

Lumpy Skin Disease and its Emergence in India

Mohd Shoeb Abdul Mukhtar¹, Mohd. Juned Javed Patel², Shreesh Marathe³, Arti Ingale⁴, Achal Kale⁴

Asst, Professor, Pharmacology Department, New Montfort Institute of Pharmacy, Ashti, Wardha¹

HOD, Pharmaceutics Department, Vardhaman College of Pharmacy, Koli, Karanja Lad²

Lecturer, Geetadevi Khandelwal Institute of Pharmacy, Akola³

Students, Pharmacology Department, New Montfort Institute of Pharmacy, Ashti, Wardha⁴

mohd.shoeb.7588@gmail.com

Abstract: Lumpy skin disease is a viral disease that affects cattle. It is transmitted by blood-feeding insects, such as certain species of flies and mosquitoes, or ticks. It causes fever, nodules on the skin and can also lead to death, especially in animals that have not previously been exposed to the virus. Lumpy skin disease is a vector-borne pox disease of domestic cattle and Asian water buffalo and is characterized by the appearance of skin nodules. Endemic across Africa and the Middle East, the disease has, since 2015, spread into the Balkans, the Caucasus and the southern Russian federation. Outbreaks of LSD cause substantial economic losses in affected countries, but while all stakeholders in the cattle industry suffer income losses, poor, small-scale, and backyard farmers are hit hardest. The disease impacts heavily on cattle production, milk yields, and animal body condition. It causes damage to hides, abortion, and infertility. Total or partial stamping-out costs add to direct losses. Indirect losses stem from restrictions on cattle movements and trade. In addition to vectors, transmission may occur through consumption of contaminated feed or water, direct contact, natural mating or artificial insemination. Large-scale vaccination is the most effective way of limiting the spread of the disease. Effective vaccines against LSD exist and the sooner they are used the less severe the economic impact of an outbreak is likely to be.

Keywords: Lumpy Skin Disease. Tran's Boundary Spread. Outbreak. India

I. INTRODUCTION

Lumpy skin disease is an infectious viral disease caused by lumpy skin disease virus (LSDV) of *Capri poxvirus* genus, sub family *chordopoxvirinae*, family *poxviridae*. The disease is known by various name such as "LSD", "pseudo-urticarial", "nettling virus disease", "exanthema nodular is bovis", and "knopvelsiekte". LSD is a non-zoonotic, vector borne and Tran's boundary disease with limited host range and currently restricted to ruminant's viz. Cattle and water buffaloes. [1] It is transmitted by blood feeding insects such as flies, mosquitoes or ticks. Mosquitoes are seen in increased numbers during the monsoon, and scientists believe that it could be one of the reasons for the spike in the number of cows being infected. It also spreads through contaminated water and fodder. The disease not only leaves the cows with severe painful physical symptoms but can also lead to death. [2]The disease impact heavily on cattle production, milk yields and animal body condition. It cause damage to hides abortion, andinfertility .total or partial stamping-out costs and direct losses indirect losses stem from restriction on cattle movements and trade. [3]

Lumpy skin disease was first seen as an epidemic in Zambia in 1929. Initially, it was thought to be the result of either poisoning or a hypersensitivity to insect bites. Additional cases occurred between 1943 and 1945 in Botswana, Zimbabwe, and the republic of SouthAfrica. Approximately, 8 million cattle were affected in a panzootic infection in SouthAfrica in 1949, causing enormous economic losses. LSD spread throughout Africa between the 1950s and 1980s, affecting cattle in Kenya, Sudan, Tanzania, Somalia, and Cameroon. In 1989 there was an LSD outbreak in Israel. This outbreak was the first instance of LSD north of the Sahara desert and outside of the African continent. This particular outbreak was thought to be the result of infected stomoxys calcitrans being carried on wind from Ismailia in Egypt. During a period of 37 days between august and September 1989, fourteen of the seventeen dairy herds in peduyim became infected with LSD. All of the cattle as well as small flocks of sheep and goats in the village were slaughtered. Throughout the past decade, LSD occurrences have been reported in Middle Eastern, European, and west Asian regions.lsd was first reported to the Bangladesh livestock department in July 2019. Eventually 500,000head were estimated to have been infected in this outbreak. The food and agriculture organization (fao) recommended mass



