terefe, D *et al*., 2012). Demonstration of fasciolla egg through standard examination of feces in laboratory, postmortem examination of infected animals and demonstration of immature and mature liver flukes in the liver was considered as a confirmatory diagnosis. Fecal examination was diagnosed by finding eggs in the feces by using sedimentation technique since fasciola eggs have high specific gravity and sedimentation is preferred to floatation (Sloss, M *et al*., 1994).

3.6.2. Case description and presentation

A 7-years old lactated local Cow was presented to the Veterinary Teaching Hospital of AAU-CVMA, with chief complaints of grazing at the field of marshy and mud area of cheleleka and showed gradually decreased milk yield and progressive weakness with swelling under dewlap and the neck area. Physical examination of the Cow revealed that temperature of 36.9 0C and slightly no change with respiratory rate and heart rate and "bottle jaw" due to edema under the jaw (Figure13 A&B) which is not firm upon palpation and icterus/yellowish mucous membrane was examined. The EDDiE diagnosis and examination of the case revealed fasciolosis. Based on the chief history of the animals, clinical signs and EDDiE diagnosis the case was tentatively diagnosed as fasciolosis. For case, confirmatory fecal sample was taken and sent for the parasitological laboratory of AAU-CVMA. Amebiasis, other GIT parasite infections, cysticercosis, and ascariasis were listed as differential diagnoses.

Figure 13: Cow suffered by Fasciolosis (A), edema under dewlap of the Cow (B) and isolated egg of fasciola under microscope (Cand B).

3.6.3. Laboratory findings and investigation

The fecal sample was collected from the cow directly from the rectum into a clean universal bottle. Examination of the fecal samples for Fasciola species was made according to the methodology described by Hendrix (1998) and Hansen and Perry (1994). Three grams of feces will be put in a jar and mixed with 42ml tap water and stirred well with a string rod. After the sedimentation was conducted, the supernatant part was decanted and sediment was transferred to the microscope with a cover slide, and the presence of fasciola eggs under the microscope was examined as a result thin-shelled, embryonated, and oval-shaped eggs were detected as below (Figure 13 C and D).

3.6.4. Management and treatment outcome

Triclabendazole (12 mg/kg) is considered the most common drug due to its high efficacy against adult as well juvenile flukes. It is effective against adult F. hepatica at a dose rate of 12mg/kg Po, stat in cattle. It is ovicidal and will kill any F. hepatica eggs present in the bile duct or the alimentary tract at the time of treatment. After therapeutic management of a week, the owner informed me that the Cow was fully recovered with normal milk yield.

3.6.5. Discussion

Bovine fasciolosis is an economically vital parasitic disease and is aggravated based on the distribution of intermediate hosts of liver fluke in areas where the cattle and sheep raised as a report of (Terefe *et al*., 2012). In this case report, obtained history, clinical sign and laboratory finding reveals the case was fasciolosis in which the obtained clinical sign was met with the review of (Alemu B, 2019). Sedimentation technique of parasitological laboratory examination was revealed the eggs of fasciola, oval operculated golden eggs which agreed with the finding of (Kassai, 1999). The laboratory examination obtained was agreed with the result obtained by EDDiE.

Diagnosis was made on tentative (prior knowledge of the epidemiology of the disease in a given environment, clinical sign observation, grazing history and seasonal occurrence) and

confirmatory tests (Demonstration of fasciola egg through standard examination of feces in the laboratory, postmortem examination of infected animals and demonstration of immature and mature liver flukes in the liver) as Terefe *et al*., (2012) was reviewed. For the treatment of Fasciolosis, using flukicides, chemicals toxic to flukes and triclabendazole is required. Because it's considered as the most common drug due to its high efficacy against adult as well juvenile flukes and in the current case report also we were using triclabendazole for treatment purposes which is similar to a report of Bowmann *et al*., (2003).

In conclusion, fasciolosis is considered as limiting factor for livestock production and causes several economic losses due to mortality and organ condemnation particularly liver in the abattoir. Therefore, controlling fasciolosis is possible by reducing the populations of the intermediate snail host or by appropriate anthelminthic treatment with regular deworming and destroying the environment that is suitable for snail‟s reproduction.

3.7. Colibacillosis: A case in Calf

Abstract:

Colibacillosis is considered one of the most significant bacterial diseases in calves, causing mortality and enormous economic losses in cattle-producing industries as a world. A -three- days old exotic female Calf was presented to Veterinary Teaching Hospital of AAU-CVMA on March 19, 2021 with chief complaints of the Calf was suffered from excessive yellowish diarrhea, refused to suckle milk, and lethargy. Physical examination of the Calf revealed, highly dehydrated, depressed and visible yellowish blood-tinged diarrhea and slightly foul smell with a rectal temperature of 40.2^0C, increased respiratory rate and heart rate 100beat/minute, and dry and pale mucous membranes. The EDDiE result has also revealed the case as a colibacillosis. Coccidiosis, Rotavirus, coronavirus, and salmonellosis were listed as differential diagnoses. Finally after bacterial culture showed the infection of the Calf by *E-Coli* the case was definitely diagnosed as colibacilosis. For Therapeutic management, Trimethoprim-Sulfamethoxazole 30mg/kg (Hebei Yuanheng Pharmaceutical Co., Ltd, China) administered intramuscularly (IM) with 1ml/10kg for three days with ringer lactate restore body fluids. The calf was fully recovered

after the treatment. To mitigate the infection of the calf by *E Coli*, adequate colostrums and proper sanitation of the calf are mandatory.

Keywords: *calf, colibacillosis, e-coli, sulfamethoxazole*

3.7.1. Introduction

Calf diahrrea result from a complex interaction of the environment, the infectious agent and the calf itself and it's a multifactorial disease entity that can have serious financial and animal welfare implications in both dairy and beef sucker herds. Calf scours or calf diarrhea causes more financial loss to cow-calf producers than any other disease-related problem they encounter (Bartel *et al*., 2010).

Colibacillosis also known as: E. coli infection, enterotoxigenic E. coli (ETEC) or Septicaemic Colibacillosis. Most frequently in calves, lambs and piglets 1-3 days after birth, Colibacillary diarrhea occurs. In very young calf different serotypes of enterotoxigenic E. coli can cause either diarrhea or septicemia (Bashahun and Amina, 2017; Gruenberg, 2014). Enteric colibacillosis (enterotoxin colibacillosis and local invasive) is characterized by diarrhea, dehydration, loss of weight, depression, anorexia, and weakness that results in economic losses in both dairy and beef calves production (Moon, 1974) that possess virulence properties that enables them to cross the mucous membranes of intestines, nasopharynx, crypts of tonsils or umbilical veins. The main factor which predisposes a calf to systemic colibacillosis is gamma-globulin deficiency and that the IgM fraction of serum gamma-globulin prevented colisepticaemia (Logan & Penhale, 1971). If colostrum is to be effective it must be ingested within a few hours of birth because little or no absorption occurs after 24-36 hr. generalized infection follows an acute, usually fatal course (Tennant *et al*. 1978).

Etiology and its clinical sign: The causative agent of the disease is certain strains of E. coli including enteropathogenic E. coli (EPEC). It is a gram-negative rod-shaped motile or non-motile facultative non-spore forming, variable in size or shape, anaerobic member of the entrobacteriaceae family, and facultative inhabitant found in gastrointestinal tract of humans and warm-blooded animals and also found in the environment (Han *et al*, 2007). E-coli are divided

into harmless strains of the normal flora of the gut which can benefits their hosts and Pathogenic E. coli which harms their hosts. Pathogenic E. coli are divided into: *Enteropathogenic E. coli* and *Uropathogenic E. coli*. Further pathogenic *E. coli* are classified into six well-described categories:- *enterotoxigenic E. coli* (ETEC), *enteropathogenic E. coli* (EPEC), *enteroinvasive E. coli* (EIEC) and *enterohemorrhagic E. coli*/EHEC (Radostits *et al*., 2000).

Pathogenesis: Following the invasion of pathogenic E.coli, they produce bacteriamia and septicemia having the ability to resist the host's defense mechanisms and produces septicemia and diarrhea in a wide range of hosts including man, avian and animals (Jesse *et al*., 2016). These disorders are severe enough to results in death occurred within 24 hours due to severe dehydration unless treated. E. coli causes watery diarrhea and weakness in 1 to 4 days old newborn calves (Cho *et al*., 2010). Adhesion of bacterial cells to glycoproteins on the epithelial surface of the jejunum and/or ileum promoted by fimbrial adhesion F5 (K99), and bacterial enterotoxin also causes damage to the epithelial cells, resulting in fluid secretion and diarrhea (Acres, 1985). The presence of one or more virulence factors including invasiveness factors like invasins, heat-labile, heat-stable enterotoxins, verotoxins, and colonization factors or adhesions are cause the pathogenecity of E-coli strains (Kaper *et al*., 2004). Also, the virulence reasons associated with colibacillosis include the possession of large transmissible virulence plasmids, as well as the ability to resist phagocytosis and serum killing, ability to uptake iron at low extracellular concentrations and, most importantly, the ability to attach and adhere to the host's structures (Lutful, 2010).

Clinical findings: Colibacillosis manifested by severe diarrhea caused by enteritis, lameness, stunted growth, inactivity, lack of appetite and water consumption, and unresponsiveness. However, the infected animals might not express all of these characteristics, or even most of them. But necessarily if an animal possesses one or more of these factors, it does have colibacillosis either. Colibacillosis signs are nonspecific and vary widely among different hosts. Depending on which infection/infections of the E. coli strain causes in a particular flock of animals morbidity and mortality are very variable depending (Ahmed *et al*., 2013). Profuse, foul-smelling, yellow-to-white diarrhea may infect the lungs, navel or joints and due to septicaemia or

toxaemia may cause sudden death in calves less than two weeks of age. Considerably the clinical syndromes believed to be associated with colibacillosis vary (HMD, 2010).

Diagnosis and its differential diagnosis: diagnosis of colibacillosis were on the basis of an accurate history, clinical signs, and culture of fecal and internal organs for bacteria and serotyping of the organism and site of culture from the intestine, demonstration of a severe deficiency of circulating IgG, serological test (Hudson and White, 1982). Differential diagnoses for colibacillosis are:-coccidiosis, Rotavirus, coronavirus, acute septicemias caused by Streptococcus, Diplococcus, Pasteurella, Salmonella spp and Cryptosporidia (Bashahun and Amina, 2017).

Treatment and prevention for colibacillosis: provision of adequate concentrations of immunoglobulin from colostrum is resistant to colisepticemia. Primarily prevention depends on management practices that ensure an adequate and early intake of colostrum. If available, vaccination should be given for immunity against many types of E. coli to builds high antibody levels in the colostrums. Absorption of colostrums from the gut into circulation develops acquired passive immunity as the main defense mechanism of the neonatal against diarrhea caused by E.coli (Groutides and Michell, 1990).

3.7.2. Case description on colibacillosis in Calf

A three-day-old female exotic Calf weighed about 20kg was presented to the Veterinary Teaching Hospital of CVMA-AAU on March 19, 2021. From chief complaints of the owner, the Calf was suffered from excessive yellowish diarrhea for a day (figure18A), lethargic and refused to suckle milk. Physical examination was revealed, the Calf was highly dehydrated, depressed, and a visible yellowish mixed with bloody diarrhea which was watery and slightly foul-smell was observed. Rectal temperature of the Calf was 40.2 ^{o}C with an increased respiratory rate and heart rate of 100beats/min, and the mucous membrane was pale and dry. From history and observed clinical signs, the case was tentatively diagnosed as colibacillosis. EDDiE has also revealed the case as a collibacillosis. For confirmatory diagnosis fecal sample was taken and sent to microbiology laboratory of AAU-CVMA. Salmonellosis, coronavirus, rotavirus, and coccidiosis were listed as differential diagnoses.

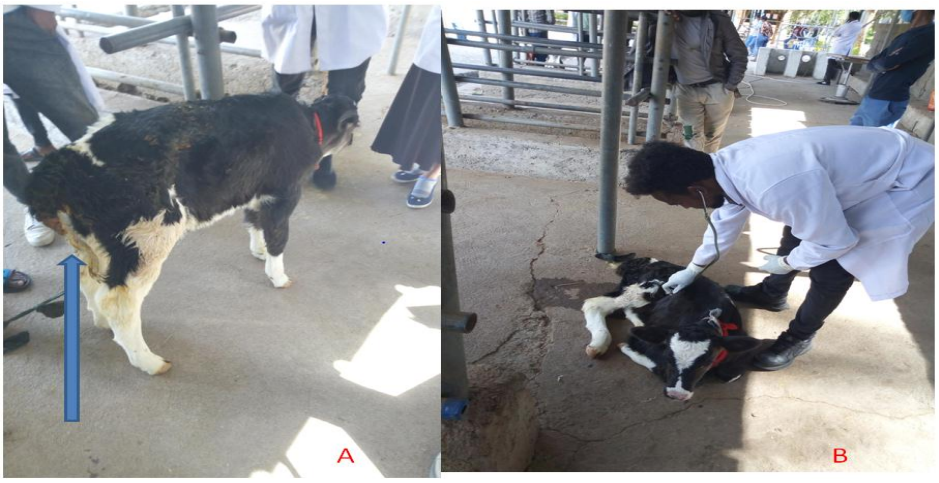


Figure 14: Pictorial presentation of Calf suffered from yellowish diarrhea (A) and physical examination of Calf (B)

3.7.3. Laboratory finding and its investigation

For laboratory investigation, fecal sample was aseptically collected from the Calf into a sterile tube and sent to parasitological and microbiology laboratory of AAU-CVMA. After the floatation technique was employed to check for the presence of Eimera, the result showed negative. Then the fecal sample was culture on Tryptone soya broth at 37^0c for 24hr for primary culturing of *E. coli* organisms. Again for the isolation and identification of *E. coli*, the sample was cultured on MacConkey (MC) agar, XLD agar and Eosin Methylene blue (EMB) agar medium which was used as a selective medium for *E.coli*. On MacConkey agar the colony observed was pink circular, On Eosin Methylene blue (EMB) agar metallic sheen, and on XLD agar yellow circular colony was characterized and from all these finding the causative agents of the calf diarrhea was due to *E.coli* infection.

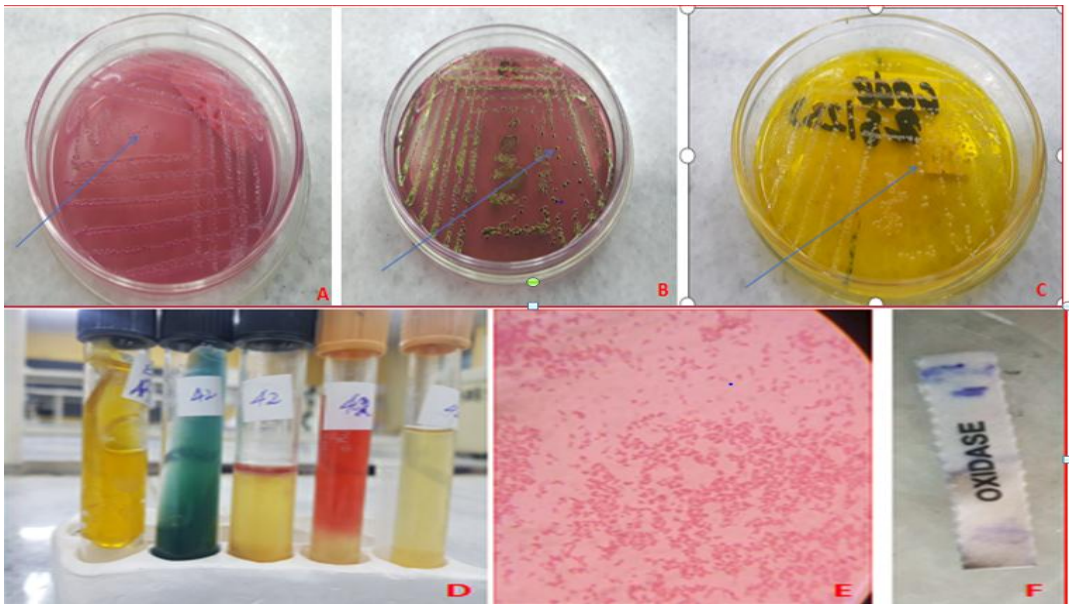


Figure 15: Isolation and identification of *E. coli* bacteria. (A) On MacConkey agar pink colony as a result of fermentation of lactose, (B) On EMB ager metallic sheen colony, (C) On XLD agar yellow circular colony, (D) Biochemical test results, (E) Gram-negative rod, and (F) Oxidase-negative.

3.7.4. Management and its treatment outcome of Colibacillosis

Definitively the case was diagnosed as colibacillosis in the Calf based on a history obtained, clinical signs observed, EDDiE result, and laboratory findings. Trimethoprim-Sulfamethoxazole 30mg/kg (Hebei Yuanheng Pharmaceutical Co., Ltd, China) was administered intraveneously (IV) and intramuscularly (IM), at a dose of 1ml/10kg as the initial dose at the first day and maintenance dose for five days with dexamethasone (Sokar Healthcare Pvt. Ltd. Gujarat India) at a dose of 0.2mg/kg/day I.M, to control pain and inflammation associated *E.coli* infection. The owner was advised to provide a sufficient amount of colostrums during an early stage of calves with good management hygiene of the calf. The calf was constantly followed during the treatment for three days and responded well to the treatment. After five days of therapeutic management, the calf recovered from the problem and start normal physiological life as indicated in the below picture (A&B).

Figure 16: Pictorial presentation of calf suffered by diarrhea (A) and Calf recovered from e-coli infection of colibacillosis after therapeutic management and relieved from diarrhea (B)

3.7.5. Discussion

Colibacillosis is a bacterial disease caused by pathogenic *Escherichia coli* specifically the enterotoxigenic, enteropathogenic, enteroinvasive, and enterohemorrhagic *E. coli* and leads to death of Calf which is deprived of colostrums and unvaccinated. In this current case report based on history, clinical signs, EDDiE application, and laboratory findings finally the case was diagnosed as colibacillosis which is in agreement with the report of Bashahun and Amina. (2017). In this current report, bacteria was isolated as causative from different causative agents of diarrhea in Calf‟s which have an agreement with the report of Brunauer *et al*, (2021). EDDiE application diagnosis and the result of laboratory obtained were also revealed similar results.

In this present case report, the most common clinical signs observed in neonatal calf diarrhea were: diarrhea, dehydration, depression, weight loss, systemic reaction, which was in agreement with (Moon, 1974). From the causative agents of calf diarrhea, the isolated pathogen was bacteria specifically *E. coli* which caused colibacillosis in a calf which is a major cause of diarrhea in calf (yimer *et al*., 2015) and Enteropathogenic *E. coli* (EPEC), which also known as adhering and effacing *E. col* is usually the causative agent for severe diarrhea in Calf and small ruminants (Wani *et al*., 2013).

The primary harm from scours is loss of water and electrolytes (body salts) in diarrhea which leads to dehydration and alteration of the acid-base balance of the bodily fluids due to

inflammation of the intestinal lining and impairs the ability of the calf's to digest nutrients as a report of Cho *et al*., (2010). Fimbrial adhesion F5 (K99) promotes adhesion of bacterial cells to glycoproteins on the epithelial surface of the jejunum and/or ileum causes to damage to epithelial cells and results in fluid secretion and diarrhea (Acres, 1985) causes the pathogenicity of E-coli strains with the presence of virulence factors as Kaper *et al*., (2004) reported.

For treatment and prevention of colibacillosis provision of adequate concentrations of immunoglobulin from colostrum enables to develop of resistance against neonatal calf diarrhea or colisepticemia. Hence, primary management of colibacillosis depends on the practice of supplying calf with a sufficient amount of colostrums and maintenance of strict hygienic and sanitary measures. Absorption of colostrums from the gut into circulation develops acquired passive immunity as the main defense mechanism of the neonatal against diarrhea caused by *E.coli* (Groutides and Michell, 1990). Currently, the case was managed by Trimethoprim-Sulfamethoxazole 30mg/kg and dexamethasone 0.2mg/kg/day with good response of post-treatment care.

In conclusion, the susceptibility of the calf to E-coli infection depends on the number of antibodies in the colostrums, intake of the colostrums, and absorption of antibodies from the gut. Therefore, an adequate supply of colostum to withstand the *E.coli* infection was required.

3.8. Treatment outcome of Pox; Cases in Ewe and Doe

Abstract

Sheep and goat pox **(**SGP**)** is a contagious viral disease causes considerable loss in the small ruminants industry worldwide. An old female goat (Doe) together with Ewe was brought to Dire veterinary clinic on February 12, 2021, with the a history of no vaccination, loss of appetite, depression, nodules like lesions on their body parts, and they were kept together at the field. Physical examination revealed a high temperature of 40.1^0C, heart rate of 84beat/min, respiratory rate of 26breath/min, with dehydration, rough hair coat, and lesion of poxes like nodules on the neck area and over the entire body of the goat and the ewe also shows the same sign with pox lesion under the tail was grossly seen. Diagnosis assisted by EDDiE revealed the case as SGP.

Based on the History, outbreak occurrence, EDDiE, clinical signs observed the case was finally diagnosed as SGP. For management of the case disinfecting by antiseptic and symptomatic treatment with 20% ox tetracycline; 20mg/kg, IM and 5% Diclofenac sodium liquid injection (AdvaCare GMP, China) 2.5mg/Kg/day IM was administered. After post-therapeutic care follows up of two weeks the doe progress was good and the ewe was also on recovery however not presented during follow-up as a report of the owner indicated. SGP are a contagious viral disease of small ruminants that significantly causes losses in wool and hide production results in a decrease of GDP. Therefore, as a control measure vaccination of apparently healthy animals was recommended to woredas livestock health officer.

Keywords: *doe, ewe, sheep, and goat pox*

3.8.1. Introduction

Sheep and goat pox (SGP) is among the major small ruminant viral diseases affecting the production and productivity of the country which is widely distributed in all regions of Ethiopia (Tsegaye *et al*., 2013). SGP is a systemic viral disease that causes high morbidity and mortality in sheep and goats (Nesradin Yune and Nejash Abdela, 2017). The virus that causes SGP is the sheep and goat pox virus of family *poxviridae*, genus capripoxvirus, one of the largest (170-260 nm by 300-450 nm), enveloped double-stranded DNA viruses (Tulman *et al*., 2002). Following Peste des Petits Ruminants (PPR) and Contagious Caprine Pleuropneumonia (CCPP) Sheep and Goat Pox (SGP) is one of the most important diseases of sheep and goats in Ethiopia that affect small ruminants entailing a huge economic loss and listed as a trans-boundary disease of animal affecting the economy of the country (Befikadu and Endale, 2017). SGP is a highly contagious viral disease of sheep and goats (ESGPIP, 2009).

SGP is manifested by the skin and internal organ and characterized by pox lesions, fever, conjunctivitis with oculonasal discharge and excess salivation associated with high morbidity, mortality and export restriction of sheep and goats and their by-products and hence it is economically an important disease (Babiuk *et al*., 2008). The virus has prolonged survival in the environment, is resistant to drying and freezing, thawing, and remain viable for months in the lyophilized tissues and inactivated by sunlight and heat, but can survive in a cool dark

environment for up to 9 six months (Davies, 1981). It is transmitted by direct contact, indirect contact with infected objects or fomites and through insects that can mechanically transmit the diseases. Upon establishment of infection in the host, it can cause highly devastating systemic viremia which is characterized by widespread skin eruption, fever, generalized papules or nodules, vesicles (rarely) on a hairless area of the skin, internal lesions in the lungs, respiratory and gastrointestinal mucosa and cause the death of the animals (Abd-Elfatah *et al*., 2018).

Etiology: SGP viruses are belonging to the family *Poxviridae*, subfamily *Chordopaxvirinae* and genus of Capripox viruses. These are large (170–260 nm by 300-450 nm), double-stranded deoxyribose nucleic acid (DNA) and enveloped viruses (Tulman *et al*., 2002). The length of the genome of SGP viruses is about 150-kbp which includes at least 147 putative genes shared between the species of viruses (Muhaidi *et al*., 2018). The genomes of SGP and lumpy skin disease (LSD) viruses have 97% similarity in their nucleotide identity (Bhanuprakash *et al*., 2006).

Transmissions: The virus of sheep and got pox is highly contagious. The respiratory tract is best route of entry for the virus and transmission is mostly by aerosol through contact with infected animal or fomite after the virus enters via the respiratory tract and transmission of the virus between and among flocks occurs from the movement of sheep and goats (OIE, 2017; Gitao *et al*., 2017). Sheep pox virus and goat pox virus appeared to be transmitted mainly during close contact, but also occur in contaminated environments. Spreads of the virus also occur from contact with contaminated materials and through skin abrasions produced iatrogenically or by insects (Kitching R, 2004). The virus is shed in oral, nasal and ocular secretions as well as in scabs that have fallen off the animal and transmission occurs through aerosols and direct contact in infected sheep and goats (Bowden *et al*., 2008). Contact with contaminated materials and through skin abrasions facilitates the spread of the disease in which the Movement of infected small animals is the main cause of spreading SGP viruses (Radostits *et al*., 2006; Alemzewud W, 2019).

