

**Publisher** : John Wiley & Sons, Inc.  
**Location** : Hoboken, NJ, USA  
**ISBN (print-13)** : 9781394189731  
**Title (main)** : Elements of Reproduction and Reproductive Diseases of Goats  
**Copyright (publisher)** : © 2024 John Wiley & Sons, Inc.  
**Numbering (edition)** : First  
  
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**Subject Info** :  
Veterinary Medicine - Farm Animals  
  
Veterinary Internal Medicine  
  
Veterinary Microbiology, Parasitology, Infectious Diseases & Immun

**ID (unit)** : c18  
**ID (file)** : c18  
**Count (pageTotal)** : 10  
**Event (xmlCreated)** : 2024-02-05 (SPi Global)  
**Numbering (main)** : 18  
**Numbering (pageFirst)** : 1  
**Numbering (pageLast)** : 9

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## Diseases of the Inguinal Lymph Nodes

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## Abstract

The inguinal lymph nodes play a pivotal role in the immune response and overall health of goats. Goats are important as sources of protein and income and are vital to global agriculture. They are susceptible to various infectious, neoplastic, and inflammatory conditions that can target the inguinal lymph nodes. Contagious diseases like caprine arthritis, encephalitis, caseous lymphadenitis, and paratuberculosis (Johne disease) are notable concerns. These conditions often lead to lymphadenitis, characterized by swelling, abscess formation, and systemic complications. Moreover, *Neospora caninum* and *Toxoplasma gondii* are emerging as important protozoan pathogens affecting inguinal lymph nodes. A proactive approach involving disease prevention, timely diagnosis, and effective management strategies is crucial to maintaining the health and productivity of goat herds. Further research into the pathogenesis, epidemiology, and therapeutic interventions is needed to enhance our understanding and control of these diseases.

**Keywords:** diseases; goat; inguinal lymph nodes; immunity; diagnosis

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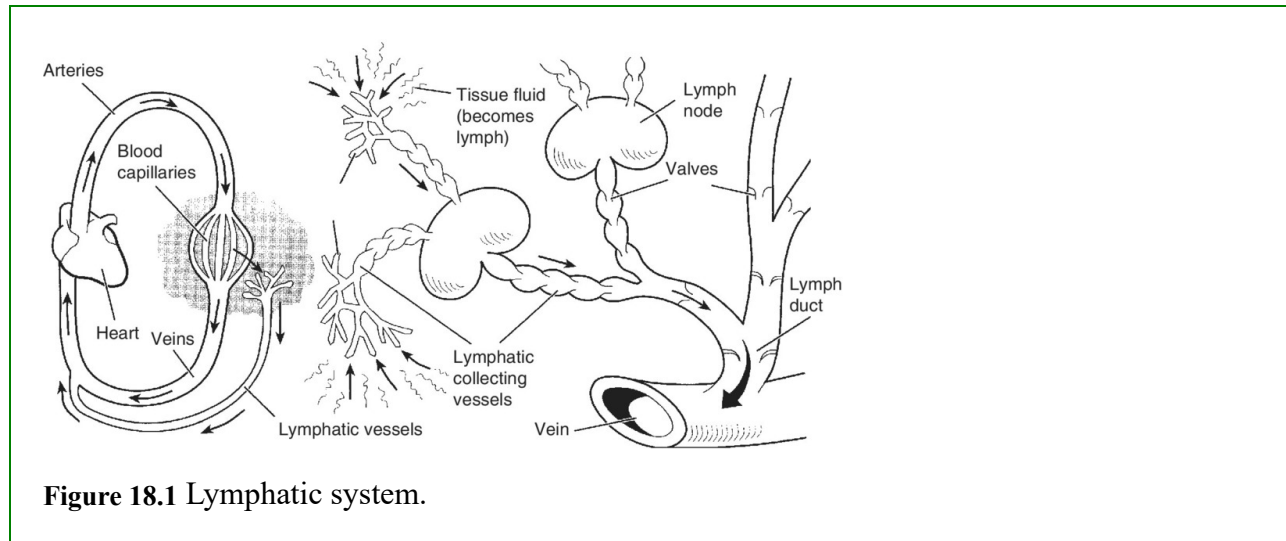
### 18.1 Introduction

The lymphatic system is a complex network of vessels, nodes, and organs that play a vital role in maintaining fluid balance, filtering harmful substances, and facilitating immune responses within the body. In animals, including goats, the lymphatic system is integral to overall health and disease resistance. One crucial component of this system is the inguinal lymph nodes, which are located in the groin area of goats (Valdes and Valdes 2022).