vaccination. As a result of the introduction of fall armyworm and this cattle plague within a few months of each other, the FAO, the World Food Programme, Bangladesh government officials, and others agreed to begin improving Bangladesh's livestock disease surveillance and emergency response capabilities. Method of entry of the virus into Bangladesh remains unknown. In 2022 a lumpy skin disease outbreak in Pakistan killed over 7000 cattle. In India between July-September 2022 the lumpy skin disease outbreak in India resulted in the death of over 80,000 cattle. The state of Rajasthan has seen a majority of the deaths. Inter-state and inter-district movement of cattle in a number of states has been restricted. Indian Council of Agricultural Research labs have undertaken creation of an indigenous vaccine. A goat pox vaccine is being used; 15 million doses had been administered by September 2022. There are at least three centres manufacturing the goat pox vaccine in India. Institutions with authority to test have been expanded. [4]

II. TRANSMISSION

Risk Factors and Sources of Infection: In most of sub-Saharan Africa, the disease has been observed to appear following the seasonal rains, when there is always an increase in the population of different arthropod species. Its onset of frosts in South Africa and Egypt results in a great fall in the number of cases of LSD, which virtually disappears over the winter to reappear again in the spring and summer. Its outbreak in Egypt in 1989 is also associated with abundance of arthropod vector during summer, despite the total restrictions of animal movements. Further it spreads to Israel some 80-200 km away from active foci of LSD in Egypt, which indicates aerial movement of biting insects had occurred [5,6]. A study investigating the risk factors associated with the spread of LSD in Ethiopia showed that warm and humid agro-climate, conditions supporting abundance of vector population, was associated with a higher prevalence of LSD [7]. In addition it was shown that husbandry practices such as communal grazing and watering points, introduction of new animals to a herd are associated with the occurrence of LSD whereas cattle movements were not associated with the occurrence of the disease. This suggests that imposition of quarantines only does not prevent the spread of LSD infection as the aerial movement of vectors can significantly contribute to the blowout [6, 8]. The most important source of infection to healthy animals is considered to be skin lesions or nodules since the virus persists in the lesions or scabs for long periods of time and has strong tropism to dermal tissues [9]. The virus is also excreted via blood, nasal and lacrimal secretions, saliva, semen, and milk of infected animals (transmissible to suckling calves) that may be sources of infection to other susceptible cattle. Nodules that appear on the mucous membranes of the eyes, nose, mouth, rectum, udder and genitalia also ulcerate and shed sufficient viruses, which can serve as sources of infections [9, 10]. Viraemic animals also play a significant role as a source of infection especially that may last for up to two weeks [11]. Consequently, the hosts contract the virus via biting from blood-feeding arthropods, including biting flies, mosquitoes and ticks. Though rare, transmission also occurs through direct contact, and can also spread from contaminated feed and water [12]. Transmission or spread can also occur iatrogenically during mass vaccination in which a single syringe and needle is used in several animals. Under this situation the needle can acquire the virus from crusts and other skin lesions and inoculate into healthy animals. [11].

