

Lumpy Skin Disease

Aruna Maramulla

* Contract teaching faculty, Department of VCC, College of veterinary science, Mamnour, P.V Narasimha Rao Telangana Veterinary University, Hyderabad, Telangana:
<https://doi.org/10.5281/zenodo.8190179>

Introduction

Lumpy skin disease is a vector born unnoticed viral disease caused by the lumpy skin disease virus under the family Poxviridae. Currently, the disease has emerged emerging threat to large domesticated ruminants (cattle and water buffalo). The severity of clinical signs of LSD depends on the strain of Capri pox virus and the host cattle breed. Lumpy skin disease (LSD) causes huge economic losses in the livestock industry. It is caused by the Lumpy skin disease virus (LSDV) which belongs to the family Poxviridae, with the Neethling strain as the prototype. LSDV belongs to the genus Capri poxvirus which includes sheep pox virus and goat pox virus. LSD is an enzootic infectious, eruptive and seldom fatal disease of cattle characterized by nodules on the skin. Cattle and water buffalo are the only animal species affected, with a high morbidity rate, but low mortality, however, death rates are higher among calves. LSD causes loss of milk and beef production, abortions in females and sterility in males. The original foci of LSD are from Zambia in 1929. LSD is considered an endemic disease in the African continent. However, the disease has been moved beyond Africa in 1984. It is reported in Madagascar and some countries in the Arab Gulf Peninsula and the Middle East. Recently, the disease is reported in LSD-free countries (Jordan, Syria, Lebanon, Turkey, Iran and Iraq) with potential economic loss to the livestock industry. This review article intends to discuss LSD in light of the recent situation that raises concerns about the spreading of the disease in LSD-free countries.

History of LSD

The first description of the clinical signs of LSD was in 1929 in Zambia (formerly Northern Rhodesia) (Morris 1931). In the beginning, LSD signs were considered to be the consequence either of poisoning or hypersensitivity to insect bites. The same clinical signs occurred in Botswana, Zimbabwe and the Republic of South Africa between 1943 and 1945, where the infectious nature of the disease was recognized in these outbreaks.

Lumpy Skin Disease in India

The first occurrence of LSD in India was reported to the OIE on 18 November 2019. LSD was introduced first time in the month of August in 2019 in Odisha. As per (FAO 2020) out of 2539 animals presented 180 were affected with LSD and in the year 2020 the disease was prevalent in states of Maharashtra and Madhya Pradesh. LSD may be an alarm for pan India. LSD has spread into several states including Kerala, Tamil Nādu, Andhra Pradesh, Telangana, Odisha, Jharkhand, West

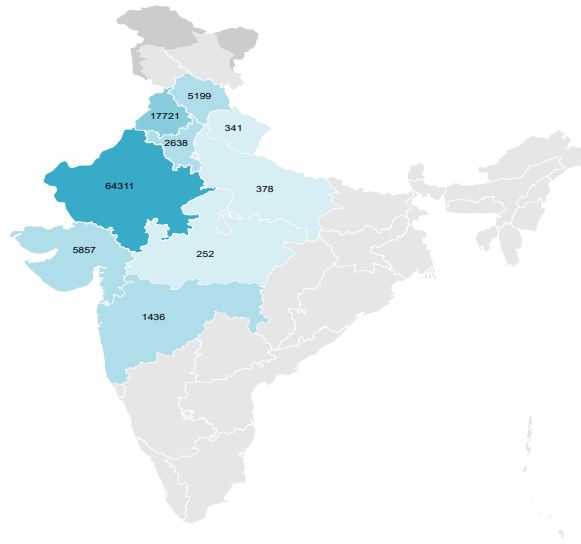
Bengal, Chhattisgarh, Maharashtra, and Madhya Pradesh. The 2022 lumpy skin disease outbreak in India resulted in the death of over 97,000 cattle in three months between July and 23 September. Starting from outbreaks in Gujarat and Rajasthan, in three months cattle in 15 states across India were affected. On 21 September, out of 18,50,000 cases over 65% of cases were from Rajasthan. Over 50,000 deaths were reported in Rajasthan. India's cattle population according to the last livestock census was 192.5 million.