### 18.2 Lymphatic System Overview

The lymphatic system is a parallel circulatory system that works alongside the blood circulation. It consists of lymphatic vessels, lymph nodes, lymphoid organs (such as the spleen and thymus), and lymphatic fluid (lymph). Lymphatic vessels carry lymph throughout the body, and lymph nodes act as filtering stations, where immune cells are stationed to detect and fight off infections, as well as abnormal cells, toxins, and debris (Albertin et al. 2023).

Lymphatic vessels originate as small capillaries that collect interstitial fluid (fluid that surrounds cells) and transport it toward larger vessels. The lymphatic system plays a vital role in maintaining fluid balance by returning excess interstitial fluid to the bloodstream, preventing tissue swelling (Figure 18.1).



**Figure 18.1** Lymphatic system.

### 18.3 Role of Inguinal Lymph Nodes

Inguinal lymph nodes are a specific group of lymph nodes located in the inguinal region of goats, which is the area where the hindlimbs meet the body. These nodes are strategically positioned to filter lymph from the lower abdomen, genitalia, and hindlimbs. Their primary role is to monitor lymph for potential pathogens, toxins, or foreign particles and initiate immune responses when necessary. The inguinal lymph nodes contain various immune cells, including lymphocytes (such as B cells and T cells) and macrophages. These cells collaborate to identify and neutralize invading microorganisms or abnormal cells. When an infection occurs in the lower body, the immune cells within the inguinal lymph nodes mount an immune response. This response involves the production of antibodies, the release of cytokines, and the recruitment of additional immune cells to the site of infection.

The inguinal lymph nodes serve as important indicators of the overall health status of goats. Changes in size, consistency, or tenderness of these nodes can be early signs of an underlying health issue, such as infection or inflammation. Monitoring the condition of the inguinal lymph nodes is crucial for timely disease detection and management (Lampejo et al. 2023).

### 18.4 Location and Structure

Inguinal lymph nodes are strategically located in the inguinal region of goats, which is situated in the groin area where the hindlimbs meet the body. These nodes are part of a larger network of lymph nodes distributed throughout the body. The inguinal lymph nodes can be palpated as small, bean-shaped structures beneath the skin in this region.

The structure of inguinal lymph nodes consists of various components that contribute to their function. Each node is encapsulated by a connective tissue capsule that houses a network of lymphatic vessels. These vessels allow lymph to flow into and out of the node. Within the node, there are different regions, including the cortex and the medulla. The cortex contains clusters of immune cells, such as lymphocytes, while the medulla contains specialized cells called medullary cords and sinuses (Albertin et al. 2023).

## 18.5 Immune Function

The inguinal lymph nodes are integral to the immune system's ability to detect and respond to infections and other challenges. Their immune function is multifaceted and includes the following key roles (Ozdowski and Gupta 2023).

- *Filtration and surveillance:* lymph from the surrounding areas, including the lower abdomen, genitalia, and hindlimbs, is collected and transported to the inguinal lymph nodes. Here, the lymph undergoes thorough filtration, as immune cells within the node scan for any foreign particles, pathogens, or abnormal cells. If any potential threats are identified, the immune response is initiated.
- *Immune response initiation:* the inguinal lymph nodes serve as sites where immune cells, particularly lymphocytes, interact with antigens. Antigens are molecules that can trigger an immune response. When immune cells encounter antigens from pathogens (such as bacteria, viruses, or parasites), they become activated. This activation leads to the production of antibodies and the recruitment of additional immune cells to combat the infection.
- *Antibody production:* B lymphocytes, a type of white blood cell, play a significant role in the production of antibodies. These antibodies are specific to the antigens encountered and help neutralize pathogens by binding to them. Antibodies can also mark pathogens for destruction by other immune cells.
- *Immune cell proliferation:* the inguinal lymph nodes provide an environment conducive to the proliferation and maturation of immune cells. This amplification of immune cells allows for a more robust response to infections.
- *Memory cell generation:* after an initial encounter with an antigen, memory B and T cells are generated within the lymph nodes. These memory cells “remember” the antigen and facilitate a faster and stronger immune response upon subsequent exposure. This is the basis of immunological memory.

