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Sheep and Goat Pox
Capripoxvirus Infection


Sheep and goat pox infections are the most important pox diseases of domestic animals, causing significant economic losses, especially among young animals, where the mortality is greatest.

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Overview

- Organism
- Economic Impact
- Epidemiology
- Transmission
- Clinical Signs
- Diagnosis and Treatment
- Prevention and Control
- Actions to Take



In today's presentation we will cover information regarding the organism that causes sheep and goat pox and its epidemiology. We will also talk about the economic impact the disease has had in the past and could have in the future. Additionally, we will talk about how it is transmitted, the species it affects, clinical and necropsy signs seen, and diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease, as well as actions to take if sheep and goat pox are suspected.

(Photos: USDA)

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The Organism

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Sheep and Goat Pox

- Family Poxviridae
 - Genus *Capripoxvirus*
- Sheep pox and goat pox viruses distinct
 - But hard to differentiate
 - Recombination can occur
- One serotype, multiple strains
- Prolonged survival in environment



Sheep pox and goat pox are classified together with lumpy skin disease virus in the genus *Capripoxvirus* (family Poxviridae). Sheep pox and goat pox are distinct viruses, but recombination can occur between them. The viruses cannot be distinguished from each other with current techniques. Only one serotype exists. Most isolates cause disease mainly in sheep or mainly in goats, but some isolates can cause serious disease in both species. The viruses are thought to have prolonged survival in the environment; they can remain infectious for up to six months in sheep pens, and may also be found on the wool or hair for as long as three months after infection.

(Photo of electron micrograph of poxvirus from www.ncbi.nlm.nih.gov/ICTVdb/ICTVdB/58000000.htm)

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Importance

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Economic Impact

- Presence of disease can limit:
 - Trade
 - Export
 - Import of new breeds
 - Development of intensive livestock production



Sheep and goat pox are contagious viral skin diseases. These diseases may be mild in indigenous breeds from endemic areas, but are often fatal in newly introduced animals. Pox infections can limit trade, export, and the development of intensive livestock production. They may also prevent the import of new breeds.

(Photo: USDA)

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Epidemiology

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History and Geographic Distribution

- 1879: Goat pox
 - Norway
- 2nd Century AD: Sheep pox
 - Central and North Africa
 - Central Asia
 - The Middle East
 - Portions of India



Goat pox was first reported in 1879 in Norway, and was later observed in Macedonia during the first world war. Sheep pox was likely present in Asia and Europe as early as the second century AD. Its infectious nature was recognized in the mid-18th century. Today, sheep pox and goat pox are found in central and north Africa, central Asia, the Middle East, and parts of the Indian subcontinent. A mild pox-like disease has been reported in California but is unlikely to be a capripox virus.

(Photos: USDA)

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Morbidity/Mortality

- Mortality up to 50% in fully susceptible flock
- Mortality up to 100% in young animals
- Symptoms severe in
 - Stressed animals
 - Animals with concurrent infections
 - Naïve animals

Morbidity and mortality vary with the breed of the host and the strain of the virus. Mortality may be up to 50% in a fully susceptible flock, and as high as 100% in young animals. Mild infections are common in indigenous breeds; however, symptoms may be more severe in kids or lambs, stressed animals, animals that have concurrent infections, or animals from areas where pox has not occurred for some time.

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Morbidity/Mortality

- European sheep breeds highly susceptible
- Subclinical cases
- No chronic carriers
- Only sheep and goats affected
 - Not seen in wild ungulates



Imported breeds of sheep and goats usually develop severe disease when they are moved into an endemic area. European sheep breeds are highly susceptible to the virus and may die before even showing signs of disease. Subclinical cases can occur, but chronic carriers are not seen. Sheep and goat pox viruses cause disease only in these two species. Infections have not been seen in wild ungulates.

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Transmission

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Animal Transmission

- Close contact
- Inhalation of aerosols
- Abraded skin
- Fomites
- Insects (mechanical)
- Infectious virus present in all secretions, excretions, and scabs



Sheep pox and goat pox viruses are usually transmitted by close contact. Inhalation of aerosols containing virus, and contact through abraded skin by fomites or direct contact, are the natural means of transmission. Stable flies (*Stomoxys calcitrans*) may transmit the viruses mechanically, although this is uncommon. Infectious virus is found in all secretions, excretions, and the scabs from skin lesions (pictured above). Contagious aerosols may also be generated from dust that contains pox scabs.

