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Lumpy Skin Disease: An Emerging Contagious Threat

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Abstract

The name is trending among livestock herders since last few months. This acute disease, which is endemic in sub-Saharan Africa, the Malagasy Republic and Egypt, have infected thousands of animals and have claimed lives of hundreds of cattle lives especially in the state of Rajasthan and Gujarat. The disease is caused by Lumpy Skin disease Virus belonging to genus Capripoxvirus of the family Poxviridae. This is a vector born disease spread mechanically by biting flies. The disease mainly occurs in cattle of all age groups but can also affect buffalo, giraffe, and impala. Lumpy skin disease is characterized by fever, followed shortly by the development of nodular lesions in the skin that subsequently undergo necrosis. The disease could be diagnosed by clinical manifestation, biopsies from lesions, trapping ELISA, indirect immunofluorescence, virus neutralization and Western blot. It is in the World Organisation for Animal Health (OIE) list for notifiable disease. For control of disease Modified live virus vaccines are used as well as a live, attenuated strain of sheeppox virus is available.

Introduction

Lumpy skin disease is an infectious, eruptive, occasionally fatal, vector borne, emerging viral disease of cattle (*Bos taurus* and *Bos indicus*), water buffalo (*Bubalus bubalis*) and several wild ruminants and is characterized by nodules on the skin and other parts of the body. Necrosis of these lesions may result in secondary bacterial infection. Though morbidity rate is low for the disease it becomes significant due to its economic implications that include reduced milk yield, abortions, infertility and permanent skin damage thus, lowering the value of their hide. The causative virus seems to be spread mainly by blood feeding insects, such as certain species of flies and mosquitoes or ticks, and outbreaks can be widespread and difficult to control. There is no evidence that Lumpy Skin Disease Virus can infect humans.

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Traditionally found in Africa, the disease has now spread to several countries in the Middle East and European countries. Currently there is an ongoing outbreak in several Asian countries.

Etiology and Transmission:

The disease is caused by lumpy skin disease virus (Neethling virus), a capripox virus. The virus belongs to family Poxviridae. Poxvirus virions are brick shaped and complex in structure, measuring about 250 x 200 x 200 nm in size. The genome consists of a single linear molecule of double-stranded DNA, with covalently closed ends, 170-250 kbp in size.

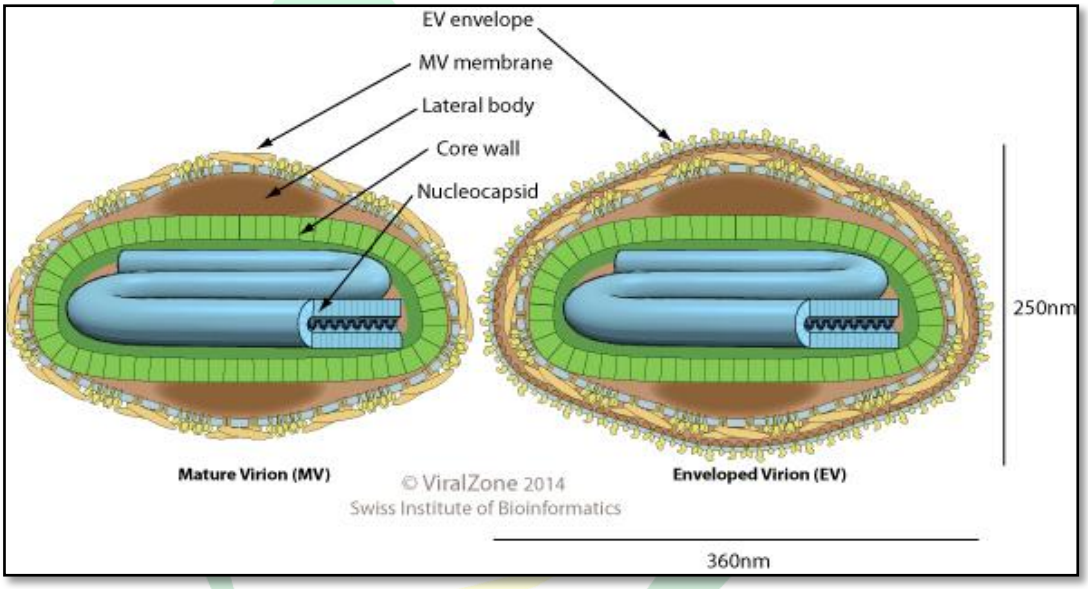

Fig. 1: A Virion of Capripox virus

The Lumpy skin Disease virus is transmitted mechanically between cattle by biting insects, with the virus being perpetuated in a wildlife reservoir host, possibly the African Cape buffalo. Main mode of transmission of LSDV is via arthropod vectors whereas direct or indirect contact between infected and susceptible animals is an inefficient method of transmission. Previous studies have demonstrated the ability of *Aedes aegypti* mosquitoes to transmit the virus. Stable flies (*Stomoxys calcitrans)* have been shown to be competent vectors for sheep pox virus, another capripoxvirus. Although many other insect species are likely to be mechanical vectors of LSDV, no other clinical transmission trials on possible insect vectors of LSDV have been carried out. The vector capacity of hard ticks has recently been under intense investigation. Mechanical transmission of LSDV by male *Rhipicephalus appendiculatus* ticks was also demonstrated.