## 18.6 Common Infectious Diseases Affecting Inguinal Lymph Nodes in Goats

### 18.6.1 Caprine Paratuberculosis (Johne Disease)

#### 18.6.1.1 Etiology

Caprine paratuberculosis, commonly known as Johne disease, is a chronic infectious disease caused by the bacterium *Mycobacterium avium* subspecies paratuberculosis (MAP). This bacterium primarily affects the gastrointestinal tract and is known for its prolonged incubation period, during which infected goats can shed the bacteria into the environment without showing clinical signs (Stefanova et al. 2023).

### 18.6.1.2 Clinical Presentation

Johne disease progresses slowly and is characterized by several stages. In the early stages, infected goats may not display any clinical signs. As the disease advances, symptoms may include chronic weight loss, reduced appetite, diarrhea, and a rough, unkempt coat. The disease often leads to emaciation despite adequate feed intake. Infected goats may have swollen, firm, and palpable inguinal lymph nodes due to the chronic inflammation caused by the bacteria.

### 18.6.1.3 Diagnostic Methods

Accurate diagnosis of Johne disease is essential for effective management and prevention. Various diagnostic methods are available.

- *Fecal culture*: this method involves isolating the bacterium from fecal samples. It is a specific but time-consuming technique.
- *PCR (polymerase chain reaction)*: PCR amplifies DNA sequences specific to MAP, allowing for its detection in fecal samples. It is a rapid and sensitive method.
- *Serological tests*: blood tests can detect antibodies against MAP. However, serological tests might not be reliable during the early stages of infection.
- *Necropsy and histopathology*: postmortem examination and histological analysis of tissues, particularly the intestines and lymph nodes, can provide definitive diagnosis.

### 18.6.1.4 Treatment and Control

Currently, there is no cure for Johne disease and infected goats remain carriers for life. Management strategies focus on disease control and prevention.

- *Culling*: infected goats should be culled to prevent further spread of the disease within the herd.
- *Biosecurity*: implement strict biosecurity measures to prevent the introduction of MAP into the herd. Avoid purchasing animals from known infected herds.
- *Sanitation*: proper cleaning and disinfection of facilities, equipment, and feed/water sources can help reduce the risk of transmission.
- *Vaccination*: vaccines have been developed to reduce the prevalence of Johne disease. These vaccines aim to reduce clinical signs and shedding of the bacteria.
- *Herd testing*: regular testing of the herd using a combination of diagnostic methods can help identify and manage infected animals.
- *Calf management*: separating calves from infected mothers at birth and feeding them heat-treated colostrum and milk can reduce the risk of transmission.

- *Pasture management*: avoiding overgrazing and maintaining clean pastures can help minimize exposure to contaminated environments.

## 18.6.2 Caseous Lymphadenitis

### 18.6.2.1 Causative Agent

Caseous lymphadenitis (CLA) is a contagious bacterial infection in goats caused by *Corynebacterium pseudotuberculosis*. This bacterium primarily affects lymph nodes, causing abscesses filled with a thick, cheese-like material. CLA is highly contagious and can spread within a herd through direct contact with infected animals or contaminated environments (El Damaty et al. 2023).

### 18.6.2.2 Clinical Signs

The clinical signs of CLA can vary depending on the stage of the disease. Infected goats may initially exhibit no noticeable symptoms. As the disease progresses, the following clinical signs may become apparent.

- *Lymph node enlargement*: the inguinal lymph nodes are commonly affected, leading to swelling and palpable lumps in the groin area.
- *Abscess formation*: abscesses can develop in the affected lymph nodes. These abscesses are filled with a thick, caseous (cheese-like) material.
- *Fever*: infected goats may show signs of fever and general malaise.
- *Reduced appetite and weight loss*: the presence of abscesses and systemic infection can lead to decreased feed intake and subsequent weight loss.
- *Lameness*: CLA abscesses in the inguinal region can cause discomfort and lameness.

### 18.6.2.3 Diagnosis and Management

Early diagnosis and prompt management of CLA are crucial to prevent its spread and mitigate its impact on the herd. Diagnostic methods and management strategies include the following

#### 18.6.2.3.1 Diagnosis

- *Physical examination*: palpation of the inguinal region for swollen lymph nodes and abscesses is an initial step in diagnosing CLA.
- *Ultrasound*: ultrasound can be used to visualize the internal structures of the lymph nodes

and confirm the presence of abscesses.

