REVIEW ARTICLE Bhartiya Krishi Anusandhan Patrika, Volume 37 Issue 3: 241-244 (September 2022)

Lumpy Skin Disease: Emerging Concern for Livestock Owners: A Review

Aakriti Pathania, Adarsh Mishra, Yashpal Singh Malik

10.18805/BKAP594

ABSTRACT

Lumpy skin disease is a transboundary viral disease that affects cattle and buffaloes. It is caused by lumpy skin disease virus (LSDV) of genus *Capripoxvirus* and *Poxviridae* family. It is now spreading in a rapid pace in many countries especially in South Asia. The primarily noticeable symptoms of the disease include a lump like formation on the outer skin and mucosal membrane of buffaloes and cattle. It is an arthropod vector borne disease. LSD causes high morbidity and low to moderate mortality in the affected herd. It also often causes abortion in pregnant animal and infertility in male. Milk production is also reduced in affected milch animals. Strict quarantine, control of vector population and vaccination are some of the effective precautionary measures to control the ailment. Present mini-review highlighted various risk factors, transmission, clinical signs as well as precautionary measures to control LSD.

Key words: *Capripoxvirus*, Lumpy skin disease, Preventive measure, Risk factors.

Livestock industry, a prime part of agriculture sector is contributing a major share towards country's gross value added (GVA). However, this industry faces severe economic loss due to various infectious diseases time-to-time. Lumpy skin disease (LSD) is one of the emerging infectious diseases in Indian subcontinent affecting cattle and buffaloes. It is caused by LSD virus (LSDV), a *Poxviridae* family member which belongs to *Capripoxvirus* genus and subfamily *Chordopoxvirniae*. The disease is also known as knopvelsiekte, exanthema nodularisbovis and pseudo-urticaria (Tuppurainen *et al.,* 2017). Currently, the disease has emerged as a devasting threat for the large domesticated ruminants in Asia, Europe and Middle East. The disease is enlisted by the WOAH (World Organization for Animal Health, formerly OIE) as one of the trans-boundary diseases. Disease is found more prevalent in cattle compared to buffaloes. The disease is characterized by nodular skin lesions especially in head, neck, brisket and back regions of effected animals. It also results in infertility in bulls, abortion in pregnant animals as well as drop in milk production (Sudhakar *et al*., 2020). The draught animals are also seen affected with signs of lameness, leading to economic loss to the farmers.

Lately, LSD has appeared in certain countries in Southern Asia. It was first reported in Bangladesh in mid-2019 (Badhy *et al.,* 2021) followed by its transmission to Indian subcontinent. In India, the disease was first reported in Odisha, an eastern state of the country in 2019 (Sudhakar *et al*., 2020) during the peak monsoon seasons. Following its initial appearance, it gradually got transmitted to southern states of the country. Recently, in 2022 it appeared as one of the most contagious diseases affecting large ruminants in northern and western states of the country *i.e.* Gujarat, Rajasthan, Punjab, Haryana, Uttar Pradesh, Himachal Pradesh *etc*.

College of Animal Biotechnology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 004, Punjab, India.

Corresponding Author: Yashpal Singh Malik, College of Animal Biotechnology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 004, Punjab, India.

How to cite this article: Pathania, A., Mishra, A. and Malik, Y.S. (2022). Lumpy Skin Disease: Emerging Concern for Livestock Owners: A Review. Bhartiya Krishi Anusandhan Patrika. 37(3): 241-244. DOI: 10.18805/BKAP594.

Submitted: 19-09-2022 **Accepted:** 22-09-2022 **Online:** 06-10-2022

Etiology

The causative agent is an enveloped brick-shaped, double-stranded DNA virus that replicates in the cytoplasm of the host cell. The virus has approximately 151 kbp long genome. It has similarities to other members of the *Capripoxvirus* genus *i.e.* sheeppox and goatpox virus.

The virus can survive for a long duration in environment. It survives approximately up to 35 days in the dried epidermal crusts, 33 days in necrotic nodules and at least 18 days in air-dried hides. Virus becomes inactive at temperatures of 55°C for 2 hours and 65°C for 30 minutes. Although it is sensitive to extremely alkaline or acidic pH, virus can be maintained at pH 6.6 to 8.6 for five days without a substantial decrease in titers. Virus is also vulnerable to chemicals like ether, chloroform, formalin, phenol, sodium hypochlorite, iodine compounds and quaternary ammonium compounds (OIE, 2021). Since, LSDV is extremely stable, it can be retrieved from skin nodules preserved at -80°C even after years.

