

LUMPY SKIN DISEASE

Aetiology Epidemiology Diagnosis Prevention and Control References

AETIOLOGY

Classification of the causative agent

Lumpy skin disease (LSD) is caused by lumpy skin disease virus (LSDV), a virus from the family *Poxviridae*, genus *Capripoxvirus*. Sheeppox virus and goatpox virus are the two other virus species in this genus.

Resistance to physical and chemical action

Temperature:	Susceptible to 55°C/2 hours, 65°C/30 minutes. Can be recovered from skin nodules kept at –80°C for 10 years and infected tissue culture fluid stored at 4°C for 6 months.
pH:	Susceptible to alkaline or acid pH. No significant reduction in titre when held at pH 6.6–8.6 for 5 days at 37°C.
Chemicals/Disinfectants:	Susceptible to ether (20%), chloroform, formalin (1%), and some detergents, e.g. sodium dodecyl sulphate. Susceptible to phenol (2%/15 minutes), sodium hypochlorite (2–3%), iodine compounds (1:33 dilution), Virkon® (2%), quarternary ammonium compounds (0.5%).
Survival:	LSDV is remarkably stable, surviving for long periods at ambient temperature, especially in dried scabs. LSDV is very resistant to inactivation, surviving in necrotic skin nodules for up to 33 days or longer, desiccated crusts for up to 35 days, and at least 18 days in air-dried hides. It can remain viable for long periods in the environment. The virus is susceptible to sunlight and detergents containing lipid solvents, but in dark environmental conditions, such as contaminated animal sheds, it can persist for many months.

EPIDEMIOLOGY

- Morbidity rate varies between 10 and 20% although it has been reported in some places to be as high as 45%.
- Mortality rates of 1 to 5% are considered usual.

Hosts

- LSDV is highly host specific and causes diseases only in cattle (*Bos indicus* and *B. taurus*) and water buffalo (*Bubalus bubalis*). There is evidence from a study in Ethiopia of differential breed susceptibility to LSD, with Holstein Friesian or crossbred cattle exhibiting higher morbidity and mortality due to LSD when compared with local zebu cattle.
- In wildlife, the presence of the virus has been reported in springbok (*Antidorcas marsupialis*) and in asymptomatic eland (*Taurotragus oryx*) in Namibia; oryx (*Oryx gazelle*) in South Africa; Arabian oryx (*Oryx leucoryx*) in Saudi Arabia; and in Guar (*Bos gaurus*), Mainland serow (*Capricornis sumatraensis*) and Banteng (*Bos javanicus*) in Thailand in 2021. The susceptibility of wild and captive wild ruminants (e.g. zoo ruminants) is not well-known and their possible role in the epidemiology of LSD is still under investigation.
- LSDV is not zoonotic, so humans cannot get affected by the disease.
- There are no reports of LSD in sheep and goats or of their epidemiological involvement in the disease despite being kept in close proximity to cattle.

Transmission

- The principal means of transmission is believed to be by arthropod vector. Mechanical LSDV transmission leading to clinical disease in recipient cattle under experimental conditions has been shown for *Aedes aegypti* mosquitoes (and *Stomoxys calcitrans* and *Haematopota spp.* biting flies. It is highly likely that several other mosquitoes (e.g. *Culex mirificens* and *Aedes natrionus*), biting flies (e.g. *Biomya fasciata*), *Culicoides* and male ticks (*Rhipicephalus appendiculatus* and *Amblyomma hebraeum*) could play a role in the transmission of the virus under field conditions. The relevance of different arthropod vectors is likely to vary in different areas depending on the abundance and feeding behaviour of the vector.
- Direct contact with an infected animal is considered to play a minor role in the transmission of the virus. It is not known if transmission can occur via fomites, for example ingestion of feed and water contaminated with infected saliva, but the occurrence of newly detected recombinant field strains suggests these routes may be at play.
- Infected bulls can excrete the virus in their semen and transmission of LSD via infected semen has been demonstrated.
- There has been one report of placental transmission of LSD.

