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Caseous Lymphadenitis: A Global Perspective on the Veterinary and Economic Impact of *Corynebacterium pseudotuberculosis*

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ABSTRACT

Caseous Lymphadenitis (CLA), which is caused by *Corynebacterium pseudotuberculosis*, is an important infectious disease in many parts of the world. This article describes pathogenesis, epidemiology, and clinical manifestations of the disease in goats and sheep. We review the incidence and epidemiological factors of the disease by region, noting the high economic impact through direct costs of veterinary care and through losses in production and trade. Furthermore, the existing management measures and the need for partnerships in the control process. These include the review of the current literature to create awareness of the need to undertake further research to help reduce the effects of CLA on the livestock industry globally.

Keywords: *Corynebacterium pseudotuberculosis*, Economic Impact, Small Ruminants, Livestock Diseases, Infectious Diseases

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Introduction

Caseous lymphadenitis (CLA) is a chronic and contagious disease that affects primarily small ruminants including sheep and goats but the disease can also affect cattle and other livestock [1, 2]. CLA is an abscess-forming disease, which affects the lymph nodes and internal organs and is caused by *Corynebacterium pseudotuberculosis*. The disease is known to be chronic in nature and can affect an animal without being noticed until much damage has been done. The signs of CLA include enlarged lymph nodes as shown in figure 1, dyspnea, and poor gain in body weight, which negatively affect the health of the animals [3]. It is hard to combat the bacterium because it can live in the environment for quite some time. Some carriers may not show symptoms of the disease and are a source of the infection, which contributes to the spread of the disease in herds. There is a long period of subclinical infection in which animals shed the organism and may transmit the disease to other animals within the herd. Economically, CLA has both direct and indirect effects. The direct losses consist of expenditure on veterinary services, treatment of affected animals and reduced output in the form of milk and meat [4]. Disease can also affect marketability indirectly by lowering the prices of infected animals or products from infected herds. Also, trade barriers may start worrying about animal diseases which will increase the costs for farmers and the agriculture industry.

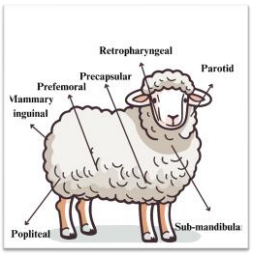

Fig.1 Position of lymph nodes animal's skin.

It is important to know the global burden of CLA to come up with the right control measures. This disease affects differently in different areas of the world due to farming systems, weather conditions, and resources that can be used in management of the disease [5]. Although some countries have had positive experiences with control measures, others still experience high infection rates. So, presenting a global view on Caseous lymphadenitis, including the pathogen and disease characteristics, its spread and consequences for the veterinary field and economy. With the aim of raising awareness and furthering understanding of CLA and its consequences, this special issue focuses on research, education, and international cooperation to protect the health and productivity of livestock around the world [6].

Pathogenesis of *Corynebacterium pseudotuberculosis*

Corynebacterium pseudotuberculosis is a non-spore forming, gram positive bacterium of the genus Corynebacterium [7]. This bacterium has an unusual pleomorphic morphologic appearance, with cell shapes including round, filamentous rod and can also produce a lipid waxy cell wall, which gives it a high degree of pathogenicity and the ability to survive in harsh environments. It is a facultative anaerobe meaning that it can metabolize in the presence or absence of molecular oxygen and is particularly useful when the pathogen is within the host tissues [8]. This infection is mainly due to the situation in which the bacteria enter the body through a crack or a wound on the skin or on the surface of the membrane that lines the mouth. It is also spread from infected animals or through contact with contaminated food and water. After entering the host, *C. pseudotuberculosis* sticks to epithelial cells and can bypass the host's immune response by several mechanistic actions

1. Intracellular Survival

The bacterium may be able to trick the immune system and then dwell within the macrophages, which are white blood cells that are supposed to kill pathogens [9] and other immune cells that way, *C. pseudotuberculosis* can multiply and spread inside the body as it invades immune cells.

2. Production of Virulence Factors

The bacterium has various virulence factors that enhance its ability to produce pathological microorganisms. These include Phospholipase D, the enzyme which is essential in tissue destruction and abscess formation through disruption of cell membrane and inflammation [10]. Exotoxins also secrete several toxic substances that can adversely affect the host tissues and suppress the immune system of the host even more. The pathogenesis of CLA includes the formation of Caseous nodules in the form of abscesses in the lymph nodes and internal organs [11]. Because of the infection, an inflammation process happens. The abscesses can be localized, which means that the immune system cannot easily eliminate them and antibiotics cannot get to them easily [12]. This bacterium often can be present in the host's body in a latent form therefore leading to chronic infections. Clinical signs in affected animals may not be apparent until some form of stress trigger the clinical signs of CLA due to reactivation of the disease [13].