State	Deaths
Gujarat	6,193
Himachal Pradesh	10,681
Punjab	17,932
Rajasthan	75,819
Uttarakhand	919
Madhya Pradesh	681
Jammu Kashmir	2,698
Uttar Pradesh	647
Haryana	2,937
Maharashtra	24,430
Goa	1
West Bengal	0
Andhra Pradesh	58
Delhi	0
Bihar	0
Tamil Nadu	0
Jharkhand	0
Karnataka	12,244
Telangana	70
Kerala	50
Chhattisgarh	0
Odisha	6
Total	1,55,366

Impact

The direct economic loss includes the value of the dead cattle, and associated losses such as a decrease in the production of milk, including a decrease in yield in infected cattle. Movement restrictions add to the indirect losses. In August 2022 Gujarat reported a dip in milk collection amounting to approximately 1,00,000 liters per day in certain locations. Collection of milk in Rajasthan fell by over 20% in August 2022; by September collection had decreased by 500,000-600,000 liters per day. In some places, the collection has fallen to zero in Rajasthan. This has not impacted the price of milk. On 12 September Mother Dairy's managing director said the impact on production was minor.





Five states with the most cattle deaths- Rajasthan, Punjab, Gujarat, Himachal Pradesh, Haryana. Other states such as Madhya Pradesh reported its first death in mid-September 2022. there have been 1436 deaths in Maharashtra. UP has seen at least 378 deaths.

Epidemiology

- Morbidity rate varies between 10 and 20%.
- Mortality rates of 1 to 5% are considered usual.

Host

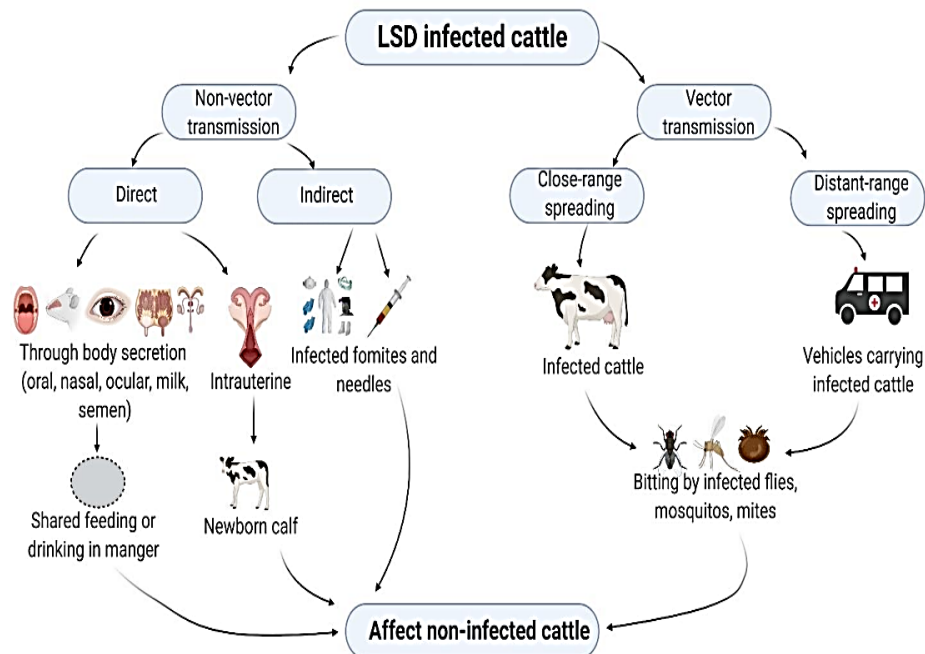
- LSDV is highly host-specific and causes diseases only in cattle (*Bos indicus* and *B. Taurus*) and water buffalo (*Bubalus bubalis*). There is evidence from a study in Ethiopia of differential breed susceptibility to LSD, with Holstein Friesian or crossbred cattle exhibiting higher morbidity and mortality due to LSD when compared with local Zebu cattle
- Extensive serological surveys of wild ruminant species in Africa have not identified a wildlife reservoir of LSDV. The virus appears to be highly hosted specifically.
- LSDV is not zoonotic.