Host range

Cattle and buffaloes, both are susceptible to the LSD infections. Zebu cattle (*Bos indicus*) as well as exotic cattle (*Bos taurus*) are equally susceptible to the infection,

however, disease prevalence is more in exotic cattle. Compared to adults, calves are more susceptible and develop lesions in 24 to 48 hours (Al-Salihi and Hassan, 2015). Although wild animals are supposed to be resistant to infection in their natural habitats, clinical lesions have been produced following experimental infection in giraffes (*Giraffe camelopardalis*), impala (*Aepyceros melampus*), springboks (*Antidorcas marsupialis*), Arabian oryx (*Oryx leucoryx*) and Thomson's gazelles (*Eudorcas thomsonii*) (Greth *et al*., 1992; CFSPH, 2003-2017).

Transmission

LSD is a vector borne disease. Summer months and start of seasonal rain which coincides with the peak activities of vectors, increase the incidence of the disease dramatically. Notably, disease incidence declines with the arrival of winter season and increases again on the onset of upcoming spring and summer seasons (EFSA *et al*., 2020). It has been observed that tick species like *Amblyomma spp.,* especially *Amblyomma hebraeum*, *Rhipicephalus decoloratus* and *Rhipicephalus appendiculatus* acts as mechanical vectors (Lubinga *et al.,* 2013). In addition, mosquitoes like *Culex mirficens* and *Aedes natrionus;* biting flies like *Stomoxys calictrans* and *Biomyia fasciata* acts as mechanical vectors for the transmission of disease within animals (Sohier *et al*., 2019). Animals sharing feeding and watering troughs may become infected indirectly (Fig 1). Transmission occurs through blood, milk, saliva as well as nasal and lachrymal secretions. Virus can also spread through intrauterine route (Rouby and Aboulsoud, 2016). From infected dam, the infection can be passed on to calves either through milk or skin abrasions. Transmission may also occur through semen (Annandale *et al*., 2014; Sudhakar *et al*., 2020) where virus remains alive up to 42 days post infection (Irons *et al*., 2005). Use of single needle during mass vaccination may also act as a possible route of disease transmission.

Clinical signs and symptoms

Incubation period of the disease may vary, which may take up to 2-5 weeks in clinical cases; whereas it may be of 7-14 days in laboratory conditions (OIE, 2021). The disease occurs in three different forms: acute, sub-acute and chronic. Biphasic fever is the first symptom of the sickness (Gupta *et al*., 2020). The temperature of the infected animals rises to 40-41.5°C, which may last for 6-72 hours or longer and in rare cases it may go up to 10 days. The animals with infection also exhibit lacrimation, increased nasal and pharyngeal secretions, anorexia, dysgalactia, general sadness and reluctance to move. The severity of the initial clinical manifestations of LSD varies depending on the herd management technique. Several nodular lesions appear on the skin, which may be in patches or appear as generalized lesions all over the skin of affected animal (Fig 2a). Skin nodules are found on face, eyelids, neck, snout, nostrils, udder and limbs. These erupted nodules appear as round, irregular and approximately 5-50 nm in diameter. These may appear as concentric rings of hard patches with an elevation on skin. The cutaneous lesions involve the epidermis, dermis and sub-cutaneous layer of the skin. These lesions are often edematous in nature, which gradually become harder. The lesions develop into papules, vesicles, pustules with exudate and finally scab development. Lesions eventually develop on the mucous membranes of the gastrointestinal and respiratory tract especially mouth, nostrils and vulva. Nodular lesions are often observed in internal organs. The skin sores harden and become necrotic after 2 to 3 weeks making the

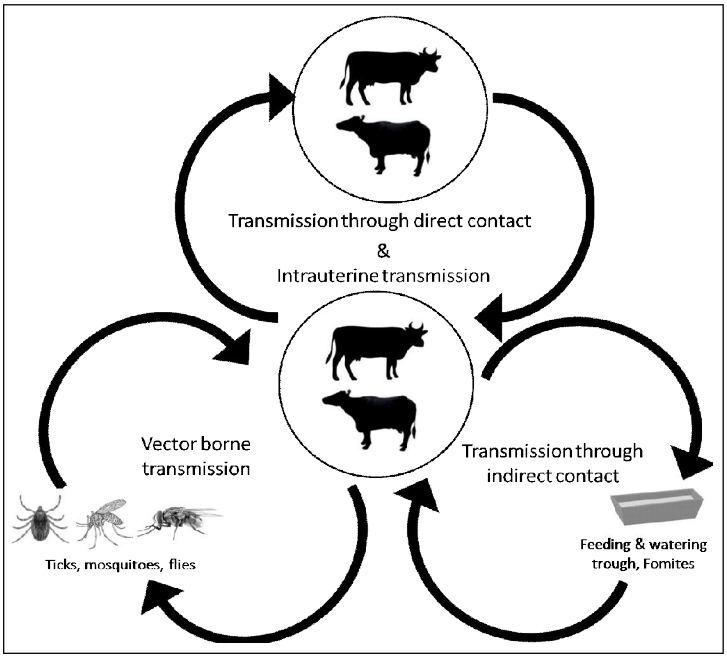

Fig 1: Routes of transmission of Lumpy skin disease in cattle and buffaloes.