Sources of virus

- Skin nodules, scabs and crusts contain relatively high amounts of LSDV. Virus can be isolated from this material for up to 35 days and likely for longer.
- LSDV can be isolated from blood, saliva, ocular and nasal discharge, and semen.
- LSDV is found in the blood (viraemia) intermittently from approximately 7 to 21 days post-infection at lower levels than present in skin nodules
- Shedding in semen may be prolonged; LSDV has been isolated from the semen of an experimentally infected bull 42 days post-inoculation.

Occurrence

LSD is endemic in most African countries. Since 2012 it has spread rapidly through the Middle East, south-east Europe and West and Central Asia.. Since 2019, several outbreaks of LSD have been reported by Members in Asia, and recently, south-east Asia.

For more recent, detailed information on the occurrence of this disease worldwide, see the WOA World Animal Health Information System Interface [<https://wahis.woah.org/#/home>]

DIAGNOSIS

Under experimental conditions, following the virus inoculation, the incubation period is between 4 and 14 days. For the *Terrestrial Manual* purposes, the incubation period is 28 days.

Clinical diagnosis

LSD does not cause chronic disease. It does not exhibit latency, and recrudescence of disease does not occur.

LSD signs range from inapparent to severe disease.

- Fever that may exceed 41°C
- Marked reduction in milk yield in lactating cattle
- Depression, anorexia and emaciation
- Rhinitis, conjunctivitis and excessive salivation
- Enlarged superficial lymph nodes
- Cutaneous nodules of 2–5 cm in diameter develop, particularly on the head, neck, limbs, udder, genitalia and perineum within 48 hours of onset of the febrile reaction. These nodules are circumscribed, firm, round and raised, and involve the skin, subcutaneous tissue and sometimes even the underlying muscles
- Large nodules may become necrotic and eventually fibrotic and persist for several months (“sit-fasts”); the scars may remain indefinitely. Small nodules may resolve spontaneously without consequences
- Myiasis of the nodules may occur
- Pox lesions, erosions and ulcers may develop in the mucous membranes of the mouth and alimentary tract and in the trachea and lungs

- Limbs and other ventral parts of the body, such as the dewlap, brisket, scrotum and vulva, may be oedematous, causing the animal to be reluctant to move
- Bulls may become permanently or temporarily infertile
- Pregnant cows may abort and be in anoestrus for several months
- Recovery from severe infection is slow due to emaciation, secondary pneumonia, mastitis, and necrotic skin plugs, which are subject to fly strike and shed leaving deep holes in the hide.

There is no current evidence of variation in virulence regarding the different LSDV strains.

Differential diagnosis

Severe LSD is highly characteristic, but milder forms can be confused with the following:

- Bovine herpes mammillitis (bovine herpesvirus 2) (sometimes known as pseudo-lumpy skin disease)
- Bovine papular stomatitis (Parapoxvirus)
- Pseudocowpox (Parapoxvirus)
- Vaccinia virus and Cowpox virus (Orthopoxviruses) – uncommon and not generalised infections
- Dermatophilosis
- Demodicosis
- Insect or tick bites
- Besnoitiosis
- Rinderpest
- *Hypoderma bovis* infection
- Photosensitisation
- Urticaria
- Cutaneous tuberculosis
- Onchocercosis.

Laboratory diagnosis

Samples

Identification of the agent

- Conventional polymerase chain reaction (PCR) is the least expensive and quickest method for detection of LSDV. Skin nodules and scabs, saliva, nasal secretions, and blood are suitable samples for PCR detection of LSDV.
- Real-time PCR methods are available for detection of capripoxvirus; species-specific PCR methods are available to differentiate between LSDV, sheeppox virus and goatpox virus, and DIVA PCR methods have been published to differentiate a homologous vaccine virus from virulent field strain
- Virus isolation has the advantage of demonstrating the presence of live virus in the sample.
- Immunohistochemistry can be used to identify presence of virus to the genus level.
- Electron microscopy can be used to identify the classic poxvirus virion but cannot differentiate to genus or species level.
- Sequencing (partial or whole-genome) provides the most information relating to cluster grouping (classical field, vaccine-like or, more recently, field recombinant strains).

