International Journal of Livestock Research, Vol. 14 (5) May' 2024
http://www.ijlr.org
eISSN: 2277-1964
NAAS Score:4.31

Review

Lumpy Skin Disease - An Emerging Threat to Livestock Industry

Mahendra Pal[1*], Anand Sejra[2], Tesfaye Rebuma[3], Mulugeta Tashoma[4] and Nidhish Bhardwaj[5]

[1]Narayan Consultancy of Veterinary Public Health, and Microbiology, Bharuch, Gujarat, INDIA
[2]Department of Animal Husbandry, Government of Rajasthan, Jaipur, INDIA
[3]School of Veterinary Medicine, Ambo University Guder Mamo Mezemir Campus Veterinary Teaching Clinic, Ambo, Oromia, ETHIOPIA
[4]Nono Woreda Agricultural office, Silk-Amba, West Shewa, Ambo, Oromia, ETHIOPIA
[5]CII-Food and Agriculture Centre of Excellence, 4th Floor, Andhra Association Building 24-25, Lodi Road, New Delhi - 110003, INDIA

*Corresponding Author: palmahendra2@gmail.com

How to cite this paper
Pal, M., Sejra, A., Rebuma, T., Tashoma, M., & Bhardwaj, N. (2024). Lumpy Skin Disease - An Emerging Threat to Livestock Industry. *International Journal of Livestock Research*, 14 (5), 1-6.

Received : May 03, 2024
Accepted : May 25, 2024
Published : May 31, 2024

Abstract

Viral diseases are an important cause of morbidity as well as mortality in humans and animals. Cattle are affected with many viral diseases including lumpy skin disease (LSD) which represents a significant economic loss to the livestock industry in many regions of the world including India. It is a devastating disease that is caused by the genus Capripoxvirus. The rainy season is the main time when cases of LSD are seen in animals, and it can spread through vector and non-vector channels. Cattle and buffalo are the primary victims, exhibiting a high fever, and skin nodules on their mucous membranes. The disease reduces milk production, abortion, infertility, and other problems, leading to significant economic losses even if its death rate is lower. LSD can cause symptoms that range from mild sickness to severe illness. The affected animals include fever, emaciation, swollen lymph nodes, skin edema, and occasionally even death. Nodules can also appear on the skin, mucous membranes, and internal organs. Laboratory test helps to establish an unequivocal diagnosis of disease. There is no specific antiviral drug available to treat the affected animals with LSD. The best ways to prevent and control the disease are strict quarantine, vector control, and preventive vaccination.

Keywords: Cattle, Control, Emerging Threat, Lumpy Skin Disease Virus, Transmission, Prevention.

Introduction

Many infectious diseases caused by multiple etiological agents, which include viruses, bacterium, fungi, actinomycete, protozoa, helminths, and ectoparasites are reported in cattle worldwide (Pal,2007). These diseases can occur in sporadic and epidemic forms resulting in morbidity, and mortality in susceptible cattle. Among the most significant transboundary viral diseases that afflict cattle in particular is lumpy skin disease (LSD) (Sprygin *et al*., 2020). With its high fever, swollen lymph nodes, and solid, confined nodules, it is one of the most economically significant viral emerging illnesses (OIE, 2010). Cattle of all ages and breeds are susceptible to this disease, which has a high morbidity and low death rate. In addition to cattle, infection has also been recorded in buffaloes (Ganesh *et al*.,2020). Due to decreased milk production, loss of draft power and beef, infertility, abortion, condition loss, and hide damage, it results in large economic losses (CFSPH, 2008). The extremely contagious cause of lumpy skin disease (LSD) is the lumpy skin disease virus (LSDV), a member of the *Capripoxvirus* genus of the *Poxviridae* family (Sprygin *et al*., 2020; OIE, 2010). Three important viral species that are closely linked genetically and belong to the genus *Capripoxvirus* are the sheep pox virus (ShPV), goat pox virus (GPV), and cattle pox virus (LSDV) (Babiuk *et al*., 2008).

