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Research Article

Lumpy skin disease: A clinical study of an outbreak

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Abstract

Lumpy skin disease (LSD) is a vector-borne viral disease affecting cattle and buffalo characterized by eruption of skin nodules, high fever, lacrimation and nasal discharge. This clinical study reports LSD outbreak in cattle population in March 2020 from Maharashtra. LSD caused heavy economic losses to farmers and cattle rearers due to reduction in milk production, chronic emaciation in the affected herd, poor growth, mastitis, infertility, abortion and death in some cases. Affected animals showed skin nodules on different parts of the body, rectal temperature between 102 to 103°F, painful swelling at dewlap and shoulder region, lameness and dollar-like skin lesions in some animals. Clinical signs and polymerase chain reaction (PCR) confirmed lumpy skin disease. Affected animals were treated with a combination of antihistaminic, non-steroidal anti-inflammatory drugs (NSAIDs), antibiotics and ivermectin, along with spraying of cypermethrin and sodium hypochlorite. Healthy animals were vaccinated with goat pox vaccine in the wake of the outbreak to prevent further spread.

Key words: Antibiotics, NSAIDs, PCR, Skin nodules, Vector

Highlights

- This study involves an investigation of LSD-affected cases in the Gadchiroli District of Maharashtra.
- Animals with clinical signs were examined for patterns of disease manifestations.
- Clinical cases were confirmed with PCR.
- Diseased animals were treated with antihistamines, NSAIDs and antibiotics.
- Healthy animals were vaccinated with goat pox vaccine.

INTRODUCTION

Lumpy skin disease is a vector-borne viral disease caused by lumpy skin disease virus, also called as Neethling virus, which is a DNA virus belongs to genus *Capripoxvirus* of Poxviridae family (Davies, 1991; OIE, 2010; Gumbe, 2018). LSD virus is closely related to goat pox virus (GTPV) and sheep pox virus (SPPV) as it contains all identical genes in its genome (Tulman *et al.*, 2002; CFSPH, 2008). LSD is highly contagious in nature and characterized by fever, eruption of nodules on the skin and mucous membrane, enlargement of lymph nodes, oedema in the brisket region, salivation, lacrimation, nasal discharge, debility, laminitis and death in some cases (Davies 1991 and Issimov *et al.*, 2020). Swollen skin nodules separate from healthy dry and haired skin parts and become to form "sit-fast".

LSD is transmitted by haematophagous insects like *Aedes aegypti* and *Stomoxys calcitrans* being most common vectors for LSD (Kitching, 2008). *Boophilus decoloratus* (blue tick), *Rhipicephalus appendiculatus* (brown ear tick) and *Amblyomma hebraeum* also act as vectors for the disease (Lubinga *et al.*, 2014; Gumbe, 2018), whereas *Culicoides nubeculosus*, *Anopheles stephensi* and *Culex quinquefasciatus* act as component vectors for transmitting LSDV (Gubbins, 2019; Issimov *et al.*, 2020).

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The first outbreak of LSD was reported in Zambia in 1929, where it was considered as poisoning and insect-bite hypersensitivity (Brenner, 2006; Abdulqa *et al.*, 2016; Al-sabawy *et al.*, 2020). Other reported outbreaks include cases in Botswana, Zimbabwe and Republic of South Africa between 1943 and 1945 (Abdulqa *et al.*, 2016; Al-sabawy *et al.*, 2020). It was again recorded in South Africa in 1949 and outside the African continent in Egypt in 1988, Israel in 1989, Kuwait in 1991, Yemen in 1995, UAE in 2000, Bahrain in 2003, Israel in 2006-2007 and Oman in 2010 (Abdulqa *et al.*, 2016). LSD outbreaks were reported in Israel, Lebanon and Turkey in 2012, in Iraq, Jordan, Turkey and Iran in 2013 and in Cyprus, Azerbaijan and Turkey in 2014 (EFSA, 2016; Sudhakar *et al.*, 2020). LSD outbreak occurred in Greece in 2015 and at a larger scale in 2016 when it covered several countries in South Eastern Europe, Saudi Arabia, Russia, Georgia and Kazakhstan (EFSA, 2017; Sudhakar *et al.*, 2020). LSD outbreak continued in Russia, Turkey and Israel in 2018 and 2019, which has further extended into South Asia in China and Bangladesh (Sudhakar *et al.*, 2020). In August 2019, India witnessed its first outbreak of LSD in Mayurbhanj and Bhadrak Districts of Odisha. The disease was further spread in Jharkhand, West Bengal, Chhattisgarh, Andhra Pradesh, Telangana, Kerala and Karnataka (Face2vet clinical update, 2020).

