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Is there any Correlation between Monkey Pox Virus in Humans & Lumpy Disease in Animals: A Differential Diagnosis

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ABSTRACT:

The lumpy skin disease virus, or LSDV, belongs to the Capri poxvirus genus and family of Pox viridae and is the culprit behind lumpy skin disease (LSD). Cattle and water buffaloes are affected by this trans-boundary disease, which has a high morbidity and low fatality rate. With a 7.1% morbidity rate among cattle, lumpy skin disease has just been discovered for the first time in India. Typically, the disease's clinical symptoms include fever, anorexia, and distinctive nodules on the skin and mucous membranes of the mouth, nostrils, udder, genital, and rectum. The condition can also cause abortion, infertility, and occasionally even death. The contagious viral disease known as monkey pox, on the other hand, causes skin lesions that are identical to those of the former. Animals then people were exposed to it. This virus is a fresh worry, as was the discovery of newly emerging monkey pox cases outside of the African Continent in May 2022. Due to global travel and the trade of specific species, it demonstrated its spread to other parts of the world. Therefore, it is crucial to assess and talk about how to treat human infections with monkey pox in order to stop the disease from spreading.

This study seeks to provide an overview of recent advances in epidemiology with an emphasis on zoonotic and trans-boundary dissemination, aetiology and transmission, clinical manifestations, diagnostics, and treatment of both illnesses with widespread skin lesions.

Keywords: Lumpy skin disease, Cattles, Monkey pox, Zoonotic, Ortho Poxvirus, Human, Animals.

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INTRODUCTION:

Lumpy skin disease and Monkey pox infection, both are viral disease. Lumpy skin disease is caused by the lumpy skin disease virus (LSDV), a member of the Capri poxvirus (CaP V) within the Poxviridae family[1], the same family which causes monkeypox disease,the outbreak which was declared a global health emergency by the World Health Organisation last month. Monkeypox is also a viral disease in which virus is transmitted to humans from animals, hence it also called *Zoonosis.*[1] Its symptoms are similar to smallpox disease, although it is clinically milder.[1] As both diseases have viruses in their origin and clinically present almost similar skin-lesions, hence the curiosity appears behind the correlation among both lesions due to similarity in clinical appearance of these two lesions.

The purpose of this review is to address the global expansion of monkey pox illness and lumpy skin disease, as well as to identify these diseases' distinct symptoms quickly in order to eliminate all potential transmission routes, safeguard public health, and avoid the likelihood of further spread.

WHAT IS LUMPY SKIN DISEASE?

Introduction

Lumpy skin disease or LSD is an infective viral-originated disease[1]. The first case of LSD was reported from Zambia, Africa in 1929 but recently the cases has been also found from new zones around the world especially in South -Asia region, initially in Bangladesh in July 2019.Initial cases of LSD were confirmed in India in August 2022 from Bangladesh most probably through borders[1].

Etiological Agent-

It occurs by Lumpy skin disease virus (LSDV) of Capri poxvirus genus, family Poxviridae.[1] Monkey pox virus and smallpox also members of same family. Shape of LSDV is similar to brick. It is 320 × 260 nm in size, with double stranded DNA enveloped virus .[1]Symmetry of virus is complex and it replicates in cytoplasm of the host cell. The virus is easily persist in ambient conditions for longer duration. It can even viable in desiccated skin crusts and necrotic nodules for more than one month, and in air-dried hides for at least 18 days.[2]

Transmission-

LSD is a non-zoonotic, vector borne and trans-boundary disease which has limited host in the form of ruminants viz. cattle and water buffaloes.[1] Non-Zoonotic means it does not spread from animals to humans. Disease is usually transmitted by biting flies, mosquitoes and ticks hence mode of transmission is mechanical.[1] This is the reason by which LSD mostly occurs in monsoon season.