The Role of Vectors: Evidence from different sources elucidated that LSDV can be mechanically transmitted by a variety of hematophagous arthropod vectors. Alike high morbidities are seen where mosquito populations are abundant and associated with warm and humid weather conditions, with 50-60% attack rates; and low, 5-15% morbidity in arid environments where there are fewer potential mechanical vectors [13,6,12]. Recent studies in ticks have shown transstadial and transovarian persistence of LSDV in *Rhipicephalus decoloratus*, *Rhipicephalus appendiculatus* and *Amblyomma hebraeum*, and mechanical or intrastadial transmission by *Rhipicephalus appendiculatus* and *Amblyomma hebraeum* [14,15]. On the other hand, mechanical transmission of LSDV has been experimentally demonstrated in female *Aedes aegypti* mosquitoes; however, clinical disease recorded in most of the animals exposed to infected mosquitoes was generally of a mild nature [16]. In the mechanical mode of transmission, the virus is transmitted via contaminated mouth parts of vectors without actual replication of the virus in the arthropod cells or tissues. *Aedes aegypti* has been incriminated in airborne transmission over long distance in disease-free areas, which is thought to complicate the control measures by movement restriction [13]. The virus has been also recovered from *Stomoxys*, *Biomyia*, *Muscat*, *Culicids* and *Glossing* species that may have a potential to transmit LSD, as all feed voraciously upon domestic cattle [17, 18]. Although the virus was detected in *Anopheles stephensi*, *Culex quinquefasciatus*, *Stomoxys*

calcitrans and culicoidesnebeculosis, attempts to transmit LSD mechanically to susceptible animal is failed [19]. In recent times, the potential role of theculicids spp. In the transmission of LSDV was investigated by sevikand dogan and revealed that culicids punctatus could have played role in transmitting LSDV during 2014-2015 outbreak in turkey [20].therefore, it is clear that various arthropods feeding on cattle can transmit the LSDV and spread the virus.

Other means of transmission: another attempts to transmit LSDV via the manual handling of infected animals immediately prior to contact with susceptible cattle, or keeping naive and infected animals in the same pen, failed. This leads to the conclusion that direct or indirect contact between infected and susceptible animals is an inefficient method of transmission [11, 8]. In previous reports transmission of LSDV through semen (natural mating or artificial insemination) has not been experimentally demonstrated, but LSDVhas been isolated from semen of experimentally infected bulls [19, 21].conversely, a recent study by Annandale et al. Showed that experimental transmission of LSDV via semen from infected cattle is possible; however, whether this also occurs during natural mating or artificial insemination needs further investigation [22].

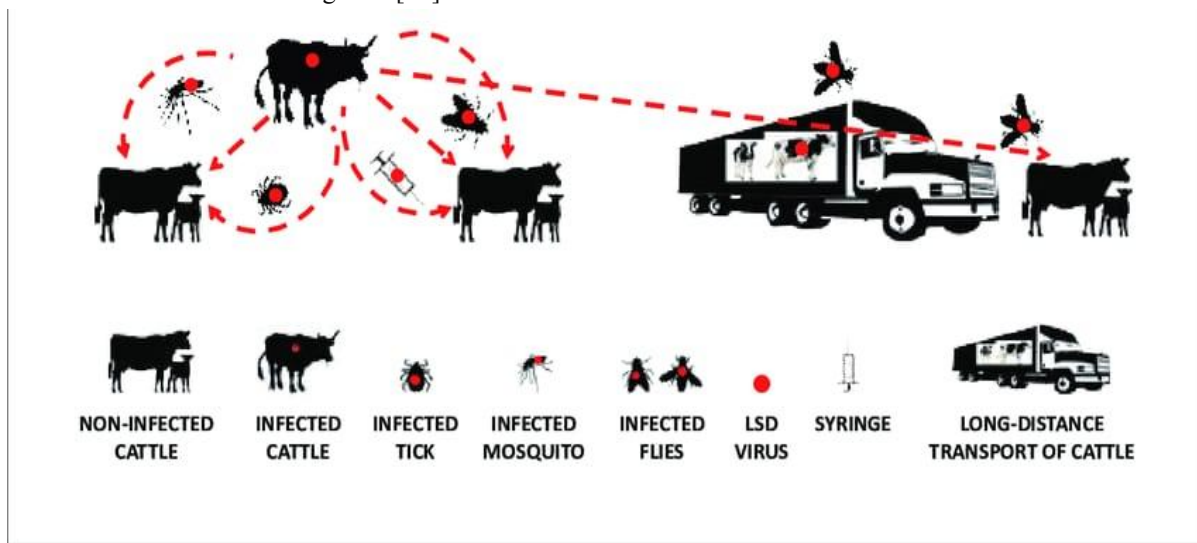


Fig.2 Schematic Illustration of the spread of LSD. [23]

