



A review on Lumpy Skin Disease (LSD) in Livestock - Fatal turn in Rajasthan

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Abstract

The Lumpy Skin Disease (LSD) caused by an infectious virus of the capripoxvirus genus. The LSDV mainly affects cattle-cow and its progeny, and the Asian water buffaloes. The disease is transmitted by vector (ticks, mosquitoes, houseflies), contaminated food and water in livestock animals and cause severe morbidity in cattle. This disease was first reported in Zambia, Africa, and now spread around the globe. The outbreaks can be severe and challenging to control in Rajasthan. The disease was first identified in Rajasthan on July 2022, in the Jaisalmer district and then spread in 32 district. LSD infected nearly 8,74,242 cattle and died 38,191 cattle in Rajasthan till September 2, 2022 over the past of one month. The mortality and morbidity rates were extraordinarily high about 1.5%. The current outbreak occurs during the monsoon and rainy season. The symptoms of this diseases skin nodules appear 2-6 cm in diameter on whole body of cattle, with the lumps gradually opening up like deep wounds. The incubation time in infected cattle ranges from 5 to 7 days, although it can last up to 4-5 weeks in naturally affected animals. Sometimes, painful ulcerative lesions develop in the cornea of one or both eyes leading to blindness in worst cases and even animal death. Therefore, a variety of approaches are needed to prevent and manage these diseases. Movements of diseased animals could be prohibited, and quarantine, ongoing testing, vector control, and vaccine could also be used. Ayurveda, traditional medicine, fogging and spraying Sodium hypochlorite could be the effective strategy for the controlling and managing lumpy diseases.

Keywords: - Lumpy disease, Cattle, Mortality, Rajasthan, Vector, Vaccine, Ayurveda

Introduction

The disease named Lumpy Skin Disease is caused by a virus called the Capripoxvirus, which is “an emerging threat to livestock worldwide”. It’s genetically similar to the goatpox and sheeppox virus family. Numerous names for the condition exist, including exanthema nodularis bovis, pseudo-urticaria and Neethling virus sickness [1, 2].

LSD has not been detected in India first time. The disease has been endemic in most African countries [3-6], and since 2012 LSD has spread rapidly through the Middle East, Southeast Europe [2] and West and Central Asia. Since 2019, several outbreak of LSD has been reported in Asia. In May this year, Pakistan's Punjab also reported the deaths of over 300 cows due to LSD [7].

In 2019, Odisha in India became the primary state to report the Lumpy skin disease [6] and by 2021, 15 states had been affected but mortality had never been reported [8, 9]. Later, it expanded quickly and covers all of the states within the India. The most recent outbreak recorded in Rajasthan's western region in July-August 2022 and it is first identified in the Jaisalmer district.

Rajasthan is the most concerned state with 32 districts reporting a surge in such cases. As of September 2, 2022, according to the official figures, more than 8,74,242 animals are infected with the disease so far in the state of Rajasthan while 38,191 of such animals have died. Evidence shows that the transmission of the virus via arthropods such as insects or ticks these are termed virus "vectors"[10]. Outbreaks of LSDV are concurrent with high temperature and high humidity while the disease usually moderate in the cold winter months [11, 12]. Additionally, LSD epidemics are often characterized by new outbreaks occurring at distances over 50 km from the closest known disease focus. The virus and viral antigen of are found in the saliva and the different organs of ticks like the haemocytes, salivary glands and midgut in saliva and different organs of ticks such as haemocytes, salivary glands and midgut [13, 14]. Furthermore, the transstadial and mechanical transmission of the virus by ticks was demonstrated by molecular evidence [10]. However, their lengthened link to the host does not explain the rapid occurrence of broad epidemics. Movement of infected cattle can also be a significant cause in the spread of LSD over large distances.