Pathogenesis: There is variation in the incubation period of SGP ranges from 4-14; however OIE recorded a maximum incubation period of 21 days (OIE, 2010). After it enters, the SGP virus

replicates locally in the tissues. Since the virus is epitheliotropic, it will infest the epithelium tissues of the organism. Then the virus spreads to the regional lymph nodes, after 3-4 days of primary viremia then spread in the body and affects the spleen, lungs and liver and also inhaled virus may also cause lungs lesions. Within 24 hours of the appearance of generalized papules, affected animals develop conjunctivitis, rhinitis and enlargement of all the superficial lymph nodes, in particular the prescapular lymph nodes. Excessive salivation can also occur after an infection (OIE, 2012). There are five stages in the development of poxvirus infection i.e.: roseola stage in which Skin lesions typically begin with small red spots and febrile within three days of infection, papules where nodular skin lesions are hard during palpation, vesicular when papules changed into vesicles, postural develops after three days of vesicular stage and the last stage of pox lesion is scab as stated by researchers (Bowden *et al*., 2008).

Clinical sign and findings: in field condition the clinical sign of sheep and goat pox are and their incubation period is between 4-15 days (Kitching and Taylor, 1985). SGP is characterized by Fevers which peak at 40-42 °C, dyspnea and oculonasal discharge and pox lesion on alopetic skin are manifested. The severity of disease was more common in young than adults (House, 1992).

Diagnosis and differential diagnosis: antigens and nucleic acids of Capripoxviruses can be detected in skin lesions (e.g., biopsies, scrapings, vesicular fluid, scabs); oral, nasal and ocular secretions; blood; lymph node aspirates; and tissue samples from external or internal lesions collected at necropsy. However the clinical signs of severe sheeppox and goatpox are highly characteristic, in their mild form they can be confused with parapoxvirus causing orf or urticaria from multiple insect bites, Contagious ecthyma (contagious pustular dermatitis), insect bites, Bluetongue, PPR, Photosensitization, Dermatophilosis, Parasitic pneumonia, Caseous lymphadenitis and mange (WHO, 2012; OIE, 2008).

Treatment and prevention SGP It is obvious that there is no specific treatment for pox virus of sheep and goat; however management strategies should be directed to control complication of secondary bacterial infection as supportive treatment. In countries free of pox virus controlling the importation of sheep and goats and prompt movement restriction of animals, culling affected and in contact animals and ring vaccination of sheep and goats flocks regularly on an annual basis

with a safe and efficient vaccine is possible (Yeruham *et al*., 2007). In countries where pox virus were enzootic control measure are vaccination and implementation of biosecurity (Kitching, 1986; Bhanuprakash *et al*., 2011).

3.8.2. Case history and description of SGP

An old female goat (Doe) weight about 35kg with Ewe was brought to Dire veterinary clinic on February 12, 2021 with a history of no vaccination, loss of appetite, depression, nodules like lesion on their body parts, and also Ewe was suffered similarly with Doe due they were kept and extensively managed together at the field. Physical examination showed temperature of 40.1^0C, heart rate 84beat/min, respiratory rate 26breath/min, with dehydration, depression, rough hair coat and pox like lesion on the neck area and all over the superficial parts of the goat and the ewe with pox lesion under the tail was grossly seen as indicated below (figure 17C). The goat was also in a dehydrated stage, depressed, rough hair coat, and pock lesion in head, neck and tail region as indicated below in figure, emaciation, and erosion on the tongue and eye. The area of nodules and lesions was easily visible due to the surrounding hair are coated and erected. The EDDiE diagnosis revealed the case as SGP. Based on the History, outbreak occurrence, EDDiE, clinical signs observed the case was finally diagnosed as SGP.

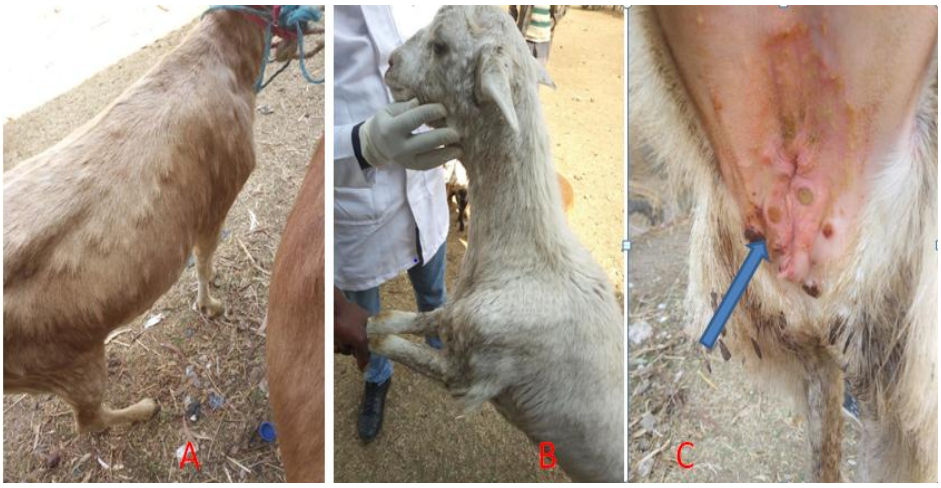


Figure 17: Pictorial presentation of Doe suffered by pox virus with viscible nodules on the superficial body(A), Ewe suffered by poxvirus with visible nodules on fascial and neck area(B) and lesion of pox under the tail of Ewe(C)

3.8.3. Management and treatment outcome of SGP

However there is no specific therapeutic management for viral diseases, the Doe and Ewe were treated with antibiotic Oxytetracycline 20%; 20mg/kg for prevention of secondary bacterial complication and 5% Diclofenac sodium liquid injection (AdvaCare GMP, China) 2.5mg/Kg/day. After two weeks of post-treatment the Doe was visited and was recovered (Figure 18) and the Ewe was also recovered from the report of the owner, however, was not presented during the follow-up period.

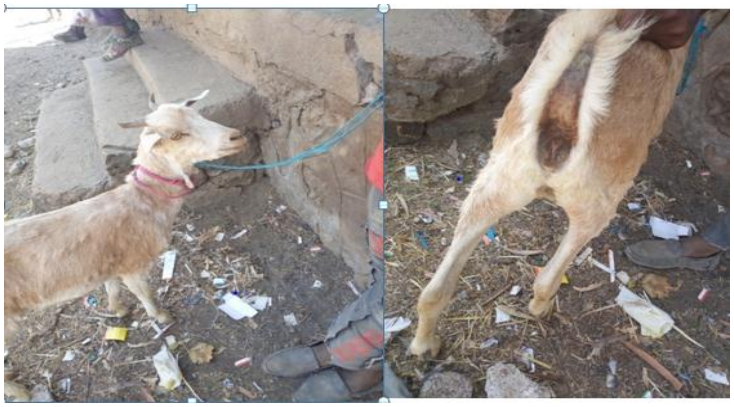


Figure 18: Photograph of Doe after therapeutic management of two weeks follow-up

Limitations

Laboratory confirmation was not made for this disease due to scarcity of viral transport media facilities and hence treatment was done based on the clinical picture only (symptomatic therapy).

3.8.4. Discussion

Sheep and goat pox (SGP) is known for contagious viral disease affecting small ruminants. Based on the limitation of international trade of animals and decreased animal products like milk and meat production, damage to the estimated values of quality hides and wool, and other products (Barua *et al*., 2017) it's considered a major viral disease causing economic losses on GDP of the country. Sheep and goat pox (SGP) was diagnosed on the basis and concern of the animal's previous history from the owner, occurrence in the flock, clinical signs, and lesions observed with

EDDiE result. Examination of the clinical signs and observation of gross nodules and lesions that appeared, in this case, agrees with the report of House, (1992). The first case was reported in goat and further to Ewe in communal grazing and watering area even due they were housed and managed at the same place. As a report of OIE the maximum incubation period of SGP is ranged up to 21 days (OIE, 2010) while its occurrence was manifested by high fever (41 to 42°C), marked depression, and discharges from the eyes and nose, swelling of nostrils, followed thick discharges from the nose and watery discharges from the eyes, and keratitis may develop, in which the current case report was in agreement with the report of Daoud, (1997).

SGP virus enters via the respiratory tract and aerosol infection is considered as the main route of transmission associated to close contact with infected animals. However viruses are shed in secretions and excretions of infected animals, it is believed that they are not important sources of transmission during outbreaks, because it is difficult to recover live viruses on tissue culture from scabs materials. The main cause of spreading SGP viruses is considered as movement of infected animals to susceptible animals (Kitching, 2004; Radostits *et al*., 2006). viral DNA in secretions of infected animals and the highest level of shedding of the infectious virus occurred between about 1-2 weeks post-inoculation, and this secretion continued for up to an additional 3-6 weeks (Bowden *et al*., 2008). EDDiE result was agreed to the current clinical signs observed in this case report.

For confirmatory diagnosis, due to scarcity of VTM, the biopsy of the nodules was not collected and processed. Management and prevention strategies are highly focused on control of the disease, once it has entered, is usually by early detection and notification, prompt movement restriction of animals, ring vaccination with a dead vaccine and culling affected and in-contact animals (Kitching, 1986; Radostits *et al*., 2006; EFSA Panel on Animal Health and Welfare, 2014) with routine control measures include the disinfection and cleaning of depopulated premises and establishment of protection and surveillance zones, around the outbreak, as recommended by EU Council Directive (Mangana *et al*., 2008). In this present case report, symptomatic-based treatment of long-acting oxytetracycline and 5% Diclofenac sodium liquid injection were recommended and this agreed with the report given by Barua *et al*. (2017) on therapeutic management of SGP. In conclusion, SGP causes considerable economic losses in

dairy sheep and goat flocks. Therefore, to mitigate and minimize the risk of SGP, regular vaccination in collaboration with the district livestock office is forwarded.

3.9. Peste des petits ruminants (PPR): A case in buck

Abstract: Peste des petits ruminant (PPR) is an economically important and highly contagious viral disease affecting sheep, goats and wild ruminants. A 10kg weighted young buck was presented to Veterinary Teaching Hospital of Addis AAU-CVMA on February 26, 2021 with compliants of the buck was bought from Arsi Negelle and suffering from depression, frequently coughing, diarrhea (watery), loss of appetite, Ocular and a clear nasal discharge with progressive dehydration and emaciation with no history of treatment and vaccination after bought. Physical clinical examination revealed a temperature of 41.3^{0}C, RR-36breath /min, highly increased pulse rate and the buck was dehydrated with sunken eyeball and matted together of eyelids. The EDDiE was revealed the case as PPR. Based on the evidence obtained from history, clinical signs, and EDDiE result, the disease was diagnosed as PPR. For confirmatory, serum sample was taken and sent to NVI and the RT-ELISA revealed positive result. The result of Ultrasound indicated inflammation of the lung (pleurisy). Currently the case was managed by 5% Diclofenac sodium liquid injection (AdvaCare GMP, China) 2.5mg/Kg/day for three days as antipyretic and anti-pain and Oxytetracycline 10% at a dose of 10mg/kg/day was administered and the buck was finally recovered. PPR causes huge substantial economic losses to the farmers. Therefore, control measures should be put in place to minimize the loss associated with the disease.

Keywords*: buck, Oxytetracycline, PPR*

3.9.1. Introduction

In Ethiopia, Sheep and goat populations are estimated to be 25.5 million and 26.43 million, respectively, and this is to be the largest population in Africa (Gargadenne L *et al*., 1942). A Peste des petits ruminant (PPR) is a widespread, acute, highly contagious, virulent and frequently fatal viral disease of sheep, goats and wild ruminants. It is characterized clinically by fever, mucopurulent ocular and nasal discharges, necrotizing and erosive stomatitis, severe enteritis, and pneumonia leading to death (Furley W *et al*., 1987; Gargadenne L *et al*., 1942). The causal agent

is a Morbillivirus (Albina E *et al*., 2013). PRR virus belongs to order Mononegavirales, genus Morbillivirus of family Paramyxoviridae (Gibbs E *et al*., 1979). It is antigenically very similar to the Rinderpest virus and other members of the genus Morbillivirus including measles virus, phocine distemper virus, canine distemper virus and dolphin morbillivirus (Bailey D *et al*., 2005). PPR is a transboundary animal disease of significant economic importance, ranking among the top ten diseases affecting small ruminants (Diallo A, 2006; Perry D *et al*., 2002).

PPR was first described in Ivory Coast, West Africa in 1942 and then spread to many Africa and Asian countries and currently, it's a global issue causing major economic losses in tropical and sub-tropical countries of the world (Gargadennec and Lalanne, 1942). In Ethiopia, PPR was clinically suspected in 1977 in a goat (Abraham G *et al.,* 2005) and serological evidence was reported in 1984 and later confirmed in 1991 with a cDNA probe (Roeder *et al*., 1994). PPR is among the commonest of diseases that affect small ruminants entailing a huge economic loss as it is listed transboundary diseases affecting the economy of the country through limiting international trade of animals and animal products (OIE, 2008). Currently, PPR is endemic in Ethiopia and the National Veterinary Institute (NVI) produces live attenuated vaccines using PPR75/1 (LK6 Vero74) strain (Ayalet G *et al*., 2012).

Morphology of PPRV: PPR virus is single-stranded RNA, lymphotropic, non-segmented and enveloped pleomorphic, negative in polarity, with diameter range from 150 -700 nm, with a mean of 500 nm (Dhar P *et al*., 2002). Due to the presence of helicoidal nucleocapsid surrounded by lipoprotein envelope PPRV can be easily destroyed by through lipid solvents and is very delicate, especially outside the host. The genome of nucleocapsid is surrounded by three viral proteins: nucleoprotein (N), phosphoprotein (P) and the large protein (L). Most importantly nucleoprotein (N protein) is the major viral protein that plays an important role in inducing antiviral immunity. Currently, the great interest in this protein is the use of its cDNA as a potential specific diagnostic probe (Albina E *et al*., 2013).

Transmission; during close contact between animals PPRV is transmitted by the aerosol route mainly through sneezing and coughing (Banyard *et al*., 2010). Affected animals are an important source of transmission during incubation periods, subclinical cases or before the onset of clinical

signs. Animals affected shed the virus in exhaled air, in secretions and excretions from natural orifices approximately 10 days after the onset of fever (Abubakar M *et al*., 2011). Spread through ingestion and conjunctival penetration, by licking of bedding, feed and water troughs are also common. Furthermore, Infection may spread to offspring through the milk of an infected dam (Munir M *et al*., 2013). Moreover, mixed populations of sheep and goats, the introduction of new animals into a herd/flock, the congregation of susceptible animals at grazing land and watering points and, the intensive type farming system facilitate the transmission of this highly contagious disease (Biruk A, 2014).

Clinical sign According to OIE (OIE, 2013), in acute cases, sudden fever may observe that will stay for 5-8 days before the animal either dies or begins to recover. A clear nasal discharge that eventually becomes grey and sticky exudates with severe inflammation of the mucous membrane of the nose, causing respiratory distress is the characteristic sign of PPR. It also causes erosion of nasal and oral mucous membranes, severe oculonasal discharge and congestion of conjunctiva with matted eyelids, profuse non-hemorrhagic diarrhea, severe dehydration progressive emaciation, difficult breathing and death within 5-10 days in the affected animals. Bronchopneumonia with productive cough and dyspnea is common late in the disease while abortion may be seen in pregnant animals (Abubakar, M *et al*., 2008).

Diagnosis and its differential diagnosis: Diagnosis of PPR can be based on history, geographical location, clinical observations, characteristic symptoms, epidemiology, post-mortem lesions and histological findings. Clinical signs and lesions can be misleading for PPR diagnosis with; rinderpest, contagious caprine pleuropneumonia, bluetongue, Pasteurellosis, contagious ecthyma, foot and mouth disease, heartwater, coccidiosis, and even mineral poisonings have similar outcomes (OIE, 2013). Laboratory confirmation of PPR can be diagnosed by various serological and molecular techniques. Serologically the virus was diagnosed by conventional reverse transcription-polymerase chain reaction (RT-PCR) due to its high specificity and sensitivity and indirect ELISA technique is an accurate screening test for diagnosis of PPR, Immunocapture ELISA (ICE) also can be used since it is rapid, specific and rather sensitive for PPRV antigen detection in sick animals (Bao *et al*., 2008).

Treatment and prevention of PPR: However there is no specific treatment for PPR, supportive treatment like dextrose normal saline for restoration of body ionic fluid balance is given with broad-spectrum antibiotics to stop secondary bacterial complications and antipyretic and anti-pain were also given to reduce pain and fever. Prevention of PPR is based on the restriction of movements of sheep and goats from affected areas or newly introduced animals should be quarantined for three weeks (Bharath K *et al*., 2016).

3.9.2. Case description of goat

A young buck weighed about 10kg was presented to the Veterinary Teaching Hospital of AAU-CVMA, on February 26, 2021, with the complaints of the buck was bought from Arsi Negelle for market and with unknown vaccination and treatment history and the buck was suffered from loss of appetite, depression, and diarrhea. After an introduction of the buck into the other flocks, similar signs and symptoms were observed. Physical clinical examination was revealed; there was a high temperature of 41.3^0C, and 36breath/min RR with increased pulse rate, watery diarrhea (figure 19A), and severe oculonasal discharges (Figure 19B), and congestion of conjunctiva with sunken eyeball and matted eyelids (Figure 19C). The EDDiE has diagnosed the case as PPR. Based on the history, clinical signs, and EDDiE result tentatively the case was diagnosed as PPR. For confirmatory test serum sample was collected and sent NVI. Rinderpest, contagious caprine pleuropneumonia, and Pasteurellosis were listed as differential diagnosis.

Figure 19: picture taken during clinical examination of buck: the buck suffered by PPRV infection (A), mucopurulent nasal discharge from the nose (B), congestion of conjunctiva with matted eyelids (C), presence of diahrrea, Lung Ultrasound examination of PPR affected buck (E) and a result of ultrasound revealed pluerisy due to PPRv (F)

3.9.3. Laboratory investigation and USG findings

A blood sample of 4ml from the jugular vein of the buck was collected using a sterile needle and plain vactunair tube labeled with species code. Collected blood sample was put at room temperature for about 24hr in a tilted position to obtain serum, and then sera were decanted into a cryo-vial tube and stored at -20^{0}C until serological analysis to screen for antibodies against PPR virus. Finally, serum sample was sent to National Veterinary Institute (NVI, Bishoftu, Ethiopia) and analyzed using RT-ELISA kit according to the manufacturer instructions and revealed seroposetive for PPR antibodies detecting (annex4). Lung ultrasonography examination has also revealed inflammation of lung/pleurisy (Figure 23F).

3.9.4. PPR treatment and its management outcome

Aiming to reduce further complication, pain, and pyrexia the treatments of the buck were continued. Hence the bulk was treated with 5% Diclofenac sodium liquid injection (AdvaCare GMP, China) 2.5mg/Kg/day for three days as antipyretic and anti-pain with Oxytetracycline 10% at a dose of 10mg/kg/day was administered for five successive days, given by advising the owner to nurse and separate from the other flocks and vaccinates health flocks.

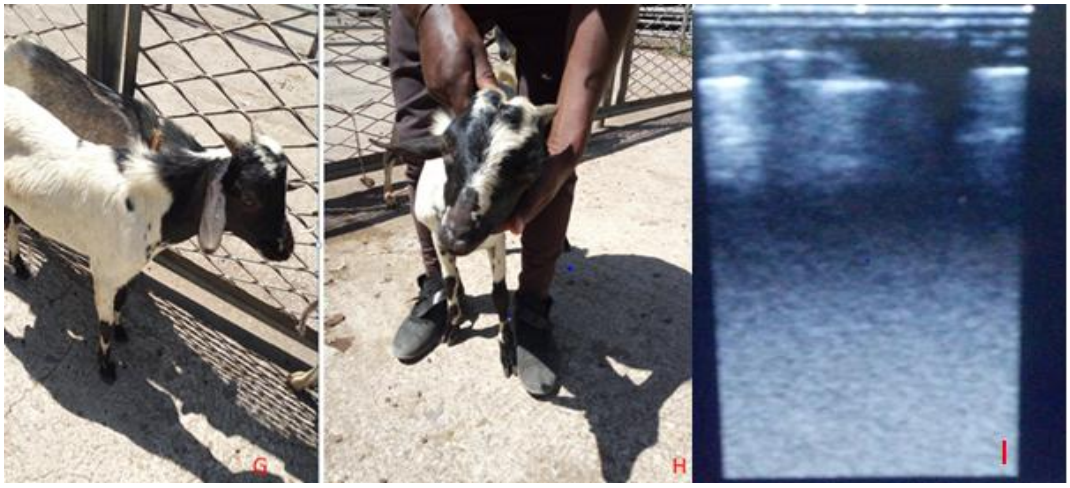


Figure 20: pictorial presentation of the buck recovered after treatment of five days (G) with no sign of mucopurulent nasal discharges from nose and eye (H) and USG of the lung showing normal lung images after 5 days treatment follow up (I).

3.9.5. Discusion

A Peste des petits ruminant is considered the most important transboundary and one of the top ten viral diseases of small ruminants. Its acute or subacute and clinically characterized by fever, watery diarrhea, necrotic stomatitis, gastroenteritis, and sometimes death and can cause significant economic losses due to reduced milk production, increased abortion rates, decreased weight gain, increased susceptibility to secondary bacterial infections, high mortality, and trade embargo and even the death of the animals itself (Alvi *et al*., 2017). In this clinical case report, there is an observation of signs of pyrexia, depression, anorexia, nasal and ocular discharges, and crust on the lips, matted eyelids, and watery diarrhea which are consistent with PPR infection.

These observations were similar to the report of Abraham *et al*. (2005) among different Ethiopian goats and sheep in different parts. The current clinical case report of observed clinical signs like depression, nasal and ocular discharge, watery diarrhea and fever even congestion of conjunctiva with matted eyelids are in agreement with the reported case by Abubakar M *et al*. (2008).

In the Current case report, the history of the buck was purchased from the market and union with another flock not following quarantine periods for housing and feeding had occurred and such phenomena has occurred with the case, Taylor. (1984) that states goats are affected more severely by PPR virus exposure compared to sheep in Ethiopia and they exhibit striking clinical signs while sheep undergo a mild form of the disease.

For laboratory confirmation of the case, a serum sample was extracted from a collected blood sample and sent to NVI for detecting the presence of antibodies. The result of serum analysis by RT-ELISA indicated the presence of antibody for PPR which is in agreement with 'EDDiE' result. Management of the case was based on controlling complication and inflammation by Oxytetracycline 10% at a dose of 10mg/kg/day and 5% Diclofenac sodium liquid injection (AdvaCare GMP, China) 2.5mg/Kg/day.

In conclusion, PPR is a viral disease of major economic importance on small ruminants. Therefore, control measures should be put in place to minimize the loss associated with the disease.

3.10. Caseous lymphadenitis/ Corynebacteriosis: A case in goat

Abstract

Caseous Lymphadenitis (CL) is a chronic contagious bacterial disease of small ruminants and cattle caused by *Corynebacterium pseudotuberculosis* worldwide and lack effective control measures. A 6-month-female goat was presented to Veterinary Teaching Hospital of AAU-CVMA on March 2, 2021 with a complaint of swelling around submandibular, pain upon palpation, and redness. Physical examination revealed slightly normal parameters except a rectal temperature of 40.1^0C. EDDiE diagnosis result showed the case as an abscess. Pus sample was

collected aseptically by scraping from the wall of abscess and an incision was made with a sterile blade with animal identification and was sent for microbiology laboratory and a specimen was cultured on blood agar. Definitive diagnosis was made based upon careful clinical examination and culture of *C. pseudotuberculosis* from discharging lymph nodes. *S.aureus, C.pyogens* and *actinomyces pyogens* were listed as other organism's tha can cause abscess with differential diagnosis of actinobacillosis and tuberculosis. Aspirating the content of the pus, drainage and lavage with antiseptics and penstrip (Chongqing Fantong Animal Pharmaceutical Co.Ltd, China) for five successive days at 1ml/20kg/day was recommended. After follow-up of three days the goat showed a good prognosis. Since therapy of *C. pseudotuberculosis* is unsuccessful, sanitary measure and proper animal handling is necessary to prevent and control of contamination of animals by an organism.

