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Bluetongue Virus

*Sore Muzzle, Pseudo
Foot-and-Mouth
Disease, Muzzle Disease*




Bluetongue virus is also known as sore muzzle, pseudo foot-and-mouth disease, and muzzle disease.

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Overview

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




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In today's presentation we will cover information regarding the organism that causes bluetongue 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 findings and necropsy signs, as well as diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease and actions to take if bluetongue is suspected.

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The Organism



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Bluetongue Virus

- Family Reoviridae
 - Genus Orbivirus
- 24 serotypes worldwide
 - 5 serotypes isolated in the U.S.
- Non-contagious
- Insect-borne viral disease
- Ruminants: Primary host is sheep
- Others infected: Cattle, goats, deer

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Bluetongue is a non-contagious, insect-borne viral disease of ruminants. Bluetongue virus (BTV) belongs to the family Reoviridae, genus *Orbivirus*. There are 24 serotypes identified worldwide, five of which have been isolated in the U.S. Bluetongue primarily affects sheep and wild ruminants, with asymptomatic infections occurring in cattle, goats, deer and carnivores. This disease can result in significant morbidity. Affected sheep may have erosions and ulcerations on mucous membranes, dyspnea, or lameness from muscle necrosis and inflammation of the coronary band.

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Importance



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History

- First described in South Africa
 - Broad distribution worldwide
- Mediterranean outbreak, 1997-2002



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BTV was first described in South Africa, and the virus has since been recognized in Africa, Europe, the Middle East, the South Pacific, North and South America, and parts of Asia. As the virus cannot be transmitted between susceptible animals without the presence of insect carriers, the distribution of vector limits the spread of infection (e.g., distribution of *Culicoides variipennis* var *sonorensis*, the principal vector of BTV, limits infections in the U.S. to the southern and western states). From 1997 to 2002 there was a progressive spread of bluetongue within the Mediterranean region, as shown in red in the map above (www.fas.org).

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Economic Impact

- Trade restrictions
 - Imposed by BTV-free countries
 - Animals and animal products
- Cost to U.S.
 - Greater impact on cattle industry
 - Reservoir for virus
 - \$125 million per year
 - Lost trade and animal testing

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Bluetongue has a strong impact on trade: countries that are free of bluetongue restrict importation of live animals or animal products, including semen and embryos, from countries that may have BTV. Although BTV primarily affects sheep, it has a great economic impact on the cattle industry (which is larger than the sheep industry in the U.S.) because cattle can carry the virus for a few months following infection and show no clinical signs. This costs U.S. sheep and cattle producers \$125 million per year in lost trade and in testing to certify that animals or animal products for export are free of any of the bluetongue viruses.

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Epidemiology




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In sheep, the severity of disease varies with the breed of sheep, strain of virus, and environmental stress. Morbidity can be up to 100% and mortality is usually 0-50%.

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Morbidity/Mortality: Sheep

- Sheep
 - Severity of disease varies
 - Breed
 - Strain of virus
 - Environmental stress
 - Morbidity: up to 100%
 - Mortality: usually 0-50%




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Most infections in cattle, goats, and North American elk are asymptomatic. In cattle, morbidity may be up to 5%, but death is rare. Infections are usually severe in whitetail deer and pronghorn antelope, with morbidity rates as high as 100% and mortality usually reaching 80-90% in these two species. In some animals, lameness and poor condition can persist for some time.

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Morbidity/Mortality: Other Species

- Cattle, goats
 - Morbidity: up to 5%
 - Death is rare
- Deer, antelope
 - Severe infection
 - Morbidity: up to 100%
 - Mortality: 80-90%
- Animals may remain lame




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Transmission




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Animal Transmission

- Biting midges
 - Genus *Culicoides*
 - Principal vector
 - *C. variipennis* var. *sonorensis*
- Ticks, sheep keds
- In utero
- Mechanical
- Venereal?




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BTV is transmitted by biting midges in the genus *Culicoides* (shown above), with the *Culicoides variipennis* var *sonorensis* as the principal vector in the U.S. Ticks or sheep keds can be mechanical vectors, but are probably of minor importance in disease transmission. While bluetongue is not a contagious disease, the virus can be transmitted to the fetus *in utero* or spread mechanically on surgical equipment and needles. Although BTV can be found in semen, venereal spread does not appear to be a major route of infection. Photo: *Culicoides* species, courtesy of www.usda.gov.

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Animals and
Bluetongue



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Clinical Signs: General

- Incubation period: 5-20 days
 - Fever, depression, salivation
 - Facial swelling, dyspnea, panting, nasal discharge
 - Hyperemia of muzzle, lips, ears
 - Pregnancy: Reabsorption, abortion, “dummy” lambs

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The incubation period for bluetongue is 5-20 days. In sheep, the clinical signs may include fever, excessive salivation, depression, dyspnea and panting. The muzzle, lips and ears are hyperemic and the lips and tongue may be very swollen. The head and ears may also be edematous. Initially, animals have a clear nasal discharge; later, the discharge becomes mucopurulent and dries to a crust around the nostrils. Pregnant ewes infected during the first trimester may reabsorb the fetus, abort, or give birth to “dummy” lambs.