MATERIALS AND METHODS

Clinical study of an outbreak: In March 2020, nodular skin lesions (Fig. 2, 3 and 4) and lameness with swollen limbs (Fig. 1) were observed by locals in Sironcha block of Gadchiroli district of Maharashtra, India. Sironcha is located at the bank of Pranhita river with a latitude and longitude of 18.83°N 79.96°E. Sironcha is surrounded by dense forest, and people depend on farming and livestock for their livelihood. The first case was reported to the veterinary officer on 18th March 2020; the bullock was presented with nodular eruptions all over the body along with fever. Similar symptoms were also reported in two or more cases of LSD in the villages of Sironcha block. The history revealed that the affected animals shared the same grazing land, farm or stable. So, these farms, stables and the same grazing land acted as an epidemiological unit for LSD. In the present outbreak, blood-feeding vectors played an important role in transmitting disease within the herd. According to 19th livestock census, total population of cattle and buffalo in Sironcha tehsil was 5785, amongst which 719 cattle were clinically affected by LSD with a morbidity rate of 12.43% and no mortality. The clinical data were collected by the veterinary officers of the block and presented to the District Authority.

A total of 23 samples were collected from cattle showing clinical symptoms of LSD for virus identification by a team of veterinary officers as per established rules and guidelines of the Department of Animal Husbandry, Government of Maharashtra. The animals were selected on the basis of clinical signs after receiving the owner's consent. The samples included 8 skin biopsies, 7 nasal swabs and 8 whole blood samples, were collected out of 719 affected animals. Skin biopsies and nasal swabs were taken from the animals in a virus transport medium i.e., phosphate buffered saline (PBS), and stored at 4°C. At the same time, 3 mL of whole blood was also collected from those animals in Ethylene diamine tetraacetic acid (EDTA) vials. These samples were sent to ICAR-National Institute of High Security Animal Diseases, Anand Nagar, Bhopal within 5-6 days of collection, and all the other procedures were carried out in Bio-security Level (BSL) 3 containment laboratory.

All the samples were processed for real time PCR (RT-PCR) at ICAR-National Institute of High Security Animal Diseases, Bhopal.

Case management, treatment and prophylaxis: Treatment was done with a combination of antibiotic, non-steroidal anti-inflammatory drugs (NSAIDs), antihistaminic and B-complex. The therapy included ampicillin @ 5-10 mg/kg/day, flunixin meglumine @ 1.1 to 2.2 mg/kg/day, meloxicam @ 0.5 mg/kg/day, chlorpheniramine maleate @ 4 mg/kg/day by intramuscular route

Clinical study of lumpy skin disease

Fig. 1. Engorged lymphatic veins and brisket edema

Fig. 2. Nodules on dewlap

Fig. 3. Nodules on left side of animal

Fig. 4. Nodules on right side of animal

for five consecutive days. Along with this treatment, B-complex was injected as a supportive treatment. In some animals, ivermectin was given @ 200 µcg/kg by subcutaneous route along with spraying of cypermethrin and sodium hypochlorite as those could act as repellent for vectors.

Goat pox vaccine (Uttarkashi strain) was procured from the Institute of Veterinary Biological Product (IVBP) Pune, and vaccination of healthy unaffected animals were carried out during the outbreak.

RESULTS

The clinical symptoms of LSD in affected cattle were generalized eruptive skin nodules at different parts of the body, fever, inappetence and swelling of pre-scapular lymph nodes in some cases. Skin nodule biopsies were found to be more reliable samples for the detection of LSD virus, followed by nasal swab samples. In the present study, all eight tissue samples were positive for LSDV. In comparison, only two nasal swabs could detect LSD virus and all blood samples were negative for LSDV. RT-PCR confirmed the entire samples positive for lumpy skin disease virus (LSDV). In this study, real time PCR detected 100% of skin nodular biopsies positive for LSDV, whereas only 22.2% of nasal swabs were detected positive. These results are in accordance with previous studies by Kumar (2011), Feyisa (2018) and Sudhakar *et al*. (2020). The morbidity varies from 3 to 85% and can reach up to 100% (Barnard *et al*., 1994; Carter *et al*., 2005; Kumar, 2011), whereas mortality is less than 5% and may reach to 20% in few instances (Babiuk *et al*., 2008; Tuppurainen *et al*., 2012; Issimov *et al*., 2020).

