

Clinical importance of lymph nodes in farm animals

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Abstract

Lymph nodes are vital components of the lymphatic and immune systems and play a crucial role in maintaining animal health by filtering lymph, trapping pathogens, and initiating immune responses. In farm animals, examination of superficial lymph nodes is an essential part of routine clinical evaluation because changes in their size, consistency, temperature, and pain response often provide early indications of local or systemic diseases. Enlargement of lymph nodes may result from bacterial, viral, fungal, or parasitic infections, inflammatory conditions, neoplasia, or immune-mediated disorders. Careful assessment of lymph nodes enables veterinarians to identify disease processes, determine the severity of infection, monitor treatment response, and guide further diagnostic investigations. Knowledge of the anatomical location and normal characteristics of major lymph nodes is indispensable for accurate clinical examination and disease diagnosis. Advances in diagnostic imaging, cytology, histopathology, and molecular techniques have further enhanced the diagnostic value of lymph node evaluation. This article discusses the anatomy, functions, clinical examination, common pathological changes, and diagnostic importance of lymph nodes in farm animals while emphasizing their role in veterinary practice and herd health management.

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Introduction

The lymphatic system is an essential component of the immune and circulatory systems, playing a central role in maintaining tissue fluid balance, transporting immune cells, and protecting the body against infectious agents. Among its various components, lymph nodes serve as biological filters that trap microorganisms, foreign particles, cellular debris, and abnormal cells before they enter the bloodstream. They are strategically distributed throughout the body along lymphatic vessels and act as important sites for antigen presentation, lymphocyte activation, and immune surveillance.

In veterinary medicine, lymph nodes possess considerable diagnostic significance because they often undergo noticeable changes during infectious, inflammatory, parasitic, metabolic, and neoplastic diseases. Enlargement, pain, altered consistency, fixation, or asymmetry of lymph nodes may represent the earliest clinical evidence of disease. Consequently, routine palpation of accessible lymph nodes forms an indispensable part of clinical examination in cattle, buffaloes, sheep, goats, horses, pigs, and

companion animals. Many economically important diseases such as bovine tuberculosis, brucellosis, actinobacillosis, caseous lymphadenitis, lymphadenitis caused by pyogenic bacteria, leukemia, lymphoma, and several viral infections involve regional or generalized enlargement of lymph nodes. Therefore, careful evaluation of lymph nodes provides valuable information regarding disease localization, progression, prognosis, and treatment response. In addition to disease diagnosis, lymph node examination is widely used during herd health investigations, pre-purchase examinations, certification of animal health, meat inspection, and surveillance of zoonotic diseases. Modern veterinary practice increasingly combines traditional clinical examination with advanced diagnostic techniques such as ultrasonography, fine-needle aspiration cytology, histopathology, immunohistochemistry, polymerase chain reaction (PCR), and advanced imaging modalities. These techniques improve diagnostic accuracy and facilitate early detection of pathological conditions affecting lymph nodes. Understanding the normal anatomy and physiological functions of lymph

nodes is therefore essential for veterinary students, clinicians, livestock owners, and field veterinarians. A systematic examination of lymph nodes not only assists in identifying the primary disease process but also supports rational therapeutic planning and effective herd health management. Regular assessment of lymph nodes should always be considered an integral component of comprehensive clinical examination in all farm animal species.

Functions of lymph nodes

Lymph nodes perform numerous physiological and immunological functions essential for maintaining animal health. Their primary function is to filter lymph by removing microorganisms, toxins, dead cells, and foreign particles before the lymph re-enters the bloodstream. Within the lymph nodes,

macrophages and dendritic cells capture and process antigens, while lymphocytes initiate specific immune responses. Lymph nodes also serve as sites for the proliferation and maturation of B and T lymphocytes. Following antigen stimulation, plasma cells formed within lymph nodes produce antibodies that contribute to humoral immunity. The nodes further regulate lymphocyte recirculation and facilitate communication between different components of the immune system. Besides immune defense, lymph nodes play an important role in limiting the spread of localized infections and malignant cells. Enlargement of regional lymph nodes often indicates activation of immune responses occurring in nearby tissues. Consequently, evaluation of lymph nodes provides valuable information regarding the location and severity of disease.