(Photo source: USDA)

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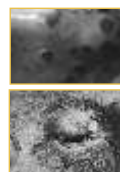
Animals and Sheep and Goat Pox

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Clinical Signs

- Incubation period: 4 to 21 days
 - Fever
 - Conjunctivitis
 - Depression, anorexia
 - Dyspnea, nasal or ocular discharge
 - Secondary bacterial infections are common




The incubation period varies from four to 21 days, but it is usually 1 to 2 weeks. All ages of sheep and goats can be affected, however, disease is more severe in young animals. Systemic signs may include fever (104-107.6°F), conjunctivitis, rhinitis, lymphadenopathy, anorexia, and depression. Lung lesions can cause dyspnea (above photo). The mucous membranes can become necrotic, and animals may develop a mucopurulent nasal or ocular discharge (bottom photo). Secondary bacterial infections are common and death can occur at any stage of the disease. Some European breeds of sheep die before the characteristic skin lesions appear.

(Photos: USDA)

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Clinical Signs

- Papules forming into hard scabs
- Lesions may cover body or be restricted to axilla, perineum and groin, ears, or tail
- Death may occur at any stage




The first sign of infection is a fever, followed by erythematous macules that develop into hard papules (pictured above). Dark, hard scabs eventually form and may take up to six weeks to heal. Skin lesions can be restricted to the axilla, perineum, and groin, or may cover the entire body. In animals with heavy wool, the lesions can be easier to find by palpation than visual inspection. Mild infections can easily be missed, as only a few lesions may be present, often around the ears or the tail. Death may occur at any stage.

(Photos: USDA)

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Post Mortem Lesions

- Skin macules, papules
 - Papules may extend into the musculature
- Mucous membranes necrotic or ulcerated
- Nodules in lungs
 - Up to 5cm diameter
- Swollen lymph nodes



The skin usually contains macules and papules, with areas of edema, hemorrhage, congestion, necrosis, and vasculitis. Papules penetrate through both the dermis and epidermis (right photo); in severe cases they may extend into the musculature. The mucous membranes of the eyes, nose, mouth, vulva and prepuce may be necrotic or ulcerated. The abomasal mucosa, rumen, and large intestine may also be affected. The lungs often contain discrete congested or edematous lesions or hard white nodules (left photo). Nodules in the lungs can be up to 5cm in diameter. Pale foci are sometimes present on the surface of the kidney, liver, and testicles. The lymph nodes are usually swollen.

(Photos: USDA-APHIS, right photo; www.fao.org, left photo)

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Differential Diagnosis

• Contagious exthyma	• Peste des petits ruminants
• Bluetongue	• Parasitic pneumonia
• Mycotic dermatitis	• Caseous lymphadenitis
• Sheep scab	• Insect bites
• Mange	
• Photsensitization	

Differential diagnoses include contagious ecthyma (contagious pustular dermatitis), bluetongue, mycotic dermatitis, sheep scab, mange, photosensitization, peste des petits ruminants, parasitic pneumonia, caseous lymphadenitis, and insect bites.

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Sampling

- Before collecting or sending any samples, the proper authorities should be contacted
- Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease

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Contact authorities if you are suspicious of sheep and goat pox. Samples must be properly obtained, securely packaged, and sent to authorized laboratories for diagnosis. Call before sampling as a USDA trained Foreign Animal Disease Diagnostician (FADD) will need to collect and ship the samples.

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Diagnosis

- Clinical
 - Suspect in animals with characteristic skin lesions, fever, and lymphadenitis
- Laboratory
 - Virus isolation, electron microscopy
 - PCR
 - Viral antigen detection (AGID, ELISA)
 - Serology
 - Characteristic histopathologic lesions

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Sheep or goat pox should be suspected in animals with the characteristic full-thickness skin lesions, fever, and lymphadenitis. Laboratory procedures for the diagnosis of sheep and goat pox include observation of the virus by electron microscopy (morphology is characteristic) and virus isolation (identification is by immunofluorescence or immunoperoxidase staining). A PCR assay is also available. Viral antigens can be detected by agar gel immunodiffusion (AGID) or enzyme-linked immunosorbent assay (ELISA). However, cross-reactions occur in the AGID test with parapoxvirus. Serology is also useful; antibodies can be found one week after the skin lesions appear. Serologic tests include virus neutralization, AGID, indirect immunofluorescence, ELISA, and immunoblotting (Western blotting). Virus neutralization is the most specific serological test, but is not sensitive enough to detect infections in all animals. Cross-reactions with other viruses are seen in the AGID and indirect immunofluorescence tests. Histopathologic lesions are also characteristic.

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Treatment

- Antibiotics for secondary infection
- Good nursing care



Treatment is directed at preventing or controlling secondary infection. Administration of antibiotics to control secondary infection and good nursing care are recommended. Infection results in good immunity.

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Public Health Significance

- No conclusive evidence of infection in humans
- Anecdotal reports of sheep or goat pox lesions in humans in India and Sweden
 - Not verified by virus isolation

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There is no conclusive evidence that sheep and goat pox viruses can infect humans. A report from India that implied goat pox caused human infection was merely based on clinical signs. There was no attempt to isolate the causative virus or perform serology on the convalescent serums of the three patients to differentiate the infection from contagious ecthyma, which is a known zoonotic agent that occurs worldwide. A report from Sweden indicated that human infection occurred during an outbreak of goat pox. Although serological studies seemed to indicate that the apparent causative agent of the outbreak was not vaccinia or contagious ecthyma, no virus was isolated.