Diagnosis & Clinical Findings of Lumpy Skin Disease in Cattle:

- Histopathology, virus isolation, or PCR.
- Infected cattle develop fever, lacrimation, nasal discharge, and hyper salivation, followed by the characteristic eruptions on the skin and other parts of the body in ~50% of susceptible cattle. The incubation period is 4–14 days.
- The nodules are well circumscribed, round, slightly raised, firm, and painful and involve the entire cutis and the mucosa of the GI, respiratory, and genital tracts. Nodules may develop on the muzzle and within the nasal and buccal mucous membranes. The skin nodules contain a firm, creamy-gray or yellow mass of tissue. Regional lymph nodes are swollen, and oedema develops in the udder, brisket, and legs. Secondary infection sometimes occurs and causes extensive suppuration and sloughing; as a result, the animal may become extremely emaciated, and euthanasia may be warranted. In time, the nodules either regress, or necrosis of the skin results in hard, raised areas (“sit-fasts”) clearly separated from the surrounding skin. These areas slough to leave ulcers, which heal and scar.
- Morbidity is 5%–50%; mortality is usually low. The greatest loss is due to reduced milk yield, loss of condition, and rejection or reduced value of the hide.[24]

Symptoms



Fig.2.1 symptoms of lumpy skin disease. [25]

Acute fever, discharge from the eyes and nose, salivation, soft blister-like nodules all over the body, marked reduction in milk yield, difficulty in eating and other symptoms leave these innocent beings struggling to survive. The disease not only leaves the cows with severe painful physical symptoms but can also lead to death. [26]

Effects of LSD on animal-to-human:-

India continues to face the wrath of lumpy skin disease, which has claimed the lives of more than 1 lakh cattle. Meanwhile, veterinary experts have dismissed the concerns regarding the transmission of the disease from animals to humans and informed that there is evidence of animal-to-animal transmissions, but not of animal-to-human transmission.

"There is no evidence that the disease can transmit from animals to humans. It is not a zoonotic disease. It is goat pox that has gone into the cow. That is how the transmission happened. It means it is transmissible from animals to animals. The buffaloes, cows, goats and sheep are affected. No such case of transmission from animals to humans has been reported yet," Dr. Rita goyale told news agency ANI.

The doctor further mentioned that the infected animal initially suffers from high fever and bump nodules on the body. The virus then travels to the immune system of cattle creating respiratory troubles and ultimately affecting multiple organs leading to the death of the animal.

"As **prevention**, it is better to take pasteurized milk instead of unpasteurized milk for humans. The best thing is to boil the milk and put it on a sim and give it another boil for another minute. So that most of the viruses get destroyed,"[27]

Effect on milk production of cattle:-

It is safe to consume milk from cattle infected by lumpy skin disease, which is a non-zoonotic infection and not transmissible from animals to humans, according to a senior official of Indian veterinary research institute (IVRI).

Lumpy skin disease (LSD) has spread in more than a dozen states including Gujarat, Rajasthan, Punjab and Haryana.

The disease has affected 16.42 lakh cattle in 197 districts and has killed 75,000 cattle between July and September 11, 2022, according to data maintained by the department of animal husbandry.

Speaking to PTI, on safety and quality of milk from the infected cattle, IVRI joint director Ashok Kumar Mohanty said LSD is a non-zoonotic disease and not transmissible from animals to humans.