animal uncomfortable. Often of tendosynovitis and laminitis are observed making the animals difficult to move (Fig 2b). The characteristic lesion “sitfast” may slough, leaving the holes that may lead to bacterial invasion as well as invasion of screwworm flies, both of which can result in septicemia (Abutarbush, 2016). LSD often accompanied with the side effects *viz*., pneumonia. Often, in the pregnant animal, abortion occurs. Infertility in male as well as female animals often results due to this illness.

Diagnosis

For diagnosis of LSD, suspected clinical samples are usually collected from the nodular skin lesions by skin biopsy or punch biopsy method. Blood samples may be collected in EDTA vials for PCR based detection or in serum vials for serological detection. In case of any mortality, tissue samples like lungs, liver, heart and kidneys may be collected; however, the epidermal skin lesions are proved as best for diagnosis of LSD (Zeynalova *et al*., 2016). The clinical samples are transported in viral transport media or any other suitable transport medium containing 20 to 50 per cent glycerol in phosphate buffered saline over ice. The samples are packaged in triple packaging system, recommended for transportation of contagious materials following proper biosecurity measures. The dispatch should be properly labeled with the type of clinical materials and any another relevant information as specified by the concerned diagnostic laboratory.

The clinical symptoms of LSD may be mistaken for certain other disease conditions of infectious origin like Foot-and-Mouth Disease (FMD), Cowpox, buffalopox and demodicosis or non-infectious origin like insect-bite and hypersensitivity reactions. Hence, differential diagnosis of LSD from other such ailments should be ruled out. However, the contagious nature of LSD in infected population makes the differential diagnosis clearer from non-infectious ones. Virus can be isolated using appropriate cell-lines in reference laboratories with high containment facility for confirmatory diagnosis. Vero cell culture is mostly used for the purpose of virus isolation apart from primary cell cultures. Electron microscopy can be used for observation of virus in cell culture as well as in clinical skin samples. Typical histological changes in skin samples includes vasculitis and perivascular infiltration with white cells that results in a thrombosis of the vessel in the dermis and subcutis. The epithelial cells “celles clavelauses” invading the lesions are similar to those found in other capripox virus infections like goatpox and sheeppox. At present, molecular diagnostics are evolved as promising platforms for rapid diagnosis of such elements. Polymerase chain reaction (PCR) based amplification techniques like conventional PCR and Real-time PCR are used in the laboratories with diagnostic facilities.

Prevention and control

Prevention and control of LSD is very curial not only in order to minimize its threatening spread in susceptible bovine population, but also its possible chance of spill-over to wild ruminants or appearance in other animal hosts. Unfortunately, no effective treatment is present till now specifically against LSD. The only protective way of this is to restrict the movement of infected animal to stop the transboundary spread. If any symptoms appear, animal should be separated from rest of the herd to prevent fast spread of the disease within the herd. Another possible way to prevent the incidence of the disease is through controlling the vector population. Especially, attention should be focused on reducing the breeding places of these vectors by using appropriate insecticides. The secondary bacterial infections may be checked with the use of appropriate antibiotics. In remote places, certain herbal formulations are in use for topical application over the infected area of the animal body to minimize the disease transmission. At present, live attenuated goatpox vaccine is being used for vaccinating the susceptible population for controlling LSD infection as one of the prophylactic measures in India. However, homologous vaccines are always preferred compared to vaccines of heterologous origin. A LSD vaccine

(a) (b)

Fig 2: Nodular skin lesions in brisket and back regions of LSD affected animal (a); laminitis and tendosynovitis leading to lameness in LSD affected cattle (b).

based on Indian virus strain has been launched recently by Indian Council of Agricultural Research.

CONCLUSION

Effective disease surveillance, use of appropriate diagnostics and adoption of suitable preventive strategy are some of the pre-requisites for successful control of a disease epidemic in a particular geographical area or a country. LSD has appeared as one of the emerging pathogens affecting bovine population in India. The root of the disease is gradually spreading with appearance of clinical incidences in new geographical boundaries. Country is now progressing towards development of suitable diagnostic as well as preventive strategies for controlling the ailment. However, strict vigilance by the regional, state level as well as national governing bodies are crucial for effective surveillance of the disease condition. Transparent as well as early system of reporting any disease incidence is crucial for disease preparedness. Following the initial appearance of LSD in 2019, the magnitude of the disease severity is changing gradually and it is anticipated that appropriate monitoring of the incidences will reveal the diversity and nature of the circulating pathogen in the country. In addition, appropriate vaccination strategy either with homologous or heterologous vaccines are the need of the hour to control the ailment.

