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Vesicular Stomatitis

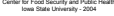


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Overview

- 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 vesicular stomatitis and its epidemiology. We will also talk about the economic impact the disease has had in the past. Additionally, we will talk about how it is transmitted, the species it affects (including humans), 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 Vesicular Stomatitis is suspected.

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The Organism





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Vesicular Stomatitis Virus

- RNA Vesiculovirus
 - Family Rhabdoviridae
 - Types VSV-NJ and VSV-I
- Western hemisphere
- Affects horses, cattle, swine, camelids, and humans
 - Sheep and goats resistant
- Clinical signs similar to FMD

Vesicular stomatitis virus (VSV) is a bullet shaped RNA virus in the genus *Vesiculovirus* in the family *Rhabdoviridae*. It is found only in the western hemisphere. There are many different types found around the world, but the New Jersey (VSV-NJ) and Indiana (VSV-I) types predominate in the Americas. This vesicular disease can cause lesions in the mouth and feet of a wide range of animals, but it primarily affects horses, donkeys, cattle, swine, and South American camelids. Sheep and goats are resistant to VSV and rarely show clinical signs. Humans can also become infected producing influenza-like symptoms. VSV has clinical signs almost identical to Foot and Mouth Disease. Photo source: www.aphis.usda.gov

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Importance



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History

- Early 1800's: Horse illness resembling VSV
- 1927: Virus etiology discovered
- 1950: Human infections recorded
- 1982-83: Outbreak in western U.S.
- 1998-99: NM, CO, TX; 130 positives
- 2004: TX, NM, CO
 - Horses and cattle
 - Quarantined premises

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Although the exact etiology was not known, an illness resembling VSV was first noted in horses with "sore tongue" in the early nineteenth century. The Civil War in 1862 disabled 4000 horses with a disease resembling VS. It wasn't until 1927 that it was identified in horses. Human infections were thought to occur during the first half of the 20th century but weren't recorded until the early 1950's. Canada had its last case of VSV in 1949. Epizootic waves tend to occur approximately every 10 years and there was a major outbreak in 1982 and 1983 in the western U.S. But since then, the VSV-New Jersey serotype has been found each year in the U.S. The May 1998 U.S. outbreak started in a horse in New Mexico and spread to other horses in Colorado and Texas, and ended in January 1999. In all, 130 were positive and VSV was isolated out of 27 horses. The 2004 outbreak began on May 19 on a horse and cattle premise in western Texas, and as of July 7, 2004 confirmed outbreaks have occurred in Texas, New Mexico, and Colorado. The confirmed VS outbreaks, involving both cattle and horses, have resulted in livestock quarantines of infected premises.

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Economic Impact

- 1928: California dairy herd
 - \$97-202 per head lost
- 1995: New Mexico beef herd
 - \$53 per head lost
- Losses due to
 - Increased culling
 - Reduced milk production
 - Increased mortality
 - Labor, medicine, veterinary costs

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Based on the economic data collected after the 1982 VS outbreak in two California dairy herds, dollars lost per cow varied from \$202 on dairy 1 to \$97 on dairy 2. Both were intensively managed, dry lot dairies with close animal contact, facilitating spread. During the 1995 outbreak in the western U.S., New Mexican beef cattle owners put the cost per head at \$53 for each case of VS. Losses were attributed to increased culling, reduced milk production, increased mortality, and labor, medicine, and veterinary costs.

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Epidemiology



Vesicular stomatitis is a western hemisphere disease that is indigenous in North and Central America and the northern part of South America. Outbreaks tend to occur in the warmer regions around riverways and valleys but occasionally occur in more temperate regions. In the United States, the southwest has experienced outbreaks during the warmer months. The southeast U.S. has an enzootic cycle in which the virus has been isolated in sandflies. France had it in horses in 1915 and 1917 (WWI) from the shipping of infected horses to those eastern seaports, but it quickly died out. The same occurred in South Africa with epidemics in the late 1800's and periodically until 1943. It has not been seen outside the western hemisphere since then.

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Geographic Distribution

- Western hemisphere
 - North America, Central America and Northern South America
 - Southwest U.S.: Enzootic cycle
 - Outbreaks in warmer regions
 - Riverways, valleys
 - Occasionally in temperate regions
- 1915 and 1917: France
 - Shipping horses from the U.S.