"It is safe to consume milk from the infected cattle. There is no problem in the quality of milk even if you have it after boiling or without boiling,"

However, milk production in the infected cattle gets affected depending on the severity of the disease and immunity level of the animal,

There can be a localised impact on milk production but it is difficult to quantify right now in the absence of accurate data on the spread of the infection in cattle across the country.

"When cattle are infected, the animals become weak due to nodule formation, fever and other symptoms. This severely affects milk production. When the animal is dying, its entire body system is affected,"

The disease and its impact on milk output can be arrested if cattle are vaccinated on time. If cattle are infected for the first time and not vaccinated, then milk production can get reduced up to 40-50 per cent. [28]

Preventive Measures

- Control of animal movement - in order to minimize the economic impact of the outbreaks and to control LSD, the movement of animals to and from the infected area and from affected states should be completely banned. This will check the transmission/spread of LSD.
- Restriction with affected animals and persons dealing with such animals - the movement of people to and from the affected area should be restricted. The animal handlers and those attending to the affected animals should be advised to keep away from healthy animals. It is, therefore, of utmost importance to ensure these safety measures.

Vaccination:

- The infected villages are identified so that precautionary plans are carried out in a specific area and ring vaccination carried out in villages up to 5 km around the affected village.
- Cattle and buffaloes should be vaccinated with the available goat pox vaccine (cattle and buffalo at the age of 4 months and above through the s/c route) with 103.5 tcid₅₀ of gtpv vaccine (uttarkashi strain). However, the dose of 103.0 tcid₅₀ (same dose of vaccine for goat against goat pox) can be used for prophylactic vaccination/ring vaccination in cattle and buffalo.
- However, affected animals should not be vaccinated.
- Preventive vaccination should also be undertaken in high risk areas like border area of affected district and state and animals should be identified and document.
- The staff and vaccinators should be trained for vaccination drive including storage and preparation of vaccine, dosing and injection and identification of animals.

Bio-Security Measures

- Immediate isolation of sick animal from the healthy animals. Symptomatic treatment of affected animals may be carried out with all precautions and bio security measures. Feeding of liquid feed, soft feed and fodder is recommended.
- Clinical surveillance against LSD in affected districts and around surrounding villages should be intensified.
- The buffaloes should be kept separately till complete recovery of the affected animals, if reared together.
- Disinfection of premises at regular intervals.
- Ecto-parasiticide should also be applied to healthy animals on the infected and on surrounding farms.
- The persons dealing with the infected animal should wear gloves and face masks and carry out hygienic and disinfection measures at all times.
- Care should be taken to report any unusual sickness of other animals to the nearest veterinary hospital/dispensary.
- Hygiene practices should be followed at the animal farm and by the people in areas where animals are infected.
- Farms with affected animals should be visited regularly by field veterinarians until all the cases are recovered. The veterinary staff should take all precautionary hygiene measures to avoid the further spread of disease to other farms/households.
- In case of mortality, carcass should be disposed of by deep burial method observing all hygienic measures.
- Cattle markets located within 10 km radius of the epicentre of infection should be closed.
- Trade of live cattle, participation in fairs, and shows should be banned immediately upon confirmation of the disease in the affected areas.
- Semen from LSD-affected animals should not be collected and processed for production and distribution.

Vector Control

- Control of vector population (ticks, flies, mosquitoes, fleas, midges) in the premises and the animal body should be carried out using insecticide, repellents and other chemical agents.

Disinfection and Cleaning Measures

Affected premises, vehicles plying through the affected animal holdings should be carried out with appropriate chemicals/disinfectants [ether (20%), chloroform, formalin (1%), phenol (2% /15 minutes), sodium hypochlorite (2-3%), iodine compounds (1:33 dilution) and quaternary ammonium compounds (0.5%)].