The disease is characterized by fever, enlarged superficial lymph nodes and multiple nodules measuring 2–5 centimeters in diameter on the skin and mucous membranes including those of the respiratory and gastrointestinal tracts [15, 16]. Infected cattle develop edematous swelling in their limbs and express weakness. The virus has important economic manifestation since affected animals tend to possess permanent damage to their skin and also lowering the commercial value of their hide. Additionally, the disease often results in chronic debility, reduced milk production, poor growth, infertility, abortion, and sometimes outbreaks can be severe and challenging to control which leads to death. The World Organization for Animal Health standards identifies this condition as a notifiable disease because it has a significant negative impact on cow mortality [17, 18].

This time, the mortality and morbidity rates were extraordinarily high about 1.5% in contrast to 2019, when LSD was thought out to have expanded to central and southern India via Bangladesh, the outbreak this time is thought to have originated in Pakistan [19, 20]. The aim of this review is to raise awareness of this disease in Rajasthan and to provide valuable information on early detection and diagnosis for veterinary professionals.

Virology

The virus that cause lumpy disease belongs the Order Chitovirales, Family poxviridae and genus *Capripoxvirus* [21]. The sheep pox virus, goat pox virus and Lumpy skin diseases virus all belong to the

same genus but are phylogenetically distinct to each other. There is only one known serotype of the Lumpy skin disease virus [22].

Classification of Lumpy Skin Disease Virus			
Kingdom:	Bamfordvirae	Order:	Chitovirales
Phylum:	Nucleocytoviricota	Family:	Poxviridae
Class:	Pokkesviricetes	Genus:	Capripoxvirus

Table: 1 Classification of Lumpy Skin Disease (LSD) virus

(Source: Wikipedia)

Lumpy skin disease virus is a large, Double-standard DNA virus, and the genome size is about 150 kbp [23, 24]. The 155 putative genes in the LSDV middle coding region are surrounded by inverted terminals, and its amino acid identity is lacking [25]. Lumpy skin disease virus is stable and there is very little genetic variation. This virus can survive in organic materials for a longer period of time, can be found in skin nodules even after 30 days, and can endure ambient temperature for a longer period of time. The virus is susceptible to even mild chemical modification with either an alkaline or acidic pH, which could reduce the virus load. Ether, Chloroform, Formalin, phenol and other substances may also reduce the virus load. The virus's titer remains unchanged after being exposed to a pH range of 6.5 to 8.5 for four to seven days at 37 °C [26].

Transmission and Symptoms

Outbreaks of LSDV are associated with high temperature and high humidity [27]. It is usually more prevalent during the wet summer and autumn months, especially in low-lying areas or near bodies of water, however, outbreaks can also occur during the dry season [28]. Blood-feeding insects such as mosquitos and flies act as mechanical vectors to spread the disease at a distances over 50km from the nearest known disease focus. The virus is transmitted mechanically it means that the virus is not replicate in the tissues or cells of the arthropod. The transmission occurs via infected mouth parts of vectors. The mechanical transmission was demonstrated to be effective by *Aedes aegypti*, where the infected mosquitoes that had fed upon lesions of LSDV infected cattle could transmit the virus to susceptible cattle over a period of 2-6 days [29]; Ticks are also potential vectors of LSDV. A single species vector has not been identified. Instead, the virus has been isolated from *Stomoxys*, *Biomyia fasciata*, *Tabanidae*, *Glossina*, and *Culicoides* species [28]. The particular role of each of these insects in the transmission of LSDV continues to be evaluated [28]. Outbreaks of lumpy skin disease tend to be sporadic since they are dependent upon animal movements, immune status and wind and rainfall patterns, which affect the vector populations [30]. The survival of the virus in fomites, feed, feces, urine and pastures is still unknown, but indirect transmission via those commodities cannot be excluded [31].