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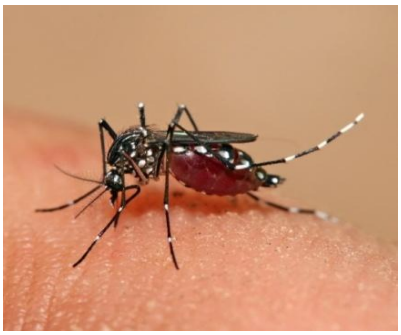

Fig 2: ***Rhipicephalus appendiculatus*** **Fig 3:*Stomoxyscalcitrans*** **Fig 4:** ***Aedes aegypti***

Epidemiology:

The disease was first recognized in an extensive epidemic in Zambia in 1929. Additional cases occurred between 1943 and 1945 in Botswana, Zimbabwe and the Republic of South Africa. A panzootic at South Africa in 1949 caused severe economic losses. The disease spread throughout Africa between 1950s and 1980s. First instance of LSD infection outside African continent was reported in 1989 as an outbreak in Israel. The disease created havoc in Greece and Turkey in 2015 followed by Russian outbreak in 2016. The disease marked its entry in South East Asia in 2019.

Name of country	1st outbreak date	1st outbreak location	Types of strain	Diagnostic test	Apparent morbidity %		Mortality%
Bangladesh	22nd July, 2019	Chattagram District	Closely related to LSDV KSGP-0240, LSDV NI-2490, and LSDV Kenya	PCR, Real time PCR, Phylogenetic Analysis	Chattagram Gazipur Naryanganj Dhaka Satkhira Pabna	23 1.42 0.87 0.21 0.06 0.05	0.002 0.003 0 0.0004 0 0
China	3rd August, 2019	Xinjiang Province	Closely related to LSDV/Russia/Saratov/2017	Virus Isolation, Phylogenetic Analysis	19.5		0.9
India	12th August, 2019	Odisha State	Closely related to South African NI2490/KSGP like strain	PCR, Real time PCR, Phylogenetic Analysis	Cuttack Bhadrak Mayurbhanj Balasore Kendrapara	38.34 14.04 7.59 6.12 0.75	0 0 0 0 0
Nepal	Last week of June, 2020	Morang District	N/A	RT-PCR	100% sample positive out of 34		0
Bhutan	1st July, 2020	Not specified	N/A	Information not available	148 (animal)		3 (animal)
Vietnam	Early of October, 2020	Huu Lung District	Closely related to Chinese and Russia LSDV strain	Information not available	147 (animal)		11 (animal)
Hong Kong	4th October, 2020	Sai Kung Country Park	N/A	PCR, DNA Sequencing	20-30		2 (animal)
Myanmar	9th November, 2020	Not Specified	N/A	Information not available	3-6		0

Table 1: Courses and extents of Lumpy Skin Disease in Cattle at South-East Asian countries from 2019 to 2020. (image source: Moumita *et al.*, 2021)

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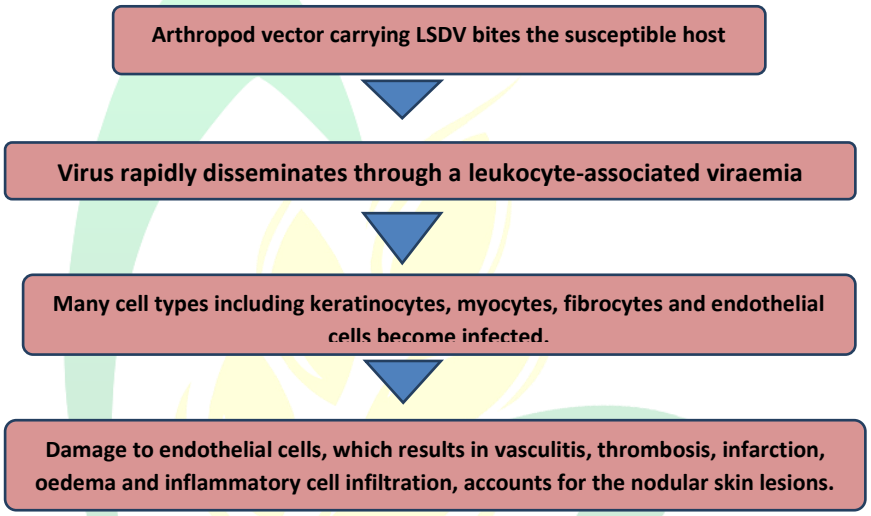
In 2021, there was an outbreak in Thailand and in February 2022, LSDV outbreak was reported in Karachi, Pakistan. In India, LSDV made its entry in 2019 and spread to several states. After this it was first reported in Jaisalmer, Rajasthan on April 7, 2022 and spread further to neighbouring state Gujarat where it is epidemic.