Awareness Programme



Fig. 3. Awareness for disease [29]

Mass awareness campaign to be taken up to make the public aware of the disease and report to the veterinary authority immediately when suspected cases are detected. This will help in prevention and control of LSD regular training and sensitization of veterinarians including awareness to animal owners and other stake holders should be enhanced on clinical presentation of the disease along with surveillance strategy and control measures.

Animal husbandry department should maintain proper liaison with police and border agencies to check illegal entries of cattle from neighbouring countries (wherever required). [30]

Treatment for Lumpy Skin Disease

No specific treatment is available. Chronic lesions are harmless. Strong antibiotic therapy prevents secondary infection. Virus spreads rapidly; therefore restriction of animal movement and quarantine restrictions are of limited use. Homologous live attenuated vaccine is available. [31]



Fig. 4. Treatment on disease. [32, 33, 34]

- Antiviral treatment with methylene blue
- Use of non-steroidal anti-inflammatory drug to treat the inflammatory condition
- Use of paracetamol for high fever
- Administration of antibiotics to control secondary infection
- Vaccination. [35]

Best Healthy Feed for Cattle

1) Grain supplement

Grain can get cattle growing quickly and can help cattle get fat. In fact, many farmers feed grains to growing cattle to reduce costs and get cattle ready sooner. Grain supplements are also a good solution for winters and for cattle that lack access to high-quality hay and grazing pastures.

However, it's important not to get cattle too reliant on supplements, as this will discourage them from more nutritionally diverse pastures and foraging.

2) Hay

Hay can provide every important nutrient for cattle, but it has to be picked at the height of its nutrient richness à that is, before it becomes too dry. To be a good food source for cattle, hay must also be carefully cured and stored to prevent rot and damage.

There are many hay varieties that offer good nutrition. Alfalfa hay, for example, has more calcium and phosphorus than grass hay, but some grass hay can be high in proteins. Most experts recommend mixing alfalfa with grass hay, rather than relying exclusively on alfalfa hay. Alfalfa hay is often recommended for dairy cattle, but may not be a good fit for beef cattle, since it can lead to bloat. Legume hay is another nutritious option for cattle, since its high in protein.

3) Pasture and forage

Forage and pasture can provide cattle with all the nutrients they need (unless the soil is depleted or the season is too early for rich grass growth). Pasture is also the most cost-effective solution for cattle feed. If you hope to feed your cattle with forage and pasture, it's important to test soil fertility and to maintain good watering to ensure plants are at their best nutritional density. You'll also want to keep an eye on the types of plants available, and monitor their maturity and their overall condition.

4) Concentrates

Concentrates, such as oats, corn, wheat, barley, grain sorghum, wheat bran and liquid supplements are high in nutritional value and low in fiber. They have plenty of carbohydrates, but also come with a higher price tag than forages.

Concentrates can be great as a supplement, but carefully consider cattle needs and weights when offering this feed to prevent digestion issues. [36]

III. CONCLUSION

Cattle and buffaloes are important livestock contributing substantially to the Indian economy. Lumpy skin disease is a serious disease of cattle and buffalo. Earlier the disease was restricted to African countries and few other countries but the recent spread of disease to India and other Asian countries, previously disease-free region, is a matter of concern for the livestock rearing sector as most of these countries have agriculture-based economies. As this disease is economically important, spread of this disease to larger geographical regions of Indian subcontinent will surely hamper the rural economy in particular. LSD can also lead to reduction in export of livestock and livestock products. The reasons behind the entry of LSD in India need to be investigated along with epidemiological random screening in different regions to access the actual disease prevalence.