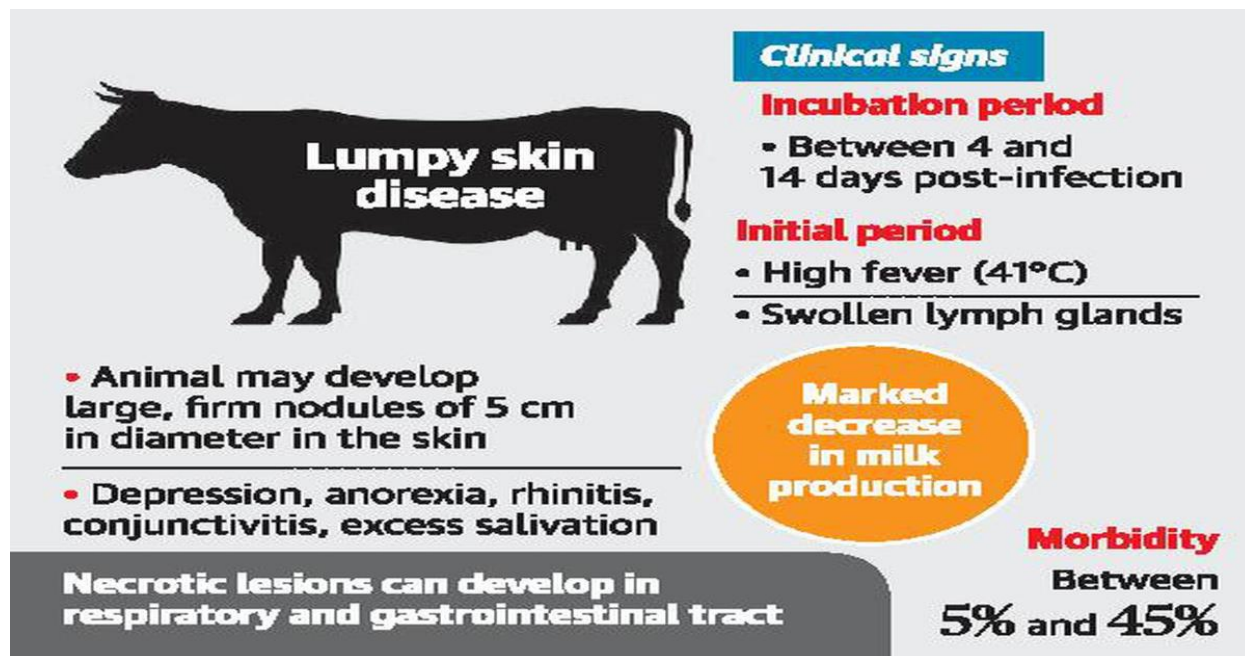


Fig. 1: Symptoms of LSD in Livestock

(Source: The Hindu Newspaper)

The virus can be transmitted through blood, nasal discharge, lacrimal secretions, semen and saliva. The disease can also be transmitted through infected milk to suckling calves [28]. LSD virus sexual transfer was seen from infected bull semen to the heifer and even congenitally to the foetus [32, 33]. Natural mating or artificial insemination may expose females to the virus since it lingers in the semen of infected bulls. It is known that infected pregnant cows give birth to calves sucking through contaminated milk or from sores on the teats [34]. In experimentally infected cattle, LSDV was found in saliva 11 days after the development of fever, in semen after 22 days, and in skin nodules after 33 days. The study shows that virus is not seen in urine or stool. Like other pox viruses, which are known to be highly resistant, LSDV can remain viable in infected tissue for more than 120 days.

The onset of fever occurs almost one week after infection by the virus. This initial fever may exceed 41 °C (106 °F) and persist for one week [30]. At this time, all of the superficial lymph nodes become enlarged approx. 2-6 cm in diameter on whole body of cattle [30, 35] (Fig-1-3). In lactating cattle there is a marked reduction in milk yield. Lesions develop over the body, particularly on the head, neck, udder, scrotum, vulva and perineum between 7 and 19 days after virus inoculation [28]. Coinciding with the appearance of the nodules, discharge from the eyes and nose becomes mucopurulent [30].