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Morbidity/ Mortality

- Morbidity 90%
 - Variable with conditions
 - Sporadic infection in 5-10% of herd
- Mortality rate low
 - Death in young not as common as for FMD

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Morbidity can be up to 90% but does vary with conditions and species. Often infection is sporadic in the exposed group and only 5-10% of the animals in affected herds show clinical signs of VSV. Mortality rate is low and death is not as common in young animals as it is for FMD.

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Transmission


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Animal Transmission

- Vectors
 - Sandflies
 - Blackflies
 - Seasonal outbreaks
- Direct contact
 - Infected animals
 - Contaminated objects



Sandfly



Blackfly

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Transmission of VSV can occur in many ways. Vectors, such as sand flies (*Lutzomyia shannoni*) and black flies (Simuliidae) will transmit the virus through injection and can pass it transovarially to their offspring. There is ample evidence to indicate this is an arthropod borne disease due to its seasonal patterns; begins in spring/early summer and disappears after first frost. Direct contact with infected animals' saliva, exudate, epithelium of open vesicles or contaminated objects is also effective, which is often the reason for spread in concentrated animal populations. The top photo is of a sandfly and the bottom photo of a blackfly accessed at edis.ifas.ufl.edu/pdf/IG/IG08100.pdf

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Human Transmission

- Contact with infected tissues, vesicular fluid, saliva
- Vector injection
 - Blackfly, sandfly
- Aerosol transmission in a laboratory setting

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Humans are often infected through contact with infected tissues, vesicular fluid, or saliva. Also, the bite of an infected sandfly or blackfly can transmit the disease to humans. Finally, aerosol transmission in a laboratory setting has led to infection.

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Animals and Vesicular Stomatitis


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Clinical Signs

- Incubation period
 - 3-5 days
- Fever and vesicles that resemble FMD
- Horses severely affected
 - Oral lesions
 - Drooling, chomping, mouth rubbing, lameness
 - Coronary band lesions



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All affected animals develop fever and clinically the lesions will resemble those of foot and mouth disease. Unlike FMD, horses are affected and very severely with oral and coronary band vesicles. This causes drooling, chomping, mouth rubbing, and lameness. The incubation period in animals is 3-5 days. The above photo depicts an ulcerated lesion on the upper gums of a horse. Taken from USDA APHIS website at www.aphis.usda.gov

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Clinical Signs

- Cattle, pigs
 - Vesicles: oral, mammary gland, coronary band, interdigital region
 - Salivation, lameness
- Vesicles isolate to one area of body
 - Mouth or feet
- Recover within 2 weeks



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Cattle and pigs have oral vesicles, causing salivation, vesicles on the mammary gland, coronary band and interdigital region leading to lameness. These vesicles seem to isolate to one area of the body unlike other vesicular diseases. Recovery is within 2 weeks if there is no secondary infection. The photo is a vesicle on the tongue of a pig with vesicular stomatitis accessed at www.vet.uga.edu/esp/OLD_Svd/VS_tongue

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	Foot & Mouth Disease	Vesicular Stomatitis	Swine Vesicular Disease	Vesicular Exanthema of Swine
Clinical Signs by Species	All vesicular diseases produce a fever with vesicles that progress to erosions in the mouth, nares, muzzle, teats, and feet			
Cattle	Oral & hoof lesions, salivation, drooling, lameness, abortions, death in young animals, "asters"?	Vesicles in oral cavity, mammary glands, coronary bands, interdigital space	Not affected	Not affected
Pigs	Severe hoof lesions, hoof sloughing, snout vesicles, less severe oral lesions; Amplifying Hosts	Same as cattle	Severe signs in animals housed on concrete; lameness, salivation, neurological signs; younger more severe	Deeper lesions with granulation tissue formation on the feet
Sheep & Goats	Mild signs if any; Maintenance Hosts	Rarely show signs	Not affected	Not affected
Horses, Donkeys, Mules	Not affected	Most severe with oral and coronary band vesicles; drooling, rub mouths on objects; lameness	Not affected	Not affected

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Clinically, all vesicular diseases produce a fever with vesicles that progress to erosions in the mouth, nares, muzzle, teats and feet. Vesicular diseases are clinically indistinguishable from one-another, especially in swine as this chart shows, and diagnosis can only be made through virus isolation initially. Any disease with vesicles and fever should be reported to a state or federal veterinarian.