Keywords*: abscess, Caseous Lymphadenitis, C. pseudotuberculosis, goat*

3.10.1. Introduction

Caseous Lymphadenitis (CL) is the most significant of *Corynebacterium pseudotuberculosis* a gram-positive facultative, anaerobic, and pleomorphic bacterium as a causative agent. The disease is a chronically insidious and recurring bacterial infectious disease affecting small ruminants. Its distribution is worldwide and lacks effective control measures because of its poor response to treatment, its ability to persist in the environment, and the limitations in detecting subclinically infected animals (Williamson LH, 2001). The consistency of CL is a cheesy gland and a chronic granulomatous infectious disease of sheep and goats that is characterized by caseous abscesses in peripheral lymph nodes although the organism can spread and cause abscessation in other organs. CL causes ulcerative lymphadenitis in horses and superficial abscesses in bovines, swine, rabbits, deer, laboratory animals, and humans. Globally CLA is distributed and causes important economic losses for ovine and caprine breeders due to estimated values of condemnation of downgraded of affected carcasses and wool and body wasting, milk yields, subsequently reduced meat and segregation of affected animals, and devaluation of skins/hides in the abattoirs (Pacheco *et al*., 2007).

Clinical signs are associated with the localization of pyogranuloma and enlargement of the skin and peripheral lymph nodes can be appreciated, especially the retropharyngeal, mandibular, parotid, prescapular, femoral, and popliteal lymph nodes are recognized. There was no overt clinical disease or impairment of health in the majority of infected animals other than visible abscessation but the disease is of considerable economic importance to sheep and goat industries (Radostits *et al*., 2007). Following the rupture and drain of infected lymph nodes of a diseased animal, the bacterium is spread when infecting naive animals that come in contact with the purulent infectious exudates. This draining exudates or pus with bacteria enter through superficial skin cuts, abrasions or via mucus membranes (ingestion). The chance of infection by the bacteria could be increased as a result of Shearing, castration, docking, head butting and licking of another animal's draining abscess (Nicastro, 2004).

Microbial adaptation and change; host susceptibility; climate alteration; demographic, changing ecosystem, and population including issues of economic development and land use; international trade; technology and industry; reduction in animal and public health services are critical factors influencing the transmission dynamics and the coarse of infections of Corynebacterium pseudotuberculosis. The organism is capable of surviving in the soil for several weeks which give an opportunity to the period of infection might last for a while. In Ethiopia, recent studies reveal about 15% prevalence of caseous lymphadenitis was reported from goats slaughtered in Luna Export Abattoir originated from district area of Borena Range Land (Fikre & Abraha, 2014) and 10% prevalence of local abscess was also reported in Boer goats of Adami Tulu ARC (Hunduma *et al*., 2010).

Transmission: Infection of CLA occurs typically via skin or mucous-membrane wounds, followed by dissemination of the bacteria to the superficial lymph nodes, in which caseous abscesses develop and necrosis occurs. The route of entry for the bacteria in the body possible is through the injured skin and mucous membrane as well traumatic skin lesions after a fight, the ear lesions after marking or tattooing and skin lesions during shearing and browsing, the primary contamination of feeding a kind of stuff, water and troughs are responsible for the spread of the organism (Baird, 2000).

Pathogenesis: The bacteria spread to the regional lymph node where they can progress to other nodes or internal organs through the lymphatic's or vasculature at shearing and the infection of a superficial wound is often incurred. The onion-like appearance on a cross section of involved lymph nodes is due to stages of necrosis and capsule formation of the abscess. C. pseudotuberculosis bacteria are able to survive within intracellular parasites phagocytic cells (monocytes and macrophage cells responsible for engulfing and digesting bacteria and debris) and multiply, then kill the cell, allowing dissemination of more bacteria(Constable *et al*., 2017).

Diagnosis: Accurate CLA diagnosis is based primarily on clinical observations of external abscesses and coetaneous forms (Baird G and Malone F, 2010). Confirmation of the diagnosis is through aspirates of enlarged nodes with cytology, gram stain and culture. Culture is definitive when supported by biochemical characterization of bacteria. Post mortem inspection can recognize internal abscess and can be a cause of carcass condemnation (Thrusfield M, 2005).

3.10.2. Case presentation of CLA in Goat

A-6-month female goat of about 30kg was presented to the Veterinary Teaching Hospital of AAU-CVMA, with a complaint of swelling around submandibular, pain upon palpation, and redness of the udder. Then the superficial presentation of swelling in live animals was analyzed by careful observation and palpation of the goat revealed, there is the development of external enlarged and localized abscessed superficial lymph nodes swelling around the submandibular region (Figure 21B). Physical clinical examination of the goat revealed the parameters are slightly normal except rectal temperature of 40.1^0C. The diagnosis was made based on history and clinical signs as caseous lymphadenitis and EDDiE showed abscess. For confirmatory test pus discharged from lymph nodes were sent to microbiology laboratory of AAU, CVMA. Finally, the case was diagnosed as caseous lymphadenitis in a goat with differential diagnosis of actinobacillosis and tuberculosis, as other bacteria such as *S.aureus, C.pyogens* and *Actinomyces pyogens* can be differentiated by isolation and characterization of the bacteria.

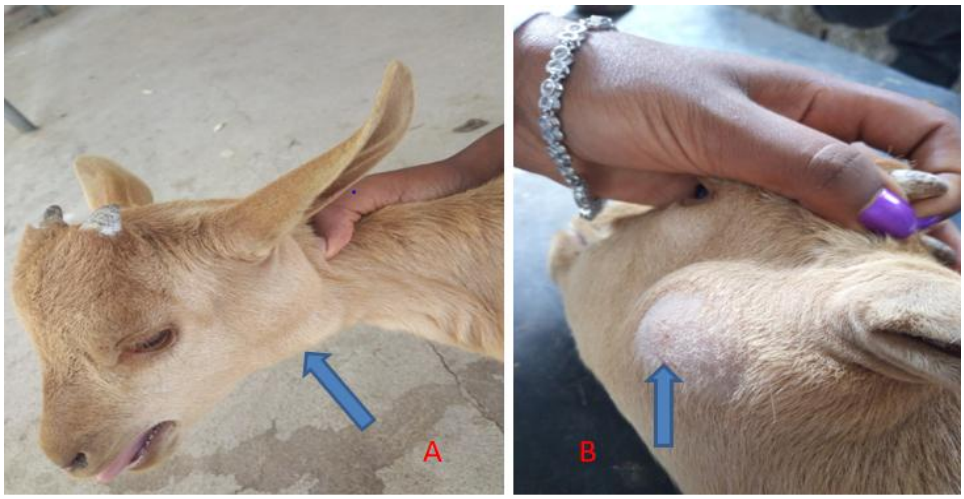


Figure 21: Photograph of goat suffered by caseous lymphadenitis: mandibula abscess (A) and the area was aseptically shaved and prepared for small incision of sample collection (B**)**

3.10.3. Laboratory findings and its investigation

Sample collection of pus carried out accordingly by scraping from the wall of abscess and an incision was made with a sterile blade and the samples containing abscess was collected aseptically using screw caps that are clearly marked with animal identification and the date of collection, and transported by icebox to microbiology then refrigerated at 4°C until processed. Pus from infected goats was processed for laboratory isolation of the causative agent (*C. pseudotuberculosis*) (Figure 22A). After the sample was enriched overnight it was subjected to culture on blood agar and incubated for 48–72 hr at 37°C, and bacterial colonies were identified on the basis of morphological characteristics. The colonies were differentiated based on their shape, size, color and presence of hemolysis which was small and scattered in growth, weak zone of hemolysis (Figure 22B) showed the characteristic of *C. pseudotuberculosis* causes caseous lymphadenitis. A loop full of the colony was taken from blood agar and gram staining was conducted which revealed, characteristic of gram-positive bacteria, filamentous rods and slightly curved rod shape was observed (Figure 22C).

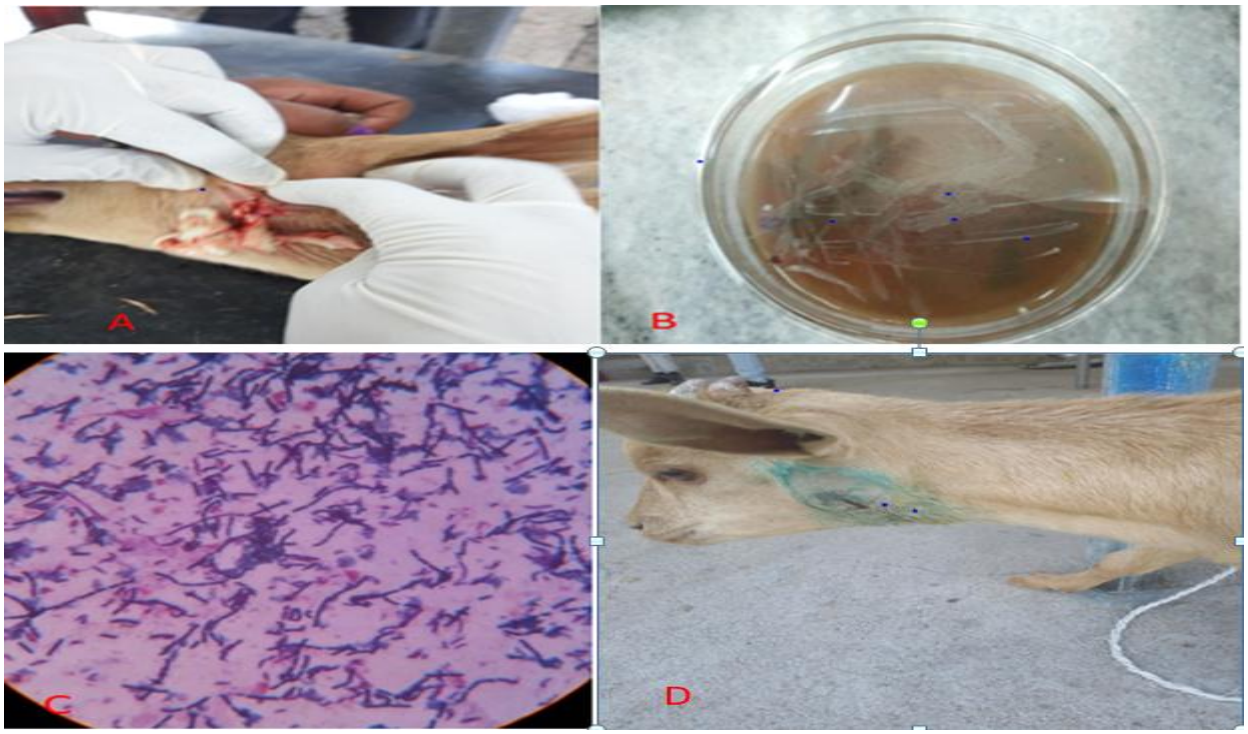


Figure 22*:* Photograph of drained abscess purulent content (A), Blood Agar culture showing colonies of Corynebacterium pseudotuberculosis (B), gram staining (C) and goat during management and follow-up (D).

3.9.4. Case management and its treatment outcome

Caseous Lymphadenitis was primarily managed by surgical drainage of the abscesses aseptically after swelling area was clipped and shaved. Then by incision, gently the pus was drained and removed. To avoid contamination of the environment the area was disinfected by iodine tincture with the application of cyclo spray into the cavity as necessary and all used materials were properly cleaned and disinfected. Antibiotic treatment of Oxytetracycline 20 %,(Shanghai Thongren Pharmaceutical Co., Ltd, China) at a dose of 20mg/kg/day was administered. At the end of treatment follow-up, the goat was recovered and the opened cavity was gradually healed (Figure 22D).

3.10.5. Discussion

Caseous lymphadenitis is a debilitating and most important zoonotic bacterial disease of livestock mainly small ruminants in sheep and goats. The causative agent of the disease was *Corynebacterium pseudotuberculosis* characterized by abscessation of one or more lymph nodes. CLA causes enormous economic losses due to body wasting, subsequently reduced meat, wool, milk yields and segregation of affected animals, condemnation of downgraded of affected carcasses and skins in abattoirs in animal industry worldwide (Pacheco *et al*., 2007).

The current case was diagnosed as caseous lymphadenitis based on the history and clinical signs observed and also the EDDiE report as it was an abscess, the laboratory finding was positive to caseous lymphadenitis which was agreed with the report of (Baird G and Malone F, 2010) that diagnosis is made by aspirating the content and culturing with gram staining and cytology examination. Typical clinical signs observed were also indicatives of caseous lymphadenitis. The laboratory result obtained was slightly agreed with the diagnosis obtained by EDDiE. Observation in clinical changes in this current case report was fever, depression, pain up on palpation and development of external enlarged and localized abscessed superficial lymph nodes swelling around the submandibular region which is agreed with the most common lesions seen in the affected lymph nodes and to a lesser extent in internal organs were caseous abscess filled with greenish-yellow pus (Fikre Z and Abraha G, 2014).

In conclusion, CLA is a highly contagious bacterial disease with limited treatment and vaccination. Therefore, proper management was recommended for controlling the disease transmission by improving animal health and good husbandry practices.

3.11. Pneumonic pasteurellosis: A case in Ewe

Abstract

Pneumonic pasteurellosis is a multi-factorial bacterial infectious respiratory disease of sheep, goats, and cattle caused by a combination of etiologic agents. A- five- years old Ewe was presented to Veterinary Teaching Hospital of AAU-CVMA on February 11, 2021, with chief

complaints of transportation from the market and shows symptoms of poor appetite, breathing problem, discharges from the nose with coughing and weakness. Physical clinical examination was showed serous nasal discharge, depression, the temperature of 41.2^0C. The result of EDDiE diagnosis revealed the case as pneumonic pasteurellosis. Based on a history obtained, clinical signs observed and EDDiE diagnosis a case was tentatively diagnosed as pneumonic pasteurellosis. Bacteriological laboratory examination has also revealed the case as Pasteurella organism and finally the case was diagnosed as pneumonic pasteurellosis. PPR, Verminous pneumonia, and other respiratory disease complex were listed as differential diagnoses. As a treatment, Oxytetracycline 10%, consecutively for three days at 10 mg/kg was given and the sheep were well responded to the treatment. The chance of recovery depends on the management of flocks with early prompt treatment. Therefore, effective control with early treatment and proper vaccination program to prevent the disease was recommended.

Key words*: EDDIE, Ewe, Oxtyetracycline, Pasteurellosis*

3.11.1. Introduction

Pasteurellosis is a multi-factorial respiratory disease that causes pneumonia by a combination of several etiologic agents. Both *Mahenemia haemolytica* and *Pasteurella multocida* are commensal organisms of the tonsils and nasopharynx of healthy cattle and sheep; whereas certain factors can trigger the bacteria to move quickly to invade the lungs and cause pneumonic pasteurellosis (Abdelsalam, 2008). Pneumonic pasteurellosis is a common disease of the respiratory system of cattle and small ruminants as a result of inflammation of pulmonary parenchyma which is usually accompanied by inflammation of bronchioles and pleural membrane. The most common cause of pneumonia is *Mannheimia haemolytica* biotype A serotype1. The disease is determined by specific serotypes found in cattle and small ruminants. Eleven serotypes have been demonstrated within *M.haemolytica*, (A1, A2, A5, A6, A7, A8, A9, A11, A12, A13, A14, A16 and A17) and four T serotypes (T3, T4, T10, and T15) based on capsular antigen typing using Indirect Haemagglutination Test (Haig, 2011). Serotypes 6, 2, 9 and 11 and untypable serotypes have been found in lesions of Pneumonic Pasteurellosis (Angen *et al*., 2002). The bacterial incubation period may be predisposed by several respiratory viruses including PI-3 virus, BHV-1 and BRSV

(Quinn *et al*., 2002). *Pasteurella multocida* has 16 serotypes using LPS antigens as tested by a gel diffusion precipitation test although it has five serogroups (A, B, D, E, and F) using capsular antigens as tested by a passive haemagglutination test. It is known that besides the geographical distribution these serogroups are more or less specific concerning to the host and the disease induction. *P. multocida* serotypes A and D cause pneumonia in sheep (Boyce *et al*., 2000).

Following the breaking of respiratory tract defense mechanisms, invasion of the lung by species of Pasteurella and Mannheimia might result in a disease complex (Abebe W, 2018). It is a disease of great economic importance which causes death and illness, contributing to losses amounting to millions of dollars through treatment costs, reduced meat yields, and mortalities (Larson, 2005).

Sheep with Pneumonic Pasteurellosis can be characterized or suffer from fever, cough, nasal discharge and respiratory distress combined with inappetence and loss of weight. An acute outbreak of Pneumonic Pasteurellosis in sheep flock normally begins with one or more death cases. The animal suffers tremendously from high temperatures (> 40°C) and dyspnoea and observing the rest of the flock will demonstrate a mild respiratory disease such as coughing and oculo-nasal discharges. Pneumonic Pasteurellosis can affect severely lambs, clinical signs of fever, lethargy, dyspnoea, and reduced appetite can be observed, and sudden death is more common in young animals. Those animals who survive from the acute phase of the disease may recover, or they may become chronically infected with the disease have reduced lung capacity and impaired weight gain, and the occurrence of sporadic death (Boyce *et al*., 2000).

The organisms are facultatively anaerobic. The optimum temperature for growth is 37 ^{0}C at pH 7.2 to 7.4. Although non-enriched media support their growth, *Mannheimia* and *Pasteurella* species grow best in the presence of serum or blood (Quinn *et al*., 2002). *M. haemolytica* grows best on Blood agar and MacConkey agar. Those microorganisms grow well in medium containing amino acids, a mixture of salts, vitamins, sugars like galactose and glucose. *M. haemolytica* requires a higher concentration of iron for the production of cytotoxin than is needed for growth. *P. multocida* on the other hand grows well on blood agar with no growth on MacConkey agar (Tabatabaei and Abdollahi, 2018).

Epidemiology: Pneumonic Pasteurellosis is one of the most economically important bacterial infectious diseases of sheep with a high prevalence occurs throughout the world (Prabhakar *et al*., 2012). It was first described in Iceland and subsequently has been reported in many countries such as Australia, Britain, Ethiopia, Norway, South Africa, Somalia and USA (Habashy *et al*., 2009). In Europe, Pasteurollosis was widespread in many countries where sheep production is known (Niemann *et al*., 2019). *Pasteurella* and *Mannheimia* organism is reported most frequently in Asia and Africa countries where sheep breeding is widespread (Nicholas *et al*., 2008). All age groups can be infected but the most susceptible age group is 6 months up to 2 years of age. Pasteurellosis is an endemic disease that occurs mostly in sporadic form (Sarangi *et al*., 2016).

Transmission: *Pasteurella* species are highly susceptible to environmental influences probably a transmission occurs by the inhalation of infected droplets coughed up or exhaled by the infected animal and close contact is an important factor in the spread of the disease (Wilkie *et al*., 2012). The disease may spread very quickly and affect high proportion of the herd within a short period particularly when animals are closely confined in inadequately ventilated trains or held for long periods in holding pens and feedlots (Legesse *et al*., 2018).

Pathogenesis and virulence factor: The primary development of Ovine Pasteurellosis is highly mediated by complex interactions between the naturally existing causative organism in the upper respiratory tract, the immunological status of the animal and the role of predisposing factors in the initiation of infection. In either situation, the disease is essentially triggered by sudden exposure to a stressful condition or by the initial infection with certain respiratory viruses or bacteria (Sherrill, 2012).

Diagnosis and its differential diagnosis: diagnosis of pneumonic pasteurellosis depends on the history, recent movement, weaning or housing, isolation and identification of the causative agent, variety of clinical signs ranging from occasional coughing to sudden death in sheep and nasal discharge, inappetence, weight loss and high temperature in the 40.4°C-42°C range, history of stress like transportation, even necropsy finding after postmortem, isolation and identification of an organism and serology technique and molecular identification are some suggestive of diagnosis (Radostitis *et al*., 2007).

Respiratory diseases which are confused with Pneumonic Pasteurellosis were bacterial pneumonia caused by *Mycoplasma* species (*M. ovipneumoniae* and *M. agalactiae*), *B. parapertussis*, pulmonary caseous lymphadenitis (*C. pseudotuberculosis)*, lung abscesses caused by *S. aureus*, *A. lignieresii*, and Tuberculosis *(M. bovis* and *M. caprae)*. The Viral pneumonia caused by *Para-influenza virus* Type 3, *Adenovirus*, *Respiratory syncytial virus*, *Reovirus*, *Herpesvirus* Types-1 and 2, *Peste des petits ruminants* can also be confused with Pneumonic Pasteurellosis (Sherrill, 2012).

Treatment and prevention: Good management is the key method for preventing the disease. Stress factors such as inadequate ventilation, overcrowding, mixing of animals from the various farms, poor nutrition, failure of feeding colostrum, transportation and other stress have all been associated with pneumonia outbreaks due to *M. haemolytica* and *P. multocida*. So control and prevention that incorporates avoiding or minimizing such factors will reduce the risk factors especially during extreme weather conditions will reduce the outbreaks of the disease (Sherrill, 2012). Treatment of Ovine Pasteurellosis is an effective method of control of the disease. Early treatment is important for a more complete recovery. Knowledge of the antibiotic sensitivity pattern of prevalent strains is also important. Commonly recommended antibiotics include Penicillin, Ampicillin, Amoxicillin, Tetracycline, Oxytetracycline, Tylosin, and Florfenicol (Sherrill, 2012; Politis *et al*., 2019).

3.11.2. Case description on pneumonic pasteurellosis

A-five-years old Ewe was presented to Veterinary Teaching Hospital of AAU-CVMA, on February 11, 2021, with chief complaints of transportation from the market before two days and shows symptoms of inappetence, breathing problem, nasal discharges, and reduced feed intake. After physical clinical examination, there were findings of serous nasal discharge (Figure 23A), rough hair coat, temperature of 41.2^0C, heart rate of 84beat/min, respiratory rate of 32breath/min, and pale mucous membrane were observed. EDDiE diagnosis revealed the case as pneumonic pasteurellosis. Based on a history obtained, clinical signs and EDDiE diagnosis a case was tentatively diagnosed as pneumonic pasteurellosis. For confirmatory diagnosis, a nasal swab of clinical specimen was aseptically collected and sent to microbiology laboratory of AAU-CVMA

and cultured on 5% sheep blood agar. USG (ultrasonography) examination was also revealed, Pneumonia on cranio-ventral right lung (Figure 23B). The growth of colonies on blood agar revealed characteristics of pasteurella organisms. Definitive diagnosis was made based on tentative diagnosis, USG and conventional biochemical test of *Manhemiahemolytica* as pneumonic pasteurellosis and its differential diagnosis were PPR, Verminous pneumonia, and other respiratory disease complexes.

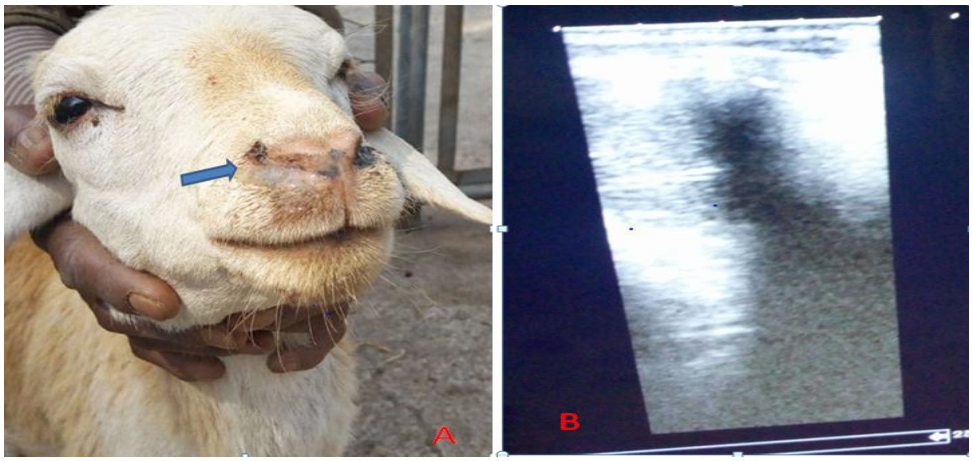


Figure 23: sheep suffered by pneumonic pasteurellosis: A) presence of mucoid nasal discharge, frequent coughing, and pyrexia B) USG examination images indicating pneumonia on cranio-ventral right lung.