The nodular lesions involve the dermis and the epidermis, but may extend to the underlying subcutis or even to the muscle [30]. Cutaneous bruise either may be resolved or they may persist as hard lumps. At the initial onset of the nodules, they have a creamy grey to white color upon cut section, and may exude serum [30]. After about two weeks, a cone-shaped central core of necrotic material may appear within the nodules [30]. Additionally, the nodules on the mucous membranes of the eyes, nose, mouth, rectum, udder and genitalia quickly ulcerate, aiding in transmission of the virus [30].



Figure 2-4: Skin lesions in body parts of cattle. Several skin nodules that varied in diameter, shape, and appearance were observed in various regions of the cattle.

Other symptoms include difficulty in eating, decreased productivity, and pneumonia, which can occasionally result in animal death [36]. Pneumonia caused by the virus itself or secondary bacterial infection, and mastitis are common complication [37]. The incubation time in infected cattle ranges from 5 to 7 days, although it can last up to 4-5 weeks in naturally affected animals. Sometimes, painful ulcerative lesions develop in the cornea of one or both eyes leading to blindness in worst cases [38, 39]. Subclinical infections and persistent skin nodules can both occur in the field. Early primary care can help with healing. The current outbreak occurs during the rainy season, when animal stress levels are at that highest and mosquito reproduction is rampant. Lacking a burial strategy, carcasses of cattle that had died from Lumpy diseases had been discovered lying around in a local region, prompting concerns that the virus would spread throughout the entire state of Rajasthan (India).

Diagnosis, Prevention and Treatment of Lumpy disease

LSD can be chaotic with many other diseases, like: Pseudo lumpy skin disease which is caused by Bovine Herpes virus, Bovine papular stomatitis (Parapox virus), Pseudo-cowpox (Parapox virus), Cowpox, cutaneous tuberculosis, Demodicosis (Demodex), insect or tick bites, urticaria, photosensitisation,

Papillomatosis (Fibropapillomas), Rinderpest, Dermatophilosis, Besnoitiosis, Hypoderma bovis infection and Oncocercosis. Symptoms like fever and reduction of milk are not particular and can be seen with many other diseases. On the basis of symptoms seen in the animals, LSD can be diagnosed. Depending on the animal health, the symptoms may be severe, minor or long- lasting. The severity of disease in the 10% of affected cattle in the herd can vary from mild to fatal. Sometimes less number of nodules develops on cattle which can be difficult to spot; on the other hand countless nodules develop up to 3cm in diameter. The factors are still unknown which determines development of mild and severe nodules.

Control and prevention of LSD depend upon four strategies - movement restriction (quarantine), vaccination, slaughter campaigns and management plan. In affected villages, cattle herds should be kept discrete from other herds by avoiding community grazing. To minimize the risk of vector transmission of the disease, bovines must be treated continuously with insect repellents. Lowering breeding sites of vector such as stagnant water, slurry and manure, and improving drainage in holdings are sustainable, affordable and environmentally friendly techniques of reducing the number of vectors on and around cattle.

Numerous tests have been used by many Scientists to diagnose lumpy diseases, but molecular approaches have emerged as the most effective. Compared to other procedures, genetics and molecular methods are quicker, more precise, and more reliable [40, 41]. LSDV can be confirmed using the Polymerase Chain Reaction technique [42], and the RT PCR method is also helpful for detecting this disease [16, 43, 44]. To distinguish between the vaccine strain and the virulent LSDV, the blotting hybridization technique and RFLP are used [45]. For the identification of LSDV, numerous other techniques, such as ELISA and Western blotting for serological purpose, as well as virus isolation, and virus neutralization, are also used [46]. The only reliable test is the viral neutralization test, which is expensive, time consuming, and has a poor sensitivity and high specificity [15]. Although there is no effective antiviral drugs available for lumpy disease but there are a number of therapy options that can help sick cattle with skin wounds and pneumonia by using antibiotics [47, 48]. Therefore, a variety of approaches are needed to prevent and manage these diseases. Movements of diseased animals could be prohibited, and quarantine, ongoing testing, vector control, and vaccine could also be used [22]. Use of Potash alum, *Azadirachta indica* (Neem) leaves, *Ocimum tenuiflorum* (Tulsi), *Aloe barbadensis miller* (Aloe vera) gel, in the area of skin lesion, and diclofenac gel in the area of swelling in infected animals are all recommended [49]. The use of Multivitamins, Dexamethasone, Antibiotics, anti-inflammatory, anti-histaminic, antimicrobials and anti-septic solution helped treat LSDV infection and prevent the spread of secondary bacterial infections [50].