Morbidity rate may be up to 20% and in susceptible herds it may reach 100% but mortality rate for LSD is found to be 10% while in some books it is mentioned to be less than 5% and even lower to 1-2%.

Pathogenesis:



Clinical Manifestation:

- The incubation period is usually 2 to 4 weeks
- Persistent fever, lacrimation, nasal discharge, loss of appetite and hypersalivation
- Generalized cutaneous eruptions of round, firm nodules. These skin nodules involve the dermis and epidermis.
- Superficial lymph nodes become enlarged and there is oedema of the limbs and dependent tissues.
- Some skin lesions may develop into 'sit-fasts'. These are composed of a central plug of necrotic tissue which sloughs producing a deep ulcer.
- Secondary bacterial infection or myiasis can exacerbate the condition. Recovery may take several months.
- Affected animals are often debilitated and pregnant cows may abort.

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- The severity of the disease relates to the strain of virus and the breed of cattle. Domestic breeds (*Bos taurus*) are more susceptible than zebu (*Bos indicus*).

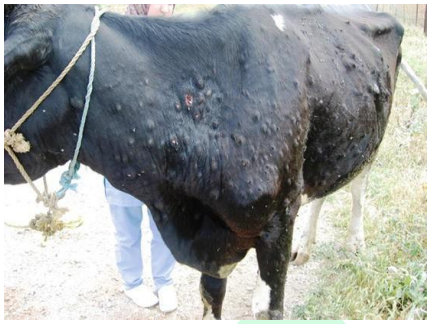

Fig 5: A cattle showing nodule formation

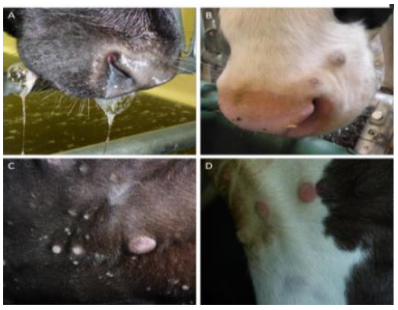

Fig 6: Various clinical signs of LSDV infection

Diagnosis:

- Generalized skin nodules in cattle in an endemic area are highly suggestive of lumpy skin disease.
- Clinical specimens: Biopsies (fresh and fixed) from lesion
- Intracytoplasmic inclusions may be demonstrable histological in recently developed lesions.
- Capripoxvirus particles in biopsy material or desiccated crusts can be identified using electron microscopy.
- The virus can be isolated in lamb testis cell monolayers.
- An antigen trapping ELISA is available for the detection of capripoxvirus antigen.
- Serological assay methods include virus neutralization, western blot analysis and the indirect fluorescent antibody test.
- Lumpy skin disease should be differentiated from pseudo-lumpy skin disease, which is caused by bovine herpes virus-2. The two diseases can be distinguished clinically based on the fact that in pseudo lumpy skin disease the lesions are confined to teats and udder of the cows. Laboratory test to distinguish the two diseases is ELISA.

Treatment:

- There are no specific antiviral drugs for LSDV.
- As a supportive therapy broad spectrum antibiotics (eg. Gentamicin) can be given. Non Steroidal Anti Inflammatory Drugs (NSAIDs) can be given.
- Treatment of skin care lesions using wound care sprays.
- If required intravenous fluid therapy.

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- Cattle showed 100% recovery when Propolis-Alginate nanoparticles (Propolis-ALgNps) were used through different routes (eye drop, oral route and topical spray) to treat clinical infection of cattle with LSDV (Farag *et al.*, 2020).

Prevention and Control:

- In endemic regions vaccination is the method of control. Two modified live vaccines, one based on a South African strain of lumpy skin disease virus (attenuated) and the other on a Kenyan strain of sheep pox virus (Tissue culture propagated) are available.
- A recombinant vaccine providing protection against lumpy skin disease and rinderpest has been developed.
- Imported cattle should be vaccinated before introduction into high risk areas.
- Since this is a transboundary disease, surveillance and eradication policies are appropriate control measures in countries bordering on endemic regions.
- Cattle should be treated regularly with insect repellents to minimize risk of vector transmitted disease.
- Cattle movement should be controlled especially during outbreaks.
- Since LSDV is transmitted principally by insect vectors, the importation of wild ruminants to zoos could establish new foci of infection, if suitable vectors were available.
- Separate the susceptible species from rest of the herd.
- Biosecurity measures should be at the highest feasible level.
- Cleaning and disinfection of personnel, premises, equipments and environment.
- This is a reportable disease. State and federal regulatory officials should be contacted if lumpy skin disease is suspected.
- Surveillance programmes can be helpful in countries where the disease is emerging (Silvia *et al.*, 2015).

Conclusion:

Lumpy skin disease is a transboundary disease that is spread mechanically. It has high morbidity and low mortality rate with great economic losses. Vector control and strict hygienic measures can help to curb the spread of disease.

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