There are several known ways that LSD can spread, including seminal transmission, arthropod transmission, and direct and indirect contact (Tuppurainen, 2017). It is known that a variety of arthropods serve as LSDV transmission vectors, and the virus has been observed in those vectors (Chihota *et al*., 2003). Annandale and co-workers (2014) reported that there has been evidence of sexual transfer of the LSD virus from the bull's infected semen to the heifer and even congenitally to the fetus. Through artificial or natural insemination, the sick bull can also spread the virus to adult females, and the infected female can give birth to calves that have skin lesions (Tuppurainen *et al*., 2017).

LSD is an emerging transboundary viral disease that has a significant impact on the livestock industry (Pal *et al*.,2024). The disease is characterized by pyrexia, lachrymation, nasal discharge, swelling of the superficial lymph nodes, and the presence of highly characteristic flat-topped papules and nodules of size 5–50 mm all over the body, particularly in the head, neck, genitalia, udder, buccal mucosa, and limbs (Tuppurainen *et al*., 2017). Therefore, the main objective of this communication is to raise awareness of LSD as an emerging viral disease of major significance to the livestock industry.

Etiology

The lumpy skin disease virus, which causes the condition, belongs to the sub-family *Chordopoxvirinae* of the *Poxviridae* family and is classified as a member of the genus *Capripoxvirus* (Gumbe, 2018). The sheep pox virus (ShPV), goat pox virus (GPV), and lumpy skin disease virus (LSDV) are all members of the genus *Capripoxvirus*, according to Tulman *et al*., (2001). According to Rashid and co-workers (2017), there are close genetic links between the species of the *Capripoxvirus*, which is a big double-stranded encased DNA virus. These three viruses pose a substantial threat to the worldwide animal husbandry industry by having the potential to produce transboundary diseases in ruminants that could have dire effects (Sprygin *et al*., 2018). Each has a unique natural reservoir of its own. While cattle and water buffalo are the primary targets of the LSDV, sheep and goats are the primary hosts of the first two viruses (Afonso *et al*., 2012; Lefkowitz *et al*., 2018). Furthermore, LSDV can also infect wildebeests, giraffes, and impalas (Dao *et al*., 2022).

Mode of Transmission

There are several ways that LSD might spread, including seminal transmission, arthropod transmission, and direct and indirect contact (Tuppurainen, 2017). It is mentioned that there has been evidence of the existence of the LSDV virus in a variety of arthropods, which are known to transfer the virus (Chihota *et al*., 2003). The LSD virus has been shown to spread sexually from the bull to the heifer and even congenitally to the fetus through contaminated semen (Annandale *et al*., 2014). Through artificial or natural insemination, the sick bull can also spread the virus to adult females, and the infected female can give birth to calves that have skin lesions (Tuppurainen *et al*., 2017). Feeding, watering, sharing similar grazing grounds, and limiting animal movement are risk factors for the spread of LSD (Gari *et al*., 2010).

Epidemiology

Lumpy skin disease can occur in sporadic as well as epidemic forms both in cattle and buffaloes (Ganesh *et al*.,2020). It is a significant, economically disastrous, and reportable illness that has resulted in a reduction in cow productivity owing to widespread malaises and persistent debility. Comprehending the epidemiological features of LSD to the pathogen, host, and environment could be beneficial for developing control and preventative strategies. The importance of exposing hosts to pathogens in an environment that promotes the spread and transmission of the disease cannot be overstated. LSD is more common in low-lying places and beside water courses, especially during the rainy summer and fall months (Tuppurainen *et al*., 2012). It is an important transboundary viral disease of cattle with economic concern to livestock owners (Pal *et al.*, 2024). The disease has been reported in many countries of the world (Pal *et al*.,2024).