- *Aspiration and culture*: aspirating fluid from suspected abscesses and culturing the bacterium can provide a definitive diagnosis.

### 18.6.2.3.2 Management

- *Isolation*: infected goats should be isolated to prevent the spread of the disease to other animals.
- *Abscess drainage*: abscesses can be drained by a veterinarian to reduce discomfort and promote healing.
- *Antibiotic treatment*: early treatment with antibiotics can help reduce abscess size and prevent the spread of infection.
- *Culling*: in severe cases or recurrent infections, culling affected goats may be necessary to prevent further spread.
- *Vaccination*: vaccines against CLA are available in some regions and can help reduce the prevalence of the disease within a herd.
- *Biosecurity measures*: strict biosecurity practices, including quarantine and monitoring of new animals, can prevent the introduction of CLA into the herd.
- *Hygiene and sanitation*: regular cleaning and disinfection of facilities and equipment can reduce the risk of bacterial contamination.

## 18.6.3 Brucellosis

### 18.6.3.1 Pathogen and Transmission

Brucellosis is a bacterial disease caused by various species of the genus *Brucella*, with *B. melitensis* being the most common species affecting goats. This zoonotic disease can also infect other animals, including cattle, pigs, and dogs, as well as humans. Transmission of brucellosis in goats occurs through contact with infected animals, consumption of contaminated feed and water, or exposure to contaminated materials. Infected goats can shed the bacteria in their milk, urine, and reproductive fluids, posing a risk to other animals and humans (Burns et al. 2023).

### 18.6.3.2 Symptoms in Goats

Brucellosis can lead to various symptoms in infected goats, although some individuals may show no signs. Clinical manifestations of brucellosis include the following.

- *Abortion*: one of the hallmark signs of brucellosis in goats is late-term abortion or stillbirths, often without apparent signs of illness in the doe.
- *Infertility*: infected bucks may experience reduced fertility, resulting in fewer pregnancies in the herd.
- *Retained placenta*: infected does may have difficulty expelling the placenta after giving birth.
- *Lameness*: in some cases, brucellosis can lead to joint inflammation, causing lameness.
- *Swollen joints*: enlarged joints, especially the knee joints, can be a symptom of brucellosis.
- *Generalized weakness*: goats may appear weak and lethargic, and have a decreased appetite.

### 18.6.3.3 Diagnosis and Control

Diagnosing and controlling brucellosis are essential to prevent its spread within goat herds and to other susceptible animals.

#### 18.6.3.3.1 Diagnosis

- *Serological testing*: blood tests can detect antibodies against *Brucella* species. Positive serological results may indicate exposure to the pathogen, but further testing is needed for confirmation.
- *Culturing*: isolating the bacteria from clinical samples, such as blood, milk, or tissues, can confirm the presence of the pathogen.

#### 18.6.3.3.2 Control

- *Culling*: infected animals should be culled to prevent further transmission.
- *Quarantine and testing*: new animals introduced to the herd should be quarantined and tested for brucellosis before integration.
- *Vaccination*: while vaccines are available for brucellosis, their use varies depending on the region and the specific *Brucella* species present.
- *Biosecurity measures*: strict biosecurity practices, including isolation of new animals, proper sanitation, and control of movement, can help prevent the introduction of brucellosis.
- *Testing and monitoring*: regular testing and monitoring of the herd are essential to detect



and manage infections early.

- *Education*: educate herd owners and workers about the importance of proper hygiene, disease prevention, and zoonotic risks associated with brucellosis.

## 18.6.4 *Corynebacterium pseudotuberculosis* Infection

### 18.6.4.1 Clinical Features

*Corynebacterium pseudotuberculosis* is the causative agent of several infections in goats, including CLA, as discussed earlier. This bacterium can also cause other infections, such as ulcerative lymphangitis and external abscesses. The clinical features of these infections can include the following.

- *External abscesses*: infected goats may develop abscesses on the skin, often in the neck, chest, or shoulder regions. These abscesses are filled with thick, caseous material and can rupture, leading to the spread of infection.
- *Ulcerative lymphangitis*: this condition involves inflammation and ulceration of the lymphatic vessels, often resulting in swollen and painful limbs. Infected goats may exhibit lameness and reluctance to move (Nicoletti et al. [2023](#)).