The application of fresh solution containing 10% Ascorbic acid, 5% Sodium carbonate, 2% Formalin and 2% Sodium hydroxide in the area of skin wound on infected cattle. Numerous Gaushalas in Rajasthan have reportedly used Ayurvedic and traditional medicine with varied degree of success, including *Curcuma longa* (Haldi), *Aloe barbadensis miller* (Aloe Vera), *Piper nigrum* (Black Pepper), *Tinospora cardifolia* (Giloy), *Phyllanthus emblica* (Amla), *Ocimum tenuiflorum*, *Cinnamomum verum*, *Piper betle*, *Alium Sativum*, *Syzgium aromaticum*, *Coriandrum sativum*, *Cuminum cyminum* and Ghee. Keeping gaushalas clean, fogging, and spraying Sodium hypochlorite are further frequent methods for managing and controlling

lumpy disease. To control this disease, the government should firmly forbid the transportation of diseased animals within the nation and across border. The best defense is universal animal vaccination [15, 17]. In order to reduce the risk of vector transmission of the lumpy diseases in the affected district and villages of Rajasthan, the herds of Infected animals should be maintained apart from other herds by preventing communal grazing. Deep dumping of carcasses, barn cleaning and Scrubbing [51]. Village farmers and veterinary professionals who have received training will be better equipped to detect infections early and hence help to control their spread [15]. The control and prevention of these disorders can be greatly aided by vaccination, and the live vaccine used for LSD provides long-lasting immunity [52]. Inactivated vaccines are helpful and secure, but they are expensive and call for numerous doses to increase protection. Additionally, this vaccination can be employed as a first-line live vaccine extermination method during the last stage of LSD [53]. Goat pox vaccine and Sheep pox vaccine used in many countries [54]. To control the viral infection the goat pox vaccine (GPV) is currently using in India.

A homologous live-attenuated LSD vaccine “**Lumpi-provacInd**” was introduced in India on August 10, 2022, to protect animals against LSD. The vaccine has been developed by the National Equine Research Center, Hisar (Haryana) in collaboration with the Indian Veterinary Research Institute, Izzatnagar (Uttar Pradesh). Describing this vaccination as a turning point in the cattle to eradicate the LSD from India as well as Rajasthan. The vaccine is safe in use and generates protective immunity in animal and this vaccination provides protection against virulent challenge strain, according to field and experimental studies.

Current Scenario with Lumpy Disease in Rajasthan

The major economic activity of the rural people is animal husbandry, mainly in the arid and semi-arid regions of Rajasthan. Around 10 % of the state's total domestic product is contributed by the livestock sector only.

According to the census of livestock in 2012, there were 57.73 million livestock, which covers cattle, buffalo, sheep, goats, pigs, camels, horses, and donkeys. Rajasthan has about 7 percent of the country's cattle population and contributes over 12.72 percent of total milk production. The outbreak was most recently recorded in Rajasthan's western region. This disease was first identified in Rajasthan on July 20, 2022, Jaisalmer district. It quickly spread to 32 districts in Rajasthan, particularly those with high commercial cattle populations. Buffalo are also affected by this disease in some regions of Rajasthan. The fear is that Lumpy Disease has killed roughly 38,191 cattle in Rajasthan and infected 8, 74,242 as of 02 September 2022 in 32 districts of Rajasthan over the past one month. Table-2 displays the most recent cases distribution in Rajasthan. The outbreak is thought to have originated in Pakistan. The worst-affected district is Sri Ganganagar, Barmer, Jodhpur, Jaisalmer, Jalore, Nagaur, Churu, Hanumangarh, and Pali districts and has reported a large number of cases (Table-2). Rajasthan has a 1.5% livestock mortality rate. The districts with fewest cow deaths are Tonk, Banswara, Rajsamand, Bhilwara and Alwar (Table-2).