3.11.3. Laboratory finding and its investigation

For the identification of the etiology of this case, a representative sample was processed at the microbiology Laboratory of AAU-CVMA accordingly of the technique, nasal discharge was aseptically taken from the sheep using sterile cotton ended nasal swab through gentle progression into the nostril and rotated against the wall of the nasal cavity. The sample was then placed in tryptose soya broth overnight for pre-enrichment. On the next day, it was streaked in pre-prepared 5% sheep blood agar for appreciation of hemolytic pattern. Odorless beta-hemolytic mucoid continuous colonies were observed on the plate (Figure 24A). Gram staining of developed colonies from BA revealed short rod bacterial colonies with few mixed cocci bacteria (Figure 24B). Typical less condensed biomass (colony) was streaked on MacConkey agar and it revealed

pinkish (lactose fermenter) mucoid colonies (Figure 24C). Primary and secondary biochemical tests were done from fresh colonies of nutrient agar. Oxidase test indicates a change of color to blue within 15-30 seconds (Figure 24D).

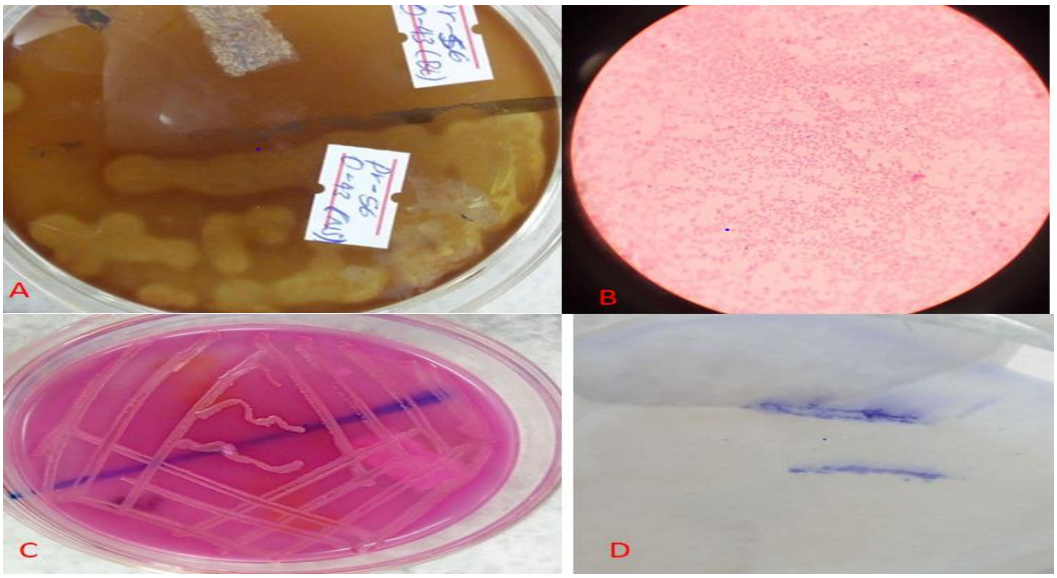


Figure 24: Microbiological examination of a clinical specimen of pasteurellosis: A) Beta hemolytic colonies developed on 5% sheep blood agar from nasal swab samples, B) Gram staining: short rod bacterial colonies with few mixed cocci bacteria taken from the above BA media, C) Pinkish mucoid continues colonies developed on MacConkey agar indicating that the developed bacteria is gram-negative and lactose fermenter and D) Oxidase positive: color changes to blue within 15 to 30 seconds.

3.11.4. Case management and its treatment outcome

Therapeutic management was done to relieve the problem and treating the ewe by administration of Oxytetracycline 10% (Phenoxy 10%, Belgium) for five consecutive days at a dose of 10mg/kg IM and Dexamethasone (Sokar Healthcare Pvt. Ltd. Gujarat India) 0.2mg/kg/day to control pyrexia. Post therapy of the second day, the Ewe was presented with lowered temperature and third-day therapy was completed with a good prognosis. The owner was advised to vaccinate the flock and to properly manage to protect them from any stress to avoid reinfections for extra time. From the report of the owner, two weeks after therapy the Ewe was fully recovered.

3.11.5. Discusion

Pasteurellosis is a multi-factorial respiratory disease that causes pneumonia by a combination of several etiologic agents and possed to great economic losses (*Quinn et al*., 2002). The current case was diagnosed as pneumonic pasteurellosis based on obtained history, presentation of clinical signs, and findings, 'EDDiE' diagnosis, USG examination of the lungs and bacteriological examination of the clinical specimen. The result of 'EDDiE' diagnosis was in agreement with bacteriological examination and USG examination that revealed inflammation of the lung (pneumonia).

Microbiological examination of the case was conducted by culturing of Clinical specimen on 5% Sheep blood agar and characteristic colony growth of *Manhemia hemolytica;* beta-hemolytic mucoid continuous colonies were observed which that colony growth of the bacteria is in line with Abebe W. (2018). Culturing of pre enriched sample on MacConkey agar showed, pinkish mucoid continues colonies developed which are gram-negative and lactose fermenter agreed with the result obtained by Legesse *et al*., (2018).

The case was currently managed by administration of broad-spectrum antibiotic and ant-inflammatory drugs to control problem associated which is similar with Politis *et al*., (2019) who reported that antibiotics oxytetracycline were effective in the treatment of pneumonic pastereurellosis in lambs. The case was currently treated by administration of Oxytetracycline 10% (Phenoxy 10%, Belgium) for five consecutive days at a dose of 10mg/kg IM and Dexamethasone (Sokar Healthcare Pvt. Ltd. Gujarat India) 0.2mg/kg/day to control pyrexia.

In conclusion, pasteurellosis is a multifactorial disease caused by numerous etiologic agents. Therefore, to reduce and mitigate the prevalence of the disease improving management practices by providing optimal sanitation and air quality in housing, minimizing transportation stress, providing good quality hay and water should be taken into account.

3.12. Listeriosis, circling disease: a case in goat (buck)

Abstract

Listeriosis is one of the important food-borne bacterial zoonotic diseases caused by *Listeria monocytogenes*, being the most pathogenic species to small ruminants. A -7-month old male goat (buck) was presented to Veterinary Teaching Hospital of AAU-CVMA on April 15, 2021, with complaints of disorientation and propelling themselves into corners, circling movement toward the left and reduced feed intake and fed leftover vegetables from the market. Physical examination revealed a febrile rectal body temperature of 40.9 ^{0}C. EDDiE diagnosis assisting showed the case as listeriosis. Tentatively the current case was diagnosed as listeriosis based on obove results. For confirmatory, the whole blood specimen was aseptically collected and sent for microbiology for further examination and revealed listeriosis. Differential diagnosis of listeriosis include CNS disease; coenurosis, bacterial meningoencephalitis, and neurology. Finally, the case was definitively diagnosed as listeriosis. For therapeutic purpose procaine penicillin G at a dose of 20,000 IU/kg/day for five successive days with dexamethasone at a dose of 0.2 mg/kg/day as antipain for two days was administered and the buck was successfully responded. Listeria spp. is mainly acquired by eating contaminated silages. Therefore feeding good quality silage is important in preventing listeriosis.

Keywords: *buck, listeriosis, treatment*

3.12.1. Introduction

Listeriosis is a sporadic bacterial infection that affects a wide range of animals, including people and birds. Listeriosis is a serious and life-threatening bacterial disease caused by *Listeria monocytogenes* and Characterized by fever, muscle aches, and sometimes gastrointestinal symptoms. The bacteria are motile, gram-positive, facultative anaerobic intracellular, non-spore - forming coccobacillus bacterial pathogen of genus Listeria. It is a sporadic bacterial infection that affects a wide range of animals, including people and birds. It is seen worldwide, more frequently in temperate and colder climates. There is a high incidence of intestinal carriers. Encephalitis or meningoencephalitis in adult ruminants is the most frequently recognized form. The organism

resists freezing and thawing and is able to survive for several years in feces, soils, straw and silage (Radostits *et al*., 2007).

The genus of listeria is composed of 10 species, in which two of them are pathogenic. *Listeria monocytogenes*, the more important of these two pathogens, have been implicated worldwide in diseases of many animal species and humans. *Listeria ivanovii* occasionally causes abortions in cattle and sheep. *L. monocytogenes* is considered a ubiquitous organism, which can be isolated from many different environmental sources (surface water, soil, sewage, plant material, etc). The organism is extremely resistant that can grow over a wide range of pH and temperature in which they are ubiquitously distributed in the environment. Its ability to grow at low temperature is an important diagnostic aid for the isolation of the organism from brain tissue but not from placental or fetal tissues (WHO/ FAO, 2004).

Transmissions and Pathogenesis: ingestion of contaminated feed and soil contamination are the primary modes of transmission. Then *Listeria* organisms are follow ingestion or inhalation of contaminated feed and it tends to cause septicemia, abortion, and latent infection. Listeria gets entries to tissues that have a predilection to localize in the intestinal wall, medulla oblongata, and placenta or to cause encephalitis via minute wounds in the buccal mucosa (Scanlan M, 1988). Listeria encephalitis affects sheep, cattle, goats, and occasionally pigs and it's essentially a localized infection of the brain stem that develops when *L monocytogenes* ascends the trigeminal nerve. There is variation in clinical signs according to the function of damaged neurons but often are unilateral and include depression (ascending reticular activating system), ipsilateral weakness (long tracts), trigeminal and facial nerve paralysis, and less commonly, circling (vestibulocochlear nucleus). Neurologic signs indicating bilateral cranial nerve deficits are occasionally seen in lambs <4 mo old. Infections acquired via ingestion tend to localize in the intestinal wall and result in prolonged fecal excretion (Songer and Post, 2005).

Clinical findings: Listeriosis usually starts with the animal showing weakness on one side. It will then only be able to walk in circles, and eventually becomes paralyzed and dies. It has three major clinical forms;-are septicemia, encephalitic, and abortion forms. The formation of septicemia is marked by depression, inappetnce, fever and death. Encephalitic Form sometimes

called circling disease is more acute and frequently fatal in sheep and goats and death is mostly happened due to dehydration and starvation (Scanlan M, 1988). Infection in sheep and goats is rapid, and death may occur 24–48 hr after the onset of signs; however, the recovery rate can be up to 30% with prompt, aggressive therapy. Affected animals are anorectic, depressed, and disoriented and they propel themselves into corners, circle toward the affected side, or leaning or stumbling against stationary objects. Sometimes facial paralysis with a drooping ear, deviated muzzle, flaccid lip, and lowered eyelid often develops on the affected side, as well as lack of a menace response and profuse, almost continuous, salivation; food material often becomes impacted in the cheek due to paralysis of the masticatory muscles. Terminally affected animals fall and, unable to rise, lie on the same side; involuntary running movements are common (Carter, G.R., 1984).

Diagnosis and Differential diagnosis: Tentatively listeriosis can be diagnosed based on clinical signs and its confirmation is by isolating the pathogen from appropriate specimens. CNS disease; coenurosis, bacterial meningoencephalitis and neurology were listed as a differential diagnoses of listeriosis (Quinn and Markey, 2003).

Isolation and identification of organism: Samples from cases of septicemia inoculated directly onto blood agar, selective blood and the plates are incubated aerobically at 37°C for 24 to 48 hours by adding of indicator media Listeria selective agar (Oxoid). Small transparent colonies with smooth borders appear on blood agar in 24 hours (Quinn and Markey, 2003).

Treatment and control: Its recovery depends on early, aggressive antibiotic treatment. If signs of encephalitis are severe, death usually occurs despite treatment. *L monocytogenes* is susceptible to penicillin (the drug of choice) with supportive therapies such as rehydration with electrolytes, ceftiofur, erythromycin, and trimethoprim/sulfonamide. High doses are required because of the difficulty in achieving minimum bactericidal concentrations in the brain (Fentahun and Fresebehat, 2012).

3.12.2. Case description of listeriosis

A 7-month old Buck was admitted to Veterinary Teaching Hospital of, AAU-CVMA on April 15, 2021, with history of the circling movement and reduced feed intake. The Buck was managed extensively at the field with other goats. The goats were primarily kept for commercial and fed household leftovers and vegetables from the market. Physical examination showed that the buck was febrile with a rectal body temperature of 40.9^0C and about 72beats/min and 32breaths/min heart rate and respiratory, respectively. There is disorientation and propelling themselves into corners, circle toward the affected side, or lean against stationary objects and pedal movement with head turned to the left seen from visual observation (Figure 25A). The EDDiE revealed the case as Listeriosis. Tentatively the case was diagnosed as listeriosis based on the history, clinical findings, and EDDiE. For confirmatory diagnosis, a blood sample was taken and sent for culturing to the microbiology laboratory of AAU-CVMA and the result was positive for listeriosis. CNS disease; coenurosis, bacterial meningoencephalitis, and neurology were listed as differential a diagnoses for listeriosis.

Figure 25: pictorial presentation of buck suffered by listeriosis, circling movement of the buck toward one direction (A) and physical examination of suspected buck (B)

3.12.3. Laboratory identification of the organism

The whole blood is taken from septicemic febrile goat (buck) and enriched and cultured on blood agar then Characteristics of growth on blood agar after incubation at 35-37°C for 16-48hr, colonies are characterized as smooth, translucent with a characteristic ground glass appearance able to be emulsified and with a zone of hazy β-hemolysis(Figure 26A). Colonies suspected to be *Listeria* were confirmed by different tests including gram staining, catalase test and characteristics of hemolysis. Grown colonies showed hemolysis on blood agar (Figure 26A), positive catalase (Figure 26B) and negative oxidase reaction and latex agglutination test (Figure 26C)

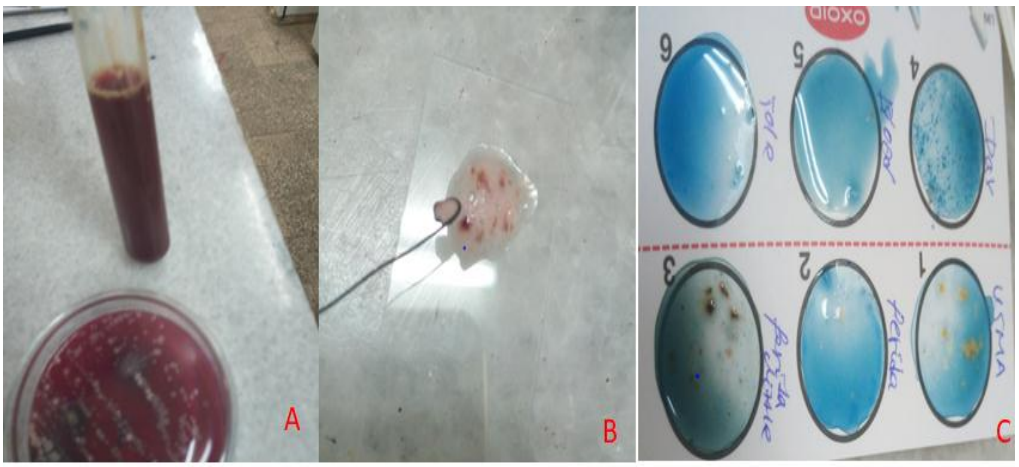


Figure 26: Culturing and growth of listeria organism on blood agar (A), catalese positive test by formation of buble (B) and latex agglutination test (C)

3.12.4. Case management and treatment

Since listeriosis is susceptible to a high dose of penicillin to achieve minimum bactericidal concentrations in the brain the buck was treated by procaine penicillin G (EPHARM, Addis Ababa, Ethiopia) 22,000IU/kg body wt, IM, for five consecutive days together with dexamethasone (Sokar Healthcare Pvt. Ltd. Gujarat India) at a dose of 0.2 mg/kg/day for two days as ant pain and antipyretic. Following post-treatment of 2nd day, the parameter of the kid

was returned to its normal ranges (38.2^0C). After completing medication for five days the owner reports me that his kid starts to eat and has no problem in movement

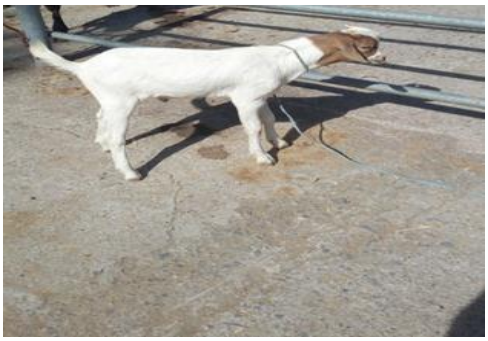


Figure 27: The buck during therapeutic management of 2rd days

3.12.5. Discussion

Listeriosis is one of the most important food-borne bacterial zoonotic diseases caused by listeria species and is pathogenic for both humans and animals worldwide (Temesgen Z, 2019). In the present case, a kid (young goat buck) with a history of propelling himself toward corners by leaning against stationary objects and circling movement was clinically examined. Based on the EDDiE result and clinical findings observed, the case was tentatively diagnosed as listeriosis. Scanlan M. (1988) indicates from the three forms of listeriosis septicemia is marked by depression, inappetence, and fever whereas encephalitic called circling disease is more acute and frequently fatal in sheep and goats and death is mostly happened due to dehydration and starvation in young animals. Sporadically occurrences of this most common form of the disease in all age groups can be affecting a single animal in a herd or flock or a few individuals over several weeks. Following the inhalation or ingestion, the organisms get access to the brain through damaged oral, nasal or ocular mucosal surfaces via the neural sheath of peripheral nerve endings, particularly where the trigeminal nerve enters bloodstream leads to infection of CNS. The most commonly cranial nerve signs observed are vestibular ataxia with a head tilt and facial paralysis (Gebretsadik *et al*., 2011).

The current clinical case report may have an association with environmental contamination which is in agreement with the owner report. As a report of (Molla *et al*., 2004; Pal, 2013; Riemann and

Cliver, 2007; Barros *et al*., 2007) Listeria organisms are ubiquitous that can be found in the environments of agricultural and animal products including contaminated soil and silage (poor quality silage) with a probability of found in animal feces, human feces, farm slurry, sewerage sludge, soil, farm water troughs, surface water, vegetables, animal feeds, and the walls, floors, drains, and other.

The report of Firehiwot, (2007) showed that the dose and duration of the therapeutic management recovery status of listeriosis was depended on its severity and forms of its stage. In this current case report, it's less severe and well responded to administered drug. Therefore, less severe and early cases were well responded to the highest dose of drug choice. However, death can be reported in severe cases of when encephalitis symptoms manifested beyond its treatment. Based on the drug sensitivity test the organism is most susceptible to penicillin, ceftiofur, erythromycin, and trimethoprim/sulfonamide. Morvan et *al*., (2010) reported due to the challenge of difficulty in achieving minimum bactericidal concentrations in the brain, High doses of penicillin were required for treatment.

In conclusion, listeriosis is a significant bacterial disease both in animals and humans having high risk and public health concerns with worldwide occurrence in which numerous risk factors are associated with its contamination and growth. Hence, knowing sources of the pathogen and factors that contribute to the risk of contamination, growth, and spread of the pathogen are important for an effective control programs.

3.13. Mange mites infestation: A case in Buck

Abstract

Mange mites are one of the most common and widely distributed ectoparasites of small ruminants in Ethiopia. A 2-years-old male goat (buck) was presented to Modjo Veterinary Clinic, Lume woreda on March 1, 2021, with chief complaints of not being de-wormed, skin itching to hard objects (wall), hair loss (alopecia), and poor body condition then become emaciated. Physical clinical examination of the buck was revealed a temperature of 37.6^0C, and slightly other parameters are normal. Itching himself to hard objects and staring/rough hair coat, painful rash,

and deterioration of the skin with severe discomfort was observed. Diagnosis by EDDiE revealed the case was as mange mite. Eczema, skin dermatitis, psoriasis and skin malignancy were listed as differential diagnoses. For confirmatory tests, deep skin scraping at prephery of the lesion was collected and sent to the parasitological laboratory of AAU-CVMA and investigation of mite's infestation was revealed, presence of *Sarcoptes var Caprae* mange which is positive for the case. For management and treatment, ivermectin, 0.02mg/KG, SC was administered with 1ml/10kg of multivitamin to restore poor body condition. After therapeutic, the buck was fully recovered. Mange mite infestation leads to severe hindrances to the countries economy by affecting the quality of skin and hides. Therefore, Prevention and control of mites are possible by isolation and quarantine of affected animals and disinfect all infected premises with regular deworming.

Keywords*: buck, ivermectin, mange mite*

3.13.1. Introduction

In Ethiopia, estimated numbers of sheep and goats are about 24 million and 19 million respectively (FAO-WHOOIE, 1993). They represent important sources of protein in the world, supplying daily a quality of meat and milk products in urban and rural areas. Small ruminants are important contributors to the economy of Ethiopia in which they account for 40% of cash income and 19% of the use household consumptions (Bayou, 1998; Yacob *et al*, 2008; CSA, 2013). Ectoparasites are commonly ticks, mites, lice, and ked are important parasites because of their disease transmission, blood-feeding habit and skin damage in most of the livestock population (CSA, 2004).

Mange mites belong to the phylum Arthropoda and the parasitic mites are small almost being less than 0.5mm long while a few are attaining several mm when blood-sucking species are fully engorged. Mange is a collective name for allergic dermatitis caused by ectoparasitic infestations by mites which parasitize different domestic and wild animals, are obligate parasites, and spread from animal to animal by direct contact. They spent their lives on the animal body by feeding on blood, lymph, skin debris and inject subcutaneous secretion while puncturing the skin, damaging the skin surface (Asfaw F *et al*., 2015). Mange infestation by mites usually appears as skin conditions associated with irritation and scratching that leads to inflammation, exudation, crusts

and scabs forming on the skin. It leads to thickening of skin and loss of condition of the animal if they left untreated. Mange is often seen in animals during the winter season and can be a big welfare issue in herds of animals (Yohannes M, 2018; Radostitis *et al*., 2007; Taylor *et al*., 2007).

Transmission of mange occurs mainly by direct contact from animals to animals by overcrowding in houses, markets, dips, and communal grazing lands facilitate the rapid spread of the parasites (Agyomang *et al*., 1991; Hall, 1988). Poor nutrition and intercurrent infections increase the susceptibility of animals to mange mites (Lusiluka *et al*., 1995; Radostitis *et al*., 2000). Transmission appears to occur during the earlier days of suckling. Although they can survive for about a week in the environment like posts (Taylor *et al*., 2007). Different species which causes goat manges are; *Demodex spps, Sarcoptes spps, Chorioptes spps* and *Psoroptes spps* (Bowman, D, 2003). Generally they are characterized by intense itching and scratching accompanied by exudates which coagulate form crust on the surface of the skin leading to huge loss of skin and hides and decrease production capacity of animals and in some case leading to death (Nejash, A.M., 2013).

Etiology: In Ethiopia varieties of mange mites belonging to four genera were reported to infest sheep and goats. The report indicates *Psoroptes communis var. ovis, Sarcoptes scabies var ovis* and *Demodex folliculorum var. ovis* in sheep and *P. communis var.caprae, Sarcoptes scabiei var. caprae* and *Demodex folliculorum var. caprae* in goats in the Hararghe (Fentanew A *et al*., 2015), psoroptes cuniculi in sheep from central Ethiopia and Chorioptes spp in goats around south rangelands of Oromia were identified (Molu, 2002).

Pathogenesis and its clinical features: Some species of mites like sarcoptes spp pierce the skin, suck lymph and feed on young epidermal cells and cause marked irritation. Due to intense itching animals rubs on hard surfaces and objects results in partial or complete alopecia which is evident in the medial aspects of the rear limbs, axillae and on the brisket, as a result, dry and bran-like scales are formed, later the scales transform into hard crusts then, cracks and fissures appear on the skin at the hock joint which was thickened and wrinkled and in hairy areas covering the neck and abdominal areas heavy dandruff was evident (Zeryehun and Mengesha, 2012). Non-burrowing mites like *Psoroptes spp* are punctured the epidermis, suck lymph and stimulate a local

inflammatory reaction. Pasorptic mange in goats is characterized by the accumulation of hyaline material in the external ear canal resulting in occlusion of the canal and deafness (Fentanew *et al*., 2015). Psoroptes spp infestation in sheep causes a highly contagious infection known as sheep scab, which is characterized by intense purities, restlessness, scratching and rubbing on objects and raised turfs of wool where vesicles, pustules and papules are formed as reddish or yellowish also presence of exudates from papules result in the formation of crusts and matting of the wool which finally causes thickening and cracking of the skin occur (Zeryehun and Tadesse, 2012). Chorioptic mange was characterized in small ruminants by, itching, intense erythema, restlessness, scratching and rubbing which results in alopecia. Scales, crusts and wart-like growths, thickening and folding of the skin are common features. In goats, lesions appear on the interdigital clefts, coronet, muzzle, eyelids, udder, scrotum, anus and tail regions whereas in sheep lesions begin at the fetlock region and spread to the udder and scrotum (Sheferaw *et al*., 2010).

Diagnosis and differential diagnosis: To diagnose mange mites it's based on clinical manifestations, the demonstration of mites or their developmental stages in skin scrapings from visible lesions and identification of the large mites. The reaction of the host to scratching or rubbing of the affected skin by the operator was an indication of the presence of mange mites. Eczema, skin dermatitis, psoriasis, skin malignancy, popular urticaria, and other allergic reaction were listed as differential diagnoses (Agumas *et al*., 2015).