Transmission

- The principal means of transmission is believed to be by arthropod vector. Though no specific vector has been identified to date, 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*) could play a role in the transmission of the virus. The importance of different 2 arthropod vectors is likely to vary in different areas depending on the abundance and feeding behaviour of the vector.
- Infected bulls can excrete the virus in the semen, however transmission of LSD via infected semen has not been demonstrated.
- It is not known if transmission can occur via fomites, for example, ingestion of feed and water contaminated with infected saliva.



- Animals can be infected experimentally by inoculation with material from cutaneous nodules or blood.
- Direct contact is considered to play a minor if any, role in the transmission of the virus.



Aedes aegypti mosquito
Sources of Virus

Stomoxys calcitrans fly

Amblyomma hebraeum tick

- Skin nodules, scabs and crusts contain relatively high amounts of LSDV. Viruses can be isolated from this material for up to 35 days and likely for longer.
- LSDV can be isolated from blood, saliva, ocular and nasal discharge, and semen.
- LSDV is found in the blood (viremia) intermittently from approximately 7 to 21 days post-infection at lower levels than present in skin nodules
- Shedding in semen may be prolonged; LSDV has been isolated from the semen of an experimentally infected bull 42 days post-inoculation. There has been one report of placental transmission of LSD.
- LSD does not cause chronic disease. It does not exhibit latency and recrudescence of disease does not occur.

Clinical Signs

LSD signs range from inapparent to severe disease. There is no current evidence of variation



in virulence regarding the different LSDV strains.

Fever that may exceed 41°C., Marked reduction in milk yield in lactating cattle. Depression, anorexia and emaciation. Rhinitis, conjunctivitis and excessive salivation. Enlarged superficial lymph nodes. Cutaneous nodules of 2–5 cm in diameter develop, particularly on the head, neck, limbs, udder, genitalia and perineum within 48 hours of onset of the febrile reaction. These nodules are circumscribed, firm, round and raised, and involve the skin, subcutaneous tissue and sometimes even the underlying muscles. Large nodules may become necrotic and eventually fibrotic and persist for several months (“sitfasts”); the scars may remain indefinitely. Small nodules may resolve spontaneously without consequences. Myiasis of the nodules may occur. Vesicles, erosions and ulcers may develop in the mucous membranes of the mouth and alimentary tract and in the trachea and lungs. Limbs and other ventral parts of the body, such as the dewlap, brisket, scrotum and vulva, may be edematous, causing the animal to be reluctant to move. Bulls may become permanently or temporarily infertile. Pregnant cows may abort and be in anestrus for several months. 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.



LSD-affected cattle attended at Veterinary Clinical Complex, Warangal with multiple skin lesions all over the body, oedema of brisket and limbs