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Clinical Signs: Specific

- Oral erosions and ulcerations
- Tongue
 - Swollen, protruding
 - Cyanotic = “blue-tongue”
- Feet
 - Sore hooves, lameness
 - Coronitis



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The tongue is occasionally cyanotic (“blue-tongue”) (middle photo, www.fao.org), swollen and protrudes from the mouth (top photo, www.usda.org). Erosions and ulcerations are often found in the mouth; these lesions may become extensive and the mucous membranes may become necrotic. The coronary bands on the hooves are often hyperemic, inflamed and the hooves painful (bottom photo, fao.org); lameness is common and animals may slough their hooves if they are driven.

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Clinical Signs of Sheep: Face and Mouth

- Salivation
- Nasal discharge
- Facial swelling



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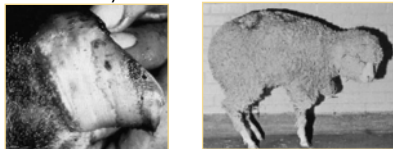
In sheep, the clinical signs may include excessive salivation (top photo, www.defra.gov.uk), facial swelling, and discharge from the nose (middle photo, Gray Book). The muzzle, lips and ears are hyperemic and the lips and nose may be very swollen (bottom photo, www.fao.org).

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Clinical Signs of Sheep: Feet

- Coronitis
 - Inflammation of coronary band
- Lameness
 - Painful hooves



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The coronary bands on the hooves are often inflamed (coronitis; left photo, www.defra.gov.uk) and the hooves painful; lameness is common and animals may slough their hooves if they are driven. Shown in the right photo is a lame sheep holding up its painful front leg, photo source: Gray Book.

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Clinical Signs

- Cattle and goats
 - Usually subclinical
 - Erosions, crusts around nose and teats
 - Coronitis
 - Reproductive failure
- Antelope and deer
 - Hemorrhage, death



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Infections in cattle are usually subclinical; often, the only signs of disease are changes in the leukocyte count and a fluctuation in rectal temperature. Rarely, cattle have mild hyperemia, vesicles or ulcers in the mouth, erosion and crusting around the nose (top photo), hyperemia around the coronary band, or lesions around the teats of lactating cows (bottom photo). Temporary sterility may be seen in bulls and infected cows may give birth to “dummy” calves with hydranencephaly or cerebral cysts. Cattle that have clinically apparent disease may develop severe breaks in the hooves several weeks after infection; such breaks are usually followed by foot rot. In pronghorn antelope and whitetail deer, the most common symptoms are hemorrhages and sudden death. Infections in goats are usually subclinical and resemble disease in cattle. Photo source: Gray Book.

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Post Mortem Lesions: Sheep

- Sheep:
 - Face and ears edematous
 - Dry, crusty exudate on nostrils
 - Coronary bands hyperemic
 - Internal hemorrhaging
 - Hydranencephaly, cerebellar dysplasia
- Cattle
 - Skin: Edematous, ulcerated, dry, thick folds
 - Mouth: Vesicles, ulcers, necrosis

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In sheep, the face and ears are often edematous, and a dry, crusty exudate may be seen on the nostrils. The coronary bands of the hooves are often hyperemic; petechial or ecchymotic hemorrhages may be present and extend down the horn. Petechiae, ulcers and erosions are common in the oral cavity, particularly on the tongue and dental pad, and the oral mucous membranes may be necrotic or cyanotic. The nasal mucosa and pharynx may be edematous or cyanotic and the trachea hyperemic and congested. In some cases, hyperemia, hemorrhages, and edema are found throughout the internal organs. Hemorrhage at the base of the pulmonary artery is particularly characteristic of bluetongue. In newborn lambs, there may be hydranencephaly or cerebellar dysplasia. In cattle infected with BTV, the skin is often edematous and ulcerated or eroded with dry, thick folds. Vesicles, ulcers, and necrotic debris may be found in the mouth; these erosions are most common on the buccal mucosa and dental pad. The oral mucosa can be intensely congested. The external nares may contain erosions and a crusty exudate. Hyperemia is often seen at the coronary band. Affected fetuses can have hydranencephaly or cerebral cysts. In deer, the most prominent lesions are widespread petechial to ecchymotic hemorrhages. More chronically infected deer may have ulcers and necrotic debris in the oral cavity and lesions on the hooves, including severe fissures or sloughing.

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Differential Diagnosis

- Foot-and-mouth disease
- Vesicular stomatitis
- Peste de petits ruminants
- Malignant catarrhal fever
- Bovine viral diarrhea
- Contagious pustular dermatitis
- Sheep pox
- Foot rot
- Actinobacillosis

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The differential diagnosis includes foot-and-mouth disease, vesicular stomatitis, peste de petits ruminants, malignant catarrhal fever, bovine virus diarrhea, contagious pustular dermatitis, sheep pox, foot rot, and actinobacillosis.