3.13.2. Case description of mange mites in Goat

A 2-year old male Goat (buck) was presented to Lume woreda, Modjo Veterinary Clinic on March 1, 2021 with chief complaints of not being de-wormed, skin itching to hard objects (wall), hair loss (alopecia), and poor body condition with progressive emaciation. General physical examination was conducted and revealed that temperature of 37.6^0C, and slightly other parameters are normal and showed signs of itching himself to hard objects and staring/rough hair coat, painful rash and deterioration of the skin with severe discomfort (Figure 28A). Diagnosis assisting tools of EDDiE examination revealed, the case was mange mite infestation. Finally based on history, vital clinical signs, and EDDiE results, the case was tentatively diagnosed as

mange mite again. Eczema, skin dermatitis, psoriasis, skin malignancy, popular urticaria, and other allergic reaction were listed as differential diagnoses. For a confirmatory test, deep skin scraping technique was applied and collected sample was sent for a parasitological laboratory of AAU-CVMA and examination of skin scraping for the presence of mange.

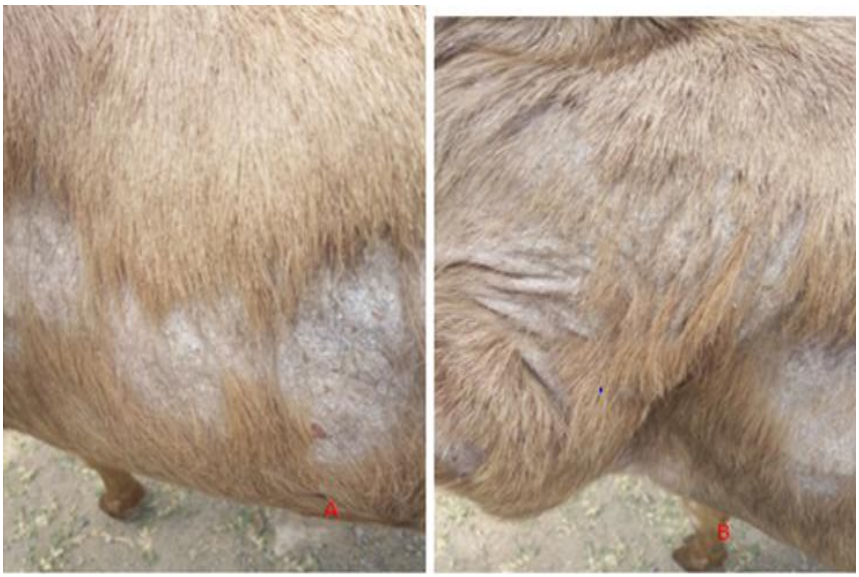


Figure 28: Photograph of the buck suffered by an infestation of mange mites: the presence of generalized skin lesions on the ventral abdomen (A) and on forelimb (B)

3.13.3. Laboratory examination and its findings

The infested skin parts are scraped to confirm the presence of mite infestation by microscopic examination and the area should be thoroughly cleaned free of any debris or medication by using alcohol or by washing. Place a drop of mineral oil on a sterile scalpel blade to allow mites will adhere to the oil and skin scales will mix with the oil. After scraping examination under a microscope was done *Sarcoptes scabies var caprae* (figure 35C&D) which was positive for tentative diagnosis suspected.

Figure 29: Laboratory examination and diagnosis of a goat by deep skin scraping; sample taken by deep skin scraping aseptically (A), area of deeply scraped (B), result confirmed for the presence of Sarcoptes scabies var caprae (C&D).

3.13.4. Case management and treatment outcome

Treatment of mange is using ivermectin, at a dose of 0.2mg/Kg weekly interval until recovery and with the recommendation of application of diazinon 0.05% at their bedding area also for the flocks. There is no commercially available vaccine to protect animals from mange infestation. Finally after recovery of the buck from the problem, the owner sold it to the market for the Easter holidays upon phone interview.

3.13.5. Discussion

Mange mites are ectoparasitic dermatitis, very contagious, can spread rapidly, and can have severe economic sequences on animal health (Haben, 2020). In the present case, a buck (young goat) with a history of itching to hard objects with alopecia was examined and tentatively

diagnosed as mange mites infestation based on the clinical findings. Radostits, (2006) indicated that mange is one of the cutaneous diseases of domestic and wild animals of all ages and both sexes including human beings. Some species of mange mites like *sarcoptes spp* pierce the skin, suck lymph and feed on young epidermal cells and cause marked irritation. Due to intense itching animals rubs on hard surfaces and objects results in partial or complete alopecia which is evident in the medial aspects of the rear limbs, axillae and on the brisket, as a result, dry and bran-like scales are formed, later the scales transform into hard crusts (Zeryehun and Mengesha, 2012).

In the case report typical clinical sign of mange mites was observed characterized by itching, intense erythema, restlessness, scratching and rubbing which results in alopecia. Based on the history and typical clinical signs observed the case was finally diagnosed as mange mites infestation in line with Sheferaw *et al*., (2010) described that itching, scratching, and rubbing which result in alopecia is the most prominent clinical symptom of mite's infestation in small ruminants and in the current case report, a variety of clinical signs was observed in agreement with the report of Zeryehun and Mengesha, (2012). The therapeutic management using ivermectin given at the dose of 0.2 mg/kg at the weekly intervals was in line with Agumas *et al*., (2015).

In conclusion, mange mite's infestations are very contagious, spread rapidly, and can have severe economic sequences on animal health due to decreased production. Therefore, appropriate management and prevention with proper hygiene to minimize the risk of losses from damaged skin are forwarded.

3.14. Hypocalcemia or milk fever: Cases in pregnant Ewes

Abstract

Milk fever or hypocalcemia is an acute metabolic disorder that occurs predominantly in late pregnancy and early lactating animals. Late pregnant ewes were presented by cart to Veterinary Teaching Hospital of AAU-CVMA on March 08, 2021, and April 21, 2021, with complaints of weakness, unable to stand, and inappetence. Physical clinical examinations were revealed temperature of 36.4^0C, 36.9^0C, and dehydration in *case1* and *case2* respectively with left lateral recumbency of the neck curved towards the right flank (*S-shaped*). The case was tentatively

diagnosed based on the history of late pregnancy, inappropriate nutritional management, presented typical clinical features of parturient paresis and EDDiE as parturient paresis. Pregnancy toxemia, vitamin D deficiency and Hypomagnesemia were listed as differential diagnoses. Ewes were treated with 40% calcium borogluconate intravenously and immediately responded to the treatment which confirmed the case as milk fever. Hypocalcaemia is the result of a reduction of blood calcium in the early stages of lactation due to a dramatically increased demand for calcium. Therefore, regulating calcium haemostasis by considering the feeding system of animals was recommended.

Keywords*: Calcium borogluconate, Ewe, milk fever/hypocalcemia*

3.14.1. Introduction

Hypocalcemia or milk fever even parturient paresis is an acute or subacute metabolic disorder usually seen in sheep more often shortly before or after parturition when an abnormally low level of blood calcium. Acute calcium deficiency or low level of blood calcium can lead inability of a sheep to rise feet up the ground as calcium is vital for muscles and nerves function, which results in a metabolic disorder termed as milk fever, parturient paresis and parturient apoplexy(Oetzel, 2011). Milk fever is a common noninfectious and nonfebrile disease of dairy cattle's and sheep throughout the world with associated risk factors are intrinsic risk factors, which are associated with the animal itself and extrinsic risk factors, which are outside of the animal's body which is commonly known as environmental factors (Aberaw, 2017). The disorder is seen when the body fails to mobilize enough calcium from the bones to maintain normal blood calcium levels, or when certain compounds known as oxalates bind up the calcium. It is characterized by tetany; incoordination, paralysis, and coma are caused by an inadequate supply of metabolizable calcium (Jensen, 1982). The incidence of the disease is associated with imbalanced nutrition and/or improper handling and housing. The ability of absorption and mobilization of stored calcium is reduced in older animals; as result, older animals are more susceptible to the condition (Goff, 2000; Woldemeskel *et al*., 2000T).

Generally, milk fever affects high producing exotic breeds in their productive stage and older dairy cows and sheep which have reduced ability to mobilize calcium from their bone (Amjad *et*

al., 2015). A mild degree of milk fever develops in sheep from several weeks before until the first 2 weeks after parturition when the fetal skeletons are mineralizing. Incidence of the disease is usually less than 5%, only occasionally rising up to 20% and has been linked to calving problems, retained placenta, uterine prolapse, metritis, mastitis, ruminal stasis, depression of the immune system and generally reduced reproductive performance and resulting in a reduction of productive life by 3-4 years. In a small proportion of animals, hypocalcemia becomes severe and results in paresis, recumbency, and, occasionally, death (Bhanugopan, 2014).

Occurrences at the early stages of the disease were manifested when animals become isolated from the flock/herd and have a temporary stiff gait, with muscle tremors; potentially, they can become hyperesthetic and they become hypesensitive and weak and remain recumbent. Depleted muscle contractions result in constipation and decreased rumen motility, leading to the development of bloat (Cockcroft and Whiteley, 1999). As the disease progresses depression can occur, usually ending in a coma. Ears are typically cold, although rectal temperature usually remains within the normal range (Brozos *et al*., 2011a).

Etiology: Causative agent for milk fever or hypocalcemia is a severe deficiency of metabolizable calcium ion (Ca++) in the circulation (Oetzel, 2011). Calcium requirements increased during late gestation since calcium is one of the most abundant minerals in sheep milk and the concentration of calcium in the colostrum is almost double than in milk later lactation of the sheep which results in a low serum calcium concentration, particularly in animals pregnant with multiple fetuses (Tsioulpas *et al*., 2007). A transient period of hypocalcemia Occurs when Colostrum and milk synthesis increase around parturition and decrease in dry-mater intake transiently (Reinhardt *et al*., 2011). Impairment of absorption of calcium from the intestine at parturition and insufficient mobilization of calcium from storage in skeleton, which could arise because of parathyroid insufficiency since the gland is relatively quiescent in the dry period (Mulligan *et al*., 2006).

Clinical Findings and Diagnosis: Hypocalcaemia can be clinical or subclinical based on signs they indicates. When cow's inability to stand after calving results in clinical milk fever which is the most severe hypocalcemia (Bhanugopan, 2014) and is the most easily recognized form of hypocalcemia with blood calcium concentration less than 5 mg/dL where, subclinical

hypocalcemia results in less severe disturbances in blood Ca and does not have any outward sign and blood calcium concentration ranges between 5.5 and 8.0 mg/dL (Wubishet *et al*., 2016). In early hypocalcemia in sheep, the most commonly noted signs are stiff gait, ataxia, salivation, constipation, and depressed rumen motility, progressing to hyposensitivity, bloat, recumbency, loss of anal reflex and, if untreated, death. The sheep can exhibit moderate to severe depression, cold extremities, mild bloat, and partial paralysis and typically lie with their head turned into their flank (Oetzel, 2011). Tachycardia may be present; heart sounds are quieter than normal. Often when recumbent, ewes are in a sternal frog-lying position, with the hind legs extended behind. Goats have a similar presentation, although muscle tremors are more commonly seen than in sheep (Asbury, 1992; Silva and Noakes, 1984).

Diagnosis and differential diagnosis: Diagnosis is based on history taking from the owner and clinical signs observed from suspected sheep. Laboratory determination of blood calcium level and good response to intravenous calcium solutions are the most accurate method to diagnose a case of milk fever. Hypocalcemia is often classified as total serum calcium levels (Hunt, 2002). Milk fever is confused with the diagnosis of Pregnancy toxemia, hyperthyroidism, vitamin D deficiency and Hypomagnesemia (Wubishet *et al*., 2016).

Treatment and Prevention: milk fever should be treated as early as possible with oral calcium solutions and intravenous (IV) calcium borogluconate given slowly to effect (monitor heart rate and intensity). Intravenous administration of 30 to 60 mL of 20% calcium borogluconate solution usually with a combination of a product containing phosphorus, magnesium, and/or potassium with dextrose can also be used and may be preferred (Goff, 2008). For subclinical manifested hypocalcemia in sheep supplementation of calcium borogluconate by the oral route is the best approach. To ensure a more prolonged absorption and to support blood calcium concentrations around calving, an additional dose of 60 mL of calcium borogluconate, without dextrose, can be administered subcutaneously. For grazing animals, attention to calcium content of feeds during diet formulation and avoidance of unnecessary stressors usually suffice to reduce the risk of animals developing the disease (Brozos *et al*., 2011a).

Therefore, the objective of this case report is to discuss the therapeutic response and minimizing the risk by regulating calcium haemostasis.

3.14.2. Case description on parturient paresis in ewe

Case 1

A 4-year-old local ewe of 32kg was presented at Veterinary Teaching Hospital of AAU-CVMA on March 08, 2021, with a chief complaint of prolonged weakness, splayed out hind legs, paresis (difficulty to rise from lying down), and unable to stand especially on the hind legs and poor appetite. A ewe was pregnant at last trimester almost near to parturition and was managed semi intensively on the field. Physical clinical examinations revealed that ewe was dehydrated and vital parameters were temperature of 36.4^0C, heart rate of 80beat/min and respiratory rate of 22beat/min. The sheep was on lateral recumbency with the neck curved towards the left flank/S-shaped (figure32 A). Based on the history of pregnancy, inappropriate nutritional management and the presented typical clinical features the case was tentatively diagnosed as hypocalcemia. EDDiE diagnosis revealed the case as parturient paresis/hypocalcemia. The differential diagnoses were; Pregnancy toxemia, hypoglycemia and metabolic acidosis.

Case 2

A late pregnant local breed ewe with a history of inability to stand and distended abdomen was presented to Veterinary Teaching Hospital of AAU-CVMA by cart on April 21, 2021. From chief complaints of the owner, the ewe was managed intensively with other sheep and fed overleft from the market with some additional of frushka. Prior to the presentation early morning, the ewe was laid down and unable to stand even with support and inappetnce. Physical examinations revealed a temperature of 36.9^0C, respiratory rates of 37breaths/min and increased heart rate. The sheep was on left lateral recumbency with the neck curved towards the right flank (S-shaped) (Figure 30A and C). The ewe was dehydrated, depressed, and also had a distended abdomen. The case was tentatively diagnosed as hypocalcemia based on the history of late pregnancy, inappropriate nutritional management and the presented typical clinical features of ewe. EDDiE diagnosis

revealed the case as parturient paresis/hypocalcemia. The case was confused with pregnancy toxemia, hypoglycemia and metabolic acidosis as differential diagnoses.

Figure 30: Pictorial presentation of pregnant ewes suffered by hypocalcemia: lateral recumbency of pregnant ewe in *case1* (A), ewe able to stand while therapeutic management in *case1* (B), Ewe on right lateral recumbency with the neck curved towards the left flank in *case2* (C) and Immediate Recovery of ewe after instituting the treatment in *case2* (D).

3.14.3. Hypocalcaemia management and its treatment outcome

The case of hypocalcemia or milk fever diagnosed tentatively was handled at the time by fluid therapy of ringer lactate and 40% glucose. However the ewes were not well responded to the therapy and administration of 40 % Calciumborogluconate containing 400mg/ml calcium borogluconate (1ml/Kg), 30 ml slowly (case1) and 40ml (case2), intravenously in order to restore blood calcium level was recommended as indicated in the (Figure 31B&D), then an immediate response to the treatment with shivering and urination was noticed, hence it is confirmed as hypocalcemia case. The ewe was well responded to the therapy given as indicated below (figure 31B&D). Finally based on history, clinical signs and therapeutic diagnosis response, the case was definitely diagnosed as Ewes were suffered from hypocalcemia/parturient paresis.

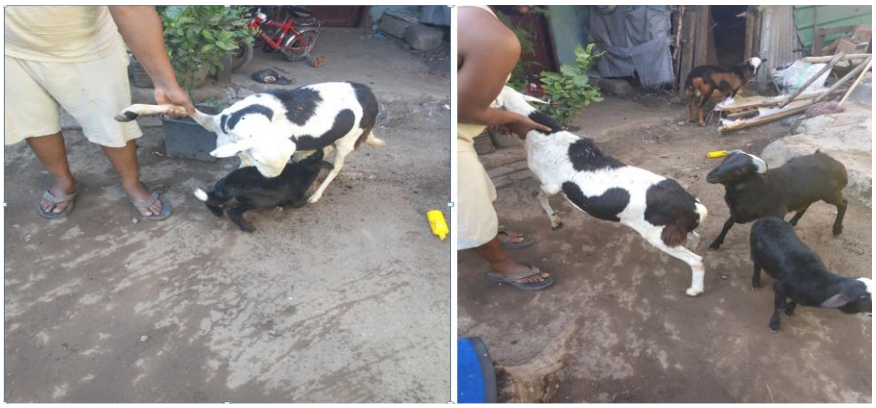


Figure 31: Photograph of ewe recovered from hypocalcemia after treatment of three weeks

3.14.4. Discussion

Hypocalcemia is an acute metabolic disorder and the most commonly occurred in modern dairy industry cattle and sheep of highly desired for maximization of profit soon before or after calving. Occurrence is due to inadequate supply of metabolizable calcium during the peak demand associated with the drain of calcium within the fetus and milk during pregnancy and calving, respectively (Bzuneh *et al*., 2020). The deficiency and further interruptions of the activities of calcium are impaired by different factors including reproductive events (gestation and lactation), high dietary cation-anion difference, vitamin D deficiency and hypomagnesemia challenge tissue sensitivity to a parathyroid hormone (Goff, 2014) beyond the calcium is for optimal and normal physiological functioning of neural transmission, membrane stability, bone structure, blood coagulation, muscle movement, intracellular signaling and it is also an important cofactor for hormonal secretion in endocrine organs (Samuel *et al*.,2012).

Finally, the case was diagnosed as milk fever or hypocalcemia based on the history, clinical signs observed and therapeutic response. As the report of Goff, (2008) indicates, milk fever is caused by an inadequate supply of metabolizable calcium ion (Ca^{++}) in the circulation which is in agreement with the current case report based on rapid response of therapeutic measures. The problem is characterized by stiff gait, ataxia, salivation, constipation, and depressed rumen motility, progressing to hyposensitivity, bloat, recumbency, loss of anal reflex typically is

associated with parturition and beginning lactation and, if untreated, even death can occur (Oetzel, 2011).

Appropriate fluid and therapeutic management for hypocalcemia is a therapy of 40% injection of commercially prepared solution of calcium borogluconate (IV, slowly) to restore blood calcium level and addition of finely ground limestone (calcium carbonate) when feeding grains low in calcium (1-1.5% limestone) which is in agreement with the report of (Tadesse and Belete,2015).

In conclusion, milk fever (parturient paresis) is a febrile disease that typically is associated with parturition and beginning lactation. It is characterized by a sudden paralysis, gradual loss of consciousness and, if untreated, usually terminates in death (Hibbs, 1990). Therefore, for controlling of the incidence of milk fever, oral drenching around calving with a supplement of easily absorbed calcium, anionic salt supplementation during the last weeks of pregnancy with low calcium rations and prepartum administration of vitamin D measures were recommended.

3.15. Epizootic lymphangitis (EL): A case in horse

Abstract: Epizootic lymphangitis is a chronic infectious disease of horses and other equids caused by dimorphic fungus: Histoplasma capsulatum var. farciminosum (HCF). An investigation of a clinical case report of epizootic lymphangitis was conducted at Society for the Protection of Animals Abroad (SPANA), AAU-CVMA on January 21, 2021, by presenting about 220 kg stallion used for cart purpose with chief complains of wounds early on its body especially on front limbs and chests with visible palpable nodules and ruptured nodules oozing pus. Physical examination revealed, almost the horse was depressed and slightly normal parameters with the presence of cutaneous nodules on forelimbs, around chest and neck area. EDDiE diagnosis revealed the case as epizootic lymphangitis. For confirmatory diagnosis, the infected area was cleaned and shaved. Using a sterile syringe and needle content was aspirated from that not ruptured nodule and immediately Giemsa staining was conducted at SPANA laboratory of AAU-CVMA and revealed positive. Finally, the case was definitely diagnosed as EL with differential diagnosis of histoplasmosis, farcy (the skin form of glanders) and ulcerative lymphangitis. The case was managed by disinfecting with antiseptics of ruptured wounds by 7% iodine tincture for seven days and administration of topical ointment to facilitate wound healing. Finally, the owner

was advised to give rest during treatment and until recovered. Isolation and quarantine of infected horses to prevent the spread of organisms by grooming or harnessing equipment were recommended.

Keywords: *Epizootic lymphangitis, stallion, SPANA*

3.15.1. Introduction

Epizootic lymphangitis (EL) is one of the infectious diseases which influence the health and productivity of the equine, cause inflammation of regional lymph nodes. Epizootic lymphangitis is a chronic and contagious disease of horses, mules and donkeys. The disease is characterized clinically by pyogenic, suppurative, ulcerating and spreading pyogranulomatous; multifocal dermatitis, lymphangitis and a cordlike appearance of the subcutaneous lymphatic vessels (lymphangitis) were detected (Al-ani FK, 1999). EL is a debilitating fungal disease seen in equids mainly in the horse. The disease results from infection by a dimorphic fungus, (HCF) Histoplasma capsulatum var. farciminosum (FSPH, 2009).

Epizootic lymphangitis has been called pseudofarcy or pseudoglanders. Moreover, another synonym is Equine Histoplasmosis, Histoplasmosis Farciminosi, Pseudoglanders, African Farcy, Equine Blastomycosis, and Equine Cryptococcosis. Equine AIDS may be a more accurate name for the disease (Radostitis OM *et al*., 2007; Ameni G, 2006). In the Ethiopian context, epizootic lymphangitis is named as ‘biichee fardaa’ locally in Afaan Oromoo. The OIE classifies Epizootic lymphangitis as a list B disease (OIE, 2008).

The disease was seen commonly in the extremities along the front and hind legs, chest wall, belly, and neck. Additionally, it can also be detected as ulcerating conjunctivitis of the palpebral conjunctiva with excessive ocular serious discharge, or rarely as multifocal pneumonia. It is more common in the tropical and subtropical regions than in temperate areas (Radostitis OM *et al*., 2007). In ruptured strangle‟s abscesses and male castrated wounds, the organism might also invade open fresh or non-fresh lesions (Ameni G *et al*., 2006). It is mostly diffused in areas characterized by humid and hot climates (Ameni G, 2006). Biting flies and ticks can also transmit the disease (Gebreab F *et al*. 2015). Depending on the route of entry and Incubation period,

epizootic lymphangitis is variable and it has three forms: the cutaneous, the ocular and the pulmonary (OIE, 2000). In a recent study, the incubation period was much longer in a horse inoculated with mycelial organisms than in a horse inoculated with the yeast form (FSPH, 2009).

Treatments have been tried largely without success and rarely responding to the treatments. Reported effective treatments were Parenteral Amphotericin B and iodides (Scantlebury C, 2009). For recurrences of clinical signs months later is possible, Furthermore, in vitro sensitivity of the organism to amphotericin B, nystatin and clotrimazole has been reported, successful treatment with intravenous administration of sodium iodide, oral administration of potassium iodide and surgical excision of lesions are limited (Ameni G & Terefe W,2004). Quarantines and the euthanasia of infected animals were suggested as eradication and control measures of epizootic lymphangitis (FSPH, 2009). Epizootic lymphangitis disease is a chronic infectious granulomatous disease of the skin, lymph vessels and lymph nodes of the neck and legs of horses and other equines (OIE,2008).In Ethiopia, it's considered as the top disease of equids that have severe economic and veterinary consequences (Ameni G & Siyoum F,2002).

Etiology: The cause of epizootic lymphangitis is *Histoplasma capsulatum var. farciminosum,* is a thermally dimorphic fungus. It is also known as *Histoplasma farciminosum*, *Cryptococcus farciminosis*, *Zymonema farciminosa* and *Saccharomyces farciminosus* (Ameni G, 2006). HF organism exists as yeast in animal tissues and saprophytic mycelium in the environment (Radostitis *et al.,* 2007).

Transmission: by direct or indirect contact of HCF with traumatized skin, by biting flies, by ticks, or by inhalation of HCF, which occur in exudates from skin lesions, nasal, and ocular secretions and other affected sites. Most animals are thought to become infected through breaks in the skin, but H. capsulatum var. farciminosum can also invade mucous membranes (e.g., the conjunctiva or nasal mucosa), and some cases affecting the respiratory tract are thought to be acquired by inhalation. Also sexual transmission was described from stallions to mares. H. capsulatum var. farciminosum can be spread on fomites such as grooming or harness equipment, and biting flies, e.g., members of the genera Musca and Stomoxys, appear to transmit it mechanically (Al-ani, 1986; Morrow A, 1990; Ameni G, 2004).

