A Brief review on Lumpy Skin Disease

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Abstract: Lumpy skin disease is one of the rapidly spreading viral disease among cattle.Lumpy skin disease (LSD) causes huge economic losses in the livestock industry. It is caused by Lumpy skin disease virus (LSDV), which belongs to the family Poxviridae, with the Neethling strain the prototype. LSDV belongs to the genus Capripoxvirus that includes sheep pox virus and goat pox virus. LSD is an enzootic infectious, eruptive and seldom fatal disease of cattle characterized by nodules on the skin. Cattle and water buffalo are the only animal species affected, with high morbidity rate, but low mortality, however, death rates are higher among calves. LSD causes loss of milk and beef production, abortions in females and sterility in males. The original foci of LSD are from Zambia in 1929. LSD is considered as an endemic disease in the African continent. However, the disease has been moved beyond Africa in 1984. It is reported in Madagascar and some countries in the Arab Gulf Peninsula and Middle East. Recently, the disease is reported in LSD free countries (Jordan, Syria, Lebanon, Turkey, Iran and Iraq) with potential economic loss to the livestock industry. This review article intends to discuss the LSD in the light of the recent situation raises conckeerns the spreading of the disease in LSD free countries.

KEYWORDS: Lumpy Skin disease, biology, symptoms, diagnosis, transmission, treatment, prevention, impact.

INTRODUCTION

Lumpy skin disease is a high impact trans boundary pox disease of cattle and Asian water buffalo caused by a lumpy skin disease virus (LSDV).The disease is categorized on the list of Notifiable disease by the WORLD HEALTH ORGANIZATION (WHO) for animal health Due to its capability of rapid trans boundary spread and to cause substantial cattle production losses. Lumpy skin disease is widely spread in Africa and in the Middle East. In 2013 The first LSD outbreaks were reported in Turkey from where it swiftly spreads to the northern part of Cyprus, Southeast Europe and the northern Caucasus region . Currently those countries neighboring the affected areas in Europe and Asia are facing a risk of incursion of LSD into their territories. This disease virus is likely transmitted mechanically between cattle by biting insects, with the virus being permeated in a wildlife reservoir host, possibly the African Cape buffalo. If suitable vectors are available .the importation of wild ruminants to zoos might also spread the virus. This virus has affected over 67,000 cattle in India also. Since July, more than 65,000 cattle have died in more than eight states including Gujrat, Rajasthan, Punjab and Haryana. In endemic areas, LSD is a re emerging transmissible infection that results significant socioeconomic impairment to small-scale and courtyard agrarians . Considering the disease burden, morbidity and mortality cattle are found as more sensitive to the illness compared to buffalos and other ruminants. Despite the practice of mixed herd farming in many countries consisting of cattle, sheep, and goats, it is not yet evidenced that small ruminants act as reservoirs.Despite the economic importance of LSD, limited number of studies are accessible on this extremely devastating arthropod-borne disease in South and East Asian states. Recurrent outbreak and reappearance of the disease in various parts of the world pointed out the importance of re-evaluation of the disease biology, viral transmission mechanism and updated preventive and adaptive control techniques.

Fig .1.1

INFORMATION ABOUT LUMPY SKIN DISEASE VIRUS (LSDV)

VIRUS CLASSIFICATION

Type:- virus
Realm:- varidnaviria
Kingdom:- Bamfordvirae
Phylum:- Nucleocytoviricota
Class:- Pokkesviricetes
Order:- Chitovirales
Family:- Poxviridae
Genus:- Capripoxvirus
Species:- Lumpy skin disease virus

Lumpy skin disease virus (LSDV) is the double stranded DNA virus. It is a member of Capripoxvirus genus of Poxviridae. Capripoxvirus (CaPVs) reoresebts one of eight genera within the Chordopoxvirus genus consists of LSDV, as well as sheep pox virus and goat pox virus. CaPVs infections are usually host specific within specific geographic distributions even though though they are serologically indistinguishable from one another. Like other virus in the Poxviridae family, capripoxviruses are brick-shaped. Capripoxvirus virions are different than orthopoxvirus virions in that they have a more oval profile, as well as larger lateral bodies. The average size of Capripoxvirus is 320 nm by 260 nm.