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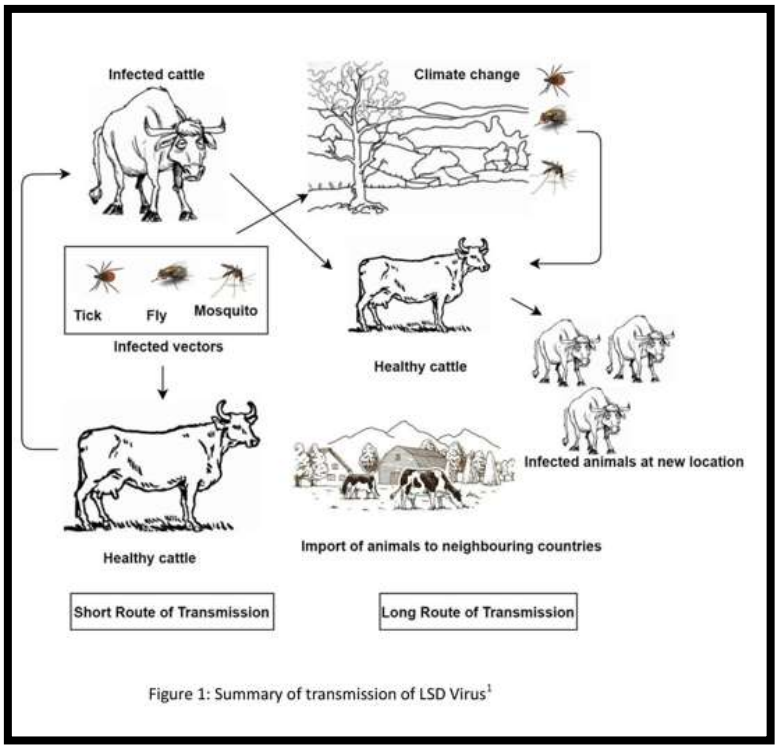

Figure: 1 Summary of transmission of LSD virus[1]

Clinical Presentation-

The disease is onset by fever, enlargement of lymph node, circumscribed nodules on skin causing excessive weakness, decreased milk production and impotency. The incubation period of onset of lesion in usually of between 2 and 5 weeks.[2] The LSD-infection occurs in three forms: acute, sub-acute and chronic form. In the intial phase, infection appears as one or two lumps of nodules followed by 2 to 3 days of fever. Gradually infected animal becomes extremely weak has fluid-discharge from nose and eyes with decreasing milk-productivity. The skin of the muzzle, nares, back, legs, scrotum, perineum, eyelids, lower ear, nasal and oral mucosa, and tail are particularly vulnerable to nodular lesions in their mature stages because of how painful they become. 3 This stage lasts for 7 to 12 days, during which nodules grow larger, are raised, and eventually become separated by a thin hemorrhagic ring. The muscle, surrounding sub-cuticle, dermis, and epidermis are all affected by the nodules. 1 After that, the lesions develop into papules, vesicles, pustules with exudate, and finally, slowly, scab development. The lesions heal quite slowly.

Diagnosis-

Skin nodules found on the body of an affected animal might be used to make a preliminary diagnosis. Therefore, a confirming diagnosis should be obtained during the biopsy. To transport the biopsy specimen to the lab, transport medium made of 20 to 50% glycerol in phosphate buffer saline is utilised. 1 Electric microscope is used to see the virus. 4 An

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unusual histological change in the form of vasculitis and perivascular infiltration with white cells that results in a thrombosis of the vessel in the dermis and sub-cutis is visible in the biopsy specimen. Epithelial cells, also known as "celles clavelauses," are encroaching on the lesion. 1 The most innovative and effective test for viral illness is molecular diagnosis with PCR. As a result, conventional and real-time PCR have been created for quick diagnosis.

Preventive measure-

To eradicate spread of disease, effective control and preventive measures needs to be implemented. Infected animals shed viruses through oral and nasal secretions, which may contaminate further, hence infected animal should be kept in quarantine. For relief Anti-inflammatory and antibiotics are used for symptomatic treatment. Although long term vaccination with 100% coverage should be made mandatory for cattle-owners for their cattle ,as LSD virus being stable and have longer survival. Vaccination done by a live attenuated vaccine which is based on different strains of LSD virus.[1]

WHAT IS MONKEYPOX?

