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Lumpy skin disease (LSD): An overview

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Abstract

A contagious, eruptive, and occasionally fatal disease of cattle, lumpy skin disease is characterised by nodules on the skin and other body regions. The situation is frequently made worse by secondary bacterial infection. Although it can happen in the winter, its occurrence is greater in humid summer conditions. It is mainly common in low-lying areas and beside waterways. The time of incubation is 4 to 14 days. To prevent the transmission of infection, attenuated virus vaccines like the LSDV live attenuated vaccine and the sheepox or goatpox virus live attenuated vaccine may be administered.

Keywords: LSD, *poxviridae*, mechanical transmission, neethling strain, homologous and heterologous live attenuated vaccine

Introduction

Lumpy skin disease (LSD) is a viral disease caused by the *Lumpy skin disease virus (LSDV)*, a member of the *Capripoxvirus* genus of the *Poxviridae* family. The disease is known by various names such as “LSD”, “Pseudo-urticaria”, “Neethling virus disease”, “exanthema nodularis bovis” and “knopvelsiekte”^[1]. LSD is a non-zoonotic, vector-borne and transboundary disease with a limited host range and currently restricted to ruminants *viz.* cattle and water buffaloes. It is a notifiable disease having a devastating effect on international livestock trade^[2, 3]. The disease is transmitted by arthropod vectors and causes high morbidity and low mortality. LSD has recently been reported first time in India with 7.1% morbidity among cattle. The disease is endemic in African and Middle East countries but has started spreading to Asian and other countries. It has been recently reported from China and Bangladesh sharing borders with India^[4]. Over 97,000 cattle died between July and September 23, 2022, due to the outbreak of lumpy skin disease in India. Cattle in 15 states across India were afflicted in three months, starting with epidemics in Gujarat and Rajasthan. The lumpy skin disease had spread across 251 districts in 15 states and affected over 20 lakh animals till September 23, 2022^[5]. About 50% of vulnerable calves who become infected experience fever, lacrimation, nasal discharge, and hypersalivation before developing typical body eruptions.

Economic importance

Even though the morbidity and mortality rates of LSD are usually low, it is an economically important disease of cattle because of the prolonged loss of productivity of dairy and beef cattle, use of the animals for traction, decrease in body weight, mastitis, severe orchitis, which may result in temporary infertility and sometimes permanent sterility^[6]. The financial cost of infected herds was estimated to be 27.9 British pounds per head in the Jordan outbreak^[7]. The average financial cost in infected herds was estimated to be 6.43 USD per head for local zebu and 58 USD per head for Holstein Friesian or crossbred cattle^[8]. Gujarat reported a decrease in milk collection in August 2022 of about 100,000 litres per day in some areas^[9]. In August 2022, milk collection in Rajasthan plummeted by almost 20%; by September, it had fallen by 500,000–600,000 litres per day^[10].

Etiology

Lumpy skin disease virus (LSDV) causes Lumpy skin disease that belongs to the *Poxviridae* family that contains a group of viruses causing diseases in most domestic animals except dogs. *LSDV* is a brick-shaped enveloped virus, 320 × 260 nm in size, with double-stranded DNA have complex symmetry and replicates in the cytoplasm of the host cell^[11]. The *LSDV* genome (151-kbp) consists of a central coding region bounded by identical 2.4 kbp-inverted terminal repeats. *LSDV* contains 30 structural and non-structural genes homologous to sheep pox and goat pox virus sharing 97% nucleotide identity^[12].



Fig 1: History of LSD

Epidemiology

The morbidity rate varies between 10 and 20%. Mortality rates range between 1 to 5%. LSDV is highly host-specific and causes diseases only in cattle (*Bos indicus* and *Bos taurus*) and water buffalo (*Bubalus bubalis*). There is evidence from a study in Ethiopia of differential breed susceptibility to LSD, with Holstein Friesian or crossbred cattle exhibiting higher morbidity and mortality due to LSD when compared with local zebu cattle ^[13].

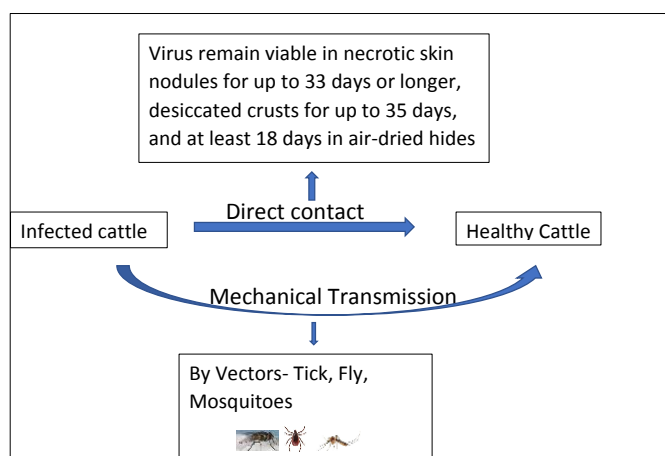
Disease Transmission

Principle method: Mechanical transmission by arthropod vectors such as mosquitoes (e.g. *Culex mirificens* and *Aedes natrionus*), biting flies (e.g. *Stomoxys calcitrans* and *Biomyia fasciata*) and male ticks (*Rhipicephalus appendiculatus* and *Amblyomma hebraeum*) and Minor source: Direct contact or Ingestion of contaminated feed and water.