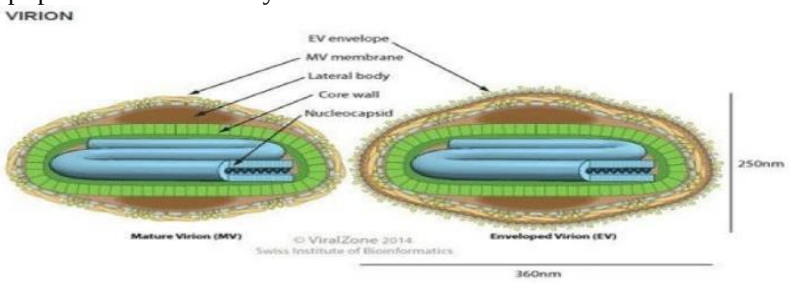

Fig 1.2

BIOLOGY OF LSDV

The virus that causes LSD is an enveloped, linear, ovoid, double-stranded DNA virus under the family Poxviridae and genus Capripoxvirus . The sole serotype of LSDV; "Neethling" was first identified in South Africa and represented similar antigenic properties with goat and sheep pox virus]. The virus is characteristically impervious to many physical and chemical agents and remains constant between pH 6.6 and 8.6, but is predisposed to higher alkaline environment . It undergoes an exclusive survival capability in necrotic skin nodules (33 days), desiccated crusts (35 days), sunlight protected infected tissue (6 months) and air-dried hides at room temperature (minimum 18 days)]. Resistance to heat is flexible but most isolates are disabled at 55ºC for couple of hours, or 65°C for 30 minute solvent The virus is susceptible to highly alkaline or acidic solutions, and detergents containing lipid solvents. The organism becomes defenseless in daylight while inactivated with ultraviolet rays and at 55 °C for one hour .Moreover, LSDV shows susceptibility to 20% chloroform, 1% formalin, ether, 2% phenol, 2–3% sodium hypochlorite, 0.5% quaternary ammonium compounds, iodine compounds dilution and the detergents containing lipid solvents.

SYMPTOMS OF LSD

Symptoms include:-

- High fever
- Reduced milk production
- Skin nodules.
- Loss of apatite
- Increased nasal discharge
- Watery eyes
- Too much of salivation
- Discharge of water from eyes
- Formation of nodules on the body

The disease is very difficult to eradicate due to subclinical infections and the presence of insects capable of spreading the virus. Nodules can raise up to 50mm in diameter develop Around the head, neck, genitals and limbs. To check the spread of disease, the animal husbandry department has issued an advisory to all 24 district in which the suspects are detected and asked them to send samples, if any such case of lumpy skin disease is reported in their respective areas.

CLINICAL SIGNS

The incubation period of the disease varies from 1 to 4 weeks and then develop fever and downheartedness after viral entry, which continues about 4 to 14 days . The clinical courses of LSD may vary, and these are acute, sub-acute, or in-apparent. Typical LSD is characterized by high body temperature (>40.50C) and skin nodules (10-50 mm diameter) that usually undergo necrosis, affecting the cranium, internal ear, eyelids, muzzle, neck, udder, limbs, perineum, genitalia, and so on.. Additional clinical signs comprise lachrymation and nasal expulsion, enlarged subscapular and pre-femoral lymph nodes, and reduced milk yield . Moreover, abortion, prolonged fever, infertility, emaciation, and lameness, may occur in infected animals. (5)

DIAGNOSIS OF LSD

Diagnosis of LSD mainly depends on the typical clinical signs, differential diagnosis, and application of various diagnostic laboratory techniques for detection and confirmation of the disease, such as ekectron microscopy examination, virus isolation (VI) , serological tests (serum neutralization test), agar gel immune diffusion, indirect enzyme-linked immunosorbent assay, and indirect fluorescent antibody technique (IFAT) , and real-time or conventional polymerase chain reaction (PCR) . Viral isolation and identification as well as PCR methods for detecting LSDV diagnosis; it is time- consuming as the protocol takes several weeks to isolate LSDV in tissue culture or chorioallantoic membrane (CAM) of embryonated chicken egg (ECE).