### 18.6.4.2 Diagnostic Approaches

Diagnosing *Corynebacterium pseudotuberculosis* infections involves a combination of clinical evaluation, physical examination, and laboratory tests.

- *Clinical signs*: external abscesses, swelling, and lameness are key indicators of these infections.
- *Aspiration and culture*: aspirating fluid from abscesses and culturing the bacteria can confirm the presence of *C. pseudotuberculosis*.

### 18.6.4.3 Treatment Options

Treatment of *C. pseudotuberculosis* infections often involves a combination of medical and surgical interventions.

- *Abscess drainage*: ruptured or mature abscesses should be drained by a veterinarian to promote healing and prevent further spread.

- *Antibiotic therapy*: antibiotics, such as penicillin or oxytetracycline, may be prescribed to treat active infections. However, treatment success can vary.

*Supportive care*: affected goats may require pain management, wound care, and supportive treatment to aid in recovery.

## 18.6.5 *Mycoplasma* Infections

### 18.6.5.1 Clinical Features

*Mycoplasma* species can cause various respiratory infections in goats, leading to pneumonia and other respiratory issues. Clinical features may include (Shi et al. 2023) the following.

- *Coughing and sneezing*: infected goats may exhibit coughing and sneezing due to respiratory irritation.
- *Nasal discharge*: clear or purulent nasal discharge may be present, indicating respiratory inflammation.
- *Labored breathing*: respiratory distress, rapid breathing, and increased effort to inhale and exhale can occur.

### 18.6.5.2 Diagnostic Approaches

Diagnosis of *Mycoplasma* infections involves a combination of clinical signs, physical examination, and laboratory tests.

- *Clinical evaluation*: respiratory symptoms and history of exposure help identify potential *Mycoplasma* infections.
- *Nasal swabs*: swabs from nasal discharge can be used for bacterial culture and identification.

### 18.6.5.3 Treatment Options

Managing *Mycoplasma* infections typically involves supportive care and antibiotic treatment.

- *Antibiotics*: veterinary-prescribed antibiotics, such as tetracyclines or macrolides, may be used to treat *Mycoplasma* infections. Treatment success may vary based on the specific *Mycoplasma* species and the extent of the infection.

- *Supportive care*: providing a clean and comfortable environment, ensuring proper nutrition and hydration, and minimizing stress can aid in recovery.

### 18.6.6 Pizzle Rot

Pizzle rot, also known as urinary calculi or urolithiasis, is a condition where mineral deposits accumulate in the urinary tract, potentially leading to blockages and infections. This can indirectly affect the inguinal lymph nodes due to the spread of infection. Symptoms include straining to urinate, restlessness, and painful swelling around the groin. Dietary adjustments, access to clean water, and veterinary care can help prevent and manage pizzle rot.

### 18.6.7 Caprine Arthritis Encephalitis (CAE)

Caprine arthritis encephalitis (CAE) is a viral disease that affects goats, causing chronic arthritis and other health issues. While it primarily impacts joints and mammary glands, the inguinal lymph nodes can also be affected. Bucks with CAE might display lameness, joint swelling, and decreased mobility. Preventive measures include screening, separation of infected animals, and avoiding the consumption of raw colostrum.

## 18.7 Noninfectious Causes of Inguinal Lymph Node Enlargement

In addition to infectious diseases, there are several noninfectious factors that can lead to enlargement of the inguinal lymph nodes in goats. These factors range from physical trauma to immune responses to neoplastic conditions (Besson et al. 2023).

### 18.7.1 Injury and Trauma

Inguinal lymph node enlargement can occur as a result of physical injury or trauma in the lower abdominal or hindlimb regions. Injuries such as kicks, punctures, or blunt force trauma can cause inflammation and swelling in the surrounding tissues, including the lymph nodes. The lymph nodes respond to the inflammation by increasing in size as part of the immune response. While injury-related lymph node enlargement is often temporary, it is essential to monitor the affected goat for any signs of infection that might develop as a secondary complication.

### 18.7.2 Allergic Reactions

Allergic reactions to various substances, such as certain feeds, medications, or environmental allergens, can trigger immune responses that lead to inguinal lymph node enlargement. Hypersensitivity reactions can cause inflammation in the lymph nodes as the immune system responds to the perceived threat. Allergic reactions are usually accompanied by other clinical signs, such as skin rashes, itching, and respiratory symptoms. Identifying and eliminating the allergen can help resolve the allergic reaction and reduce lymph node enlargement.