Pathogenesis: Following entry through wounds, the organisms invade subcutaneous tissue and setup local granuloma or ulcers then disseminates to regional lymph nodes or in severe cases to other organs through the lymphatics. Eventually, these lesions ulcerate and drain a thick, mucopurulent material containing yeast cells. Wherever there is skin trauma, particularly under the harness and on the extremities nodules are formed. Pneumonia or failure of other affected organs may be fatally overwhelmed to Horses that have a heavy systemic burden of fungi (Radostits *et al*., 2006; Jubb *et al*., 2006). The ocular form of the disease results from inoculation of the organism into the eye, likely by biting flies. Both conjunctivitis and rhinitis may occur as the extension of the skin form, because the animals will scratch the skin lesions by their teeth and lips, thereby spreading them to the surrounding organs (Ameni, 2007).

Clinical sign: Based on the pathological lesion in equids involve the skin and lymphatics, underlying bones and joints, respiratory tract and/or conjunctiva. Three forms of the disease are cutaneous (skin), ocular, and respiratory forms and they are early, moderate and sever stages. The most commonly reported syndrome is cutaneous disease, with or without ocular signs and respiratory involvement. The most common form of epizootic lymphangitis affects the skin and lymphatic (Ameni G, 2002).

Diagnosis: It depends on the clinical sign, history of animals and laboratory confirmation like microscopic examination of the yeast form of HCF in pus, serological tests and skin hypersensitivity testing. To confirm the presence of Histoplasma species Culture of the organism is necessary but it has difficulty due to the organism is slow to grow hence requires care to reduce overgrowth of contaminants and aspirate a sample from un-ruptured nodule after clipping and disinfecting the skin to reduce contamination. Confirmation of the disease was based on the demonstration of organisms in the smear (Tagesu, 2017).

Treatment: to prevent the spread of the infection, Treatment of epizootic lymphangitis is mandatory and for control of the disease culling infected horses and adoption of hygiene measures (e.g., cleaning and disinfection) and insects control is required. There is no completely satisfactory treatment against epizootic lymphangitis however successful treatment with intravenous administration of sodium iodide, oral administration of potassium iodide and surgical

excision of lesions has been reported, Localized nodules can also be lanced, the pus drained and the nodules packed with a 7% tincture of iodine. In most areas, epizootic lymphangitis is a reportable disease and treatment is not allowed (CFSPH, 2009).Intravenous injection of infected horses with amphotericin B at a dose of 0.2 mg/kg body weight three times on alternate days. Removing the scabs and clean the areas daily with an iodine solution for seven days. Surgical opening of the nodules and packing with gauze soaked in 7% tincture of iodine (Kasuga T *et al*., 2003).

Therefore, the objective of this case report is to describe the management and prevention of the disease.

3.15.2. Case presentation of epizootic lymphangitis

A stallion used for cart purposes was presented to SPANA of Addis Ababa University College of veterinary medicine on January 21, 2021. About 220 kg weight stallion with complainTs of wounds early on its body especially on front limbs and chests and its palpable nodules are visible while the ruptured oneis less visible. Physical examination of the horse revealed, depression, cutaneous nodules on forelimbs, around chest and neck area with parameters of the Horse in which at normal ranges were revealed heart rate of 72 beat/min, the respiratory rate of 26breath/min, and rectal temperature was revealed 38.7 °C. EDDiE diagnosis result was revealed the case as epizootic lymphangitis. Based on the above clues of owner complaints, clinical presentation and examination (presence of cotaneuos nodules and clinical signs with affected parts) and EDDiE result, tentatively the case was diagnosed as epizootic lymphangitis and differentially diagnosed as strangles, African horse sickness and glanders. For confirmatory, sample was taken from un-ruptured nodules (Figure 32C) to conduct gram staining and for culturing of organisms as indicated below of (Figure 32A&B).

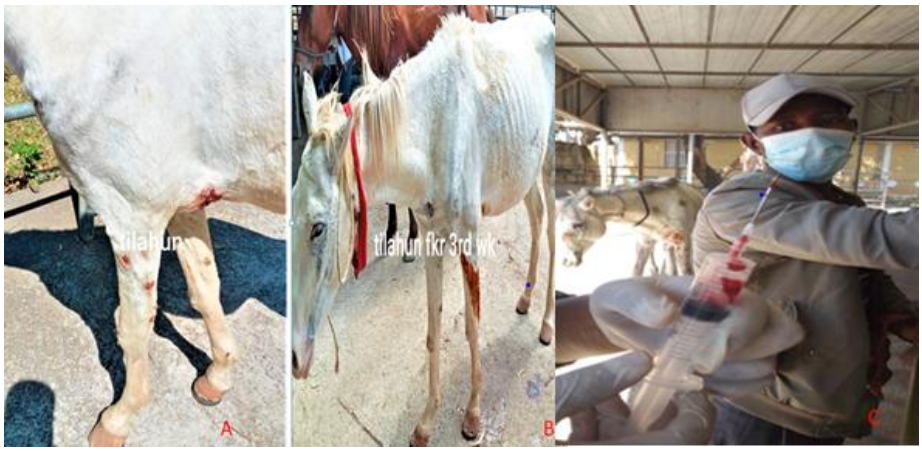


Figure 32: photograph of Horse infected by epizootic lymphangitis: first day of the horse with ELP at SPANA with visible ruptured nodules (A), horse after 3rd week of treatment (B) and a sample taken from unruptured nodules of epizootic infected horse for laboratory aanalysis (C).

3.15.3. An investigation of laboratory findings

After clipping and disinfecting of the skin to reduce contamination, a sample was aspirated from an un-ruptured nodule under sterile conditions. Then for confirmation, the sample was sent to Akililu Lema Institue of Pathobiology (ALIPB) to culture an organism in collaboration with assigned Mvsc students on the topic and also sent to SPANA Veterinary laboratory of AAU-CVMA for immediate Giemsa staining. Immediately Giemsa staining technique of the cutaneous exudates as stained smears was performed and observed under 100X magnification lens of a binocular microscope after a drop of oil immersion was added on top of the slide. The result showed Gram-positive pleomorphic, ovoid to globose structures, a halo (unstained capsule-like structure) which confirmed the yeast form of *Histoplasma capsulatum* (Figure 33A). The remaining pus sample was cultured on Sabouraud dextrose agar (SDA) and kept at room temperature. It took two months for the organism to grow. Dry, grey, white, granular with wrinkled/lined, cerebriform, convoluted mycelia colonies were observed after two-month culture on SDA (Figure 33B).

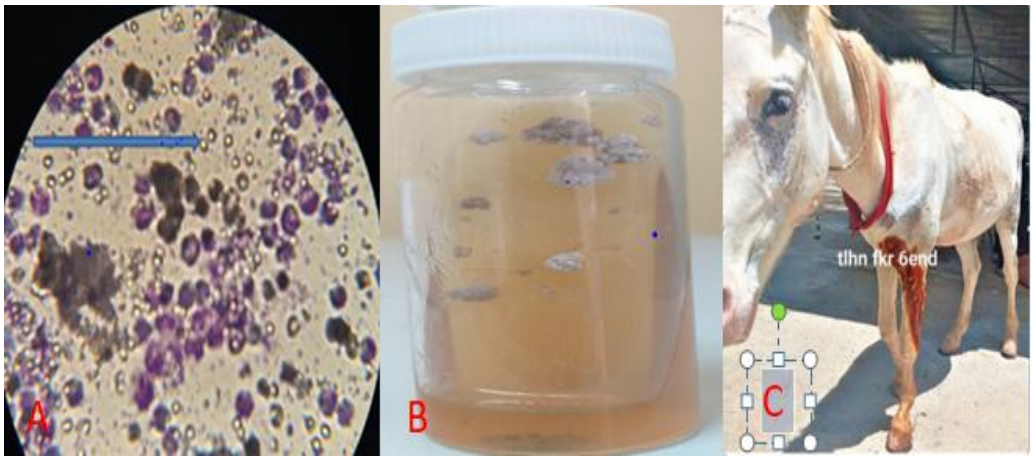


Figure 33: laboratory findings of EL, A) Giemsa staining and B) growth of EL on Sabouraud dextrose agar (SDA) and C) Photograph of a horse after treatment of 6week.

3.15.4. Treatment and management outcome of epizootic lymphangitis

However, there is no completely satisfactory treatment against EL, the area of infection was shaved and any nodule that was not ruptured was incised with Scalpel blade continued with the removal of the pus and flushing of the nodule with 4% tincture iodine. Potassium Iodide (KI) 25gm SID, with feed, was given for consecutive 5 days and then after 30gm of KI SID, with feed was given every other day for 5 weeks. For Control of the disease culling infected horses and adoption of hygiene measures (e.g., cleaning and disinfection) and insects control is required. 500ml of the iodine was given to the owner to apply on the wound until healing occurs and the owner was strongly advised to clean the infected area with soap and water every day. During the treatment new nodules were not emerged and post-treatment of 6 weeks, nodules become left as scars with a good prognosis (Figure 33C).

3.15.5. Discussion

Epizootic lymphangitis is a major chronic contagious fungal disease of the equine which causes pyogenic, ulcerative, and generalized spreading pyogranulomatous, multifocal dermatitis with lymphadenitis, and a cord-like appearance of the subcutaneous lymphatic vessels (Abdisa, 2017a). The current clinical case report was diagnosed as epizootic lymphangitis based on the

clinical findings, outbreak occurrence, EDDiE result and laboratory findings. Both finding of EDDiE diagnosis and laboratory result obtained was in agreement to each other. The clinical signs and laboratory result observed in the case reported by Radostits, *et al*., (2006) was also in agreement with clinical findings and laboratory result by gram staining observed in this current case report.

However, the disease does not have effective treatment so far literature indicates but in the current case report trial of treatment by surgical incision with potassium iodide practiced at SPANA is showing better resulst in the treatment of early cases of the EL which agreed with the report of Ameni and Terefe (2004).

In conclusion, Epizootic lymphangitis is a chronic contagious fungal disease of equines that needs accurate prophylactic care for its prevention and control than therapeutic measures. Since the treatment of EPL is not effective and even costly in advanced cases consideration should be given to control measures of the disease in addition to the hygiene of harness equipment, as contaminated bedding should be burned, since the organism may persist in the environment for a long time. Therefore quarantines and euthanasia of infected animals were recommended for control measures.

3.16. Colic due to grain overload: A case in donkey

Abstract: Colic in a donkey is a symptom of abdominal pain with various causes; impactions or blockages of a part of the intestine with partially digested food, foreign bodies such as plastic bags or parasites. A 7-year old female donkey (jennet) was presented at Donkey sanctuary open-air clinic of AAU-CVMA, with complaints of owner: the donkey was suddenly exposed to the grain at harvesting time with a history of overfeed. Gradually after being exposed, distension of the flank, lying down and aggressively roll on the ground and listen to its belly even by pawing the ground was observed. Physical clinical examination was revealed distension of the flank at both sides with severe sweats, lying down and rolling on the ground stressfully was observed with parameters: temperature of 39.6^0C, respiratory rate of 36 breaths/ minute and pulse rate of 76 beats/ minute. Based on past history of feed and clinical signs observed tentatively the case was diagnosed as colic due to grain overload. To relief, the problem nasogastric tube was

introduced to the stomach but there was no reflex. Therapeutic management was continued by administration of flunixin meglumine (1.1mg/kg SID) IV as pain killers with paraffin oil via nasogastric tube to stomach. Finally, the condition of the donkey was getting worse with severe distension and abdominal pains without fecal output with poor prognosis and early after treatment, the donkey has died.

Keyword: colic, donkey, donkey sanctuary

3.16.1. Introduction

Donkeys are versatile animals and can have many uses as draft power. Donkeys are not like horses; they differ physically, mentally and emotionally. Donkeys are more stoical in their behaviour and tend to startle less than horses. Donkeys (Equus asinus) are natural browsers and will graze up to 16 hours a day on a diet of high fibre plant material and they are very efficient at metabolizing their food and therefore their energy requirements are lower than a similar-sized pony. However, this makes them easy to overfeed, which can lead to serious health problems such as hyperlipaemia, laminitis and other organ dysfunction additionally they need grain over left supplements for energy gain. Ideally, donkeys should be fed 1.5% of their body weight in dry matter for maintenance (Svendsen, 1992).

Colic is defined as any gastrointestinal pain which is considered as the major diseaes state in horses and donkeys causing severe abdominal pain. It's a frequent and important cause of death the equines. Etiological agents to clinical syndrome of colic are various including obstructive, displacement, gas, parasite and enteritis (Radostatis *et al*., 2007). Colic is a symptom of abdominal pain, a clinical sign with many causes. Although this is commonly pain in the gastrointestinal tract, it can also be due to pain in other organs such as the kidney, ovaries, uterus and bladder. It is similar to the condition in horses but the distribution of common causes and signs can be somewhat different. Various types of colic may present differently, and they are often assessed on the basis of history, pain, heart rate, respiratory rate, gut sounds and other clinical exam findings. Signs of dehydration are not always obvious as donkeys tend to cope better with dehydration than horses due to their adaptation to arid climates (Merck, 2014).

Different kinds of colic are seen in equines including impactions or blockages of a part of the intestine with partially digested food, foreign bodies such as plastic bags or parasites (worms), spasms of the muscles of the wall of the intestine (spasmodic colic), collection of gas (flatulent colic), torsion of part of the intestine (twisted gut), painful conditions such as stomach ulcers, tumors or pancreatitis. Common Causes of colic in donkeys are Impactions: mostly pelvic flexure, occasionally small colon, Colitis, peritonitis, stomach ulcers, ovarian disease, fractures, Spasmodic colic (6%), neoplasia, diarrhoea, and pancreatitis can causes colic in the equines especially donkey (Benirschke *et al*., 1962).

Pathogenesis: The predominant reasons for the death of equines were stomach rupture, strangulating lesions or enteritis. The most common site of impaction is a large colon and when small intestinal impaction happens in donkeys it is always very fatal (Ferraro, 2008).

Clinical signs: Major sign is pain which is manifested by repeatedly lying and rising, pawing, stamping, kicking or rolling which is susceptible in equines due to their unique anatomy of the digestive system. However, the signs can be less dramatic it does not mean the donkey is feeling pain any the less. The most frequently noted signs in symptomatic grain overload include: colic, marked abdominal distension, severe lameness trembling, sweating, polypnea and less frequently diarrhea (Radostatis *et al*., 2007). Clinical findings include dullness most commonly seen as the first sign, lying down and isolating itself from friends, lack of appetite or refusing to eat, rolling and pawing at the ground (rare in donkeys, if seen indicates a very serious problem), fast breathing, rapid heart rate, excessive sweating, color of gums or inside eyelid – brick red or very pale membranes are both very poor signs, heart rate of a donkey with colic is often increased above their average normal of about 44 beats per minute. Their normal respiratory rate is 16-20 breaths per minute and this may also increase with colic, depending on the cause, dry or tacky gums and lack of or a reduction in the normal quantity of droppings were noted (Orsini and Divers, 2003).

Diagnoses of colic: Colic is diagnosed on the basis of history, clinical signs, nasogastric intubation, rectal examination, ultrasonography, abdominal auscultation and fecal examination.

Nasogastric intubation is important for the diagnosis of colic, and relief of gastric distension which will rupture the stomach if not treated (Hillyer *et al*., 2008).

Treatment and prevention: Treating colic in donkeys is very similar to horses, and the goals are to eliminate pain, correct dehydration and restore gut motility and passage of feces (manure). Painkillers, oral/IV fluids, periods of starvation and turning out may help. if diagnosis is not made after clinical examination admit a donkey for surgery carries a high risk by considering the duration of colic, distended intestines palpated on rectal examination (may not always be possible in smaller donkeys), abnormal peritoneal fluid, reduced gut sounds, a large quantity of gastric reflux, perceived severity and unrelenting pain. Introduce fluids into your donkey's stomach via a tube that is inserted up one nostril. It may be necessary to put the donkey onto a 'drip' (fluid introduction via the large vein in the neck) with a pain killer as needed (Donkey Sanctuary, 2014).

3.16.2. Description of case history

A 7- year's old female donkey was presented to Donkey Sanctuary open-air clinic, Bishoftu with chief complaints of during harvesting season at the field the donkey was exposed to the grain and overate. Gradually after exposure to the grain, its abdomen got distended and became lying down and aggressively started to roll on the ground and listen to its belly even by pawing the ground. The amount of wheat grain eaten by the donkey was not known and noted that no fecal output after exposure. Physical and clinical examination of the donkey revealed, there was distension of the flank observed at both sides with severe sweats, lying down and rolling on the ground observed. The esult of the ody parameters revealed; temperature of 39.6^0C, respiratory rate of 36 breaths/ minute and pulse rate of 76 beats/ minute which indicates increased parameters beyond its normal range. There is also congestion of visible mucous membranes; conjunctiva and gingival and upon auscultation of the gut motility, there was no peristaltic movement noted and on rectal examination colonic, there is no fecal output. A nasogastric tube was passed to the stomach but there was no reflex. 'EDDiE' diagnosis result indicated Colic. Based on a history of feed exposure, clinical signs observed and' EDDiE' result the case was tentatively diagnosed as

colic due to grain over load. Gas accumulation, intestinal displacement and parasites were listed as differential diagnosis.

Figure 34: Pictorial presentation of donkey suffered by distension of abdomen (A), diagnosis of distention by the introduction of nasogastric (B), checking for reflex and removing of blockage (C) and addition of paraffin oil to soften content of the stomach and facilitate defecation (D).

3.16.3. Case management and treatment outcome

Prevention of colic due to grain overload in a donkey is ensured by gradual access to grain for 2 - 4 weeks. Feed good quality forage and donkey-specific proprietary feeds also by avoiding moldy feed. Ensure regular feeding: little and often especially if the animal is on additional feed. Avoid access to too much rich wheat grain and checking for reflex and removing of blockage (Figure 34B and C). For therapeutic purposes Flunixin meglumine (1.1mg/kg SID) was given IV as pain killers. Using nasogastric tube paraffin oil was introduced to the donkey stomach for softening and rolling of the feed (Figure 34D). Ringer lactate 1bag (1liter) were given IV/ hour. Finally the condition of the donkey was getting worse with severe distension and abdominal pains without fecal output stayed worsen. Due to its poor prognosis the donkey was died early after treatment.

3.16.4. Discussion

Sudden exposure of the donkey to wheat grains causes the development of grain overload which resulted after excessive intake of carbohydrate-rich feeds. The history of feed over grain and clinical sign observed in this current case was severe distension of abdomen, rolling down and powing the ground with a deviation of body parameters from the normal range indicated signs of colic which is in agreement with the report of (Thiemann *et al*., 2017) and in line with the diagnosis of 'EDDiE' as colic.

Due to the progression of wheat grain to the intestine of the donkey, the introduction of a nasogastric tube does not indicate reflex which indicates a poor prognosis of the case. The objective of treating colic is to eliminate pain, correct dehydration and restore gut motility and passage of feces (manure) additionally with Painkillers, oral/IV fluids, periods of starvation and turning out may help. Its management is based on avoid sudden exposure to the grain and ensuring regular feeding. The case was managed currently by administration Flunixin meglumine (1.1mg/kg SID) was given IV as pain killers and with supportive therapy like paraffin oil to soften the content of the stomach to facilitate defecation. To resolve dehydration and restore body fluid, Ringer lactate 1bag (1liter) was given IV/ hour. However, intensive care and treatment was provided due to complication and worsening of the case with poor prognosis the donkey has died early after treatment.

In conclusion, to overcome the problem of colic due to grain over load in equine: Feed good quality forage by avoiding sudden grain exposure; ensure regular feeding of little and often especially if the animal is on additional feed. Therefore, avoid all causes and predisposing factors that contribute for the occurrence of the equine colic.

3.17. Parvovirus in puppy

Abstract: Canine parvovirus infection is one of the main causes of death in canines mostly in puppies due to hemorrhagic enteritis. A two-month-old puppy was presented at Veterinary Teaching Hospital of AAU-CVMA on December 21, 2020, with the chief complaints of depression, inappetence, and signs of illness including vomition and usual diarrhea with blood.

Physical clinical examination revealed, the puppy was febrile (41.2^0C), lassitude, vomition, foul-smelling diarrhea, and dehydration with pale mucous membrane. EDDiE diagnosis assisting tools were not employed for the dog and the case was symptomatically diagnosed as parvovirus infection based on the associated history of the puppy and clinical findings observed. Symptomatic and supportive treatment was performed to restore and maintain the hydration status of the puppy by administration of fluids therapy in addition to broad-spectrum antibiotic and antiemetic therapy. However, the puppy was promptly treated with antibiotics, fluid, and antiemetic therapy due to complications and poor response to therapeutic management the puppy was died day after admission. Hence, the case could be cured if treated promptly and vigorously with appropriate drugs accompanied by supportive therapy.

Keywords*: Canine parvovirus; diarrhea, Puppy, vomition*

3.17.1. Introduction

Parvovirus is an infectious, highly contagious viral disease of both the wild and domestic canids but it had rapidly evolved and developed in dogs. The disease is considered as the most important virus being found worldwide. Canine parvovirus is caused by a small non-enveloped virus Parvo‘means small (Latin), Strain-2 (CPV–2) of the family Parvoviridae, genus Protoparvovirus, and species Carnivore protoparvovirus-1 (Carmichael, 2005). CPV-2 is a very virulent and more pathogenic strains of CPV cause more fatal diseases and share more antigenic similarities with other viral diseases (Feline Panleukopenia Virus (FPV) and Mink Parvovirus Enteritis than with CPV-1, in fact, CPV-2 differs from (FPV). The genome is a single-stranded DNA (Murphy *et al*., 1999; James; 2017; Nemzek *et al*., 2015). Parvovirus infection is characterized by the presence of bloody diarrhea and vomiting and currently, has three antigenic variants of CPV-2 including 2a, 2b, and 2c (Adeyanju *et al*., 2017; Goddard *et al*., 2008). These clinical manifestations of CPV infection depend on the age and immune status of the dogs, virulence of the virus, dose of the virus and pre-existing or concurrent parasitic, bacterial, or virus infections (McAdaragh *et al*., 1982).

Due to lack of protective immunity from maternally derived antibodies or from ineffective responses to vaccinations puppies are the most susceptible to canine parvovirus infection

(Patterson, 2007). Prevalence of the disease is high in unvaccinated dogs due to ignorance of the owners, high costs of vaccines, poor husbandry and facilities for biosecurity practices (Muzaffar *et al*., 2006) and the disease become endemic in particular eras as a result of the continued presence of the pathogen (Dogonyaro, 2010).

Transmissions: Canine parvovirus is highly contagious. Indirectly transmissions from infected to susceptible dogs take place by the feaco-oral route, but the major means of transmission is the infection from viruses present on fomites such as shoes, clothing, human hands, food bowls and other utensils (Decaro *et al*., 2005). There is also a probability of indirect transmission. The incubation period of canine parvovirus is varying from 4-5 days in the field but its three days with an experimental infection. Canine parvovirus is stable in the environment and resistant to the effects of heat, detergent, alcohol and many disinfectants unlike other viruses (Ernest, 2009).

Pathogenesis: Following ingestion, the virus replicates in the lymphoid tissues of the oropharynx (where it spreads to the bloodstream) and attacking rapidly dividing cells throughout the body especially those in the bone marrow, lymphopoietic tissues and crypt epithelia of the jejunum and ileum and in young dogs myocardial cells (Kahn and Line, 2005). Infection of lymphatic manifested by lymphopenia and precedes intestinal infection and gastrointestinal signs. After replication of the virus in the bone marrow and lymphopoetic tissue, it causes neutropenia and lymphopenia respectively and following post-infection of three days the virus infect rapidly dividing intestinal crypt cells leading to viral shedding in the feces and peaks when clinical signs appear (De laforcade *et al*., 2003). Hemorrhagic diarrhea was formed due to the collapse of villi and loss of intestinal epithelial integrity after necrosis of infected intestinal crypts (Ettinger and Feldman, 2005). Finally, it results in bacteremia following get access of Normal enteric bacteria (Clostridium perfringens and Escherichia coli) into the denuded mucosa and may gain entry to the bloodstream (Ettinger and Feldman, 2005).

Clinical signs of canine parvovirus: a sign of infected dogs' ranges from asymptomatic infection to fulminant disease and sudden death are seen in young, immuno-compromised dogs and predisposed breeds and can be complicated by concurrent infection (Ettinger and Feldman, 2005). There are two clinical forms of parvovirus infection: myocarditis (young puppies especially in the

early neonatal period) and gastroenteritis. Myocardial necrosis with either acute cardio-pulmonary failure (causing pulmonary edema, cyanosis and collapse) or scarring of the myocardium and progressive cardiac insufficiency will occur in early infection of the puppies by a virus. However canine parvovirus myocarditis is no longer seen because of effective immunization of bitches protects pups during early period of life (Kahn and Line, 2005; Dogonyaro 2010).