Serological tests

It is not possible to distinguish the three viruses in the *Capripoxvirus* genus (sheeppox virus, goatpox virus and LSDV) using serological techniques.

- Virus neutralisation: this is currently the gold standard test for the detection of antibodies raised against capripoxviruses.
- Western blot: highly sensitive and specific but expensive and difficult to perform.
- Capripoxvirus antibody enzyme-linked immunosorbent assay: new commercial kits for detection of capripoxvirus antibodies are currently being developed and released on to the market.

A virus specific immunoperoxidase monolayer assay (IPMA) has also been developed for the detection of antibodies against LSDV but is yet to be validated as a standard by the WOAHA Biological Standards Commission.

For more detailed information regarding laboratory diagnostic methodologies, please refer to Chapter 2.4.14 Lumpy skin disease in the latest edition of the WOAHA *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* under the heading “B. Diagnostic Techniques”.

PREVENTION AND CONTROL

Evidence from the recent LSD epidemic in Europe and western Asia has revealed that successful control and eradication of LSD relies on early detection of the index case, followed by a rapid and widespread vaccination campaign. It is unlikely that total stamping-out (killing all clinically affected cattle and unaffected herd-mates) and partial stamping-out (killing only clinically affected cattle) alone, in the absence of vaccination, can eradicate LSD.

In unaffected countries or zones, it is also important to prepare any preventive vaccination or emergency vaccination plans.

Sanitary prophylaxis

- Free countries:
 - Import restrictions on domestic cattle and water buffaloes, and selected products from these animals in accordance with the recommendations in the chapter on LSD in the WOAHA *Terrestrial Animal Health Code*.
 - Surveillance measures to detect LSD are recommended over a distance of at least 20 kilometres from an infected country or zone, in reference to recommendations in the chapter on LSD in the WOAHA *Terrestrial Animal Health Code*.
- Infected countries:
 - Control of LSD depends on restriction of movement of cattle in infected regions, removal of clinically affected animals, and vaccination. Movement restrictions and removal of affected animals alone without vaccination are usually not effective.
 - Proper disposal of dead animals (e.g. incineration), and cleaning and disinfection of premises and implements are recommended for LSD.
 - There is currently no evidence of the efficacy of vector control in preventing disease
 - See WOAHA *Terrestrial Animal Health Code* for recommendations on the recovery of LSD-free status of a country or zone, including recommendations on surveillance and waiting periods.

Medical prophylaxis

- LSDV live attenuated vaccine strain, for example ‘Neethling’ LSD strain.
- Sheeppox or goatpox virus live attenuated vaccine strain against LSDV if used at a higher dose than for prevention of sheeppox or goatpox.
- Vaccine side-effects such as a local reaction at the inoculation site or small generalised skin nodules, as well as fever and reduction in milk yield, may follow vaccination with homologous vaccine, more rarely after vaccination with sheeppox vaccine.
- Currently, no new generation recombinant capripox vaccines are commercially available.

For more detailed information regarding vaccines, please refer to Chapter 2.4.14 Lumpy skin disease in the latest edition of the WOAHA *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* under the heading “Requirements for Vaccines”.

For more detailed information regarding safe international trade in terrestrial animals and their products, please refer to the latest edition of the WOAHA *Terrestrial Animal Health Code*.

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The WOA will periodically update the WOA Technical Disease Cards. Please send relevant new references and proposed modifications to the WOA Science Department (scientific.dept@woah.org). Last updated June 2022.