LUMPY SKIN DISEASE (LSD) AND FRAMEWORK FOR EARLY DETECTION OF DISEASE BY USING ARTIFICIAL INTELLIGENCE

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Abstract
Lumpy Skin Disease (LSD) is a serious viral illness in cattle cause by capripoxvirus. The mainly characterisied fever, less eating, runny nose, excess salivation and tears, swollen lymph nodes, big drops in milk yield, weight loss, and sometimes death. It is a viral disease breaks out and causes a large number of animals to get sick and even of some them leads to die, which creates economic threat for farmers. Scientists are trying to stop the spread of the disease working on earlier detection. The study found that spreading by close contact between animals do not significant role; infection is mainly spread from insect bites. This work helps explain what drives the spread of Lumpy Skin Disease and highlights the need for effective ways to control it. Fast and accurate detection is very important for implementing and introducing control measures to prevent spread, but previously used diagnostic methods are time-consuming and lack of medical facilities in rural areas. This work proposes concept of automated identification of the LSD in cattle by using the dataset of images through artificial intelligence (AI) as a solution. Using Artificial Intelligence in detecting the Lumpy Skin Disease (LSD) these findings can help in adapting better strategies to protect cattle before it turns into the pendemic.
Keywords: Lumpy skin disease, deep learning and Artificial Intelligence.

1. Introduction

Lumpy skin disease causes severe loss to the farmers in terms of decreased milk yield, poor growth rate, infertility, abortion and even death (Abutarbush *et al.,* 2013). LSD is caused by the LSDV, which belongs to the Capripoxvirus genus in the Poxviridae family. It is closely antigenically related to sheep and goat pox virus (Alexander *et al.,* 1957). Viruses can infect ruminants. Also, the LSD disease has not been reported in sheep or goats when kept in close contact with the infected cattle (Davies *et al.,* 1991). Vectors such as biting flies and mosquitoes (Aedes aegypti) and tick species like, Amblyomma hebraeum, Rhipicephalus appendiculatus and Rhipicephalus decoloratus are the most prevalent carriers of this disease (Shen *et al.,* 2011). The symptoms can range from mild to severe. Pyrexia occurs within 5–7 days of incubation period, nodules (1-5 cm in diameter) on skin, nodules on mucosal surfaces and enlargement of the superficial lymph nodes especially pre scapular lymph node are all the symptoms of LSD. All the secretions and excretions contain LSD virus. Ulcerated nodules on the skin (Figure 1), eyes, mouth, nose, rectum, udder mucous membranes and genitalia contain virus. The animal's limbs may be edematous (Figure 5) and it is reluctant to move. Infection can also get transmitted to suckling calves via milk. Pregnant cows may abort and there may be intrauterine transmission of LSD virus. bulls can Breeding become permanently infertile and the virus is present in the semen also (Al-Salihi, 2014). The affected animal is weak, may develop pneumonia or mastitis and the necrotic plugs of skin are prone to fly strike. When the necrotic plugs are shed leaving holes in the hide, thus reducing their commercial values (Jameel, 2016).

Photoghraph

Cattle Suffering from LSD in Yavatmal District

Figure 1

Figure 2

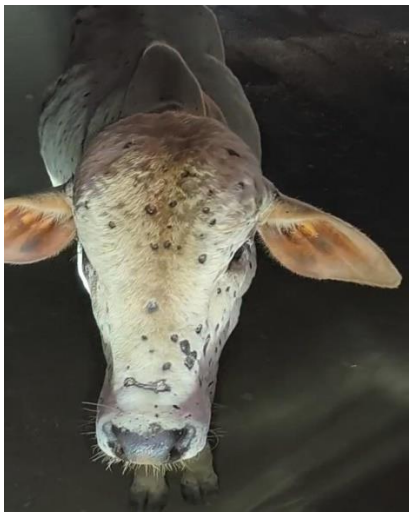

Figure 3

Figure 4

Figure 5

A cow with characteristic symptoms of Lumpy Skin Disease (LSD), including raised nodules on the skin. These visible signs are critical for early detection and diagnosis. **(Fig 1,2,4 and 5).**
A cow recoved from Lumpy Skin Disease (LSD) **(Fig 3).**

2. **Infectious organism**

The causative agent belongs to genus Capripoxvirus from the relatives Poxviridae is the causative agent of Lumpy Skin Disease. Pathogenesis on Subcutaneous or intradermal inoculation of cattle with LSDV, there is inflammation and development of a localized swelling at the site of inoculation after 5 to 7 days. Viral replication site is pericytes, endothelial cells, cells in blood vessel and lymph vessel walls causes vasculitis and lymphangitis In severe cases infarction may occurs which results in to edema

and necrosis of different organs Immunity after recovery from natural infection is life-long in most cattle Calves of immune cows acquire maternal antibody and are resistant to clinical disease for about six months (Coetzer, 2014).

3. Distribution of LSDV

Nodules that are created on the mucus membranes of the nose, mouth, eyes, abdomen, udder, and genitals, releasing sufficient viruses to serve as viral sources. Many scientifically afflicted sheep will become infectious and carriers of the virus; approximately 50 percent of the individuals exposed exhibit medical indications. LSD virus was found in saliva, sperm and skin nodules for about 11 days, 22 days and 33 days, respectively in deliberately exposed cattle, whereas it was not detected in the faeces or urine (Tuppurainen and Oura, 2012). Given that Capripox viruses are incredibly immune to chemical and biological circumstances, they can remain in lesions or scabs for extended periods and have a strong affinity for cutaneous tissues (Tageldin *et al.*, 2014).

