

LUMPY SKIN DISEASE

Aetiology Epidemiology Diagnosis Prevention and Control References

AETIOLOGY

Classification of the causative agent

Virus family *Poxviridae*, genus *Capripoxvirus* (also Sheep Pox and Goat Pox), 1 Serotype of Lumpy Skin Disease Virus (LSDV)

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 highly 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 5 and 45%
- Mortality rate up to 10%.

Hosts

- Cattle (*Bos taurus*, zebu, domestic Asian buffalo). *Bos taurus* is more susceptible to clinical disease than *Bos indicus*. Within *Bos taurus*, the fine-skinned Channel Island breeds develop more severe disease, with lactating cows appearing to be the most at risk.
- Role of wild fauna still has to be clarified. Giraffe (*Giraffe camelopardalis*) and impala (*Aepyceros melampus*) are highly susceptible to experimental infection. Suspected clinical disease has been described in an Arabian oryx (*Oryx leucoryx*) in Saudi Arabia, springbok (*Antidorcas marsupialis*) in Namibia, and oryx (*Oryx gazelle*) in South Africa. Antibodies have been found in 6 of 44 wildlife species in Africa: African buffalo (*Syncerus caffer*), greater kudu (*Tragelaphus strepsiceros*), waterbuck (*Kobus ellipsiprymnus*), reedbuck (*Redunca arundinum*), impala, springbok, and giraffe.
- LSDV will also replicate in sheep and goats following inoculation.

Transmission

- The principle method of transmission is mechanical by arthropod vector. Though no specific vector has been identified to date, mosquitoes (e.g. *Culex mirificens* and *Aedes natrionus*) and flies (e.g. *Stomoxys calcitrans* and *Biomyia fasciata*) could play a major role.
- Direct contact could be a minor source of infection.

- Transmission may also occur by ingestion of feed and water contaminated with infected saliva.
- Animals can be infected experimentally by inoculation with material from coetaneous nodules or blood.

Sources of virus

- Skin; cutaneous lesions and crusts. Virus can be isolated for up to 35 days and viral nucleic acid can be demonstrated by PCR for up to 3 months.
- Saliva, ocular and nasal discharge, milk, and semen. All secretions contain LSD virus when nodules on the mucous membranes of the eyes, nose, mouth, rectum, udder and genitalia ulcerate. Shedding in semen may be prolonged; viral DNA has been found in the semen of some bulls for at least 5 months after infection. In experimentally infected cattle LSD virus was demonstrated in saliva for 11 days, semen for 22 days and in skin nodules for 33 days, but not in urine or faeces. Viraemia lasts approximately 1–2 weeks.
- Lung tissue
- Spleen
- Lymph nodes
- No carrier state.

Occurrence

In the past LSD was restricted to sub-Saharan Africa but currently it occurs in most African countries. The most recent outbreaks outside Africa occurred in the Middle East 2006 and 2007 and in Mauritius 2008.

For more recent, detailed information on the occurrence of this disease worldwide, see the OIE World Animal Health Information Database (WAHID) Interface [<http://www.oie.int/wahis/public.php?page=home>] or refer to the latest issues of the World Animal Health and the OIE *Bulletin*.

DIAGNOSIS

The incubation period under field conditions has not been reported. Following inoculation the onset of fever is in 6–9 days, and first skin lesions appear at the inoculation site in 4–20 days.

Clinical diagnosis

LSD signs range from inapparent to severe disease.

- Pyrexia which may exceed 41°C and persist for 1 week.
- Rhinitis, conjunctivitis and excessive salivation.
- Marked reduction in milk yield in lactating cattle.
- Painful nodules of 2–5 cm in diameter develop over the entire body, particularly on the head, neck, udder and perineum between 7 and 19 days after virus inoculation. These nodules involve the dermis and epidermis and may initially exude serum. Over the following 2 weeks they may become necrotic plugs that penetrate the full thickness of the hide (“sit-fasts”).
- Pox lesions may develop in the mucous membranes of the mouth and alimentary tract and, in trachea and lungs, resulting in primary and secondary pneumonia.
- Depression, anorexia, agalactia and emaciation.
- All the superficial lymph nodes are enlarged.
- Limbs may be oedematous and the animal is reluctant to move.
- Nodules on the mucous membranes of the eyes, nose, mouth, rectum, udder and genitalia quickly ulcerate, and all secretions contain LSD virus.
- Discharge from the eyes and nose becomes mucopurulent, and keratitis may develop.
- Pregnant cattle may abort, and there are reports of aborted fetuses being covered in nodules.