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Post Mortem Lesions

- Erosive, ulcerative lesions
 - Oral cavity, teats, coronary band
- Histology
 - Degeneration of epithelial cells
- Electronmicroscopy
 - Virus in fresh lesions, vesicular fluid

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Although deaths are very rare from vesicular stomatitis, erosive ulcerative lesions can be seen post-mortem, generally in the mouth. Also, the teats and coronary bands of cattle may show lesions. Histologically, edema and degeneration of epithelial cells can be seen. If fresh lesions or vesicular fluid is available, the bullet shaped virus can be viewed using electronmicroscopy. The top photo is an ulcerative lesion on the tongue of a horse (antemortem) and the bottom photo shows the clinical signs seen in cattle: teat vesicles and erosions. Photo courtesy of USDA APHIS at www.aphis.usda.gov

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Differential Diagnosis for Vesicular Stomatitis Virus					
	Cattle	Swine	Sheep	Horses	
FMD	x	x	x		
Swine Vesicular Disease		x			
Vesicular Stomatitis Virus	x	x	x	x	
Vesicular Exanthema of Swine		x			
Chemical burn	x	x	x	x	
Thermal burn	x	x	x	x	
Rinderpest	x				
IBR	x				
BVD	x				
Malignant Catarrhal Fever	x				
Bluetongue			x		
Contagious Ecthyma			x		
Lip/Leg Ulceration			x		
Foot Rot	x		x		

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Differential diagnosis for oral lesions in cattle can resemble rinderpest, infectious bovine rhinopneumonitis (IBR), bovine virus diarrhea (BVD), malignant catarrhal fever (MCF), bluetongue and chemical or thermal burns. In pigs, differentials include foot and mouth disease (FMD), swine vesicular disease, vesicular exanthema in swine, foot rot, chemical and thermal burns. For sheep, be suspicious of FMD, bluetongue, contagious ecthyma, lip and leg ulceration, foot rot, and chemical or thermal burns.

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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 a vesicular disease. 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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Clinical Diagnosis

- Vesicular diseases are indistinguishable
- Further testing required for animals with
 - Salivation and lameness
- VSV not as contagious as FMD
- VSV lesions generally found in one area of the body



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Clinically, vesicular diseases are indistinguishable from one another, especially in swine. However, vesicular stomatitis should be suspected in horses with salivation or lameness related to vesicles. VSV is not as contagious nor does it spread as rapidly through a group of animals as FMD. Also, VSV lesions are often found in one area of the body. The photo depicts a cow drooling due to oral vesicles. Photo courtesy of USDA APHIS at www.aphis.usda.gov

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Laboratory Diagnosis

- Viral antigen
 - From vesicular fluid or epithelium
 - ELISA, complement fixation, virus neutralization
- Antibody tests
 - Paired serum samples
 - ELISA, complement fixation, virus neutralization

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Viral antigen can be detected in vesicular fluid or the base of the vesicle epithelium using ELISA, complement fixation, or virus neutralization tests. Antibody tests can also be done on paired serum samples (acute and convalescent). VSV can also be isolated in tissue culture, embryonated chicken eggs, or unweaned mice.

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Treatment

- No specific treatment available
- Supportive care
 - Fresh, clean water
 - Electrolytes if necessary
 - Soft feeds
- Antibiotics for secondary infection
- Good prognosis
- Production animals may suffer losses


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As for most viruses, there is no treatment available. Supportive care such as fresh, clean water with/ without electrolytes and soft feed, such as silages, and fresh grasses, will decrease the anorectic period. If secondary infection is present, antibiotics should be used. Prognosis is good for VSV infection but production losses can be permanent if the udder of cattle is affected. The photo depicts vesicles on the teats of a dairy cow with VSV. You can see how production may be permanently damaged in this case. http://www.aphis.usda.gov/vs/ep/fad_training/VESVOL7/page105_7.htm

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Disease in Humans



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Clinical Signs in Humans

- Incubation period: 1-6 days
- Influenza-like symptoms
 - Headache, fever, retrobulbar pain, malaise, nausea, limb and back pain, oral vesicles (rare)
- Self-limiting disease, supportive care
- Recovery can be prolonged
- Death is rare

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Following an incubation of 1 to 6 days, humans may display influenza-like symptoms. These include headache, fever, retrobulbar pain when moving eyes, malaise, nausea, limb and back pain, and rarely, oral vesicles. It is a self-limiting disease and treatment consists of supportive care. Recovery can be prolonged but death is rare.