Table 1. Major Superficial Lymph Nodes of Farm Animals and Their Clinical Importance

Lymph Node	Anatomical Location	Structures Drained	Clinical Importance
Mandibular	Ventral border of mandible	Head, oral cavity, pharynx	Oral infections, actinobacillosis
Parotid	Below base of ear	Head and face	Ear and facial infections
Prescapular (Superficial cervical)	Cranial to shoulder	Neck, forelimb	Easily palpable; indicator of systemic disease
Prefemoral (Subiliac)	Cranial to stifle	Abdominal wall, hind limb	Commonly examined during clinical evaluation
Supramammary	Above udder	Mammary gland	Mastitis diagnosis
Popliteal	Behind stifle	Distal hind limb	Limb infections and wounds
Retropharyngeal	Behind pharynx	Head and upper respiratory tract	Respiratory diseases
Superficial inguinal	Inguinal region	External genitalia, udder/scrotum	Reproductive and mammary diseases

Clinical examination of lymph nodes

Examination of lymph nodes begins with visual inspection followed by careful palpation. The clinician evaluates the size, shape, consistency, temperature, mobility, symmetry, and pain response of each accessible lymph node. Normal lymph nodes are generally small, firm, freely movable, painless, and difficult to visualize externally. Enlargement may be localized or generalized depending on the underlying disease. During palpation, enlarged lymph nodes should be assessed for whether they are soft, firm, fluctuant, or hard. Soft and painful enlargement usually indicates acute inflammation, whereas firm enlargement is commonly associated with chronic inflammatory conditions. Hard, irregular, and

fixed lymph nodes may suggest neoplastic involvement. Fluctuant lymph nodes often indicate abscess formation requiring further investigation. Clinical examination should always be interpreted alongside history, systemic clinical findings, hematological parameters, and laboratory investigations to establish an accurate diagnosis.

Diseases associated with lymph node enlargement

Enlargement of lymph nodes (lymphadenopathy) is one of the most important clinical findings during veterinary examination. It usually reflects an active immune response against infectious agents or other pathological conditions.

Lymphadenopathy may be localized, involving one or a few regional lymph nodes, or generalized, affecting multiple lymph nodes throughout the body. Determining the distribution of enlarged lymph nodes provides valuable clues regarding the underlying disease process. Bacterial infections are among the most common causes of lymph node enlargement in farm animals. Diseases such as caseous lymphadenitis in sheep and goats, bovine tuberculosis, actinobacillosis, actinomycosis, pyogenic abscesses, and mastitis frequently result in enlargement of regional lymph nodes. In these conditions, the affected lymph nodes are often enlarged, firm, painful, and occasionally fluctuant due to abscess formation. Several viral diseases also involve lymphoid tissues. Bovine leukemia virus (BLV) infection causes generalized lymphadenopathy due to lymphosarcoma. Similarly, viral infections such as bovine viral diarrhea (BVD), peste des petits ruminants (PPR), and African swine fever may produce varying degrees of lymph node enlargement depending on disease severity.

Parasitic diseases, including trypanosomiasis, toxoplasmosis, and certain tick-borne diseases, stimulate immune responses resulting in enlargement of draining lymph nodes. Chronic fungal infections and mycobacterial diseases may also produce granulomatous lymphadenitis. Neoplastic diseases such as lymphoma and metastatic tumors frequently involve lymph nodes. These lymph nodes are generally enlarged, firm, non-painful, and may become fixed to surrounding tissues. Recognition of these characteristics assists clinicians in differentiating inflammatory from neoplastic conditions.

Diagnostic approaches for lymph node evaluation

Although palpation remains the primary method of lymph node examination, modern veterinary diagnostics have considerably enhanced the evaluation of lymphatic diseases.

Fine-Needle Aspiration Cytology (FNAC) is a rapid, inexpensive, and minimally invasive technique used to collect cells from enlarged lymph nodes for cytological examination. It helps differentiate inflammatory lesions, abscesses, hyperplasia, and neoplasia.

Biopsy and Histopathology remain the gold standard for definitive diagnosis of chronic lymphadenopathy and neoplastic diseases. Histological examination provides detailed

information regarding tissue architecture, inflammatory changes, granuloma formation, and malignant transformation.