Introduction

A contagious viral illness called monkey pox can be contracted by humans from animals. 5 As a viral illness, the monkey pox virus was identified in 1958. 5,6 This virus is a fresh worry, as was the discovery of newly emerging monkey pox cases outside of the African Continent in May 2022. However, a toddler in the Congo had the first known confirmed human case in 1970. In contemporary metropolitan settings, however, it has been increasing1. A variety of rodents and non-human primates serve as animal hosts. 7 The interior of the African Continent is where monkey pox instances predominate. Due to the likelihood that many suspected cases go unreported, the risk of monkey pox spreading to humans has not yet been shown.[6]

Etiological agent

A virus causes monkey pox. It is a double-stranded DNA virus with an envelope and is a member of the Poxviridae family's Orthopoxvirus genus. 7 The size of the monkey pox virus on electron microscopy is about (200-250 nano-meters). They have a cuboid form and are encased in a lipoprotein layer that is made of double-stranded DNA. 7 All necessary proteins for the survival of the monkey pox virus are present, with the exception of mRNA translation, which is carried out by host-cell ribosomes.[6]

Transmission-

“Monkey pox can transmit via all types of fluids of body, dermal lesions, or by coughing or sneezing of infected animals or by contaminated fomites.[6] In Monkey pox, two types of transmission were reported-

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- Zoonotic transmission- In which virus transmitted from animals to humans.
- Human to human transmission - In which virus transmitted from humans to humans.

Animal-to-human (zoonotic)[5,6] transmission occurs via all types of fluids from body, or by dermal lesions of infected animals. Consumption of raw or half-cooked meat and other animal products of infected animals is a possible cause.[8] People living in or near forested areas may have natural indirect or low-level exposure to infected animals.

Human-to-human transmission[5,6] can occur as a result of close contact by coughing or sneezing, dermal lesions of an infected person or objects used by infected person".

Clinical Presentations-

"The incubation period (interval from infection to onset of symptoms) of monkey pox lasts from 6 to 13 days to 5 to 21 days.[8] The period of infection can be divided into two phases[8]:

- The **invasion** period (which lasts between 0–5 days) is characterized by increase body-temperature, headache, enlarged lymph nodes, pain in back and muscle along with lethargy[6] After virus enters into body, it uncoats its lipid layer and forms millions of its copies which cause viremia, later on it spreads to regional lymph nodes.[7] As a result, enlarge lymph nodes occurs which gave rise to viral spread to other organs.
- The **skin eruption** initiates within 1–3 days of the appearance of fever. The rash are coalesced on the face rather than their body-parts.[7] It affects the facial -region (in 95% of cases), and palms of the hands and soles of the feet (in 75% of cases)".[9]

The most prominent sign of monkey pox is a visible rash or pox that covers the entire body surface. In addition to the rash, monkey pox can elevate body temperature and result in generalised pain. 10 Other signs include tiredness and enlarged lymph nodes. 8 that frequently starts on the face before spreading to other body areas. The rash goes through several stages of change. 7 initial size of 2 to 10 mm and hard, deep-seated lesion. 6 Rashes go through a pustular phase for five to seven days before becoming crust. Subsequently In between seven and fourteen days, crusts get desquamated. 6 In most situations, the illness clears up 3 to 4 weeks following the commencement of symptoms. After de-squammation, patients are regarded as safe.

70% of cases of monkey pox infection involve the oral mucous membranes. Rashes start out as a common oral manifestation, develop into flat base lesions that become slightly raised firm lesions, occasionally become circumscribed fluid-filled lesions that turn into pus, and eventually form crusts that dry up and desquamate.[7]

Diagnosis

Hematoxylin and eosin staining is commonly used at the pustular stage on sections of formalin-fixed, paraffin-embedded skin biopsy tissues. It shows epidermal necrosis,

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spongiotic edoema, and the usual conspicuous ballooning degeneration of keratinocytes. The epidermis and superficial dermis have a moderately mixed inflammatory infiltration. 10 Eosinophilic cytoplasmic inclusions are also observed, coupled with many multinucleated keratinocytes and chromatin margination. [11]