Risk Factors

Warm, humid weather, circumstances that encourage a high number of vector populations such as those observed following periodic rains, and the addition of additional animals to a herd are risk factors linked to the spread of LSD. Other risk factors that may raise the prevalence of the disease include herd size, vector populations, proximity to the lake, herd migration, movement of sick animals into disease-free areas, shared pastures, and water sources (Gari *et al*., 2010; Sevik and Dogan, 2017). Furthermore, the wind's speed and direction may also have a role in the virus's dissemination (Chihota *et al*., 2003). Cattle of all ages, breeds, and genders are prone to the illness (Tuppurainen *et al*., 2011). In addition, age, sex, management style, mean annual rainfall, and shared water supply are risk variables linked to LSDV seropositivity (Ochwo *et al*., 2019).

Clinical Signs

The incubation of the disease is from 2 to 5 weeks. The disease carries high morbidity and low mortality. Skin nodules, which typically measure between 1 and 8 cm in size and emerge above the skin surface, are the characteristic that most clearly identifies the disease. In addition, 50% of susceptible animals experience fever reaching 40 to 41^{o}C, and 81.3% of cases have nasal discharge; 100% of cases have swollen lymph nodes; 0.4% of pregnant animals experience abortion; decreased milk production (average 72.5% in buffalo and average 54.16% in cattle) and lameness (6% of cases) are also common (Ganesh *et al*., 2020). The nodular lesion, which is most commonly observed in the abdomen, flank, and thigh (Fig.1), might be stiff and difficult to wet, necrotic, or slough. In this context, Sanz-Bernardo and co-investigators (2020) reported that nodular lesions can be observed in the upper respiratory tract (7.04%), rumen (2.82%), upper digestive tract (9.86%), and even the lungs (4.23%). Mucopurulent nasal discharge, conjunctivitis, corneal opacity, and possibly blindness are possible additional symptoms (Gautam *et al*., 2022).

Figure 1: Cattle affected with LSD showing skin lesions. **Source:** (Chouhan *et al*., 2022)

Economic Importance

One of the livestock illnesses with the greatest economic impact is lumpy skin disease, which results in significant production losses and long-term disability in affected animals (Gari *et al*., 2010; Gari *et al*., 2011). The disease's main effects include delayed genetic advancement, an inability for the animal to work, lameness-related draught power and traction loss, decreased milk production, infertility, abortion, chronic debility in beef cattle, and damaged or lost hides, all of which result in significant financial losses. LSD is one of the important diseases that affect cattle productivity causing the most economic losses in Africa and the Middle East. The disease's high morbidity rate rather than mortality accounts for the majority of its economic significance (Mulatu *et al*., 2018).

It is possible to classify lumpy skin disease's effects into two main categories: direct losses, or the effect on an animal's health and productivity, and indirect losses. Visible losses from disease or subsequent management measures, such as animal death, illness, or stunting, are considered direct losses. Conversely, indirect losses include the less obvious effects of animal disease, like decreased productivity or changes in herd fertility, as well as the prohibition of livestock trade internationally, costs associated with mitigation and control, a decline in consumer confidence, and detrimental effects on other economic sectors (Mulatu *et al*., 2018).

Diagnosis

The clinical signs and symptoms can help to make a tentative diagnosis of LSD in the affected animals. However, laboratory techniques, such as virus isolation and culture, agar-gel immunodiffusion tests (AGID), indirect enzyme-linked immunosorbent assays (ELISA), direct fluorescent antibody tests, polymerase chain reaction (PCR), dot blot hybridization (DBH), Western blot, and histopathology should be employed to make an accurate diagnosis of disease (Awad *et al*., 2010; OIE, 2021). It is suggested that LSD should be differentiated from other diseases, such as demodicosis, pseudo-cowpox, dermatophytosis (ringworm), dermatophilosis, cutaneous tuberculosis, cowpox, and others (Chouhan *et al*., 2022; Pal *et al*.,2024).