- Bulls may become permanently or temporarily infertile from orchitis and testicular atrophy, and the virus can be excreted in the semen for prolonged periods. Temporary sterility in cows may also occur.
- Recovery from severe infection is slow due to emaciation, pneumonia, mastitis, and necrotic skin plugs, which are subject to fly strike and shed leaving deep holes in the hide.

Lesions

- Nodules involving all layers of skin, subcutaneous tissue, and often adjacent musculature, with congestion, haemorrhage, oedema, vasculitis and necrosis
- Enlargement of lymph nodes draining affected areas with lymphoid proliferation, oedema, congestion and haemorrhage
- Pox lesions of mucous membrane of the mouth, the pharynx, epiglottis, tongue and throughout the digestive tract
- Pox lesions of the mucous membranes of the nasal cavity, trachea and lungs
- Oedema and areas of focal lobular atelectasis in lungs
- Pleuritis with enlargement of the mediastinal lymph nodes in severe cases
- Synovitis and tendosynovitis with fibrin in the synovial fluid
- Pox lesions may be present in the testicles and urinary bladder

Differential diagnosis

- Severe LSD is highly characteristic, but milder forms can be confused with those below.
- Pseudo lumpy skin disease/ Bovine herpes mammillitis (Bovine Herpesvirus 2)
- Bovine papular stomatitis (Parapoxvirus)
- Pseudocowpox (Parapoxvirus)
- Vaccinia virus and Cowpox virus (Orthopoxviruses) – uncommon and not generalised infections
- Dermatophilosis
- Insect or tick bites
- Besnoitiosis
- Rinderpest
- Demodicosis
- *Hypoderma bovis* infection
- Photosensitisation
- Urticaria
- Cutaneous tuberculosis
- Onchocercosis

Laboratory diagnosis

Samples

Identification of the agent

- Samples for virus isolation and antigen-detection ELISA should be taken during the first week of signs, before neutralising 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 PCR, 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, viraemic stage of disease; unlikely to be successful after generalised lesions have been present for more than 4 days.
- Samples of lesions, including tissues from surrounding areas, should be submitted for histopathology.
- 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.

Serological tests

- Frozen sera from both acute and convalescent animals.

Procedures

Identification of the agent

- Genome detection by capripoxvirus PCR: on EDTA blood, semen, biopsy, or tissue culture samples. Highly sensitive and specific. Strains can be identified by sequence and phylogenetic analysis.
- Transmission electron microscopy: on biopsy material or desiccated crusts. Rapid test and virus is morphologically distinct from Para poxviruses but indistinguishable from orthopoxviruses.
- Virus isolation: Inoculation of primary cell culture of lamb or calf testis or bovine dermis cells
 - microscopic examination with characteristic cytopathic effect
 - haematoxylin and eosin staining of intracytoplasmic inclusion bodies
 - direct immunofluorescent or immunoperoxidase staining
 - virus neutralisation using specific antisera
 - Antigen detection ELISA
- Capri pox antigen detection ELISA: on biopsy suspension or tissue culture fluid has been described

Serological tests

- Virus neutralisation – cross reacts with all capripoxviruses
- Indirect fluorescent antibody test: cross reaction with parapoxviruses
- Capripox antibody ELISA.
- Western blot: highly sensitive and specific but expensive and difficult to perform.

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

PREVENTION AND CONTROL

No specific treatment. Strong antibiotic therapy may avoid secondary infection

Sanitary prophylaxis

- Free countries: import restrictions on livestock, carcasses, hides, skins and semen
- Infected countries:
 - strict quarantine to avoid introduction of infected animals into safe herds
 - in cases of outbreaks, isolation and prohibition of animal movements
 - slaughtering of all sick and infected animals (as far as possible)
 - proper disposal of dead animals (e.g. incineration)
 - cleaning and disinfection of premises and implements
 - vector control in premises and on animals
- With the exception of vaccination, control measures are usually not effective

Vector control in ships and aircraft is highly recommended

Medical prophylaxis

- Homologous live attenuated virus vaccine:
 - Neethling strain: immunity conferred lasts up to 3 years

- Heterologous live attenuated virus vaccine:
 - Sheep or goat pox vaccine, but may cause local, sometimes severe, reactions
 - Follow manufacturer's instructions. Not advised in countries free from sheep and goat pox.
- 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 OIE *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 OIE *Terrestrial Animal Health Code*.

REFERENCES AND OTHER INFORMATION

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The OIE will periodically update the OIE Technical Disease Cards. Please send relevant new references and proposed modifications to the OIE Scientific and Technical Department (scientific.dept@oie.int). Last updated April 2013.