Till date, there is no specific treatment for LSD. In the present outbreak, a combination of inj. ampicillin, inj. ceftriaxone, inj. flunixine meglumine, inj. meloxicam, inj. clorpheneramine malleate and inj. vitamine B complex were administered for 5-7 days to control secondary bacterial infection. Similarly, other workers have also stated that the combination of antibiotics, NSAIDs, antihistaminic and vitamin B complex can control secondary bacterial infection and improve feed intake (CFSPH, 2008; Kumar, 2011; Abdulqa *et al*., 2016; Feyisa, 2018; Gumbe, 2018) and recovery rate in LSD infected animals. In cases with mild clinical signs or no signs, inj. ivermectin was injected as a preventive measure, as ivermectin could act as a repellent for insects (Floate, 1998; Dreyer *et al*., 2019). Ectoparasiticides and disinfectants, namely cypermethrin and sodium hypochlorite, were sprayed twice a week to control the vector population. This measure also yielded desirable results, which are well-established as per previous studies (Kumar, 2011; Zeynalova *et al*., 2016; Al-sabawy *et al*., 2020). The present outbreak was controlled with above mentioned treatment protocols with the uneventful recovery of all the treated animals indicating good recovery rates.

DISCUSSION

The incubation period of LSD at the field level is 1 to 4 weeks, whereas, in experimental setups, it is estimated from 4 days to 3 weeks (Haig, 1957; CFSPH, 2008; Abdulqa *et al*., 2016). Outbreaks are more frequent in wet, warm weather and areas near water sources as a result of nature of vectors. Excretion and secretion of infected animals can act as sources of infection and infect fomites, feed material, and water sources, which may affect other animals.

The clinical symptoms of LSD in affected cattle were generalized eruptive skin nodules at different regions of the body, fever, inappetence and swelling of pre-scapular lymph nodes in some cases. These symptoms are in line with the previous studies by Davies (1991), Feyisa (2018), Issimov *et al*. (2020) and Sudhakar *et al*. (2020). In the present study, the morbidity rate was 12.43%; these findings are associated with previous studies (Elhaig *et al*., 2017; Sudhakar *et al*., 2020). No mortality is observed in this study, whereas low mortality rates have been observed in earlier studies (Sudhakar *et al*., 2020). There was no evidence of any clinical signs in small ruminants, i.e., sheep and goats, even though they shared common genus for causative agent. The occurrence of high morbidity and mortality in previously reported

LSD outbreaks (Kumar, 2011; Issimov *et al*., 2020) might be due to of lack of awareness about this disease among farmers and the immune status of animals and also the type of animals (breed and age) involved in the outbreak.

LSD is mainly transmitted by blood-feeding insects including mosquitoes, flies and ticks (Kitching, 2008; Lubinga *et al.*, 2014; Gumbe, 2018; Gubbins, 2019; Issimov *et al*., 2020). In the current outbreak also transmitting factor was a blood-feeding vector along with secondary indirect transmission between animals.

Skin nodule biopsies are more reliable samples for detecting LSD virus, followed by nasal swab samples. In the present study, all eight tissue samples were positive for LSDV. This indicates the tissue tropism associated with the replication of the virus. In comparison, only two nasal swabs could detect LSD virus and all blood samples were negative for LSDV. In this study, real time PCR detected 100% of skin nodular biopsies positive for LSDV, whereas only 22.2% of nasal swabs were detected positive.

Vaccination is the only effective way to control LSD as restriction of movement of animals and segregation of affected animals are less effective due to vector movements. In line with this, goat pox vaccines were procured from IVBP, Pune, Animal Husbandry Department, Government of Maharashtra, and vaccination campaign was initiated in apparently healthy and unaffected animals from the affected area and its surroundings. Vaccination was held in cattle aged three months and above. We got satisfying results of the vaccine as there was no occurrence of new cases in the area. Many other workers have used goat pox vaccine, LSD Neethling strain vaccine and sheep pox vaccine to control LSD and have got desired results (Kumar, 2011; Abdulqa *et al.*, 2016; Zeynalova *et al.*, 2016; Gumbe, 2018 and Al-sabawy *et al.*, 2020).

The World Organization of Animal Health (OIE) has categorized LSD as a notifiable disease as it has a high impact on the economy. LSD causes several problems in cattle, including depletion or cessation of milk production, abortion, infertility, lower weight gain and permanent damage to hides affecting its commercial value (Elhaig *et al.*, 2017).

LSD is an extensively devastating vector-borne viral disease characterized primarily by skin nodules and poses a significant economic impact. A combination of treatment protocols and vaccination aimed at controlling LSD has been successful in most cases during the outbreak. There should be a regular awareness program for farmers on LSD and vector control strategies to make them alert to the impact of LSD on the economy. Further studies are required to determine the source of LSD virus introduction, the economic impact on the dairy sector, type of vectors involved in transmission, effective treatment and control strategies to prevent LSD in India and globally.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: KML, KRS: Collected samples and processed for confirmation of disease with PCR by sending samples to the laboratory; VSG, AHG: Treated cases after discussing the case and treatment protocol; RIH, KML, AHG: Analyzed data and prepared manuscript.

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