Epidemiology of Caseous Lymphadenitis

Caseous lymphadenitis (CLA), caused by *Corynebacterium pseudotuberculosis*, has a very complex epidemiology influenced by a wide range of factors namely host species, geographical distribution, environmental conditions, and farming practices [14]. Understanding these factors is crucial in developing appropriate control strategies. CLA is seen to be a prevalent disease in numerous sites worldwide, particularly in regions where sheep and goats are raised. The incidence of this disease is markedly higher in grazing system countries such as Australia, New Zealand, and partly in Europe and North America [15]. In these environments, the disease can cause flock health to be seriously affected as well as decrease productivity of affected animals. Even though the most common victims of CLA include sheep and goats, it can also occur in other species of livestock such as cattle. Different breeds may display different levels of susceptibility, depending on genetic components and the immune response of the animal. It seems the goats are to be the most frequently affected animals suffering from CLA in comparison to the sheep mainly due to variation in management as well as differences in social behaviors that influence the transmission of the disease.

Veterinary Impacts of Caseous Lymphadenitis

Caseous Lymphadenitis (CLA) is a condition that is mainly responsible for the livestock health and the welfare of the providing animals and in particular, sheep and goats. The disease presents itself as abscesses in lymph

nodes and internal organs thus, there are several clinical signals that will manifest, such as swelling, loss of weight, and respiratory distress [16]. These animals may suffer from this condition and as a result, have lower productivity and compromised overall health. The presence of abscesses is painful and can be the source of even more discomfort, thus, the animal's quality of life is further affected. From a management perspective, CLA diagnosis can be difficult since the infections can be asymptomatic most of the time, thereby transmitting the disease through a herd that is not being aware of it. The available treatment methods are limited, the drainage and antibiotics are effective if it is an individual case however, this may fail to remove the bacterium from the herd [17]. Also, the infected animals can be carriers of the disease which contributes to the spread of disease. As a result, the breeders must make the hard decision to either eradicate the infected animals or manage them, ultimately disrupting the breeding programs and causing financial losses. Regular health monitoring, biosecurity, and vaccination can be not only the solution but also an ongoing expense for farmers, and thus the need for quality management to minimize the negative effects of CLA on livestock and farm productivity is stressed [18].

Economic Impacts of Caseous Lymphadenitis

Caseous lymphadenitis (CLA) has a major share of economic influences on the livestock producers as well as the animal husbandry sector [19]. The relevant costs of the disease include direct costs of veterinary services for the diagnosis and treatment of sick animals, which often require surgical procedures to drain abscesses and the prescription of antibiotics for the infectious ones. Incidentally, these expenses can increase if extra animals and higher doses are required. Apart from that, it brings about a decrease in the productivity of the animals, as the animals suffering weight loss, milk production drop, and the lower quality meat that also affects the profitability of the stock farms. Very frequently buyers will be disheartened to buy the infected animal with the known disease which is in turn going to be a case leading to the financial dissipation for producers [20]. On the other hand, diseases are also associated with measures such as trade restrictions and so on, which have a negative impact on the export of goods to countries where CLA is found, thereby making the market less accessible and competitive. In addition, farmers must increase biosecurity expenditures to prevent the spread of CLA in their livestock, which is another financial strain [21]. In general, the financial costs of Caseous lymphadenitis highlight the significance of the use of effective management and control methods to maintain animal health as well as the profitability of the agricultural sector in the long run [22].

Figure 2. Map of countries which shows the disease Caseous lymphadenitis to World Organization of Animal Health(1).

Global organizations like the Food and Agriculture Organization (FAO) and the World Organization for Animal Health (OIE) as shown in figure 2 are working to educate and improve practices for managing contagious Lymphadenitis (CLA) globally. They provide educational materials, support research projects, and share knowledge between different countries. By working together, they seek to increase understanding of CLA, improve disease handling, and reduce its impact on livestock industries around the world(24).

Global Perspectives and Responses

Different countries have different ways of dealing with Caseous Lymphadenitis (CLA) based on their animal farming methods, resources, and how well they know about the disease. In countries where sheep and goats are common, farmers actively try to control disease through vaccinations and strict health measures. They also invest in figuring out better ways to diagnose and treat CLA, and veterinarians and farmers work together closely. On the other hand, in developing countries, where resources are limited and people don't know much about the disease, CLA can spread without being controlled [23, 24].

Conclusion

Caseous lymphadenitis (CLA), a disease spread by the bacteria *Corynebacterium pseudotuberculosis*, is a serious issue in veterinary medicine and animal farming globally. Infected animals experience long-term health issues and reduced productivity, negatively affecting their well-being and causing substantial financial losses in the agricultural sector. Veterinary expenses and reduced market value and productivity contribute to the financial burden. The spread and severity of CLA are determined by several factors, such as farming practices, environmental conditions, and animal susceptibility. While some regions have successfully implemented control measures and research efforts to manage CLA, others still struggle with high prevalence rates due to insufficient action

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