Clinical Pathology

Gross Pathological Findings

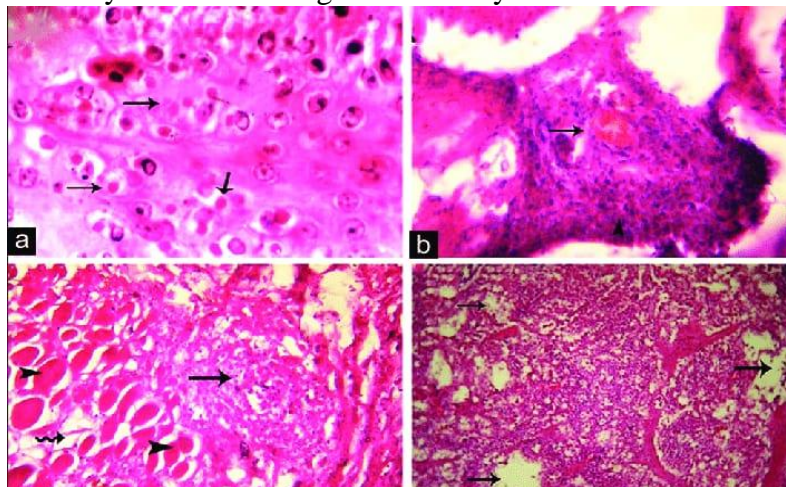
LSD has well-described gross lesions. Skin nodules are usually uniform in size, firm round and raised, but some may fuse into large irregular and circumscribed plaques. The cut surface of the nodules is reddish-gray, in addition, to the accumulation of the reddish-grey serous fluid and edema in the subcutis layer. The resolved lesions appear as indurated which is called “sitfasts” or seclude or may form deep ulcers. The typical circular necrotic alimentary lesions may also be seen on the muzzle, nasal cavity, larynx, trachea, bronchi, inside of lips, gingiva, dental pad, forestomach, abomasum, uterus, vagina, teats, udder and testes. Regional lymph nodes are grossly enlarged and can be 3-5 times their usual size, oedematous and have pyaemic foci, in addition to local cellulitis. Muscle tissue and the fascia over limb muscle may show nodular lesions that are grey-white surrounded by red inflammatory tissue. The same nodules are distributed throughout the carcass. It is about 10-30 mm in diameter in the kidney. Interstitial or bronchopneumonia associated with 10-20 mm diameter lesions are also scattered in the lungs. These lesions result from infiltration of the large epithelioid 'celles claveleuses', described by Borrel for sheep pox. The lesions are separated from the necrotic epithelium far from the healthy tissue. The necrotic tissue sloughs away to leave an ulcer that slowly heals by granulation. Severely infected animals may show secondary bacterial pneumonia, tracheal stenosis, acute and chronic orchitis, mastitis with secondary bacterial infection, and similar lesions in the female reproductive tract.