Nodules are present, which involve all layers of the skin, the subcutaneous tissue and sometimes the adjacent musculature. Granulomatous lesions are found on various mucous membranes and in some organs (particularly the lungs) and in the upper respiratory and digestive tracts. Acanthosis (thickened epidermis), parakeratosis (thickened stratum corneum containing pyknotic nuclei) and hyperkeratosis (thickened stratum corneum) of epidermis occurs. Eosinophilic intracytoplasmic inclusion bodies found in keratinocytes, fibroblasts and macrophages, etc. (Tageldin *et al.* 2014).

4. Diagnostic characterstics of LSDV

The clinical signs of Lumpy skin disease include high temperature, satiation, runny nose, nasal discharge, sialorrhea, decreased body weight, swelling in lymphnodes lacrimation, and reduced production of milk (Babiuk *et al.*, 2008; Abutarbush *et al.*, 2013). The snout, nasopharynx, laryngeal, windpipe, lip recesses, gums, browsing pad, digestive system, mammary glands, uterine tubes, testes & vagina may all be affected. Serious illness consequences included keratitis, diarrhoea, inflammation in the lungs, breast tissue infection, itching and pain (Tuppurainen *et al.*, 2017; AlSalihi and Hassan, 2015).

5. Treatment

Treatment Symptomatic treatment of affected animals may be carried out. Administration of antibiotics for 5-7 days to check secondary infection. Administration of anti-inflammatory and anti-histamine preparations may also be considered. In case of pyrexia, paracetamol can be given.

Application of antiseptic ointment with fly-repellent property over the eroded skin is recommended. Parenteral / oral multivitamins are advised. Feeding of liquid food, soft feed and fodder and succulent pasture is recommended for the infected animals. Control Control of vectors by following integrated management practices such as physical, biological, cultural and chemical control. The practices such as change in grazing timings by avoiding bright sunshine hours; use of biocontrol agents against flies and ticks are also recommended. Use of herbal pesticides as repellants and last resort as spray of chemical insecticides are the options available.

Vaccination in endemic areas. Quarantine of new arrived and infected animals. Disinfection of animal houses and premises with phenol 2%, sodium hypochlorite (2-3%), etc. Avoid movement/transport of infected animals and avoid trading during outbreaks.

6. Control and Vaccination

Control of Lumpy skin disease by quarantine and control on movement of animals is not very effective because biting flies and certain tick species are the most important mode of transmission of the disease. Although, the control of insects was not effective in preventing the spread of LSD, but use of insecticides together with fly repellents can be used in prevention of the spread of Lumpy skin disease.

First Lumpy Wave the initial epidemics occurred in 2019, with more significant morbidity but extremely low fatality. The epidemic spread to adjacent states as well, including all southern states. However, the sickness was minor, and only a few cases of dermal farm disease were documented in 2019-20. Second Lumpy wave 2020-21): Several southern states, as well as other central regions, were hit, although the virus was a largely dermal farm and killed considerably more people in Maharashtra than in other affected areas, including MP and UP (Reddy *et al*., 2022).

Third Lumpy Wave the disease has become further contagious. During this wave, the "respiratory form of the disease was more prevalent, along with the dermal form", and the highest mortality was reported from states, particularly northern India, where there is a higher concentration of critical condition of the cattle as well as in animal shelters, contributed to death, which was primarily related to management techniques (Mani *et al.*, 2022).

7. Imaging and Diagnostics by using Artificial Intelligence

Medical imaging is a technique that involves examining the images of cattle and its infected part of a body for clinical analysis and intervention, as well as visual representation of organ or tissue. It

aims to reveal the infected and normal cattle by using database, establish a database will sort out the of normal anatomy and physiology and abnormalities**.**

Conclusion

Lumpy Skin Disease (LSD) leads to severe economic losses in the animal husbandary due to large number of affected animals, decreased milk yield, damaged hide quality, and slow recovery during treatment. The virus mainly enters animals through bites from blood-sucking vector flies. To prevent the outbreak or occurrence of LSD, animals should not be allowed to graze in areas infested with vectors, and strict movement restrictions should be at village, implemented district, or state levels. Infected animals must be isolated in insect-proof place and fed separately. Applying fly repellents on farms helps keep insects away. Regular disposal of manure and urine, along with the removal of stagnant water, play's an important role. Chemicals and insect repellent can further reduce insect presence. Overall, animals should be kept in shades and they should be open for graze openly only in control condition with proper monitorzing them, and cow sheds must be protected against mosquitoes and insects.

Vaccination or immunization of susceptible livestock is the most effective strategy to prevent the outbreak of LSD. The incorporation of artificial Intelligence can achieve accuracy in image-based detection which will be the transformative step in early detection of the disease. It can help farmers, veterinarians, and researchers identify LSD earlier and more accurately, leading to faster treatment and control measures. By using AI models, the detection of LSD lesions on cattle skin will becomes faster and more reliable than old methods, of visual inspection. This approach can reduce economic losses by helping to control the spread of the disease more efficiently and management strategies in affected areas.

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