Conflict of interest: None.

REFERENCES

Abutarbush, S. (2016). Adverse reactions to field vaccination against lumpy skin disease in cattle. International Journal of Infectious Diseases. 45: 164. https://doi.org/10.1016/j.ijid.2016.02.390.

Al-Salihi, K. and Hassan, I. (2015). Lumpy skin disease in Iraq: Study of the disease emergence. Transboundary and Emergering Disease. 62(5): 457-462.

Annandale, C.H., Holm, D.E., Ebersohn, K. and Venter, E.H. (2014). Seminal transmission of lumpy skin disease virus in heifers. Transboundary and Emergering Disease. 61: 443-448.

Badhy, S.C., Chowdhury, M.G.A., Settypalli, T.B.K., Cattoli, G., Lamien, C.E., Fakir, M.A.U., Akter, S., Osmani, M.G., Talukdar, F., Begum, N., Khan, I.A., Rashid, M.B. and Sadekuzzaman, M. (2021). Molecular characterization of lumpy skin disease virus (LSDV) emerged in Bangladesh reveals unique genetic features compared to contemporary field strains. BMC Veterinary Research. 17: 61. DOI:10.1186/s12917-021-02751-x.

CFSPH. (2003-2017). Lumpy skin disease. The Center for Food Security and Public Health. Pp: 1-5.

EFSA, Calistri, De, P., Clercq, K., Gubbins, S., Klement, E., Stegeman, A., Cortiñas, Abrahantes, J., Marojevic, D., Eleni, Antoniou, S. and Broglia, A. (2020). Lumpy skin disease epidemiological report IV: Data collection and analysis. EFSA Journal. 18(2): 6010. DOI: https://doi.org/10.2903/j.efsa.2020.6010.

Greth, A., Gourreau, J.M., Vassart, M., Nguyen-Ba-Vy., Wyers, M. and Lefevre, P.C. (1992). Capripoxvirus disease in an Arabian oryx (*Oryx leucoryx*) from Saudi Arabia. Journal of Wildlife Disease. 28(2): 295-300.

Gupta, T., Patial, V., Bali, D., Angaria, S., Sharma, M. and Chahota, R. (2020). A review: Lumpy skin disease and its emergence in India. Veterinary Research Communication. 44(3-4): 111-118.

Irons, P.C., Tuppurainen, E.S. and Venter, E.H. (2005). Excretion of lumpy skin disease virus in bull semen. Theriogenology. 63: 1290-1297.

Lubinga, J., Tuppurainen, E., Mahlare, R., Coetzer, J., Stoltsz, W.H. and Venter, E.H. (2013). Evidence of transstadial and mechanical transmission of lumpy skin disease virus by Amblyomma hebraeum ticks. Transboundary and Emergering Disease. 62: 174-182.

OIE. (2021). Lumpy Skin Disease. In: OIE Terrestrial Manual. Chapter 3.4.12, pp: 1-13.

Rouby, S. and Aboulsoud, E. (2016). Evidence of intrauterine transmission of lumpy skin disease virus. The Veterinary Journal. 209: 193-195.

Sohier, C., Haegeman, A., Mostin, L., De, Leeuw, I., Campe, W.V., De, Vleeschauwer, A., Tuppurainen, E.S.M., Van, Den, Berg, T., De, Regge, N. and De, Clercq, K. (2019). Experimental evidence of mechanical lumpy skin disease virus transmission by *Stomoxyscalcitrans* biting flies and *Haematopota* spp. horseflies. Scitific Reports. 9: 20076.

Sudhakar, S.B., Mishra, N., Kalaiyarasu, S., Jhade, S.K., Hemadri, D., Sood, R., Bal, G.C., Nayak, M.K., Pradhan, S.K. and Singh, V.P. (2020). Lumpy skin disease (LSD) outbreaks in cattle in Odisha state, India in August 2019: Epidemiological features and molecular studies. Transboundary and Emergering Disease. 67(6): 2408-2422.

Tuppurainen, E., Alexandrov, T. and Beltran-Alcrudo, D. (2017). Lumpy skin disease field manual-A manual for veterinarians. FAO animal production and health manual No. 20. Rome. Food and Agriculture Organization of the United Nations (FAO). 60 pages.