Histopathological Findings

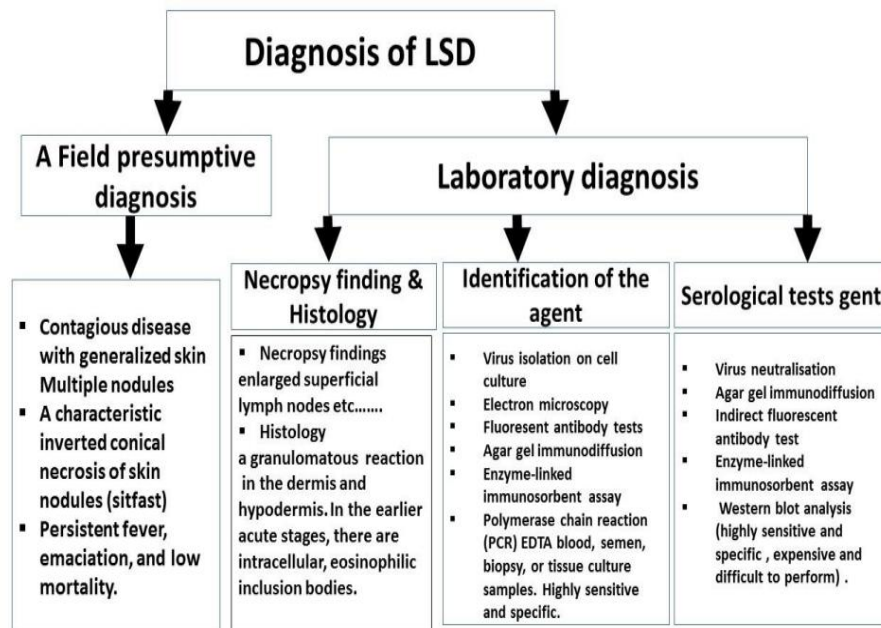


Histopathological findings of the LSD disease are very characteristic and provide a basis for diagnosis. The lesions vary considerably depending on the stage of development. In the acute stage of the disease, it is mostly characterized by lesions of vasculitis, thrombosis, infarction, and perivascular fibroplasia. An inflammatory cell infiltrated the infected areas, which include macrophages, lymphocytes and eosinophils. Keratinocytes, macrophages, endothelial cells and pericytes may be revealed in Intracytoplasmic eosinophilic inclusions. The epidermis and dermis layers of the infected animal are showing edema and are infiltrated with large epithelioid macrophage-type cells. There are edema and infiltration of the epidermis and dermis with large epithelioid macrophage-type cells, which have also been well described for sheep pox. They are found with plasma cells and lymphocytes in early lesions, and in older lesions, fibroblasts and polymorphonuclear leucocytes with some red cells predominate. Endothelial proliferation is seen in the blood vessels of the dermis and subcutis, with lymphocytic cuffing of the blood vessels, which lead to the thrombosis and necrosis. Specific intracytoplasmic inclusions may be found in the various epithelial elements, sebaceous glands and follicular epithelium. These are largely eosinophilic-purple and appear to have a clear halo surrounding them, which is probably a processing artefact. The lesions are substantially the same throughout the body.



- A. Eosinophilic intracytoplasmic inclusion bodies(arrows).
 B. Necrotic vasculitis in dermal arteriole with infiltration of neutrophils (arrows).
 C. Zenker's necrosis in the dermal muscles (arrowheads) and mononuclear cell aggregation (arrows).
 D. Severe edema (arrows) and infiltration of neutrophils





Diagnosis

Differential Diagnosis

Severe LSD is highly characteristic, but milder forms can be confused with the following:

- Bovine herpes mammillitis (bovine herpesvirus 2) (sometimes known as pseudo-lumpy skin disease)
- Bovine papular stomatitis (Parapoxvirus)
- Pseudocowpox (Parapoxvirus)
- Vaccinia virus and Cowpox virus (Orthopoxviruses) – uncommon and not generalised infections
- Dermatophilosis
- Demodicosis
- Insect or tick bites
- Besnoitiosis
- Rinderpest
- Hypoderma bovis infection
- Photosensitisation
- Urticaria
- Cutaneous tuberculosis
- Onchocerciasis

Treatment

Lumpy skin disease is caused by a virus that has no known cure. However, supportive therapy is used.

Supportive Therapy

1. Antibiotic- Inj. Dicrysticine-SH- 3g - I/M
2. Anti-inflammatory- Inj.Melonex - 0.2-0.3mg/kg B.wt - I/M (or)
Inj.Flunimeg - 1.1-2.2mg/kg B.wt - I/M
3. Anti-Histamine - Inj.avil - 30-50mg TD -I/M



4. Diuretic - Inj.Ridema - 2mg/kg B.wt - I/M
5. Fluid therapy- DNS, RL Intalyte -I/V
6. Vitamins - Inj.Tribivet- 10-15ml -I/M
7. Topical - Neem+Haladi paste

Prevention & Control

Control of Lumpy skin disease by quarantine and movement control is not very effective because biting flies and certain tick species are most probably the most important method of transmission of the disease. Although the control of insects was not effective in preventing the spread of LSD, the use of insecticides together with repellents can be an aid in the prevention of the spread of LSD. LSD outbreaks can be eradicated by quarantines, depopulation of infected and exposed animals, proper disposal of carcasses, cleaning and disinfection of the premises and insect control. LSD control can only be by vaccination or immunoprophylaxis. Live vaccines help control losses from lumpy skin disease in endemic areas. According to OIE, four live attenuated strains of Capripoxvirus have been used as vaccines specifically for the control of LSD. These are: a strain of Kenyan sheep and goat pox virus passaged 18 times in lamb testis (LT) cells or fetal calf muscle cells, Yugoslavian RM 65 sheep pox strain, Romanian sheep pox strain and lumpy skin disease virus strain from South Africa, passaged 60 times in lamb kidney cells and 20 times on the chorioallantoic membrane of embryonated chicken eggs.