Immunohistochemistry (IHC) is an essential tool for diagnosing many animal disease, including LSDV; several authors have reported it as a direct method for detecting the pathogenic antigen detecting the pathogenic antigen distribution using specific anti-LSDV antibodies in skin nodules of infected cattle. (3)

TRANSMISSION OF LSD

Transmission of virus occurs through movements of cattle. Infected animals showing lesions in the skin and mucous membranes of the mouth and nasal cavities excrete infectious LSDV in saliva, as well as in nasal and ocular discharges, which may contaminate

shared feeding and drinking sites. The virus persists in the semen of infected bulls so that natural mating or artificial insemination may be a source of infection for females. Infected pregnant cows are known to deliver calves with skin lesions. The virus may be transmitted to suckling calves through infected milk, or from skin lesions in the teats. (4)Local blood-feeding insect vectors feeding on cattle can also transmit the virus. The common stable fly (Stomoxys calcitrans), the Aedes aegypti mosquito, and some tick species of the Rhipicephalus and Amblyomma spp., have demonstrated ability to spread the LSDV. The mechanism of LSDV transmission is useful in evaluating the epidemiology of the virus, thus contribute towards progressive control strategy and extinction of the disease . An epitome of possible modes of transmission of LSDV is shown in Figure

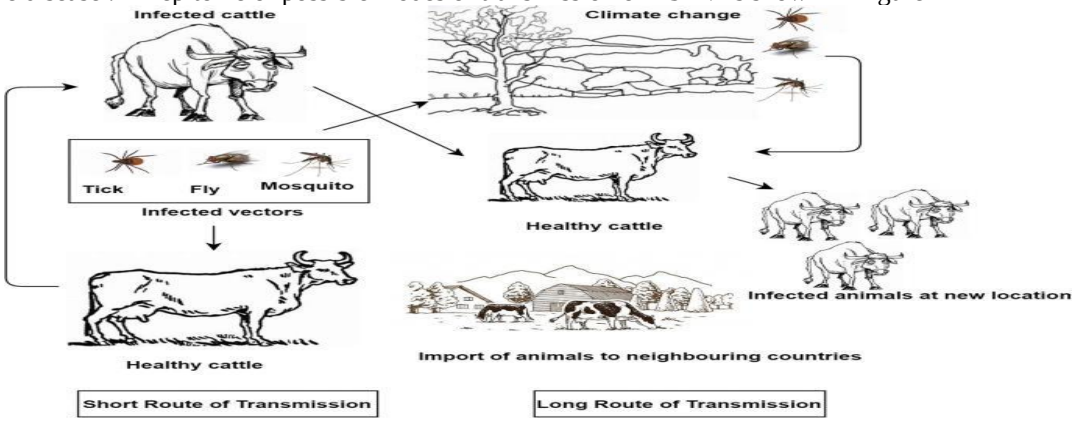

Fig 1.3

Non-vector transmission

Although ineffective, non-vectored LSD transmission happens when clinically afflicted animals come into contact with contaminated materials, without the need of biological or mechanical vectors. Infectious LSDV is excreted in saliva, nasal and ocular discharges, contaminating communal eating and drinking areas and spreading the disease . Transmission through contaminated needles during vaccination, dispersion through infected semen during coitus, ingestion of milk, and intrauterine transmission may also act as a sources of infection. Vector transmission The role of arthropod vectors in the transmission of this virus was experimentally confirmed. Several blood-sucking hard ticks, for instance, Rhipicephalus appendiculatus (brown ear tick), Rhipicephalus de colouratus (blue tick), and Amblyomma hebraeum, mosquito Aedes aegypti and flies Stomoxys calcitran, Haematobia irritans and Musca domestica have been implicated in the spreading of LSDV in sub-Saharan Africa. In the tick host, LSDV is trans-stadially and transovarially transmitted during cold temperatures. The virus may spread in short distances of a few kilometers , and even cover longer-distance due to unrestricted animal movements across international borders.