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Diagnosis in Humans

- Clinical diagnosis difficult
 - Flu-like illness
 - Many do not seek treatment
- Differentials include
 - Coxsackie A group viruses (Hand, foot and mouth disease)
 - Herpes simplex
- Diagnosis is through serology
 - Virus isolation has been unsuccessful

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Clinical diagnosis is difficult as many patients only exhibit flu-like symptoms and never seek treatment. Differentials include Coxsackie A group viruses (which includes hand, foot, and mouth disease), herpes simplex, and very rarely foot and mouth disease. Diagnosis is through serology as virus isolation has been unsuccessful.

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Public Health Significance

- Low incidence of human illness
- Chance of infection when handling contaminated tissues
 - Biosafety level 3
 - Personal protective equipment
- Rarely causes vesicle formation
- Recover in 4-7 days

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Humans that are handling tissues infected with VSV should take biosafety level 3 precautions. If in the field, wearing proper protective equipment to protect the mucous membranes and broken skin from direct contact will help decrease the chance of infection. It is a zoonotic disease of low incidence and those affected display an influenza-like virus that rarely causes vesicle formation. Recovery occurs within 4-7 days if not secondarily infected.

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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
- Movement restriction for 30 days

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State and federal veterinarians should be immediately informed of any suspected case of vesicular stomatitis virus. Animals showing clinical signs should be isolated and quarantined immediately to help control the spread within a group. Movement restrictions should be in place for 30 days after the last lesion has healed.

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Disinfection

- Many different disinfectants
 - Area must be free of organic matter
 - Contact time of at least 10 minutes
 - Soda ash
 - 2% iodophore
 - Chlorine dioxide
 - 1% chlorine bleach
 - 1% cresylic acid
 - Quaternary ammonium

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Many different disinfectants will inactivate the vesicular stomatis virus. Phenolic and halogen-based disinfectants work the best. Others include 2% sodium carbonate (soda ash), 2% iodophores, chlorine dioxide, 1% sodium hypochlorite (chlorine bleach), 1% cresylic acids, quaternary ammonium (Roccal 1:200), poly ethoxyethanol- iodine complex (4% Wescodyne) when contact is 10 minutes or longer and free of organic matter.

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Vaccination

- Vaccines may be available during an outbreak
 - Efficacy is unknown
- Contact state veterinarian for availability information

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There are inactivated and attenuated vaccines that may be made available during an outbreak but efficacy data is unknown. Contact your state veterinarian for availability information.

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Prevention

- Do not buy from positive herds for 3 months post-infection
- Avoid grazing at peak insect feeding hours
- Segregation and isolation necessary for controlling spread
- Move into stables
- Sanitation
- Insect control programs


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Advise producers not to purchase animals from herds that have had VSV in the last three months, as they could introduce it into the naïve herd. Avoid grazing in insect-laden areas or at peak insect feeding hours if in an area of concern for VSV. If VSV is diagnosed in the herd or area, segregation and isolation of animals is necessary to control the spread of the disease. Animals on pasture need to be moved to stables to prevent further spread. Good sanitation practices (cleaning out feed twice daily, disinfect feed bunks and water troughs) and quarantine are essential for control until the viral infection fades from the area. Insect control programs need to be implemented to prevent vector-spread.

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Additional Resources



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Internet Resources

- World Organization for Animal Health (OIE) website
 - www.oie.int
- USAHA Foreign Animal Diseases - "The Gray Book"
 - www.vet.uga.edu/vpp/gray_book/index
- USDA-APHIS Veterinary Services
 - www.aphis.usda.gov/
- Texas Animal Health Commission
 - www.tahc.state.tx.us/

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