The following vaccines have been used in protection of the animal:

- Homologous live attenuated virus vaccine (Neethling strain: immunity conferred lasts up to 3 years).
- Heterologous live attenuated virus vaccine (Sheep or goat pox vaccine, but may cause local, sometimes severe reactions). This vaccine is not advised in countries free from sheep and goat pox because the live vaccines could otherwise provide a source of infection for the susceptible sheep and goat populations.
- There is no new generation recombinant
- Capripox vaccines are commercially available

Producers of Lumpy Skin Disease Vaccines

Type of vaccine	Virus strain	Producer
Attenuated LSDV vaccines		
Onderstepoort Biological Products Lumpy skin disease vaccine for cattle	LSDV Neethling strain	OBP, South Africa
MSD Animal Health Lumpyvax	LSDV Neethling strain	MSD, Animal Health, South Africa
BOVIVAX LSD	LSDV Neethling strain	MCI Santé Animale, Morocco
Herbivac LS	LSDV Neethling strain	Deltamune, South Africa
LSD-NDOLL	LSDV Neethling strain	Dollvet, Turkey
Lumpyvac™	LSDV Neethling strain	Vetal Animal Health Products S.A., Turkey
Attenuated SPPV vaccines		
Jovivac	Sheeppox virus strain RM-65	JOVAC, Jordan
Attenuated GTPV vaccine		
Caprivac Freeze dried live attenuated Goatpox Virus strain Gorgan vaccine.	Goatpox virus strain Gorgan	JOVAC, Jordan
Potential attenuated GTPV vaccine		
Goat Pox Vaccine*	Goatpox virus, live, Uttarkashi strain	Hester, India

* Goatpox virus Uttarkashi strain vaccine needs to be validated to confirm it provides the same protection against LSD as the LSDV vaccines.



Conclusion & Recommendation

Complete recovery may take several months, it may take up to 6 months for animals severely affected by LSD virus to recover fully. Recovery from severe infection is slow due to emaciation, secondary pneumonia, mastitis, and necrotic plugs which are subject to fly strike and shed leaving deep holes in the hide. Attention should be concentrated on vector control, movement restriction, harsh quarantine, improved vaccination programs, proper veterinary care, and overall farm sanitary management to avoid incursion and spread of the contagion. Thus, the study encourages future scholars to focus on identifying the source of infection, molecular detection and characterization of the causal agent, and finally, the epidemiology and ecology of LSDV in Southeast Asia.

Reference

1. <https://www.woah.org/app/uploads/2021/03/lumpy-skin-disease.pdf>
2. <https://www.fao.org/3/i7330e/i7330e.pdf>
3. https://www.cfsph.iastate.edu/Factsheets/pdfs/lumpy_skin_disease.pdf
4. https://www.researchgate.net/publication/272795279_Lumpy_Skin_disease_Review_of_literature -
5. <https://www.ejmanager.com/fulltextpdf.php?mno=86749>
6. https://entnemdept.ufl.edu/creatures/aquatic/aedes_aegypti.htm
7. <https://images.app.goo.gl/SU8TpiK8SadwTL2F7>
8. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8136940/>
9. <https://timesofindia.indiatimes.com/blogs/voices/lumpy-virus-and-animal-husbandry-a-strong-pillar-of-rural-economy-affected-by-the-deemed-pandemic/>
10. <https://pashusandesh.com/State-wise-cattle-deaths-due-to-Lumpy-skin-disease>