Prevention and Control

In addition to global climate change, the distribution of *Capripoxviruses* appears to be growing as a result of the lack of availability of effective vaccines, poverty in farming communities in endemic regions, and an increase in both legal and illicit live animal trading. Along with movement limitations and the evacuation of afflicted animals, vaccination is the only effective way to control the disease in endemic areas (Sevik and Dogan, 2017). LSD is treated primarily for its symptoms, to avoid additional bacterial problems by combining antimicrobials, supportive therapy, anti-inflammatory therapy, and antiseptic treatments (Salib and Osman, 2011). Nonetheless, the disease's eradication is probably going to be challenging because of the importance of arthropod vectors, and any postponements in the evacuation of contaminated animals raise the possibility of LSD transmission (Tuppurainen *et al*., 2017). In control actions, risk variables should also be taken into account (Sevik and Dogan, 2017). Veterinarians and livestock workers could help contain the spread of disease by diagnosing clinical cases promptly if they received the necessary education (Beard, 2016).

Members of the *Capripoxvirus* are known to provide cross-protection. Hence, homologous (Neethling LSDV strain) and heterologous (sheep pox or goat pox virus) live attenuated vaccines can all be used to protect cattle against LSD infection. In LSD-free countries that use the sheep pox vaccine to protect sheep against sheeppox, it was recommended to use the same vaccine during LSD outbreaks because of potential safety issues associated with the live attenuated LSDV vaccine use (Tuppurainen & Oura, 2012). Furthermore, the rapid confirmation of a clinical diagnosis is essential so that eradication measures such as quarantine, slaughter-out of affected and in-contact animals, proper disposal of carcasses, cleaning and disinfection of the premises, and insect control can be implemented as soon as possible during the eruption (Tuppurainen *et al*., 2005). Moreover, rigorous import restrictions on livestock, carcasses, hides, and semen from endemic areas must be in place in disease-free areas (Sevik and Dogan, 2017).

Conclusion and Recommendations

Lumpy skin disease (LSD) is the most economically significant viral disease that affects domestic cattle in many regions of the world including India. Wildlife serves as a reservoir for LSDV outbreaks, which are usually connected

to warm, wet seasons. Arthropods are the virus's primary mechanical vector. The key factors thought to increase the risk of the disease are the pathogen, the environment, and host factors. Depending on the age, sex, and breed of the cattle, the clinical indications of LSD may be acute or sub-acute. In young animals and lactating cows, the condition is more severe. LSD can be controlled by immunization, limiting animal mobility, and eliminating exposed and affected animals. Better disease control may also come from applying efficient preventative measures like immunization and paying great attention to the various components of the disease, such as epidemiology and transmission. It is emphasized that vector control, prompt and accurate diagnosis in endemic areas, vaccination with the homologous strain of the LSDV, and limitations on animal movement are imperative for the control of this devastating disease of livestock in particular cattle.

Contribution by Authors

Equal contribution. All authors declared that 'written informed' consent was obtained from the approved parties for the publication of this article and accompanying images.

Conflict of Interests

There is no conflict of interest.

Publisher Disclaimer

IJLR remains neutral concerning jurisdictional claims in published institutional affiliation.