### 18.7.3 Neoplastic Conditions

Neoplastic conditions, including tumors or cancerous growths, can lead to enlargement of the inguinal lymph nodes. Lymph nodes play a role in filtering and detecting abnormal cells, and when cancerous cells or tumors develop nearby, the lymph nodes can become involved in the immune response against these abnormal cells. This can result in enlargement of the lymph nodes.

Neoplastic conditions can be benign or malignant, and a thorough veterinary evaluation, including diagnostic imaging and biopsy, is necessary to determine the nature of the growth and its impact on the lymph nodes and overall health of the goat.

## 18.8 Diagnosis of Inguinal Lymph Node Diseases

Accurate diagnosis of diseases affecting inguinal lymph nodes in goats is essential for effective treatment and management. A combination of clinical examination, laboratory tests, and imaging techniques is often used to identify the underlying cause of lymph node enlargement and associated symptoms.

### 18.8.1 Clinical Examination

A thorough clinical examination is the first step in diagnosing inguinal lymph node diseases. This involves observing the goat's overall health, assessing vital signs, and conducting a physical examination. During the examination, the veterinarian will palpate the inguinal region to assess the size, consistency, tenderness, and mobility of the lymph nodes. Clinical signs such as fever, weight loss, and lameness will also be evaluated. The information gathered from the clinical examination helps guide further diagnostic steps.

### 18.8.2 Laboratory Tests

- *Culture*: fluid or tissue samples from enlarged lymph nodes can be collected and cultured to identify the presence of bacteria or other pathogens. Bacterial cultures can help diagnose infections such as CLA caused by *Corynebacterium pseudotuberculosis*.
- *PCR*: PCR is a molecular technique that amplifies DNA sequences specific to certain pathogens. It can be used to detect the genetic material of bacteria, viruses, or other microorganisms present in lymph node samples. PCR is particularly useful for detecting infectious agents with a low load, such as *Mycoplasma* species.
- *Serology*: blood samples can be tested for the presence of antibodies against specific pathogens. Serological tests can provide information about past or ongoing infections and immune responses. However, serology might not always be suitable for early-stage or acute infections.

### 18.8.3 Imaging Techniques

- *Ultrasound*: ultrasound imaging can provide real-time visualization of the lymph nodes and surrounding tissues. It allows veterinarians to assess the size, shape, internal structure, and blood flow patterns within the lymph nodes. Ultrasound is particularly valuable for detecting abscesses, fluid accumulation, or other abnormalities within the nodes.
- *Radiography (X-rays)*: X-rays can be used to assess the internal structures of the lymph nodes and surrounding tissues. While less detailed than ultrasound for soft tissue visualization, radiography can help identify calcifications, foreign bodies, or other structural abnormalities.

### 18.8.4 Combining Diagnostic Approaches

Effective diagnosis often involves a combination of these diagnostic approaches. For example, a veterinarian may perform a clinical examination, collect tissue samples for culture and PCR analysis, and use imaging techniques to obtain a comprehensive assessment of the lymph nodes and surrounding tissues. The choice of diagnostic tests depends on the suspected underlying cause and the clinical presentation of the goat.

### 18.8.5 Summary

In conclusion, a thorough and systematic approach to diagnosing diseases affecting inguinal lymph nodes in goats involves clinical examination, laboratory tests, and imaging techniques. Accurate diagnosis is crucial for determining the appropriate treatment and management strategies to ensure the health and well-being of the affected animals and the overall herd.

## 18.9 Treatment Strategies

### 18.9.1 Antibiotic Therapy

Antibiotics are commonly used to treat bacterial infections that affect the inguinal lymph nodes. The choice of antibiotic depends on the specific pathogen causing the infection. Antibiotic therapy aims to eliminate or reduce the bacterial load, control inflammation, and promote healing. It is essential to administer antibiotics as prescribed by a veterinarian, and treatment duration should be followed carefully to prevent the development of antibiotic resistance.

### 18.9.2 Surgical Interventions

Surgical interventions may be necessary for certain cases, such as abscesses that require drainage. A veterinarian can perform incision and drainage of abscesses to remove accumulated pus and debris. Surgical removal of enlarged lymph nodes (lymphadenectomy) might be considered for cases involving neoplastic growths or severe infections. Proper wound care and postoperative management are crucial to ensure successful healing.