The current outbreak in Rajasthan correlates with the rainy and monsoon season from June to September and it may be noticed that the lumpy diseases is seen July to September month in Rajasthan. Animals continue to agitated throughout the rainy season as mosquito breeding is rife. Lacking a burial

strategy, carcasses of cattle that had died from LSD had been discovered lying around in number of local regions, prompting concerns that the virus would spread throughout the entire state. The disease is relatively new and the information regarding the status of the disease in State of Rajasthan is scarce, despite being economically important. In this regard, the Rajasthan government's AYUSH ministry has recently released a very valuable advisory.

S. No.	District	Infected Animal	Treated	Recovery	Death
1	Ajmer	29327	26190	8177	2600
2	Alwar	2891	2891	392	160
3	Banswara	1113	1113	396	52
4	Barmer	95774	93600	63320	2650
5	Bharatpur	1028	3049	174	36
6	Bhilwara	5368	5808	1411	244
7	Bikaner	72951	65611	38549	2366
8	Bundi	54	54	38	3
9	Chittorgarh	845	845	95	27
10	Churu	60595	55435	17839	2784
11	Dausa	3286	3286	580	123
12	Dholpur	71	130	5	0
13	Dungarpur	774	774	149	5
14	Hanumangarh	65368	61145	31388	2857
15	Jalore	51624	50388	27994	2499
16	Jaipur	17193	17193	4930	945
17	Jaisalmer	39612	34491	37355	980
18	Jodhpur	106705	101440	87650	3414
19	Jhunjhunu	13672	13672	4743	753
20	Karauli	94	94	9	5
21	Kota	55	55	14	0
22	Kuchaman City	29425	27403	9942	2938
23	Nagaur	60208	56453	22270	3681
24	Pali	51009	51009	23316	1529
25	Pratapgarh	638	638	24	17
26	Rajsamand	4829	4829	694	91
27	Sawai Madhopur	395	395	182	7
28	Sikar	28023	28023	7771	1584
29	Sirohi	19740	19175	13544	542
30	Sri Ganganagar	84418	69934	53163	4578
31	Tonk	6518	6518	1701	355
32	Udaipur	20639	20565	5035	366
Total	32	874242	821093	462850	38191

Table 2 : The District wise Lumpy Disease case distribution in Rajasthan on September 02, 2022

(Source: Dainik Bhasker Newspaper)

Conclusion: - Since lumpy disease is relatively new, nothing is known about their prevalence in Rajasthan. Due to this, Rajasthan farmers and villages experience severe economic losses, including decreased milk output. This disease has had a significant impact on the dairy sectors. Therefore, a variety of approaches are needed to prevent and manage these diseases. Vaccination along with strict quarantine measures and vector control could be effective for preventing the spread of the disease. Animal movements among these districts should be attentively controlled by veterinary authorities. Furthermore, paying close attention to the different aspects of the disease, such as transmission and epidemiology, and the implementation of effective preventive measures such as vaccination, could result in better disease control,

vector control; animal movement restriction and LSDV testing of bulls used for breeding are highly recommended as tools to control further spread. Village farmers and veterinary professionals can provide proper training to detect infections on time and help to control their spread. Ayurveda, traditional medicine, fogging and spraying Sodium hypochlorite could be the effective strategy for the controlling and managing lumpy disease.

This review aims to summarize the latest developments in the epidemiology with the focus on transboundary spread, aetiology and transmission, clinical presentations, diagnostics and management of the disease.

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