TREATMENT ON LSD:-

There is no treatment for Lumpy skin disease. It is difficult to stop cattle from being affected by infected vectors (flies etc.) once the infection is within the area. Risk behaviors increase the probability of infection being carried between. Non-specific treatment (Antibiotics, anti-inflammatory drugs and vitamin injection) is usually directed at treating the secondary bacterial infections, inflammation and fever, and improving the appetite of the animal.

Complete recovery may take several months and may be prolonged when secondary bacterial infections occur. Treatment is directed at preventing or controlling secondary infection. It may take up to 6 months for animals severely affected by LSD virus to recover fully. The only treatment available is supportive care of cattle. This can include treatment of skin lesions using wound are sprays and the use of antibiotics to prevent secondary skin infections pneumonia. Chronic lesions are harmless. Strong antibiotic therapy prevents secondary infection. Virus spreads rapidly; therefore restriction of animal movement and quarantine restriction are of limited use.

PATHOGENESIS

LSD is manifested by prompt explosion of multiple circumscribed cutaneous nodules and accompanied by a febrile reaction . The spread of viral particles takes place through blood and form generalized lymphadenitis. Viremia occurs after the early febrile condition for almost 4 days. Following skin lesions due to the replication of the virus in certain cells such as fibroblasts, pericytes, and, endothelial cells of lymphatic and blood vessels lesions are produced in those sites . Histopathological changes in acute skin injuries include lymphangitis, vasculitis, thrombosis, infarction, oedema and necrosis . Nodules might be found in subcutaneous tissues and muscle fascia(2). Neighbouring tissue of epidermis, dermis, and core musculature reveal haemorrhages, congestion, and oedema with distended lymph nodes. A special structure called ‘sit-fasts’ (necrotic cores detached from the adjacent skin) is usually seen indifferent parts of the body, which may ulcerate. The host immunological status exposes the lower rate of lymphocyte diffusion and phagocytic motion during the subsequent fourteen days of post infection (1)

PREVENTION

Control and prevention of lumpy skin disease relies on four tactics :-

Movement control (quarantine)

Vaccination

Slaughter campaigns

Management strategies

CONTROL OF ANIMAL MOVEMENT

In order to minimize the economic impact of the outbreaks and to control LSD, the movement of animals to and from the infected area and from affected states should be completely banned. This will check the transmission/spread of LSD. Are The movement of

people to and from the affected are should be restricted. The animal handlers and those attending to the affected animals should ne advised to keep away from healthy animals. It is, therefore, of utmost importance to ensure these safety measures.

VACCINATION

The infected villages are identified so that precautionary plans are carried out in a specific area and ring vaccination carried out in villages up to 5 km around the affected village. Cattle and buffaloes should be vaccinated with the available Goat pox vaccine (cattle and buffalo at the age of 4 months and above through the S/C route) with 103.5 TCID50 of GTPV vaccine (Uttarkashi strain). However, the dose of 103.0 TCID50 (same dose of vaccine for goat against goat pox) can be used for prophylactic vaccination/ring vaccination in cattle and buffalo. However, affected animals should not be vaccinated. Preventive vaccination should also be undertaken in high risk areas like border area of affected district and state and animals should be identified and documented.The staff and vaccinators should be trained for vaccination drive including storage and preparation of vaccine, dosing and injection and identification of animals.

Bio-security measures

Immediate isolation of sick animal from the healthy animals. Symptomatic treatment of affected animals may be carried out with all precautions and biosecurity measures. Feeding of liquid feed, soft feed and fodder is recommended. Clinical surveillance against LSD in affected districts and around surrounding villages should be intensified. The buffaloes should be kept separately till complete recovery of the affected animals, if reared together. Disinfection of premises at regular intervals. Ecto-parasiticide should also be applied to healthy animals on the infected and on surrounding farms.The persons dealing with the infected animal should wear gloves and face masks and carry out hygienic and isinfection measures at all times. Care should be taken to report any unusual sickness of other animals to the nearest veterinary Hospital/Dispensary.

Vector control

Control of vector population (ticks, flies, mosquitoes, fleas, midges) in the premises and the animal body should be carried out using insecticide, repellents and other chemical agents.

