

Lumpy Skin Disease (LSD): A New Emergence Viral Disease in India (Vinod Bhatshwar)

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Lumpy skin disease is an emerging bovine viral disease, which is endemic in most African countries and some Middle East ones, and the elevated risk of the spread of disease into the rest of Asia and Europe should be considered. The recent rapid spread of disease in currently disease-free countries indicates the importance of understanding the limitations and routes of distribution. It has been recently reported from China and Bangladesh sharing borders with India. LSD has recently been reported first time in India with 7.1% morbidity among cattle. In India, currently epidemiological status of the disease is unknown. The causative agent, Capripoxvirus, can also induce sheeppox and goatpox. Generally, fever, anorexia, and characteristic nodules on the skin mucous membrane of mouth, nostrils, udder, genital, rectum, drop in milk production, abortion, infertility and sometimes death are the clinical manifestations of the disease. The economic significance of these diseases is of great concern, given that they threaten international trade and could be used as economic bioterrorism agents.

Clinicopathology

The clinical features of the disease include fever, in appetite, nasal discharge, salivation and lachrymation, enlarged lymph nodes, a considerable reduction in milk production, loss of body weight and sometimes death. Furthermore, the disease is characterized by firm, slightly raised, circumscribed skin nodules (Figure 1) that are 2–7 cm in diameter and typically appear on the neck, legs, tail and back, shortly after the beginning of fever. The necrotic and ulcerative nodules raise the risk of myiasis. Oedema of the legs and lameness was observed in some cases.

Pathogenesis

The incubation period of disease in natural condition is between 2 and 5 weeks but in experimental condition, the duration ranges from 7 to 14 days. The LSD takes three forms: acute, subacute and chronic form. Following LSDV infection, virus replication, viremia, fever, cutaneous localization of the virus and development of nodules occur. Experimentally, after intradermal inoculation of the virus, the following events were reported:

- 4 to 7 days post-infection (DPI): localized swelling as 1–3 cm nodules or plaques at the site of inoculation and covering up to approximately 25% of the skin surface
- 6 to 18 DPI: viremia and shedding of the virus via oral and nasal discharge



Figure 1: Lumpy skin disease with raised and circumscribed nodular lesions.

- 7 to 19 DPI: regional lymphadenopathy and development of generalized skin nodules
- 42 days after fever: presence of virus in semen.

Transmission

Mechanical transmission by vectors is the prime route of spread of disease. In most of the endemic countries like sub Saharan Africa, Egypt and Ethiopia, the disease incidences significantly increase with the onset of seasonal rains and summer season, coinciding with the peak activity of the vectors. Incidences decrease significantly with the onset of winters and reappears with arrival of spring and summer. It is reported that the virus persists in necrotic skin nodules for up to 33 days or longer, in desiccated crusts for up to 35 days and for at least 18 days in air-dried hides. The virus can be inactivated at a temperature of 55°C for 2 hr and 65°C for 30 min. The main sources of infection are considered to be skin lesions as the virus persists in the lesions or scabs for long periods. The virus is also excreted via the blood, nasal and lachrymal secretions, saliva, semen and milk (transmissible to suckling calves).

Transboundary spread

LSDV was diagnosed for the first time in Zambia in 1929 and then reported in several regions of African countries (Wainwright et al., 2013). The disease has been identified in Saudi Arabia, Lebanon, Jordan, Iraq, Israel, Turkey and Iran (Abutarbush et al., 2013; Al-Salihi & Hassan, 2015; Sameea Yousefi et al., 2017). Since 2015, it has spread to Russia, Azerbaijan, Armenia, Greece and Bulgaria, Albania, Kosovo, Serbia and Montenegro. The disease further spread to other nearby countries like Turkey and Iraq in 2013 and Iran in 2014.

In India, first outbreak of the disease was reported in Odisha state in the month of August (2019), in monsoon season with high humidity and vector density. The first incident started on 12 August 2019, in Khairbani, Betnoti, Mayurbhanj districts of Orissa, where in a farm of 135 animals and 9 cases were reported. Then after few days, second outbreak was reported from the same region at new place Patalipura, where in a farm of 441 susceptible animals, 20 LSD cases were observed. With no time third case outbreak was reported on 20 August 2019 in Rajendrapur, Bhandaripokhari, Bhadrak, Odisha, with in a farm of 356 animals and 50 cases (<https://www.oie.int/>). In first published report of LSD in India, it was found that out of 2539 animals, 182 were positive with no mortality but 7.1% morbidity. On the basis of phylogenetic analysis, the strain present in India was genetically close to South African NI2490/KSGP-like strains rather than European strains.