In puppies 6-20 weeks canine parvovirus gastroenteritis is most common when the maternal antibody protection wanes and vaccination has not yet adequately protected the puppies against infection (De Laforcade *et al*., 2003; Mosallanejad *et al*., 2008). Vomiting, anorexia, depression, dehydration, foul-smelling bloody diarrhea, hypothermia or fever marked thrombocytopenia and leucopenia are the most common clinical and hematological findings of canine parvovirus infection (Yilmaz *et al*., 2005). Large protein and fluid losses from vomiting and diarrhea can cause severe dehydration and hypovolemic shock. Prolonged capillary refill time, tachycardia, hypotension, cool extremities, and low rectal temperature are signs of shock and hypo-perfusion while abdominal pain is secondary to acute gastroenteritis (Ettinger and Feldman, 2005).

Diagnosis: Diagnosis can be conducted based on the clinical sign, however; Diagnosis on the basis of clinical signs is not definitive due to several other pathogenic organisms that can cause diarrhea in dogs. Hence for definitive diagnosis laboratory tests should be suggested after clinical diagnosis. electron microscopy (EM), Enzyme-linked immunosorbent assay (ELISA), immunochromatographic tests (IC), haemagglutination (HA) tests, viral isolation (VI), haemagglutination inhibition (HI) tests, conventional polymerase chain reaction (C-PCR) and real-time polymerase chain reaction (RTPCR) are laboratory methods to be employed for definitive diagnosis of canine parvovirus infection (Alicia *et al*., 1999).

Treatment and prevention: treatment of CPV requires intense efforts of veterinarians and extensive hospitalization due to severe dehydration and damage to the intestines and bone marrow (Dogonyaro, 2010). Intravenous fluids, suppression of vomiting and antimicrobial drugs are some recommended options for the treatment of CPV. Despite ongoing fluid losses, administration of fluids such as Ringer's or 0.9 % saline at volumes sufficient to restore and

maintain hydration is a key therapy. Also to maintain normal serum potassium and glucose concentration Supplementation of fluids with potassium and dextrose may be necessary. Control of persistent vomition with antiemetic drugs like metoclopramide or chlorpromazine are considered as supportive care for affected puppies. The only appropriate way of prevention and control of CPV is proper vaccination schedule, good nutrition, and good hygiene; reduce overcrowding and intense hospitalization of sick dogs if available.

3.17.2. Case description

A-two month old puppy was presented to the Veterinary Teaching Hospital of AAU-CVMA, on December 21, 2020, with the chief complaints of the owner that his puppy was depressed and with the history of other puppies were lost in the same week before the new case was presented to VTH, and inappetence was observed. On clinical examination, the puppy was febrile (41.2^0C), lassitude, vomition, foul-smelling diarrhea, and dehydration with pale mucous membrane. Moreover, the puppy was neither vaccinated nor dewormed. EDDiE diagnosis assisting tools have not included a dog in the algorithm. Based on the history and clinical sign the case was tentatively diagnosed as parvovirus.

Figure 35: Puppy suffered by parvovirus infection

3.17.3. Management and treatment outcome

Based on symptomatic diagnosis puppy was treated with a broad-spectrum antibiotic Trimethoprim Sulfadiazine 30 mg/kg (Hebei Yuanheng Pharmaceutical Co., Ltd, China) at a dose of 1.2ml/2kg as the initial dose for the first day and as a maintenance dose 0.6ml/2kg, IM for the other three days were administered. To restore and maintain hydration administration of fluids therapy was recommended. Hence based on the calculation of deficit volume and maintenance volume, 5% dehydration ringer lactate sunsheng Pharmaceutical factory PLC, china was administered.

DRV (ml) = % dehydration x bwt (kg) x1000^{b} x 0.80 + MFV= (30 X BW_{Kg}) +70=130ml

Where, $^{b = 1000 ml = 1 kilogram}$

=0.1*2*1000*0.8 =<u>160ml</u> total volume=130+160=290~<u>300ml</u>

So 300ml of 5% ringer lactate was given per day intravenously for two days. To control persistent vomition metoclopramide 0.5mg/kg body weight for two days and vitamin B-complex 2mg/kg, IM bwt for three days to enhance appetite was given.

Follow-up: due to poor prognosis the presented case was not satisfactory because the owner not followed the treatment regime as per standard protocol directed by the Veterinarian i.e. continuation of prescribed treatment up to three (3) days with no feeding and drinking was not followed. As a result, the puppy has died.

3.17.4. Discussion

Canine parvovirus (CPV) infection is an infectious and contagious viral disease of canine especially dogs and the most common cause of enteritis and mortality in puppies (Shabbir et al., 2009). The present case report (investigation) was tentatively diagnosed as parvovirus on the basis of the history of age and other similar cases occurrence and clinical findings the puppy was elicited. The diagnosis of the present case report (investigation) was inconsistent with the result documented by Munibullah *et al*., (2017) that canine parvovirus-infected dogs exhibited clinical

signs such as anorexia, bloody diarrhea, vomiting, paleness of mucosa, and dehydration in young puppies.

However, Parvovirus infection is in all age groups, there is a high prevalence in puppies of three months of age than adults (Behera *et al*., 2015) which is supported with the study conducted by Vivek, (2011) that Prevalence of CPV infection was the higher among 1-3 month of age group than others and, due to the affinity of the virus being multiplying rapidly at intestinal crypt cells at the weaning age along with higher mitotic index, younger puppies (≤ 3 months) is mostly affected. Also, occurrence of the disease is high in unvaccinated dogs compared with vaccinated ones due to ignorance of the owners, high costs of vaccines, poor husbandry and facilities for biosecurity practices (Muzaffar *et al*., 2006) which is agreed with the findings of Godsall *et al*. (2010) where unvaccinated puppies aged between six weeks -six months are at greatest risk of developing CPV infection due to lack of protective immunity which is line with the current case report that unvaccinated puppy of 2 month old was suffered by CPV.

Symptomatic and supportive treatment of this current case report was aimed at restoring fluid and electrolyte balance and antibacterial therapy, aimed at reducing the secondary bacterial complication were similar treatment protocols with other studies (Hoskins, 1997; Prittie, 2004). In the present case report an intravenous lactated ringer solution (sunsheng Pharmaceutical factory PLC) to supplement fluids and salts in the blood, sulfadimidine sodium for secondary bacterial prevention and antiemetic to induce vomiting and vitamin B-complex to stimulate appetite were administered which is in line with the report of (Wanamaker *et al*., 2008).

Due to poor prognosis, the presented case was not satisfactory because the owner not followed the treatment regime as per standard protocol directed by the Veterinarian i.e. continuation of prescribed treatment up to three (3) days with no feeding and drinking was not followed. As a result, the puppy has died. The viral attraction for rapid multiplying intestinal crypt cells in young dogs (pups) with the highest may enhance the susceptibility of pups to CPV as a report of Deka *et al*., 2013, Stepita *et al*., 2013).

In conclusion, Parvovirus infection is a worldwide spread viral infectious with a rapid disease that affects young dogs and it can be fatal without treatment. Therefore, an appropriate treatment

regime as per standard protocol and timely vaccination of puppies was best suits as control measures.

3.18. Pharmacodermia in Dog after therapeutic management

Abstract

Pharmacodermia, a drug reaction expressed on the skin, is characterized as a dose-dependent response correlated to excessive dosage. The study of clinical case report was conducted on March 31, 2021, at Veterinary teaching hospital of AAU, college of veterinary medicine after a 7-month old female exotic puppy with no history of vaccination was presented with a history of treatment before a week at Addis Ababa private veterinary clinic for sudden vomiting and diarrhea after feed discomfort. While on treatment after three days puppy was discomfort and shows behavioral change with multiple loss of hair over the body, generalized lesions, and moderate intense pruritus. By discontinuing treatment, they presented to VTH with no information about the type of therapy administered. A physical examination, it was evidenced involvement of hair thinning area around the back of the puppy, alopecia, papule pustular lesions, erythema, worsening of the lesions and intense pruritus and pain upon palpation and temperature of 39.7^0C was noticed. Based on the symptoms shown and the history given by the owner, a tentative diagnosis of pharmacodermia or allergic reaction following treatment discomfort was deduced. There is no specific diagnostic test except the approach of animal history reports and clinical conditions. Treatment of the problem can be by removing the causative agent and making the clinical support, through the control of secondary infections. Finally, the case was treated by Hydrocortisone sodium succinate for injection, topical cream ointment, Ketoconazole shampoo for showering the puppy every day with the application of paraffin to activate hair growth and become recovered.

Keywords*: pharmacodermia, puppy, treatment*

3.18.1. Introduction

The skin is the first defense line and the largest organ of the body composed by physical-chemical and microbiological barriers (Larsson *et al*., 2016). These mechanisms alterations can predispose to Anaphylaxis a severe, life-threatening allergic reaction that occurs rarely after treatment. Adverse reactions concomitant or after treatment in the skin, mucosa and appendages due to topical or systemic use of the drugs, which may cause structural or functional alterations in skin, reflecting on localized or generalized lesions is known as Pharmacodermic reactions. In the human high incidence of the disease are affected of in patients treated with antibiotics (Arunvikram et al., 2014; Voie *et al*., 2012). Due to similarity with several skin diseases, in veterinary medicine, it is suggested that the casuistry may be underestimated and reports of pharmacodermia in dogs are scarce. This adverse disease condition is characterized by allergic reaction with clinical alterations on the skin, mucous membranes and annexes, due to use of certain medicines (Balda *et al*., 2014; Silva *et al*., 2003) and this clinical condition can lead to serious consequences such as anaphylactic reaction and death (Arunvikram *et al*., 2014; Trapp *et al*., 2005).

Etiology and pathogenesis: pharmacodermia, based on its etiopathogenesis can be classified as dose-dependent, in which reactions are associated with drug dosage, or dose- independent when it relates to the individual immune response of the animal. Dose-dependent associated with drug dose-reaction is the most frequent and may have iatrogenic character. The clinical manifestation of cause-dependent reaction is corresponding to adverse drug effects, being susceptible to any individual. Idiosyncrasy correlates only to genetic predisposition, being uncommon and unpredictable, and their exact mechanisms have not been completely understood yet. Although it is known that in cases of drug reaction the immune system is activated similarly to allergic conditions.5 the major cause of allergic reactions are antibiotics and may involve type I, II, III and IV reactions and may cause pruritus angioedema, bronchospasm and anaphylaxis, systemic alterations characterized by hemolytic anemia, thrombocytopenia and nephritis, involve severe complications of cytotoxicity, skin rash, fever, lymphadenopathy and arthralgia, cause eczema, erythema multiforme and photodermatitis (Schnyder and Pichler, 2000; Silva *et al*., 2003).

Diagnosis: There is no specific diagnostic test; therefore the approach is based on animal history reports and clinical conditions. Histopathology exams can be performed in cases of severe lesions as support to differential diagnosis. The use of skin tests in human patients as a diagnostic source was evaluated however this one presented low reliability with many false-negative results to reactions due to drug use. The treatment consists of removing the causative agent and making the clinical support, through the control of secondary infections, pruritus and other changes that may be correlated to the case (Larsson *et al*., 2016).

Due to the scarcity of relates about this severe condition in the small animal clinic, the present study aims to report two cases of canine patients with pharmacodermia after antibiotic therapy to guide and attempt the clinician about the associated changes as well as diagnosis and treatment

3.18.2. Description of case and treatment

A 7-month old female exotic puppy with no history of vaccination was presented to Veterinary Teaching Hospital of AAU-CVMA on March 31, 2021, with a history of treatment before a week at Addis Ababa private Veterinary Clinic for sudden vomition and diarrhea due to feeding discomfort. A day after drug administration, the dog presented generalized lesions and moderate intense pruritus, urticaria, with multiple loss of hair which was more evident over the body were observed. Following treatment discomfort and behavioral change, they presented to VTH with no information about the type of therapy administered. A physical examination, it was evidenced involvement of hair thinning area around the back of the puppy, alopecia, papule pustular lesions, erythema, worsening of the lesions and intense pruritus, and pain upon palpation and temperature of 39.7^0C was noticed. A tentative diagnosis of pharmacodermia or allergic reaction following treatment discomfort was deduced based on the symptoms shown and the history given by the owner.

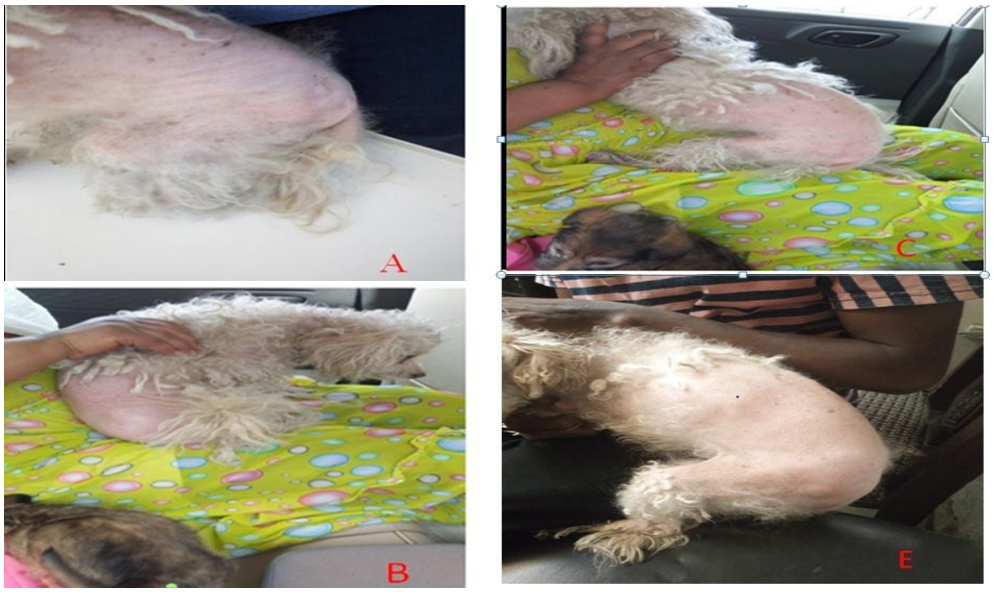


Figure 36: Puppy suffered by generalized skin lesion (A), Focal or diffuses dermatological lesions (B&C) day five cares and follows up (E)

3.18.3. Management of the case and treatment outcome

Hydrocortisone sodium succinate injection for anaphylactic reactions to drugs administered for three days (100gm dissolved in 2ml of sterilized water), ketoconazole shampoo for showering of the puppy every day, and topical cream ointment with an application of paraffin to activate hair growth was recommended to apply every day until progress was seen.

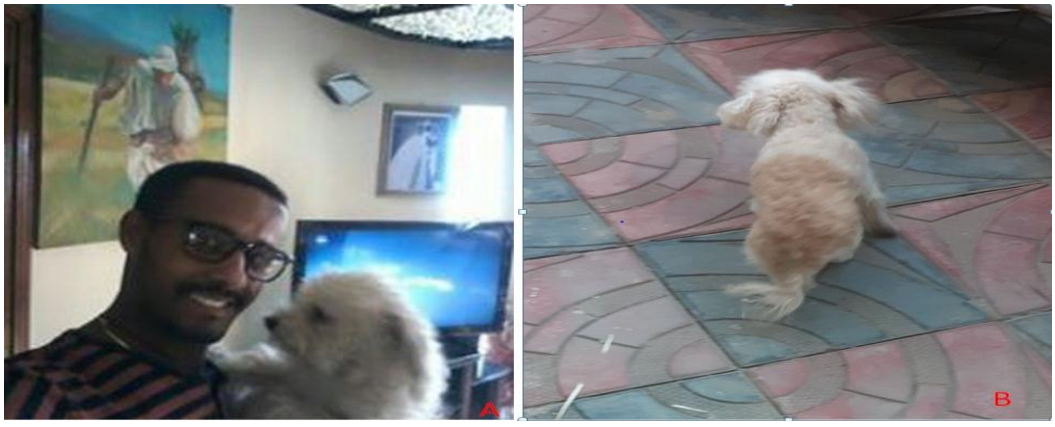


Figure 37: Photograph of dog recovered from skin problem (A&B).

3.18.4. Discussion

Pharmacodermia is being considered a diagnostic challenge due to the similarity of clinical changes to other cutaneous affections and it can occur in any patient both animals and humans. As Trapp et al. (2005) report the causes of this condition involve dosing errors in which after antibiotic therapy use with sulfadiazine and trimetropin at an excessive dosage and the current case report have also similarity with this report however the drug is not known, the canine was affected by ulcerative dermatitis with areas of necrosis and this report is in agreement with current case report however the drug of treatment before is specifically not known. After the introduction of drugs at correct dosages, cutaneous changes were noticed due to individual reactions by idiosyncrasy which is probably another cause of the condition as referred by Balda et al. (2014).

The reactions are expressed in the skin and can be characterized by acute generalized exanthematous pustulosis and common pruritus with variable manifestation in many cases (Belda, 2005) and comparatively similar with the current case report those days after treatment pruritus with worsening hair loss and the cutaneous lesion was observed. In conclusion, it is understood as pharmacodermia the hypersensitivity reaction to certain drugs manifested by focal or diffuse dermatological lesions.

3.19. Newcastle disease: case in small scale farm and its postmortem examination

Abstract: New castledisease is highly contagious devastating viral disease and left as a bottle neck in poultry industry due to loss of its high mortality. This case report was conducted after the owner of small scale farm came to Veterinary Teaching Hospital of Addis Ababa University, College of Veterinary Medicine and Agriculture on January 26, 2021.The owner complained presence of disease out breaks in her small scale poultry farm with the history of sudden death, twisted neck, paralysis (legs and wings) and gasping in small scale poultry farm. Then we were invited to visit her farm, following physical observation of depression, weakness, lying down, green diarrhea, swelling of the comb and wattle, twisting of the neck and paralysis of legs and wings with arched position of the body were observed. The farm was not well managed and there was contamination with feed and water which was a factor to complicate the case. EDDIE Smart

phone app assisting diagnosis was not employed for poultry. Based on history and clinical signs, the case was tentatively diagnosed as Newcastle disease. For confirmatory purpose, post mortem examination was conducted and the gross lesions observed were indicative of ND.

Key words*: Newcastle disease, postmortem, poultry farm*

3.19.1. Introduction

Newcastle disease (ND) is an acute and highly contagious viral disease that affects both domestic and wild species of birds across the world. But the severity of the disease generated on the hosts depends on different factors like the virus strains, host species, age, environmental stress, immune status, and concurrent infection (Al-Habeeb *et al.*, 2013; OIE, 2018). The disease causes sudden death with 100% mortality to subclinical infection in chickens. It is endemic in the poultry population and has a worldwide distribution that causes a major threat to the poultry industries due to huge economic losses especially in chickens and turkeys (Berhanu *et al*., 2010; Xu *et al*., 2017). The disease is caused by virulent *Avain orthoavulavirus* 1(*AOAV-1*) (Izquierdo *et al*., 2019).

Newcastle disease is characterized by respiratory, nervous system impairment, gastrointestinal and reproductive problems in infected hosts. The main source of infection for NDV is exhaled air from infected birds and contaminated feed and water. The major clinical signs of the disease are gasping, coughing, sneezing and rales, tremors, paralyzed wings and legs, twisted necks (Jarso, 2015; Mossie, 2018). Isolation and cultivation of the virus in embryonated chicken eggs followed by hemagglutination test, hemagglutination inhibition test and pathotyping of the virus is the gold standard diagnostic technique(Dimitrov *et al*., 2014).

Newcastle disease is Africa's most challenging avian disease, especially in Ethiopia, where it is endemic in both village and commercial poultry populations. As a result, it is the most significant stumbling block to the development, survival, and productivity of chicken flocks around the world, resulting in significant economic losses for the poultry sector. High mortality, morbidity, disease containment measures, outbreak eradication, trade restrictions, decreased egg production,

and low-quality egg production from breeder flocks all contribute to economic losses linked with Newcastle disease (Mossie, 2018).

Etiology and taxonomic classification: The *Avian orthoavulavirus* serotype 1 is the etiological agent of ND. The species Avian orthoavulavirus1 (AOAV-1) belongs to the genus *orthoavulavirus* within a new subfamily *Avulvirinae* of the family *Paramuxoviridae* depending complete nucleotide sequence of fusion gene, phnylogenic topology and evolutionary distance (Dimitrov *et al*., 2019). Previously, the virus was named Avian avulavirus 1(AAV-1) or Newcastle disease virus (Desingu *et al*., 2016). Based on serological and phylogenic analysis of the virus, fifteen (15) distinct AOAV serotypes (AOAV-1 to AOAV-15) have been found in several domestic and wild bird species. NDV strains are divided into three major pathotypes based on their virulence and clinical signs as velogenic, mesogenic and lentogenic representing high, moderate and low virulence, respectively (OIE, 2018a; Samuel *et al*., 2013). In young chickens, lentogenic strains elicit either minor respiratory signs or no clinical signs. Mesogenic strains cause respiratory and/or nervous indications in laying flocks and impair egg production. Velogenic strains induce severe necrosis and hemorrhagic lesions in the gastrointestinal tract and lymphoid organs, as well as neurological and respiratory symptoms that are associated with a high death rate in any age (Susta *et al*., 2014; Jin *et al*., 2016). It is the most lethal strain of poultry in unvaccinated flocks experiencing 100% mortality (Mesfin and Bihonegn, 2018b).

Transmission: The disease is spread mostly through direct and indirect contact between infected and healthy birds. The ND virus is transmitted and disseminated by virus-containing droppings and secretions from sick birds' noses, mouths, and eyes (Ashraf and Shah, 2014). In intensive production systems, aerosol transmission is the most common mechanism of ND infection. The main means of transmission of the virus in free scavenging chickens is through the oral route(Tulu, 2020; OIE, 2012). Movements of live birds, poultry products, contaminated feed, and water are the most common ways for viruses to spread among flocks. Oral, nasal and ocular infections are natural routes of transmission that appear to underline the disease's respiratory character. Viruses are excreted by infected birds during the incubation period, and viruses are shed in aerosol, respiratory discharges, and feces (Mossie, 2018).

Clinical feature: Depending on the viral pathotypes and hosts, ND causes a wide range of clinical illnesses in avian species, ranging from asymptomatic to 100% mortality(Rani *et al*.,2014)**.**Gasping, coughing, sneezing, greenish diarrhea, paralysis (legs and wings) and twisted neck are the most common clinical signs of the disease (Jarso, 2015; Yune and Abdela, 2017; Mossie, 2018).

Diagnosis: Newcastle disease can be diagnosed based on history, clinical signs, post-mortem examination, serological method, cell culture, and molecular techniques. Clinically, the disease resembles highly virulent avian influenza virus (Ashraf and Shah, 2014). As a result, accurate and timely diagnosis is critical during an outbreak to control and prevent disease spread. Laboratory diagnostic methods for detecting and isolating ND include virus isolation, serological tests and molecular tests.

3.19.2. Case description on Newcastle disease virus

The owner of small scale poultry farm came to veterinary teaching hospital of Addis Ababa University on January 26, 2021, from kebele 12 complaining that there wasa disease outbreak in her small scale poultry farm with the history of sudden death and inability of feed intake, abnormal positioning after an outbreak of the disease in other poultry farm. Then we are invited to visit the farm and handle the case. Based on physical examination: depression, weakness, lying down, green diarrhea, swelling of comb and wattle, twisting of the neck (Figure 45 A), and paralysis of legs and wings with arched position of the body were observed. The farm was not in a good management; where the poultrieswere easily exposed to disease due to the fact that there were no regular cleaning and disinfecting of the farm. EDDiE diagnosis was not accessed for poultry. After all, the case was tentatively diagnosed based on history, outbreak occurrence, and observed typical clinical signs and postmortem lesionssuggestive of ND and its differential diagnosis are fowl thyphoid, gumburo disease, mareks disease and avian influenza.