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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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Before collecting or sending any samples from animals with a suspected foreign animal disease, 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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Diagnosis

- Clinical signs
- History
 - Season when insects are active
 - Wasting or foot rot
- Laboratory
 - Virus isolation in cell cultures
 - ELISA, PCR, IFA, VN
 - Serology
 - Complement fixation
 - Examination of proteins
 - Differentiation from related diseases



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Bluetongue should be suspected when typical clinical signs are seen during seasons when insects are active. A recent history of wasting and foot rot in the herd supports the diagnosis. Bluetongue can be diagnosed by isolating the virus in cell cultures or embryonated chicken eggs. Appropriate cell cultures include mouse L, baby hamster kidney (BHK)-21 and African green monkey kidney (Vero). Virus identity is confirmed by antigen-capture enzyme-linked immunosorbent assay (ELISA), immunofluorescence (IFA), immunoperoxidase, virus neutralization (VN) or polymerase chain reaction (PCR) tests. These techniques allow for rapid diagnosis and can identify the virus serogroup and serotype. Virus isolation is particularly valuable when the virus titer is very low. Serology and complement fixation tests are also used, and recently a method has been developed to examine bluetongue virus proteins and genes (shown above), which helps to differentiate between BTV and related viruses that cause epizootic hemorrhagic disease (EHD). Photo source: www.usda.gov

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Treatment

- No specific treatment
- Supportive therapy
 - Protection from the elements
 - Fluids and electrolytes given
 - Antibiotics
 - Prevention of secondary infection
- Control of vectors by insecticide
 - Reduce transmission
 - Protect susceptible animals

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There is no specific or efficient treatment that can be given for an acute case of bluetongue, only supportive therapy. Animals infected with bluetongue should be protected from the elements (e.g., out of the wind or sun), kept warm and dry, given fluids and electrolyte solutions if needed and antibiotics to prevent a secondary infection. Treatment procedures may also include vector control by insecticide, which will reduce transmission of the virus to non-infected animals.

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Bluetongue in Humans



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Bluetongue in Humans

- Not a significant threat to humans
- One human infection documented
 - Reasonable precautions should be taken
- Disease in humans is not fatal
- Treatment is supportive care




Bluetongue is not a significant threat to human health. However, one human infection has been documented in a laboratory worker and reasonable precautions should be taken while working with the virus. BTV is not fatal in humans, and treatment includes supportive care.

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Prevention and Control




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Recommended Actions

- Notification of Authorities
 - Federal:
 - Area Veterinarian in Charge (AVIC)
 - www.aphis.usda.gov/vs/area_offices.htm
 - State veterinarian
 - www.aphis.usda.gov/vs/sregs/official.htm
- Quarantine





If you suspect a case or outbreak of Bluetongue, contact your state and/or federal veterinarian immediately and establish a quarantine of the premise.

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Quarantine

- Quarantine and movement controls
 - Prevent spread of virus
- Animals confined indoors (i.e., barn)
 - When vectors are active



Control strategies for bluetongue include using a combination of quarantine and movement controls to prevent spread of the virus (pictured above). When there is suspicion of BTV circulating in an area, animals should be confined indoors at times when the vectors are active. Slaughter may also be necessary, depending upon the situation. Photo courtesy of Katie Steneroden, DVM.

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Disinfection

- Disinfection
 - Does not stop virus transmission
 - Cleaning the premises
 - Sodium hypochlorite (bleach)
 - 3% Sodium hydroxide (lye)
- Insect control

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Disinfectants cannot prevent the virus from being transmitted between animals; however, where disinfection is warranted, sodium hypochlorite or 3% sodium hydroxide (lye) are effective (above photo). Insect control is important in limiting the spread of the disease; synthetic pyrethroids or organophosphates are effective against *Culicoides*, (bottom photo, <http://www.usda.gov/oc/photo/opc-pest.htm>)

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Vaccination

- Available
 - Serotype specific
- Adverse effects
 - Fetal malformations
 - Recombination
 - New strains of virus

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Vaccines are available, but are specific for each serotype. There are also adverse effects to the use of vaccines, as they can cause fetal malformations during the first 100 days of gestation in ewes and may be able to recombine with field strains to produce new strains of virus. We all need to do our part to keep our sheep healthy and free of foreign animal diseases such as bluetongue.

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Additional Resources

- World Organization for Animal Health (OIE)
 - www.oie.int
- USAHA FAD - "The Gray Book"
 - www.vet.uga.edu/vpp/gray_book/index
- Food and Agriculture Organization of the United Nations (FAO)
 - www.fao.org
- USDA-APHIS website
 - www.aphis.usda.gov

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Acknowledgments

Author: Jean Marie Gladon, BS

Co-authors: Anna Rovid Spickler, DVM, PhD
Radford Davis, DVM, MPH, DACVPM

Reviewer: Bindy Comito Sornsin, BA