Ultrasonography is increasingly used for evaluating superficial as well as deep lymph nodes. It provides information regarding lymph node size, shape, internal architecture, vascularity, and presence of abscesses or cystic lesions. Advanced molecular techniques such as **polymerase chain reaction (PCR)** facilitate rapid detection of infectious agents including *Mycobacterium bovis*, *Brucella* spp., *Corynebacterium pseudotuberculosis*, and several viral pathogens directly from lymph node aspirates or biopsy samples. Hematological and biochemical investigations complement lymph node examination by providing information regarding systemic inflammatory responses, immune status, and organ function. In suspected neoplastic conditions, immunohistochemistry and flow cytometry may further aid diagnosis.

Clinical significance in different farm animal species

The clinical importance of lymph node examination varies among different livestock species.

In **cattle and buffaloes**, examination of the prescapular, prefemoral, supramammary, and mandibular lymph nodes is routinely performed during clinical examination. Enlargement of the supramammary lymph node commonly accompanies mastitis, whereas generalized enlargement may indicate bovine leukemia or tuberculosis.

In **sheep and goats**, superficial lymph nodes are particularly important for diagnosing caseous lymphadenitis caused by *Corynebacterium pseudotuberculosis*. Regular palpation of superficial lymph nodes helps detect infected animals before abscess rupture, thereby reducing disease transmission within the flock.

In **horses**, enlargement of mandibular and retropharyngeal lymph nodes is frequently observed in strangles caused by *Streptococcus equi*. Palpation of these lymph nodes is therefore an important component of equine clinical examination.

In **swine**, enlarged lymph nodes may indicate bacterial infections, African swine fever, classical swine fever, or systemic inflammatory conditions. Postmortem examination of lymph nodes is also an important component of meat inspection and disease surveillance.

Table 2. Common Diseases Associated with Enlarged Lymph Nodes in Farm Animals

Disease	Species Affected	Characteristic Lymph Node Changes	Diagnostic Importance
Bovine tuberculosis	Cattle	Enlarged, firm, caseous	Tuberculosis surveillance
Caseous lymphadenitis	Sheep, Goat	Abscess formation	Characteristic disease lesion
Mastitis	Cattle, Buffalo	Enlarged supramammary node	Indicates mammary infection
Strangles	Horse	Enlarged mandibular and retropharyngeal nodes	Important clinical sign
Bovine leukemia	Cattle	Generalized enlargement	Suggestive of lymphoma
Brucellosis	Cattle, Sheep, Goat	Mild regional enlargement	Supports diagnosis
Actinobacillosis	Cattle	Enlarged mandibular node	Oral infection indicator
Pyogenic abscess	All species	Painful, fluctuant enlargement	Requires drainage and treatment

Role of lymph node examination in herd health

Routine examination of lymph nodes is valuable not only for diagnosing individual animal diseases but also for maintaining herd health. Early identification of infectious diseases through regular clinical examination reduces disease transmission, improves treatment outcomes, and minimizes economic losses. Veterinarians conducting herd health visits should routinely examine accessible lymph nodes while evaluating body condition, temperature, respiratory rate, and reproductive performance. Animals showing abnormal lymph node enlargement should be isolated and investigated further to prevent spread of contagious diseases. Lymph node examination also contributes to disease surveillance programs, pre-purchase examinations, livestock exhibitions, and certification of disease-free animals. During meat inspection, systematic examination of lymph nodes assists in identifying subclinical infections, tuberculosis, septicemia, and other conditions of public health significance.

Lymph nodes are among the most informative structures examined during routine veterinary clinical evaluation. Their strategic anatomical distribution and immunological functions make them valuable indicators of local and systemic diseases in farm animals. Careful assessment of lymph node size, consistency, mobility, temperature, and pain response provides important diagnostic information that assists veterinarians in identifying infectious, inflammatory, parasitic, and neoplastic diseases. Modern diagnostic techniques such as ultrasonography, fine-needle aspiration cytology, histopathology, and molecular assays have further enhanced the diagnostic value of lymph node evaluation. Regular examination of lymph nodes should therefore be an integral component of clinical practice, herd health programs, disease surveillance, and preventive veterinary medicine. Early recognition of abnormal lymph node changes enables timely diagnosis, appropriate treatment, improved animal welfare, and enhanced productivity in livestock enterprises.

Conclusion

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