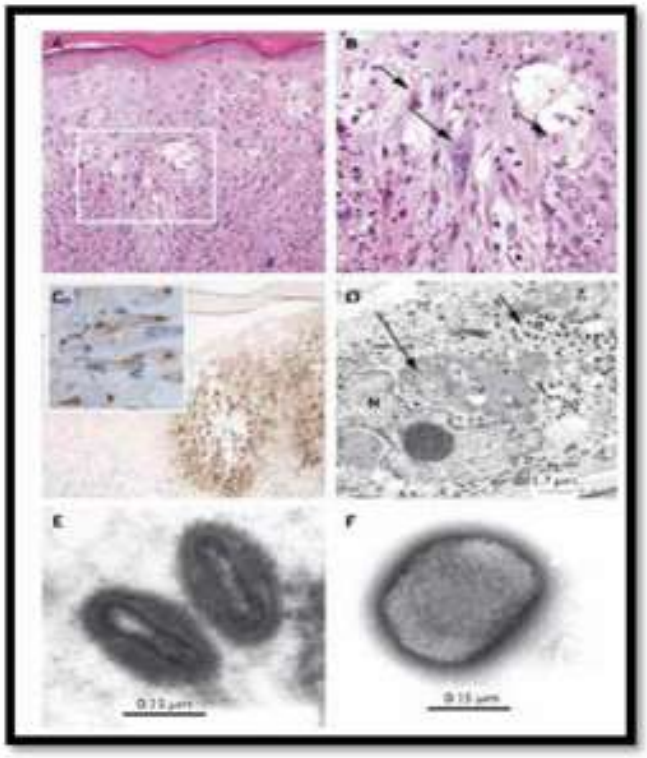

Figure: 2 Histopathologic examination of Monkey pox sample [5,10]

Polymerase chain reaction used to confirm the diagnosis (PCR). 5,6 In order to do this, samples of the roof, fluid from lesions with fluid inside of them, and de-squamated crusts are collected. 6 Samples must be kept dry and sanitary while being stored at 4 degrees. 7 Methods of antigen and serology detection are not advised for diagnosis. Orthopox viral antigen is found in skin biopsy samples using immunohistochemical staining in response to rabbit anti-vaccine polyclonal antibody.

Preventive Measures

The recommended course of action is supportive symptom management. 9 In order to prevent infection from spreading, the infected person needs to be isolated, have a surgical mask on, and have the lesions covered. 7 In a select few situations, it is strongly advised to administer a vaccine following illness. A recently released vaccine called Ankara combines the smallpox and monkey pox vaccines. 6 The CDC states that vaccination within four days of the disease may be useful in containing the outbreak, and vaccination within 14 days may lessen the disease's acute symptoms.

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Table 1: Similarity between Monkey pox virus and Lumpy skin disease

- Both the lesions are originated from the virus, belongs to Poxviridae family
- Virus of both the lesion have double-stranded DNA
- Both the lesion shows extensively enlargement of lymph-nodes
- Both the lesions show similar clinical presentations, includes initially increase in body-temperature and eventually body-rashes appears which converts into nodules and pustular phase which ultimately change into crusts.
- Lymph nodes enlargements seen in both the diseases

Figure: 3 Lumpy Skin Disease in Calf[12]

Figure: 4 Monkey pox clinical presentation[6]

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Table 2: Difference between Monkey pox virus & Lumpy skin disease

S.No.	Monkey pox	Lumpy skin disease
1.	Spread of disease is zoonotic, as it spreads from animals to human also	Spread of disease is non-zoonotic, as it does not spread from animals to human.
2.	Incubation-period is 5-21 days	Incubation-period is 4-14 days
3.	Spread of disease by raw meat or partially cooked meat or by any body-secretion of infected animals	Infected animals shed viruses through oral and nasal secretions. Mechanical transmission by vectors is the prime route of spread of disease
4.	Vaccines are introduced but still under trial and on experimental studies	Vaccines are available
5.	On histopathologic examination, A typical marked ballooning degeneration of keratinocytes with epidermal necrosis and spongiotic edema is evident.	On histopathologic examination, vasculitis and perivascular infiltration with white cells causing a thrombosis of the vessel in the dermis and subcuticle.

CONCLUSION:

A dangerous condition that affects cattle and buffalo is lumpy skin disease. Earlier, the disease was only present in a few other nations and in Africa, but it has recently spread to Asia, including India. The only way to prevent the disease is with effective quarantine measures, vector control measures, and immunisation. Giving individuals information about risk factors and teaching them is the primary method of preventing monkey pox. 7 The greatest way to stop the disease from spreading globally is to keep the sick animal localised. In order to take precautions against this virus and so stop the transmission of sickness, a healthcare provider must quickly recognise monkey pox infection in humans and animals.

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