Pathogenesis

Host susceptibility, dose and route of virus inoculation affect the severity of the disease. Intravenous, intradermal and subcutaneous routes are used in experimental infection. In natural infection, very young calves, lactating cows, and malnourished animals seem to develop a more severe disease that may be due to impaired humoral immunity. A localized swelling at the site of inoculation after four to seven days and enlargement of the regional lymph nodes, develop after subcutaneous or intradermal inoculation of cattle with *LSDV*. However, a generalized eruption of skin nodules usually occurs seven to 19 days after inoculation. *LSDV* replicates inside the host cells such as macrophages, fibroblasts, pericytes and endothelial cells in the lymphatics and blood vessel walls leading to developing vasculitis and lymphangitis, while thrombosis and infarction may have developed in severe cases. Viraemia occurred after the initial febrile reaction and persisted for two weeks. *LSDV* was

demonstrated in saliva at least 11 days after the development of fever, in semen for 42 days and in skin nodules for 39 days, from experimentally infected cattle ^[14].



Clinical signs

Clinical signs such as a fever that may exceed 41°C, Cutaneous nodules of 2–5 cm in diameter, particularly on the head, neck, limbs, udder, genitalia and perineum within 48 hours of the onset of the febrile reaction and large nodules may become necrotic and eventually fibrotic and persist for several months (“sit fasts”). Recovery from severe infection is slow due to emaciation, secondary pneumonia, mastitis, and necrotic skin plugs, which are subject to fly strike and shed leaving deep holes in the hide ^[13].

Diagnosis

Diagnosis is based on field presumption diagnosis and laboratory tests. Isolation of the virus is done by growing on the chorioallantoic membrane of embryonated chicken eggs and African green monkey kidney (Vero) cells. *LSDV*

produce Haemorrhagic pock lesions and thickening of CAM. Other techniques like Electron microscopy, Fluorescent antibody tests, Immunohistochemistry and Polymerase chain reaction can be used. Virus Neutralization Assay is currently the gold standard test for the detection of *LSDV* ^[13].



Fig 2: Cutaneous lesions in affected animals

Treatment

Sick animals should be removed from the herd and follow supportive treatment such as antibiotics, anti-inflammatory drugs, and vitamin injections. These therapies usually reduce chances for the development of secondary bacterial infections, inflammation and fever, thus improving the appetite of the animal.

Prevention and Control

Successful control and eradication of LSD relies on early detection of the case, followed by a rapid and widespread vaccination campaign.

Vaccines

- “Homologous” *LSDV* live attenuated vaccine strain for example “Neethling strain” can be used.
- “Heterologous” *sheeppox* or *goatpox virus* live attenuated vaccine strain can be used (13).
 - A public awareness campaign about the clinical symptoms and production losses caused by LSD should be carried out. When suspicious instances are discovered, they should be reported to the veterinary authority as soon as possible.
 - Animals suspected of having febrile nodular skin disease should not be introduced to farms.
 - Efforts should be undertaken to minimize the number of vectors in impacted regions. To reduce mechanical transmission of LSD, unaffected animals should be treated with insect repellent (ticks, flies, mosquitoes, fleas, midges).
 - Impacted animals should be kept away from unaffected animals in affected communities and livestock holdings by preventing communal grazing and hence direct contact.
 - All biosecurity precautions and stringent sanitary procedures should be followed while discarding personal protective equipment (PPE), among other things, used when sampling from affected animals.

- Following the detection of the illness in the afflicted areas, trading in live cattle and participation in fairs and exhibits should be prohibited immediately.
- It is important to thoroughly clean and disinfects all affected individuals, locations, and the polluted environment, including any vehicles that pass through the afflicted animal holdings with a disinfectant like phenol (2%/15 minutes), sodium hypochlorite (2–3%), iodine compound (1:33 dilution) and quaternary ammonium compounds (0.5%).
- Semen from animals exhibiting clinical signs of LSD should not be collected, processed, or distributed as frozen bovine semen.
- Before being used for AI/natural service, the blood and semen from afflicted and clinically recovered animals must undergo agent identification by PCR with negative findings.

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