

Lumpy Skin Disease

Neethling, Knopvelsiekte

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Importance

Lumpy skin disease is a poxviral disease with significant morbidity in cattle. Although the mortality rate is generally low, losses occur from decreased milk production, abortion, infertility, loss of condition and damaged hides. Lumpy skin disease is endemic in parts of Africa, where outbreaks may be widespread. This disease has the potential to become established in other parts of the world.

Etiology

Lumpy skin disease is caused by a virus in the genus *Capripoxvirus* of the family Poxviridae. Lumpy skin disease virus (LSDV) is closely related antigenically to sheep and goat poxviruses. Although these three viruses are distinct, they cannot be differentiated with routine serological tests.

Species Affected

Lumpy skin disease is primarily a disease of cattle. *Bos taurus* breeds, particularly Jersey, Guernsey and Ayrshire, are more susceptible to clinical disease than zebu cattle (*Bos indicus*). A few cases have been reported in Asian water buffalo (*Bubalus bubalis*). Clinical cases or antibodies have been reported in other species such as oryx, but could have been caused by closely related poxviruses. Wild animals are not thought to play an important role in the spread or maintenance of LSDV.

Geographic Distribution

Lumpy skin disease is generally confined to Africa. Until the 1980s, this disease was only found south of the Sahara desert and in Madagascar, but in 1988, it spread into Egypt. It may also occur in other Middle Eastern countries. In 1989, an outbreak in Israel was eradicated by slaughter and vaccination.

Transmission

LSDV is thought to be transmitted primarily by biting insects. This virus has been found in mosquitoes in the genera *Aedes* and *Culex* during some outbreaks. Experimentally infected *Aedes aegypti* are infectious for 6 days and can transmit LSDV mechanically during this time. Flies (e.g. *Stomoxys calcitrans*) and other insects might also be involved in transmission, but this remains unproven.

Direct contact could be a minor source of infection. LSDV occurs in cutaneous lesions, saliva, respiratory secretions, milk and semen. Shedding in semen may be prolonged; viral DNA has been found in the semen of some bulls for at least 5 months after infection. Animals can be infected experimentally by inoculation with material from cutaneous nodules or blood, or by ingestion of feed and water contaminated with saliva. LSDV is very resistant to inactivation, surviving in desiccated crusts for up to 35 days, and can remain viable for long periods in the environment.

Incubation Period

The incubation period in the field is thought to be two to five weeks. In experimentally infected animals, fever can develop in 6 to 9 days and lesions first appear at the inoculation site in 4 to 20 days.

Clinical Signs

The clinical signs range from inapparent to severe. Host susceptibility, dose and route of virus inoculation affect the severity of disease. *Bos taurus* is more susceptible than *Bos indicus*, and young calves often have more severe disease than adults.

Fever is the initial sign. It is usually followed within two days by the development of nodules on the skin and mucous membranes. These nodules vary from 1 cm to 7 cm and penetrate the full thickness of the skin. They are particularly common on the head, neck, udder, genitalia, perineum and legs. Although the nodules may exude serum initially, they develop a characteristic inverted conical zone of necrosis, which penetrates the epidermis and dermis, subcutaneous tissue, and sometimes the underlying muscle. These cores of necrotic material become separated from the adjacent skin and are called "sit-fasts." Secondary bacterial infections are

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common within the necrotic cores. Some nodules, particularly those on the mucous membranes and udder, ulcerate rapidly. The superficial lymph nodes become enlarged and edematous. Nodules can also occur in the gastrointestinal tract, trachea and lungs; the latter may result in primary or secondary pneumonia.

In addition, feed intake decreases in affected cattle, milk yield can drop markedly, and animals may become emaciated. Rhinitis, conjunctivitis and keratitis can also be seen; ocular and nasal discharges are initially serous but become mucopurulent. Inflammation and necrosis of the tendons, or severe edema of the brisket and legs, can result in lameness. Secondary bacterial infections can cause permanent damage to the tendons, joints, teats and mammary gland. Abortions and temporary or permanent sterility may occur in both bulls and cows.

A few animals die, but the majority slowly recover. Recovery can take several months, and some skin lesions may take a year or two to resolve. Deep holes or scars are often left in the skin.

Post Mortem Lesions [Click to view images](#)

The post mortem lesions can be extensive. Characteristic grayish-pink deep nodules with necrotic centers are found in the skin; these nodules often extend into the subcutis and underlying skeletal muscle, and the adjacent tissue exhibits congestion, hemorrhages and edema. The regional lymph nodes are typically enlarged.

Flat or ulcerative lesions may also be found in the mucous membranes of the oral and nasal cavities, pharynx, epiglottis and trachea. Nodules or other lesions can occur in the gastrointestinal tract (particularly the abomasum), udder, urinary bladder, lungs, kidneys, uterus and testes. In the lungs, the lesions are difficult to see and appear as focal areas of atelectasis and edema. The mediastinal lymph nodes are enlarged in severe cases, and pleuritis may be seen. Some animals may have synovitis and tendosynovitis with fibrin in the synovial fluid.

Aborted fetuses do not always have the characteristic external lesions, but some may be covered in nodules.

Morbidity and Mortality

Lumpy skin disease can occur as sporadic cases or in epizootics. The incidence of disease is highest in wet, warm weather, and decreases during the dry season. New foci of disease can appear at distant sites; in these cases, the virus is thought to be carried by insects.