References

1. Afonso, P.P., Silva, P.M., Schnellrath, L.C., Jesus, D.M., Hu, J., Yang, Y., Renne, R., Attias, M., Condit, R.C., Moussatché, N. and Damaso, C.R. (2012). Biological characterization and next-generation genome sequencing of the unclassified Cotia virus SPAn232 (Poxviridae). Journal of Virology, 86 (9), 5039-5054.
2. Annandale, C.H., Holm, D.E., Ebersohn, K. and Venter, E.H. (2014). Seminal transmission of lumpy skin disease virus in heifers. Transboundary and Emerging Diseases, 61(5), pp.443-448.
3. Awad, W.S., Ibrahim, A.K., Mahran, K., Fararh, K.M. and Abdel Moniem, M.I. (2010). Evaluation of different diagnostic methods for diagnosis of Lumpy skin disease in cows. Tropical Animal Health and Production, 42, 777-783.
4. Babiuk, S., Bowden, T.R., Boyle, D.B., Wallace, D.B. and Kitching, R.P. (2008). Capripoxviruses: an emerging worldwide threat to sheep, goats and cattle. Transboundary and Emerging Diseases, 55(7), 263-272.
5. Beard, P.M. (2016). Lumpy skin disease: a direct threat to Europe. The Veterinary Record, 178 (22), 557.
6. CFSPH. (2008). The Center for Food Security and Public Health, Iowa State University, USA.
7. Chihota, C.M., Rennie, L.F., Kitching, R.P. and Mellor, P.S. (2003). Attempted mechanical transmission of lumpy skin disease virus by biting insects. Medical and Veterinary Entomology, 17(3), 294-300.
8. Chouhan, A.S., Dahiya, R. and Dadhich, R. (2022). Future herbal treatment for lumpy skin diseases in cattle: A systematic research. HSOA Journal of Animal Research and Veterinary Science 6: 038.
9. Dao, T.D., Tran, L.H., Nguyen, H.D., Hoang, T.T., Nguyen, G.H., Tran, K.V.D., Nguyen, H.X., Van Dong, H., Bui, A.N. and Bui, V.N. (2022). Characterization of lumpy skin disease virus isolated from a giraffe in Vietnam. Transboundary and Emerging Diseases, 69(5), pp.e 3268-e3272.
10. Ganesh, K.C., Karki, S., Koirala, P., Upadhyaya, D., Regmi, B. and Pande, K. (2020). First report of lumpy skin disease outbreak in cattle and buffaloes of Gandaki Province, Nepal. Authorea Preprints.
11. Gari, G., Bonnet, P., Roger, F. and Waret-Szkuta, A. (2011). Epidemiological aspects and financial impact of lumpy skin disease in Ethiopia. Preventive Veterinary Medicine, 102 (4), 274-283.
12. Gari, G., Waret-Szkuta, A., Grosbois, V., Jacquiet, P. and Roger, F. (2010). Risk factors associated with observed clinical lumpy skin disease in Ethiopia. Epidemiology and Infection, 138(11), 1657-1666.
13. Gautam, M., Kattel, P. and Kaphle, K. (2022). Review on lumpy skin disease and its emerging threat to livestock in Nepal. Veterinary Sciences: Research Review, 8(1), 43-51.
14. Gumbe, A.F. (2018). Review on lumpy skin disease and its economic impacts in Ethiopia. Journal of Dairy and Veterinary Animal Research, 7(2), 39-46.
15. Lefkowitz, E.J., Dempsey, D.M., Hendrickson, R.C., Orton, R.J., Siddell, S.G. and Smith, D.B. (2018). Virus taxonomy: the database of the International Committee on Taxonomy of Viruses (ICTV). Nucleic Acids