Disinfection and cleaning measures

Affected Premises, vehicles plying through the affected animal holdings should be carried out with appropriate chemicals/disinfectants [Ether (20%), chloroform, formalin (1%), phenol (2% /15 minutes), sodium hypochlorite (2- 3%), iodine compounds (1:33 dilution) and quaternary ammonium compounds (0.5%)].

Awareness program

Mass awareness campaign to be taken up to make the public aware of the disease and report to the veterinary authority immediately when suspected cases are detected. This will help in prevention and control of LSD Regular training and sensitization of veterinarians including awareness to animal owners and other stake holders should be enhanced on clinical presentation of the disease along with surveillance strategy and control measures. Animal Husbandry Department should maintain proper liaison with police and border agencies to check illegal entries of cattle from neighbouring countries (Wherever required).

Related suggestions

Strict implementation of advisories
Strict implementation of bio-security measures
Movement restriction and isolation of affected animals
Movement control of vehicle, animals from affected area to free area
Disinfection measures to be followed strictly in liaison with Municipal bodies and administration including regular fogging and lime spray in the infected and surrounding area
Stray animals to be monitored regularly and the affected animals should be isolated under veterinary care with the help of municipal and administrative authorities
Waste disposal including feed, fodder and dead animal to be followed as per protocol and scientific method with marking and displayed safety guidelines
Animal movement from affected area to be monitored to prevent spread of the infection
Animal trade and fare should not be allowed in the affected area
Vehicle passing through the infected area should be monitored and disinfected.
Insecticides spray and fogging to be undertaken in the animal sheds, common grazing area, veterinary hospital and dispensaries, animal gathering spots and animal movement tracks to control vectors like mosquito, flies, ticks, fleas etc.

Indigenous vaccine for Lumpy Skin disease

The indigenous vaccine Lumpi-ProVacInd has been developed to protect livestock from Lumpy Skin disease. The vaccine has been developed by the National Equine Research Center, Hisar (Haryana) in collaboration with the Indian Veterinary Research Institute, Izzatnagar (Bareilly).

About the vaccine

Goat pox, sheep pox and LSD belong to the same Capri poxvirus genus of Poxviridae family. Lumpi-ProVacInd is a homologous vaccine made with the same virus as the disease.Ever since the disease came to India in 2019, research institutes have been engaged in developing the vaccine

LUMPY SKIN DISEASE OUTBREAK IN INDIA

Starting from outbreaks in Gujarat and Rajasthan, in three months cattle in 15 states across India were affected. On 21 September, out of 18,50,000 cases over 65% of cases were from Rajasthan. Over 50,000 deaths were reported from Rajasthan. India's cattle population according to the last livestock census was 192.5 million.(7)

HEALTH AND ECONOMIC IMPACT

The socio-economic impact of LSD can be direct or indirect and has been registered by several major sectors and industries. The sharp drop in milk production is the fast and foremost visible effect directly associated with LSD in the South-Asian region which

harbored 21% of the world's dairy farm animals . According to a Turkish investigation, an impacted cow's average milk yield fell by 159L each lactate. However, meat from LSD infected cattle is not prohibited from entering the food chain, despite the possibility of the meat having secondary bacterial infection. An estimated 1.2% and 6.2% reduction in beef production per annum among local breeds and Friesian cattle was reported in Ethiopia respectively, due to LSDV infection . Besides, any breaches, scars, or lesions in the raw cattle hides or skin may deteriorate the value of leather, as in the case of severely LSD affected animal hides . Bangladeshi leather is highly admired for its good quality and 56% of leather is generated from cattle , that contributed 3.5% of the country's annual exports . Similarly, having the global exporting position of ninth, India earns annual revenue of US$ 8,500 million for its leather and leather products . Pyrexia and lameness hamper the use of animals for draught purposes. LSD can be transmitted to breeding stock through artificial insemination with infected bull semen, resulting in a lower rate of pregnancy . What is more, several health complications including mastitis, orchitis, abortion, and infertility in bulls also cause huge economic losses for farm owners.(6)

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