Clinical signs and lesions

The incubation period of disease in natural condition is between 2 and 5 weeks but in experimental condition, the duration ranges from 7 to 14 days. The LSD takes three forms: acute, subacute and chronic form. The illness begins with biphasic fever. The clinical manifestations in mild form of infection appears as one or two lumps of nodules within 2 to 3 days of onset of fever, emaciation, ocular discharge, agalactia. Later on, nodular lesions, which are painful and hyperemic may be observed on the animal body especially in the skin of the muzzle, nares, back, legs, scrotum, perineum, eyelids, lower ear, nasal and oral mucosa, and tail. In severe condition, more than hundred nodules developed on skin all over the body and this stage persist for 7 to 12 days. The nodules are firm and slightly raised from surrounding skin, separated by narrow haemorrhagic ring. The nodules involve dermis, epidermis, adjacent subcutis and musculature. The lesions then progress towards papules, vesicles, pustule with exudation and then slowly to scab formation. Healing of the lesions is very slow. With time lesions develop on mucous membranes of nostrils, respiratory tract, mouth and vulva. After 2-3 weeks, the cutaneous lesions become harder and necrotic causing discomfort to animals and they become reluctant to move. The sloughing of the lesions may

create hole form “sitfast”, the characteristic lesion, which subsequently cause invasion by screw worm fly and bacterial invasion that can further lead to septicaemia. The generalized lymph node swelling also observed in infected animals. Recovery is very slow due to secondary bacterial infection, pneumonia, mastitis and fly strike in necrotic lesions leaving deep holes in the body.

Economic impact

Lumpy skin disease has led to serious economic losses in affected countries. The disease causes a considerable reduction in milk yield (from 10% to 85%) due to high fever and secondary mastitis. Other consequences of the disease include damaged hides, decline of the growth rate in beef cattle, temporary or permanent infertility, abortion, treatment and vaccination costs and death of infected animals. The total cost of the LSD outbreaks in 393 surveyed herds was 822 940.7 GBP in Turkey. In Ethiopia, the estimated financial loss was 6.43 USD and 58 USD per head for local zebu and Holstein Friesian, respectively. Total production losses resulting from the disease have been estimated at 45%–65% in industrial cattle farming.

Diagnosis

The diagnosis of exotic diseases is little challenging due to lack of familiarity and logistics. In case of LSD, clinical signs can be confused with other diseases like foot and mouth disease (FMD), insect bite, demodicosis and hypersensitivity. Tentative diagnosis can be made on the basis of skin nodules observed on face, eyelid, neck, muzzle, nostrils, udder, limbs. Skin biopsy sample can be collected for further confirmation of disease. Samples should be transported in transport medium with 20 to 50% glycerol in phosphate buffer saline. Skin samples can be checked by electron microscopy to identify virus. Samples of skin also show characteristic histopathological changes, which include vasculitis and perivascular infiltration with white cells causing a thrombosis of the vessel in the dermis and subcutis. Cells infiltrating the lesion are epithelial cells, known as “celles clavelaues”, which are also described in sheep pox. Agar gel precipitation test is not specific for LSD as the antigen of LSDV is shared with other capripoxvirus and parapox viurs. Virus isolation can be used for the confirmatory diagnosis in new niches. The bovine testes and pre-pubertal lamb, primary and secondary culture is most sensitive for isolation of virus. Molecular diagnosis with PCR is most efficient and rapid test for the diagnosis of disease. Conventional and real-time PCR have been developed for rapid diagnosis.

Prevention and control

Till date no effective treatment against LSD has been developed. Anti-inflammatory and antibiotics are used for symptomatic treatment. To control the disease, effective control and preventive measures need to be implemented, which include:

- a) Restrict movement: Movement of infected animals with LSD should be strictly prohibited to prevent the spread of transboundary disease. Within countries, if animal with such lesions are observed, they should be quarantined for inspection to prevent the rapid spread of disease.
- b) Restrict vector movements: Vectors movement due to prevailing winds may cause disease transmission. Vector control methods like use of vector traps, use of insecticides can also be used for preventing the disease.
- c) Vaccination: A live attenuated vaccine is available for LSD. Based on different strains of LSD virus, companies prepared vaccines. It is either based on Neethling strain like Lumpy Skin Disease Vaccine for Cattle (Onderstepoort Biological Products; OBP, South Africa) or Bovivax (MCI Sante Animale, Morocco), or based on SIS Neethling type (Lumpyvax, MSD Animal Health-Intervet, South Africa).

As LSD is closely related to sheeppox and goatpox virus, vaccine against sheeppox and goatpox can be used for LSD. Different strains of virus used as vaccine strain as per OIE. Homologous Lumpy skin disease virus Neethling strain from South Africa, passaged 60 times in lamb kidney cells and 20 times on the chorioallantoic membrane of embryonated chicken eggs provides immunity for 3 years. Sheeppox vaccines used against LSD includes Kenyan sheeppox virus passaged 18 times in lamb testis (LT) cells or fetal calf muscle cells, Yugoslavian RM 65 sheep pox strain, Romanian sheep pox strain. These vaccines are not advised in sheeppox and goatpox affected areas as such vaccines may serve as source of infection for susceptible population of sheep and goat. Live attenuated Gorgan goatpox strain provide good protection in cattle with practically no side effect. For effective control and prevention of disease, long term vaccination with 100% coverage should be made mandatory as LSD virus being stable survives in environment for long time. Before introducing new animals to the affected farm, they should be immunized. Calves should be immunized at the age of 3 to 4 months raised from mothers, who are vaccinated or naturally infected. Pregnant cows, breeding bulls can be vaccinated annually.

Conclusion

Cattle and buffaloes are important livestock contributing substantially to the world 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. Besides, effective quarantine methods, vector control methods, vaccination is the only method to prevent the disease.