The morbidity rate varies widely, depending on the presence of insect vectors and host susceptibility, and ranges from 3% to 85%. More severe disease is seen in *Bos taurus*, particularly Channel Island breeds, than zebu cattle. Calves and lactating cows tend to be most susceptible to disease. In addition, the disease signs can vary widely among the cattle in a group, with some animals having inapparent infections and others developing severe disease. The mortality rate is low in

most cases (1–3%), but has been as high as 20% in some outbreaks. Unusually high mortality rates of 75–85% have been reported but remain unexplained.

Diagnosis

Clinical

Lumpy skin disease should be suspected when the characteristic skin nodules, fever and enlarged superficial lymph nodes are seen. The mortality rate is usually low.

Differential diagnosis

Differentials include pseudo-lumpy skin disease/bovine herpes mammillitis, dermatophilosis, ringworm, insect or tick bites, besnoitiosis, ringworm, *Hypoderma bovis* infestation, photosensitization, bovine papular stomatitis, urticaria and cutaneous tuberculosis. Most of these diseases can be distinguished from lumpy skin disease by the clinical signs, including the duration of the disease, as well as histopathology and other laboratory tests.

Laboratory tests

Confirmation of lumpy skin disease in a new area requires virus isolation and identification. LSDV will grow in bovine, caprine or ovine cell cultures; the best growth is seen in lamb testis cells. LSDV can be distinguished from the herpesvirus that causes pseudo-lumpy skin disease by the cytopathic effect and the intracytoplasmic location of inclusion bodies. LSDV antigens can be identified with direct immunofluorescence, virus neutralization or enzyme-linked immunosorbent assay (ELISA). Nucleic acid recognition methods have also been described. LSDV can be detected in cell cultures or directly in tissues by polymerase chain reaction (PCR) assays.

Typical capripox virions can be seen in biopsy samples or desiccated crusts using transmission electron microscopy. This finding, in combination with a history of generalized nodular skin lesions and lymph node enlargement, can be diagnostic in cattle in endemic areas. Electron microscopy can distinguish capripoxviruses from the parapoxviruses that cause bovine papular stomatitis and pseudocowpox, but not from orthopoxviruses (cowpox and vaccinia virus).

Serological tests include an indirect fluorescent antibody test, virus neutralization, ELISA and immunoblotting (Western blotting). Cross-reactions with other poxviruses are seen in some assays. Agar gel immunodiffusion is also available, but cross-reactions occur in this test with bovine papular stomatitis and pseudocowpox virus.

Samples to collect

Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should

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only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

Samples for virus isolation and antigen-detection ELISA should be taken during the first week of symptoms, before neutralizing antibodies have developed. Samples for PCR can be collected after this time. In live animals, biopsy samples of skin nodules or lymph nodes can be used for virus isolation and antigen detection. Scabs, nodular fluid and skin scrapings may also be collected. LSDV can be isolated from blood samples (collected into heparin or EDTA) during the early, viremic stage of disease; virus isolation from blood is unlikely to be successful after generalized lesions have been present for more than 4 days. Samples of lesions, including tissues from surrounding areas, should be submitted for histopathology. Acute and convalescent sera are collected for serology. At necropsy, fresh and formalin-fixed samples should be taken of skin lesions and lesions in the respiratory and gastrointestinal tracts.

Tissue and blood samples for virus isolation and antigen detection should be kept chilled and shipped to the laboratory on ice. If the samples must be sent long distances without refrigeration, large pieces of tissue should be collected and the medium should contain 10% glycerol; the central part of the sample can be used for virus isolation.

Recommended actions if lumpy skin disease is suspected

Notification of authorities

State and federal veterinarians should be informed immediately of any suspected case of lumpy skin disease.

Federal: Area Veterinarians in Charge (AVIC):
http://www.aphis.usda.gov/animal_health/area_offices/
State Veterinarians:
<http://www.aphis.usda.gov/vs/sregs/official.html>

Control

Import restrictions can help prevent the introduction of lumpy skin disease. This disease is mainly spread to new areas by infected animals, but it could also be transmitted in contaminated hides and other products. Infected insects are suspected to have spread LSDV to new areas during some outbreaks.

Outbreaks can be eradicated by quarantines, depopulation of infected and exposed animals, proper disposal of carcasses, cleaning and disinfection of the premises and insect control. Vaccines were helpful in eradication during an outbreak in Israel. LSDV is susceptible to ether (20%), chloroform, formalin (1%), and some detergents, as well as phenol (2% for 15 minutes). This virus can survive for long periods in the environment: up to 35 days in desiccated scabs and for at least 18 days in air-dried hides.

Live vaccines help control losses from lumpy skin disease in endemic areas. Insecticides and repellents may also be helpful. Antibiotics are used to control secondary infections.

Public Health

LSDV does not infect humans.

Internet Resources

- Food and Agriculture Organization of the United Nations (FAO). Manual for the Recognition of Exotic Diseases of Livestock
<http://www.spc.int/rahs/>
- United States Animal Health Association.
Foreign Animal Diseases
http://www.vet.uga.edu/vpp/gray_book02/fad/index.php
- The Merck Veterinary Manual
<http://www.merckvetmanual.com/mvm/index.jsp>
- World Organization for Animal Health (OIE)
<http://www.oie.int>
- OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals
http://www.oie.int/eng/normes/mmanual/A_summry.htm
- OIE Terrestrial Animal Health Code
http://www.oie.int/eng/normes/mcode/A_summry.htm

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