<p>S 1 i d e 2 2</p>	<p style="text-align: center;">Prevention and Control</p>	
<p>S 1 i d e 2 3</p>	<p style="text-align: center;">Recommended Actions</p> <ul style="list-style-type: none"> • IMMEDIATELY notify authorities • Federal <ul style="list-style-type: none"> - Area Veterinarian in Charge (AVIC) http://www.aphis.usda.gov/animal_health/area_offices/ • State <ul style="list-style-type: none"> - State veterinarian http://www.usaha.org/StateAnimalHealthOfficials.pdf • Quarantine <p style="text-align: right; font-size: small;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>If you suspect a case of sheep and goat pox, state or federal authorities should be notified immediately. Animals suspected with sheep and goat pox should be isolated, and the farm should be quarantined until definitive diagnosis is determined.</p>
<p>S 1 i d e 2 4</p>	<p style="text-align: center;">Prevention</p> <ul style="list-style-type: none"> • Non-endemic areas <ul style="list-style-type: none"> - Infected animals, fomites, and animal products may introduce disease - Keep free with import restrictions <p style="text-align: right; font-size: small;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>Capripoxviruses are most likely to be introduced in infected animals, but fomites and animal products such as wool can also spread disease. Import restrictions help to keep non-endemic areas free of disease.</p>
<p>S 1 i d e 2 5</p>	<p style="text-align: center;">Control and Eradication</p> <ul style="list-style-type: none"> • Endemic areas <ul style="list-style-type: none"> - Vaccinate • Outbreak in endemic area, small scale <ul style="list-style-type: none"> - Quarantine, slaughter infected and exposed, clean and disinfect - Ring vaccination • Outbreak in endemic area, large scale <ul style="list-style-type: none"> - Massive vaccination - Movement restrictions <p style="text-align: right; font-size: small;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>The most effective means of controlling losses in an endemic area is vaccination. However, even with vaccination, consideration still should be given to eliminating infected and exposed herds by slaughter, proper disposal of animals and contaminated material, and by cleaning and disinfecting contaminated premises, equipment, and facilities. If the disease has spread extensively in an endemic area, massive vaccination followed by cessation of vaccination and control of animal movements from the area represent a strong strategy to control and eradicate sheep and goat pox.</p>
<p>S 1 i d e 2 6</p>	<p style="text-align: center;">Control and Eradication</p> <ul style="list-style-type: none"> • Outbreak in non-endemic area <ul style="list-style-type: none"> - Quarantine, slaughter infected and exposed, clean and disinfect - Ring vaccination • No carrier state • Isolate infected herds and sick animals for at least 45 days after recovery <p style="text-align: right; font-size: small;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>If a small scale outbreak of sheep or goat pox occurs in an area usually free from the virus, a quarantine should be placed around the infected area, infected and exposed animals slaughtered, and the premises cleaned and disinfected. Ring vaccination should also be considered. A carrier state has not been shown for SGPV. However, the virus may persist for many months on contaminated premises. Quarantine of areas and premises containing infected or exposed animals is required to prevent disease spread. Isolation of infected herds and sick animals for at least 45 days after recovery is recommended.</p>

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Disinfection

- Sodium hypochlorite
- Phenol 2% for 15 minutes
- Detergents
- Virus can survive
 - For 3 months in wool
 - For 6 months in the environment
 - For many years in dried scabs



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Sodium hypochlorite is an effective disinfectant. The virus is also inactivated by phenol (2%) in 15 minutes, and is sensitive to detergents, such as those containing sodium dodecyl sulfate. (The above photo depicts a strong disinfectant.) The virus can survive for many years in dried scabs at ambient temperatures, and remains viable in wool for 3 months and on premises for as long as 6 months.

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Vaccination

- Vaccination can provide effective control in endemic areas
- Killed vaccines do not provide long lasting immunity
- Attenuated virus vaccines give immunity up to 2 years

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In endemic areas, vaccination is an effective means of controlling losses from sheep and goat pox. Killed vaccines have not proved to be practical under field conditions because they do not provide solid lasting immunity. There are numerous attenuated virus vaccines. Immunity lasts up to 2 years.

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Additional Resources

- World Organization for Animal Health (OIE)
 - www.oie.int
- U.S. Department of Agriculture (USDA)
 - www.aphis.usda.gov
- Center for Food Security and Public Health
 - www.cfsph.iastate.edu
- USAHA Foreign Animal Diseases ("The Gray Book")
 - www.usaha.org/pubs/fad.pdf

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