REFERENCES

- [1]. <https://doi.org/10.1007/s11259-020-09780-1>
- [2]. <https://www.donatekart.com/Donatekart/Save-innocent-cows/>
- [3]. Lumpy skin disease a field manual for veterinarian's page number 01.
- [4]. https://en.wikipedia.org/wiki/Lumpy_skin_disease

- [5]. CFSPH (2008) Center for Food Security and Public Health, Iowa State University. Lumpy Skin Disease. Accessed on July 17, 2017.
- [6]. AU-IBAR (2013) African Union - Interafrican Bureau for Animal Resources: lumpy skin disease. Selected content from the Animal Health and Production Compendium.
- [7]. Gari G, Waret-Szkuta A, Grosbois V, Jacquet P, Roger F (2010) Risk factors associated with observed clinical lumpy skin disease in Ethiopia. *Epidemiol Infect* 138: 1657-1666.
- [8]. EFSA (2015) European Food Safety Authority. Scientific Opinion on Lumpy Skin Disease. EFSA Panel on Animal Health and Welfare (AHAW). *EFSA Journal* 13: 3986.
- [9]. Babiuk S, Bowden T, Boyle D, Wallace D, Kitching RP (2008b) Capripoxviruses: an emerging world wide threat to sheep goats and cattle. *Transbound Emerg Dis* 55: 263-272.
- [10]. Lefèvre PC, Gourreau JM (2010) Lumpy Skin disease. In: Lefèvre PC, Blancou J, Chermette R, Uilenberg G (Eds.) *Infectious and Parasitic diseases of Livestock*. OIE -407.
- [11]. Tuppuraine ES, Alexandrov T, Beltran-Alcrudo D (2017) Lumpy skin disease field manual - A manual for veterinarians. *FAO Animal Production and Health Manual* 20: 1-60.
- [12]. Ali H, Ali AA, Atta MS, Cepica A (2012) Common, emerging, vectorborne and infrequent abortogenic virus infections of cattle. *Transbound Emerg Dis* 59: 11-25.
- [13]. Tuppurainen E, Oura C (2012) Review: Lumpy skin disease: An emerging threat to Europe, the middle east and Asia. *Transbound Emerg Dis* 59: 40-48.
- [14]. Tuppuraine ES, Stoltz WH, Troskie M, Wallace D, Oura CA, et al. (2011) A Potential Role for Ixodid (Hard) Tick Vectors in the Transmission of Lumpy Skin Disease Virus in Cattle. *Transbound Emerg Dis* 58: 93-104.
- [15]. Lubinga JC, Tuppuraine ES, Coetzer JA, Stoltz WH, Venter EH (2014) Evidence of lumpy skin disease virus over-wintering by transstadial persistence in *Amblyomma hebraeum* and transovarial persistence in *Rhipicephalus decoloratus* ticks. *Exp Appl Acarol* 61: 77-90.
- [16]. Chihota CM, Rennie LF, Kitching RP, Mellor PS (2001) Mechanical transmission of lumpy skin disease virus by *Aedes aegypti* (Diptera: Culicidae). *Epidemiol Infect* 126: 317-321.
- [17]. Carn VM, Kitching RP (1995) The clinical response of cattle experimentally infected with lumpy skin disease (Neethling) virus. *Arch Virol* 140: 503-513.
- [18]. Weiss KE (1968) Lumpy skin disease virus. In: *Virology Monographs*. Springer Verlag, Vienna, New York, pp: 111-13.
- [19]. Chihota CM, Rennie LF, Kitching RP, Mellor PS (2003) Attempted mechanical transmission of lumpy skin disease virus by biting insects. *Med Vet Entomol* 17: 294-300.
- [20]. Sevik M, Dogan M (2015) Epidemiological and Molecular Studies on Lumpy Skin Disease Outbreaks in Turkey during 2014-2015. *Transbound Emerg Dis* 64: 1268-1279.
- [21]. Irons P, Tuppurainen E, Venter E (2005) Excretion of lumpy skin disease virus in bull semen. *Heriogenology* 63: 1290-1297.
- [22]. Annandale CH, Holm DE, Ebersohn K, Venter EH (2014) Seminal Transmission of Lumpy Skin Disease Virus in Heifers. *Transbound Emerg Dis* 61: 443-448.
- [23]. Lumpy skin disease field manual – A manual for veterinarians - Scientific Figure on Research Gate. Available from: https://www.researchgate.net/figure/Schematic-illustration-of-the-spread-of-LSdV-Short-distance-spread-Long-distance-spread_fig1_318347415 [accessed 1 Nov, 2022].
- [24]. Lumpy Skin Disease in Cattle - Integumentary System - MSD Veterinary Manual <https://www.msddvetmanual.com/integumentary-system/pox-diseases/lumpy-skin-disease-in-cattle>.
- [25]. <https://images.app.goo.gl/HXqpc8dh4V6GJEJQ6>.
- [26]. Your Support Can Save Thousands Of Innocent Cows From The Deadly Lumpy Skin Disease - <https://www.donatekart.com/Donatekart/Save-innocent-cows/>
- [27]. Lumpy Skin Disease: No evidence of transmission to humans, say experts | Mint - <https://www.livemint.com/news/india/lumpy-skin-disease-no-evidence-of-transmission-to-humans-say-experts->