### 18.9.3 Supportive Care

Supportive care is important for goats with inguinal lymph node diseases to aid in their recovery. This can include providing a clean and comfortable environment, ensuring proper nutrition and hydration, and minimizing stress. Pain management, wound care, and maintaining overall well-being contribute to the goat's recovery and immune response.

## 18.10 Prevention and Control Measures

### 18.10.1 Vaccination

Vaccination plays a vital role in preventing certain diseases that can affect the inguinal lymph nodes. Vaccines are available for diseases like CLA and can help reduce the prevalence and severity of infections. Consult with a veterinarian to develop a vaccination schedule tailored to the specific diseases prevalent in the region and the herd's risk factors.

### 18.10.2 Biosecurity Measures

Implementing biosecurity measures is essential to prevent the introduction and spread of infectious agents that can affect the inguinal lymph nodes. Biosecurity practices may include quarantining new animals before introducing them to the herd, restricting access to the farm, and implementing hygiene protocols to minimize the risk of disease transmission.

### 18.10.3 Proper Management Practices

Proper management practices contribute to maintaining overall herd health and preventing diseases. This includes providing a balanced and nutritious diet, clean and adequate housing, and regular health monitoring. Proper sanitation, waste management, and ensuring optimal environmental conditions help reduce stress and the risk of disease outbreaks.

## 18.11 Conclusion

The diseases that affect the inguinal lymph nodes of bucks can have significant implications for their overall health, reproductive capacity, and disease resistance. Timely diagnosis, appropriate treatment, and stringent biosecurity measures are key to mitigating the impact of these diseases. Goat keepers and veterinarians play a crucial role in maintaining the health of bucks and ensuring the well-being of their herds.

## References

- Albertin, G., Astolfi, L., Fede, C. et al. (2023). Detection of lymphatic vessels in the superficial fascia of the abdomen. *Life* **13** (3): 836.
- Besson, S., Boucher, E., Laurin, D. et al. (2023). Stimulation of the immune system by a tumor antigen-bearing adenovirus-inspired VLP allows control of melanoma growth. *Molecular Therapy – Methods & Clinical Development* **28**: 76–89.
- Burns, R.J., Siengsanun-Lamont, J., and Blacksell, S.D. (2023). A review of coxiellosis (Q fever) and brucellosis in goats and humans: implications for disease control in smallholder farming systems in Southeast Asia. *One Health* **16**: 100568.

- El Damaty, H.M., El-Demerdash, A.S., Abd El-Aziz, N.K. et al. (2023). Molecular characterization and antimicrobial susceptibilities of corynebacterium pseudotuberculosis isolated from caseous lymphadenitis of smallholder sheep and goats. *Animals* **13** (14): 2337.
- Lampejo, A.O., Ghavimi, S.A.A., Hägerling, R. et al. (2023). Lymphatic/blood vessel plasticity: motivation for a future research area based on present and past observations. *American Journal of Physiology Heart and Circulatory Physiology* **324** (1): H109–H121.
- Nicoleti, J.L., Braga, E.S., Stanisic, D. et al. (2023). A serum NMR metabolomic analysis of the Corynebacterium pseudotuberculosis infection in goats. *Applied Microbiology and Biotechnology* **107**: 4593–4603.
- Ozdowski, L. and Gupta, V. (2023). Physiology, lymphatic system. StatPearls Publishing. [www.ncbi.nlm.nih.gov/books/NBK557833/](http://www.ncbi.nlm.nih.gov/books/NBK557833/) (accessed 22 December 2023).
- Shi, H., Hui, R., Zhou, M. et al. (2023). Abortion outbreak in pregnant goats and cows with coinfection of ‘Candidatus Mycoplasma haemobos’ and HoBi-like pestivirus. *Veterinary Microbiology* **279**: 109690.
- Stefanova, E.P., Quesada-Canales, Ó., Paz-Sánchez, Y. et al. (2023). Morphological assessment of concomitant lesions detected in goat herds naturally infected with paratuberculosis (Johne's disease). *Animals* **13** (10): 1693.
- Valdes, J.J. and Valdes, E.R. (2022). Biological agents: threat and response. In: *Handbook of Security Science* (ed. A. Masys), 739–769. Cham: Springer International Publishing.