Research, 46, pp. D708-D717.
16. Mulatu, E. and Feyisa, A. (2018). Review: Lumpy skin disease. Journal of Veterinary Science and Technology, 9.1-8.
17. Ochwo, S., VanderWaal, K., Munsey, A., Nkamwesiga, J., Ndekezi, C., Auma, E. and Mwiine, F.N. (2019). Seroprevalence and risk factors for lumpy skin disease virus seropositivity in cattle in Uganda. BMC Veterinary Research, 15, 1-9.
18. OIE (2010). Manual of diagnostic tests and vaccines for terrestrial animals. Lumpy Skin Disease, pp.768–778.
19. OIE. (2021). Lumpy skin disease. In OIE Terrestrial Manual. OIE. https://www.oie.int/fileadmin/home/eng/health_standar ds/tahm/3.04.12_ LSD.pdf. 2021.
20. Pal, M. (2007). Zoonoses. Second Ed. Satyam Publishers, Jaipur, India.
21. Pal, M., Rebuma, T., Bulo, F. and Teshoma, M. (2024). Lumpy skin disease: An emerging transboundary viral disease. Journal of Advances in Microbiology Research, 5 (1), 43-46.
22. Rashid, P.M.A., Sheikh, M.B., Raheem, Z.H. and Marouf, A.S. (2017). Molecular characterization of lumpy skin disease virus and sheep pox virus based on P32 gene. Bulgarian Journal of Veterinary Medicine, 20 (2), 131-140.
23. Salib, F.A. and Osman, A.H. (2011). Incidence of lumpy skin disease among Egyptian cattle in Giza Governorate, Egypt. Veterinary World, 4 (4), 162-167.
24. Sanz-Bernardo, B., Haga, I.R., Wijesiriwardana, N., Hawes, P.C., Simpson, J., Morrison, L.R., MacIntyre, N., Brocchi, E., Atkinson, J., Haegeman, A. and De Clercq, K. (2020). Lumpy skin disease is characterized by severe multifocal dermatitis with necrotizing fibrinoid vasculitis following experimental infection. Veterinary Pathology, 57(3), 388-396.
25. Şevik, M. and Doğan, M. (2017). Epidemiological and molecular studies on lumpy skin disease outbreaks in Turkey during 2014–2015. Transboundary and Emerging Diseases, 64 (4), 1268-1279.
26. Sprygin, A., Artyuchova, E., Babin, Y.U., Prutnikov, P., Kostrova, E., Byadovskaya, O. and Kononov, A. (2018). Epidemiological characterization of lumpy skin disease outbreaks in Russia in 2016. Transboundary and Emerging Diseases, 65 (6),1514-1521.
27. Sprygin, A., Pestova, Y., Bjadovskaya, O., Prutnikov, P., Zinyakov, N., Kononova, S., Ruchnova, O., Lozovoy, D., Chvala, I. and Kononov, A. (2020). Evidence of recombination of vaccine strains of lumpy skin disease virus with field strains, causing disease. PLoS One, 15 (5), p.e0232584.
28. Tulman, E.R., Afonso, C.L., Lu, Z., Zsak, L., Kutish, G.F. and Rock, D.L.(2001). Genome of lumpy skin disease virus. Journal of Virology, 75 (15), 7122-7130.
29. Tuppurainen, E., Alexandrov, T. and Beltrán-Alcrudo, D.J.F.A.P. (2017). Lumpy skin disease-a manual for veterinarians. FAO Animal Production and Health Manual, Rome, Italy. (20).
30. Tuppurainen, E.S., Stoltsz, W.H., Troskie, M., Wallace, D.B., Oura, C.A.L., Mellor, P.S., Coetzer, J.A. and Venter, E.H. (2011). A potential role for ixodid (hard) tick vectors in the transmission of lumpy skin disease virus in cattle. Transboundary and Emerging Diseases, 58 (2), 93-104.
31. Tuppurainen, E.S., Venter, E.H. and Coetzer, J.A.W. (2005). The detection of lumpy skin disease virus in samples of experimentally infected cattle using different diagnostic techniques. Onderstepoort Journal of Veterinary Research, 72 (2),153-164.
32. Tuppurainen, E.S.M. and Oura, C.A.L. (2012). Lumpy skin disease: an emerging threat to Europe, the Middle East and Asia. Transboundary and Emerging Diseases, 59 (1), 40-48.
33. Tuppurainen, E.S.M., Venter, E.H., Shisler, J.L., Gari, G., Mekonnen, G.A., Juleff, N., Lyons, N.A., De Clercq, K., Upton, C., Bowden, T.R. and Babiuk, S. (2017). Capripoxvirus diseases: current status and opportunities for control. Transboundary and Emerging Diseases, 64 (3), 729-745.

****