- 11664984013569.html?utm_source%3Dshare%26utm_medium%3Dsocial%26utm_campaign%3Dshare_via_amp Download mint app for latest in Business News - <https://bit.ly/32XEfFE>.
- [28]. lumpy skin disease: Milk from LSD-infected cattle safe for consumption, IVRI official says - The Economic Times <https://m.economictimes.com/industry/healthcare/biotech/healthcare/milk-from-lsd-infected-cattle-safe-for-consumption-ivri-official-says/articleshow/94193266.cms>.
- [29]. <https://www.google.com/imgres?imgurl=https%3A%2F%2Fcdn.siasat.com%2Fwpcontent%2Fuploads%2F2020%2F10%2F08-Style-4-660x440.jpg&imgrefurl=https%3A%2F%2Fwww.siasat.com%2Fgovt-debunks-rumours-of-lumpy-skin-disease-spreading-in-cattle-1993841%2F&tbnid=n0R-0sCto2qDUM&vet=1&docid=jaJsZcmNkNi5kM&w=660&h=440&itg=1&hl=en-US&source=sh%2Fx%2Fim>
- [30]. <https://vikaspedia.in/agriculture/livestock/cattle-buffalo/lumpy-skin-disease/guidelines-for-prevention-of-lumpy-skin-disease>
- [31]. <https://doi.org/10.1016/B978-0-12-811054-6.00010-6>.
- [32]. https://www.google.com/imgres?imgurl=https%3A%2F%2Fimages.livemint.com%2Fimg%2F2022%2F08%2F12%2F600x338%2FLumpy_Skin_Disease_1660312369955_1660313059047_1660313059047.jpg&imgrefurl=https%3A%2F%2Fwww.livemint.com%2Fphotos%2Fin-pics-what-is-lumpy-skin-disease-killing-cattle-in-gujarat-11660311119247.html&tbnid=RhH6iRQXttwfUM&vet=1&docid=Bzq8FtNa7LaFwM&w=600&h=338&hl=en-US&source=sh%2Fx%2Fim
- [33]. <https://images.app.goo.gl/pDvikpwUGVdUjR8Z6>
- [34]. https://www.google.com/imgres?imgurl=https%3A%2F%2Fwww.fao.org%2Ffileadmin%2Fuser_upload%2Ffreu%2Fimg%2Fmedium_30jul.jpg&imgrefurl=https%3A%2F%2Fwww.fao.org%2Furope%2Fnews%2Fdetail-news%2Fen%2Fc%2F1146637%2F&tbnid=vu2ntkV4lyjKCM&vet=1&docid=kSW8aN9yLLXfiM&w=300&h=164&hl=en-US&source=sh%2Fx%2Fim
- [35]. <https://www.macsenlab.com/blog/methylene-blue-treatment-for-lumpy-skin-disease-in-cattle/>.
- [36]. <https://arrowquip.com/blog/animal-science/best-healthy-feed-beef-cattle>