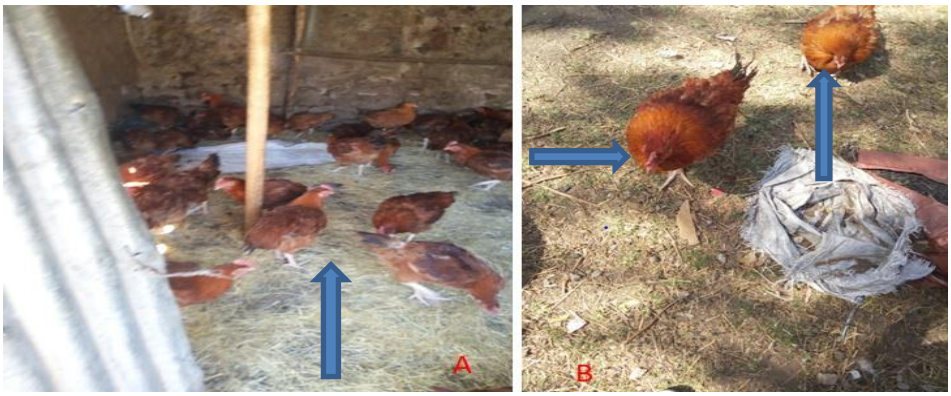


Figure 38: Small scale poultry farm suspected of ND

The Arrows in (A) and chicken populations affected by ND andin Bindicate paralysis of legs and torticollis in chickens

3.19.3. Postmortem examination

Based on the will of owner, two of the suspected chickens (Figure 45B) were examined for necropsy finding per farm during the outbreak period. The gross lesions were indicative of ND following postmortem examination conducted. Hemorrhages in the trachea and pinpoint hemorrhagic proventriculus, petechial hemorrhage in the colon, intestine, and heart were found following postmortem examinations on recently deceased or mercifully euthanized chickens (Figure 46B). Lung congestion and edema, spleen enlargement, and hemorrhagic enteritis were also observed.

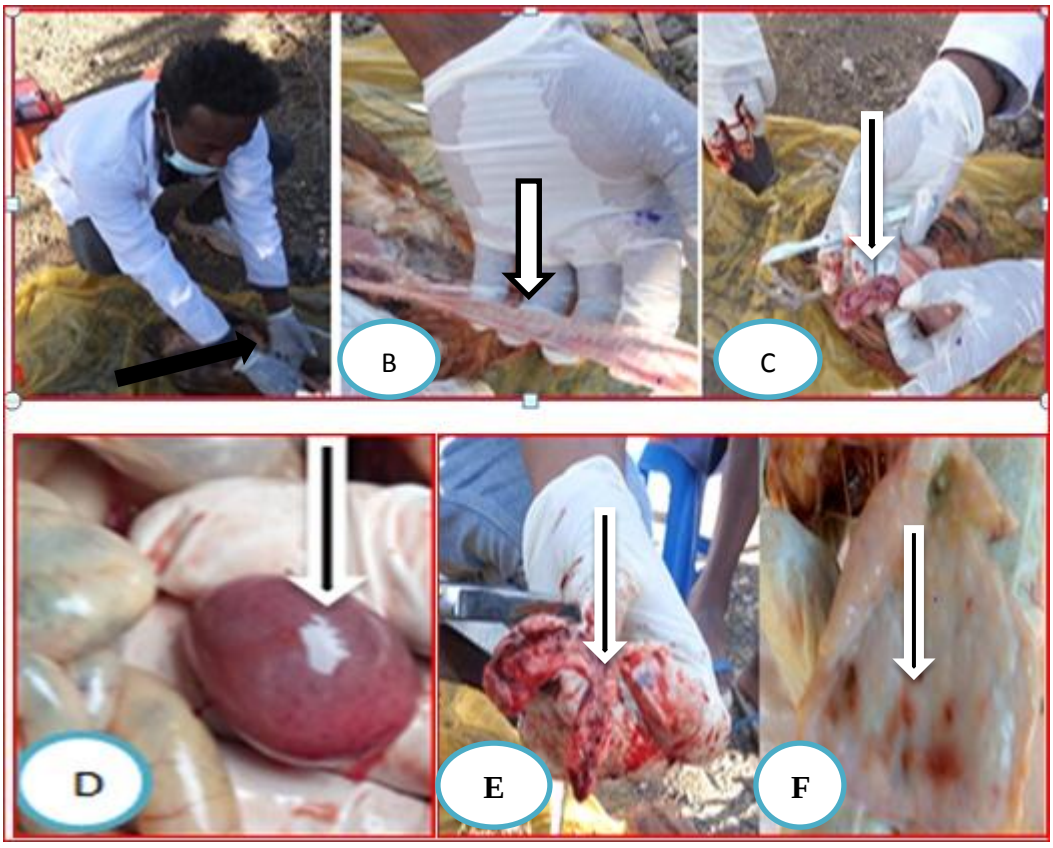


Figure 39: Post mortem examination of suspected poultry

The arrows in A) shows case handling time B) tracheal hemorrhages, in C) intestinal hemorrhages and in D) splenomegaly, in E congestion of lung, and in F) petechial hemorrhages in proventriculus

3.18.4. Management and treatment outcome

Apparently health poultry were isolated to well disinfected and cleaned room then, vaccination was recommended to enhance their immunity against this fatal viral disease. At the same time clinically suspected chickens were also identified and treated with Ashox (oxyttc10%) to control the secondary bacterial complication. Vaccination or a stamping out policy (based on slaughter of infected and potentially infected birds, quarantine procedures, cleaning and disinfection) or a combination may be used to control ND depending on the circumstances.

3.19.5. Discussion

Based on history, outbreak occurrence and clinical sign observed, the ND case was diagnosed and passed for postmortem and the result revealed the case was ND without assessing by EDDiE due to the fact that poultries were not included in the app diagnosis. Clinical signs and severities are very variable depending on the strain of virus, species and age of bird, concurrent disease and pre-existing immunity (Yune and Abdela, 2017). In this case study, observed clinical signs were in agreement with the repot of Mossie, (2018) that major clinical symptoms of the disease are gasping, coughing, sneezing and rales, greenish diarrhea, corticoids, cyanosis of comb and wattle, tremors, paralysis of wings and legs, twisted necks (torticollis) with sudden death.

Postmortem findings observed in this case report were hemorrhages in the trachea, proventriculus, colon, intestine and heart, and congestion and edema of lungs, spleen and hemorrhagic enteritis, inflamed cloudy/congested air sacs. The current case study wasin agreement with the reportsof Bilal *et al*., (2014), and Desingu *et al*., (2016) who indicatedsimilar findings of postmortem revealing the case as the ND. In conclusion, ND is one of the most important poultry diseases in the world, both for the number of chickens affected every year and for the severe economic impact on the poultry industry. Rapid and reliable detection and confirmation of ND is important to limit economic losses and to handle the disease on time. According to different case reports and studies, a continuous vaccination program and strict biosecurity measures are efficient ways to control and prevent ND.

4. DESCRIPTION OF OVER ALL CURRENT STUDY AND RESULTS

From a total of 19 different animal disease cases comprised of 24 total animals were examined in these case reports through Veterinarian examination, EDDiE disease diagnosis and treatment tool and its laboratory confirmation. From a 24 total examined diseased animals 19(79.2%) were recovered from the disease after thorough treatment, 2(8.3%) was died and 3(12.5%) were passed for postmortem examination based on the consent of the owner and postmortem examination was conducted for further confirmation of suspected disease by identifying the pathognomic lesion. The over all result of the current case study was summarized as follow in tables along with its description.

Table 1: Total number of animals examined and treatment outcome

Animals	**Total**	**Recovered**	**Died**	**post mortem**
Ruminants	17	17	0	0
Equine	2	1	1	0
Canine	2	1	1	0
Poultry	3	0	0	3
Total in %age	**24**	**19(79.2%)**	**2(8.3%)**	**3(12.5%)**

From the total cases examined, the most frequent pathogens that causes the diseases were bacteria 7(36.8%) followed by virus 6(31.6%), parasites 3(15.8%), fungal 1(5.3%), methabolic 1(5.3%) and misceleneous 1(5.3%) were encountered in the study area as indicated from below table.

Table 2: cases of disease examined during the study in their respective etiologic agents by percentage

Diseases	No. of affected animals	Diseases in percentage (%)
Bacteria	7	36.8%
Virus	6	31.6%
Parasites	3	15.8%
Fungal	1	5.3%
Methabolic	1	5.3%
Misceleneous	1	5.3%
Total	**19**	**100%**

From a total of 19 cases of diseases examined 78.9% cases were from bishoftu town and its surroundings at Veterinary Teaching Tospital of AAU-CVMA, 10.5% cases were from Dire Veterinary Clinic and its surrounding and 5.3% cases were from Modjo town, Lume Veterinary clinic and its surrounding. Examined cases at study area in relation to etiologic agents 36.8%, 21.1%, 5.3%, 5.3%, 5.3% and 5.3% cases were due to bacteria, virus, parasites, fungal, methabolic and misceleneous respectively in Bishoftu town and its sorruondings at Veterinary Teaching Hospital of AAU-CVMA, 10.5% cases were due to virus at Dire Veterinary Clinic and its surrounding and 5.3% case was due to parasite at Modjo town, Lume Veterinary clinic as its described from below table. Variation of cases and causative agents at study areas was due to frequency of visit and facilities of disease diagnostic and therapeutic availability. Most of the numbers of case studies of the diseases were visited/ handled at VTH, two case studies were at Dire Veterinary Clinic and one case study was at Modjo town, Lume Veterinary clinic during this study period. This conclude that, if equal frequency of visit time and availability of facilities for disease diagnostic and therapeutic given for studies area, the chance of handling and reporting cases of animal diseases probably similar.

Table 3: Case studies of animal diseases examined in relation to study areas and causative agents during the study period.

Disease	No of animals	Bishoftu	Modjo	Dire	Total cases (%)
Bacteria	7	7(29.2%)	0	0	29.2%
Virus	10	6(25%)	0	4(16.7%)	41.7%
Parasites	3	2(8.3%)	1(4.2%)	0	12.5%
Fungal	1	1(4.2%)	0	0	4.2%
Methabolic	2	2(8.3%)	0	0	8.3%
Misceleneous	1	1(4.2%)	0	0	4.2%
Total	**24**	**19(79.2%)**	**1(4.2%)**	**4(16.7%)**	**100%**

In this study, evaluating smartphone based mobile app as a diagnostic tool 'EDDiE' (Ethiopian differential diagnosis and investigation center) used as diagnostic and treatment aid tool was evaluated and compared with veterinarian/expert and laboratory confirmation from below table. A total of 16 different cases comprising 19 animals were diagnosed and evaluated by 'EDDiE' and 3 cases comprising 5 animals(2 dogs and 3 hens) were not diagnosed by app due to its own limitation to include other species of animals(Canine, Feline and Poultry) diseases in the algorithm. Therefore, from a total of 16 cases (19 animals) diagnosed, both 'EDDiE' and veterinarian diagnosis were in agreement with 16 cases/19 animals (79.2%) where as, not agree with 3 cases/5 animals (20.8%). Based on laboratory confirmation of case studies, from 19 cases/24 animals diagnosed, 13 cases/15 animals (62.5%) in line with laboratory diagnosis and confirmation where as, 6 cases/9 animals (37.5%) diagnosed were not agreed.

Therefore, from these case studies it indicates that evaluating smartphone based mobile app as a diagnostic tool 'EDDiE' have significant role in disease diagnosis and therapeutic management by providing the list differential diagnosis and treatment option based on the expert input for encountered disease of selected study area. Supporting disease diagnosis and treatment by newly innovated technology improves skill and guides an expert for accurate disease diagnosis and treatment. Therefore, confirmatory diagnosis along this application and including all other species

of animals in the algorithm will contribute in transformation of animal health services delivery at health facilities.

Table 4: Evaluation of 'EDDiE' with expert/veterinarian diagnosis and laboratory investigation

Animal spp	**No.**	**'EDDiE' diagnosis with expert**		**'EDDiE' with laboratory confirmation**	
		Agree	Not agree	Agree	Not agree
Bovine	8	7	1	6	2
Small ruminant	9	7	2	7	2
Equine	2	1	1	1	1
Small animals	0	0	0	0	0
Poultry	0	0	0	0	0
Total	**19**	**15(78.9%)**	**4(21.1%)**	**14(73.7%)**	**5(26.3%)**

5. CONCLUSION AND RECOMMENDATIONS

Ethiopia, was not optimally utilizing livestock sector due to constraints of high disease incidence and parasite burdens, in addition to poor reproductive performance, shortage of feed in quantity and quality, inadequate health care and management measures that will contributing to low productivity. Thus, the sector could not bring meaningful improvements in the development of the country's economy. Therefore, appropriate measures in disease diagnosis and treatment are necessary to maximize the income generated from the sector. In agroecology of the study area, these current case studies was conducted, by presenting animals of having different diseases with variety of etiological agents of bacterial, viral, parasitic,fungal, metabolic, and others were included in relation to species, ages and breeds of animals. The study was conducted by emphasizing on major encountered animals disease diagnosis and treatment supported by 'EDDiE' and laboratory confirmation with accurate therapy and proper follow-up. However, 'EDDiE' was used as diagnostic tool aid by providing essential data/information in current case study; it has his own limitation in that all species of animals (Canine, Feline and Poultry) were not included in the algorithm. Clinical case study at animal health facilities requires sophisticated laboratory, a vigorous follow-up, emergency hospitalization of patients and humanly euthnising patients of poor prognosis animals especially in 'VTH' when different cases were referred from the surrounding Veterinary clinics. Therefore,

- Improvement of animal health management policy and awering community in disease prevention and control method.
- Supporting disease diagnosis and treatment with well equipped laboratory facilities and inistalizing Ultrasound and diagnostic imaging tool for routine diagnosis.
- Diagnosis assisted tools like 'EDDiE' should encounter other very important diseases of all animal species in the algorithm and paralely evaluated with laboratory confirmation
- To conduct drug sensitivity test, disks and media should be available to identify resistance and susceptability of the conventional antibiotic disks.

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7. ANNEXES

Annex 1: Clinical Case Recording Form

ADDIS ABABA UNIVERSITY

COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE

Daily Clinical Activity Recording Form Date: ----------

Site/Name of the clinic: _____ Address: _____

Owner‟s name: _____ Address:_____ Phone number:_____

Patient identification:_____ Species:_____
Breed:_____ Sex_____ age:_____Color:_____

History:

Past immediate: _____ Immediate history: _____

Environment: _____ management and feeding:_____

Number of affected, no, at risk: _____ place of origin etc:_____

General physical examination: temperature: _____ heart rate: _____ respiratory rate:_____ , visible mucous membrane etc

Systemic physical examination: detailed examination of the affected system

Laboratory diagnosis methods employed_____ Tentative and definitive

diagnosis_____, prognosis_____ Treatment: drug_____,

dose_____, route_____, follow-up_____ Control & prevention:

Control methods prescribed, prevention and corrective management measures

recommended_____

Annex 2: Clinical Examination Protocols, adapted from Jana and Ghosh (2013)

Recording of Rectal Temperature: Recording of body temperature of animal is most important in clinical diagnosis. Temperature should be recorded while the animal is at rest. Generally rectal temperature is recorded in animals by inserting the bulb of a clinical thermometer in the rectum, placed in contact of the rectal mucosae and keeping it for one to two minutes.

Table 5: Average normal temperature of animal species

Animal	**$0_{C+/-0.5}{}^{0C}$**
Horse	38
Cow	38.5
Sheep	39.5
Goat	39
Pig	39
Dog	39
Cat	38.5
Rabbit	39.3

Recording of Pulse Rate:

Usually the pulse rate is equal to the rhythmic contraction and expansion of heart. Increased pulse rate is common and occurs in most cases of septicaemia, toxaemia, circulatory failure, excitement and in pain striken condition. Marked slowing of heart beat (bradycardia) is common in traumatic reticuloperitonitis in cattle.

Site for Recording Pulse

Cattle: Middle coccygeal artery, ventral coccygeal artery under the tail, facial artery, maxillary and median artery; femoral arteries (in case of calf).

Dog: Femoral artery on the inner side of thigh. *

Normal pulse rate in a Horse is 28-45 beats per minute.

* Normal pulse rate in a Dog is 80–120 beats per minute.

* Normal pulse rate in a Cow is 55–100 beats per minute.

* Normal pulse rate in a Sheep/Goat is 60-110 beats per minute.

* Normal pulse rate in a Rabbit is 20–150 beats per minute.

* Normal pulse rate in a Cat is 100–140 beats per minute.

* Normal pulse rate in a Swine is 60-120 beats per minute

Recording of Respiration Rate

In cattle average respiration rate per minute is 12-30. Sometimes it goes from 15-30. Variation occurs due to high ambient temperature, after exercise and it is normal. Respiratory rate is accelerated during fever and respiratory distress due to disease. Respiration rate should be noted when the animal is at rest. The type of respiration like costal, intercostal, abdominal, jerkey etc. are also to be noted. There is a ratio of 1:3 between respiration rate and pulse rate in healthy animals. Examination of respiration rate of animals is indicated for primary respiratory disease as well as secondary respiratory disease due to cardiac involvement, allergy and anaphylaxis.

* Normal respiration rate in a Dog is 15–30 per minute.

* Normal respiration rate in a Cow is 10–40 per minute.

* Normal respiration rate in a Sheep/Goat is 10–30 per minute.

* Normal respiration rate in a Rabbit is 50–60 per minute.

* Normal respiration rate in a Cat is 20–30 per minute.

* Normal respiration rate in a Swine is 8–18 per minute

Examination of Visible Mucous Membrane

This includes the examination of conjunctiva, buccal, nasal, vulval, vaginal and rectal mucosae. In normal and healthy condition of animals, the mucous membrane is moist and rosy in colouration. The following changes of mucous membrane are seen in unusual conditions of animals.

Congestion: Signs of fever and inflammation, systemic diseases and allergic sensitization. Paleness: Revealing anaemia, internal haemorrhage, hypoproteinaemia, excessive blood Loss and shock.

Yellow discolouration: Signs of ecterus and hepatic disorder jaundice.

Pin point/Petecheal haemorrhages: Indicates septicaemia, surra, phosphorus and arsenic poisoning.

Cyanotic changes: Bluish discolouration owing to dyspnoea, hypoxia, venous stasis, congestive cardiac failure, pleurisy and nitrate poisoning.

Ulcerations: Typical ulcers on oral mucous membrane seen in FMD, PPR and RP.

Examination of Eyes

Ophthalmic examination gives some clues in diagnosing some diseases.

Sunken appearance: Indicates chronic wasting disease and dehydration.

Pupillary reflex: Loss of pupillary reflex and pupillary response to light are seen in toxaemia and shock, poisoning and CNS disease.

Dilatation of pupil: Seen in poisoning and shock.

Corneal opacity, ulcers: Commonly occurs in mechanical injury or trauma. In canine it could also be due to canine distemper.

Normal Colour of Conjunctiva of Various Animals

cattle and Buffalo	Pink
Horse	Pale roseate
Sheep and goat	Pale pink
Pig	Reddish tinged
Dog	Roseate
Cat	Pale

Palpation:

Consistency of an organ or tissues or a part of the body can be felt by lying hand with gentle pressure. Tips of fingers and flat of the hand are mostly used for handling the tissues or organs. When tissue appears firm, hard, solid like muscle, that could be a neoplasm (tumour). When structure appears bone like consistency – it could be the exostosis or ossification of cartilage. Hot and painful swelling, hard or soft could be the abscess (hard in initial stage, soft in maturity/ripened abscess).

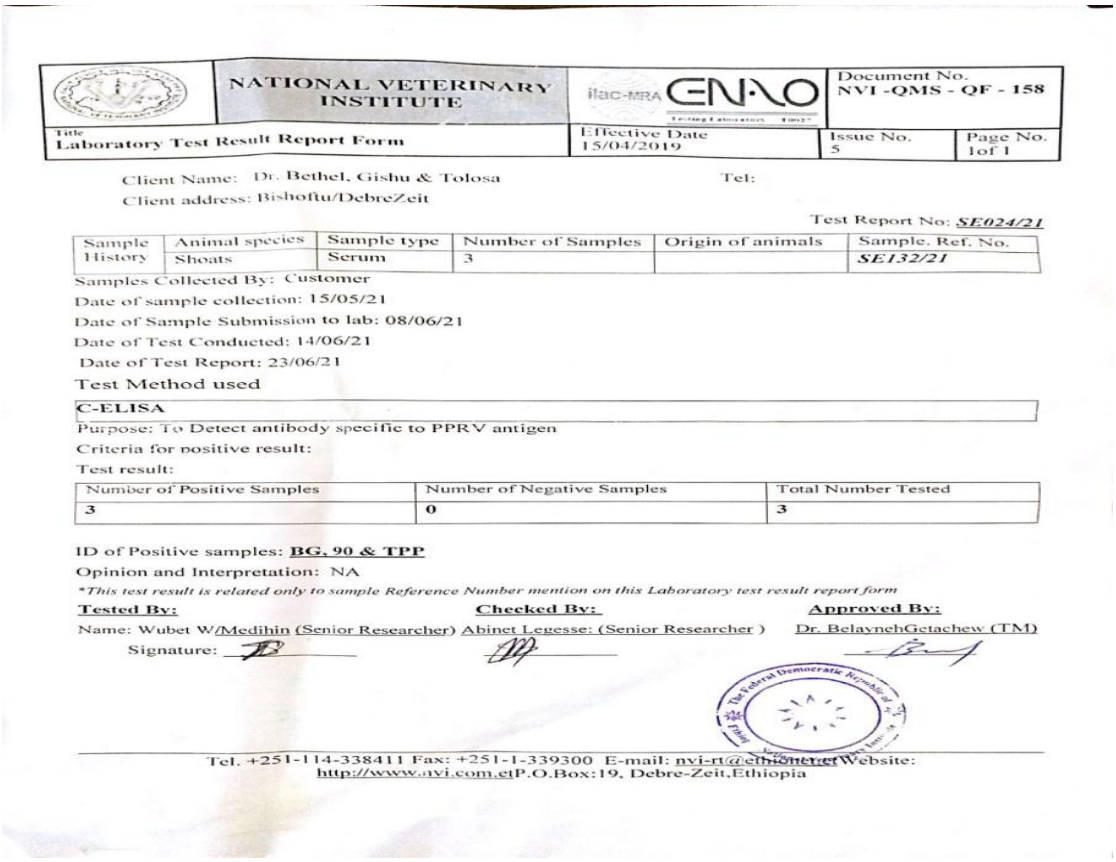
Doughy – Where soft tissues retain finger points, or causes pits on pressure – oedema and impaction of rumen.

Cold and painless (fluctuating) – could be the cyst distended with gas (bloat), distended with food (impaction), distended with fluid (ascites), crepitating sound (Black Quarter or Subcutaneous emphysema). Abnormalities of abdominal and urogenital organs can be felt by rectal palpation.

Percussion: Striking of any part of the body with a short, sharp blow that enables underlying organs to vibrate and generate an audible sound is called percussion. Drum like sound audible from rumen indicates tympanitis, dull resonance in impaction. Hyper resonant sound is observed while the lungs are filled with excessive air. Increased amount of gases will emit tympanic sound in abdomen. This method is useful in small animals than the large animals.

Auscultation: It means listening of various functional sounds produced by some thoracic and abdominal organs by use of stethoscope for ascertaining the pathological condition of lungs, pleura, heart and certain parts of alimentary tract. It is useful for hearing peristaltic sounds during ruminal and intestinal contractions, listening sounds produced in course of normal functioning of trachea and lungs (dry rales in congestion and moist rales in exudation), cardiac sounds like cardiac murmurs in valvular disease, splashing sounds in pericarditis and hydro pericardium.

Annex 3: The result of PPRv Posetive



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Document No. NVI -QMS - QF - 158

Title: Laboratory Test Result Report Form | Effective Date 15/04/2019 | Issue No. 5 | Page No. 1of 1

Client Name: Dr. Bethel, Gishu & Tolosa Tel:

Client address: Bishoftu/DebreZeit

Test Report No: *SE024/21*

Sample History	Animal species	Sample type	Number of Samples	Origin of animals	Sample. Ref. No.
	Shoats	Serum	3		*SE132/21*

Samples Collected By: Customer

Date of sample collection: 15/05/21

Date of Sample Submission to lab: 08/06/21

Date of Test Conducted: 14/06/21

Date of Test Report: 23/06/21

Test Method used

C-ELISA

Purpose: To Detect antibody specific to PPRV antigen

Criteria for positive result:

Test result:

Number of Positive Samples	Number of Negative Samples	Total Number Tested
3	0	3

ID of Positive samples: **BG, 90 & TPP**

Opinion and Interpretation: NA

**This test result is related only to sample Reference Number mention on this Laboratory test result report form*

Tested By: Name: Wubet W/Medihin (Senior Researcher) Signature:

Checked By: Abinet Legesse: (Senior Researcher)

Approved By: Dr. BelaynehGetachew (TM)

Tel. +251-114-338411 Fax: +251-1-339300 E-mail: nvi-rt@ethionet.et Website: http://www.nvi.com.etP.O.Box:19, Debre-Zeit,Ethiopia

Annex 4: Method of disease diagnosis by EDDiE