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Veterinary Services

Washington, DC
20250

VETERINARY SERVICES MEMORANDUM NO. 555.17

TO: Veterinary Services Management Team

FROM: John R. Clifford
Deputy Administrator

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SUBJECT: Vesicular Stomatitis Control Strategy

I. PURPOSE

This memorandum details the control strategies Federal and State animal health workers will use during a vesicular stomatitis outbreak.

II. BACKGROUND

Vesicular stomatitis is a sporadic, re-emerging viral disease characterized by vesicular lesions on the tongue, lips, oral and nasal mucosa, teats, prepuce, or coronary bands of cattle, horses, and swine. The disease also affects sheep, goats, and camelids. Many species of wild animals, including deer, bobcats, goats, raccoons, and monkeys, are also susceptible. People who handle infected animals also can become infected with vesicular stomatitis viruses (VSV).

Vesicular Stomatitis is a reportable disease limited to North, Central, and South America where sporadic outbreaks occur in temperate geographical areas including the United States. Vesicular stomatitis is most likely to occur during warm months in the southwestern United States, particularly along river ways and in valleys. The most recent significant outbreak in the United States occurred in 2005.

III. CANCELLATION

Veterinary Services (VS) Memorandum No. 555.17, dated May 30, 2007, is hereby cancelled.

IV. GENERAL

This document is based on information from:

- "Procedures for Investigation of Potential Foreign Animal Disease/Emerging Disease Incidents (FAD/EDI)," VS Memorandum No. 580.4, dated August 18, 2010
- VS VSV After-Action Review Subgroup recommendations from March 22, 2005, and March 4, 2006
- Recommendations made by VS VSV Working Group

- Various other documents produced by Agricultural and Agri-Food Canada, the Agricultural and Response Management Council of Australia and New Zealand, and the World Organization for Animal Health (OIE)
- Procedure Manual for Vesicular Stomatitis Viruses, Animal and Plant Health Inspection Service (APHIS), dated January, 2008.

V. ETIOLOGY AND DISEASE SUMMARY

VSVs are members of the Rhabdoviridae family. The viruses can produce vesicles on the tongue, lips, oral and nasal mucosa, teats, prepuce, and epithelium of the coronary band of infected animals. In the United States, vesicular stomatitis is a sporadic, re-emerging disease that occurs mainly in horses and cattle, but also sometimes in swine. The last reported case in domestic swine in the United States occurred in 1968. The primary VSV serotypes that cause disease in the United States are—New Jersey and Indiana-1. Indiana-2 and Indiana-3 serotypes are endemic to parts of South America and have not been reported in the United States. This disease does not generally cause death; however, morbidity rates are highly variable.

Prompt diagnosis of vesicular stomatitis is essential because clinical signs of the disease in ruminants are indistinguishable from those of foot-and-mouth disease (FMD). Moreover, in swine, clinical signs of vesicular stomatitis are indistinguishable from FMD, vesicular exanthema of swine, and swine vesicular disease. Laboratory diagnosis is necessary to differentiate VSV infections from reportable animal diseases that are not currently present in the United States.

VI. DIAGNOSTICS

The National Veterinary Services Laboratories (NVSL) maintains laboratories in two locations: the Foreign Animal Disease Diagnostic Laboratory (NVSL-FADDL) on Plum Island, New York, and the NVSL facility in Ames, Iowa (NVSL-Ames). NVSL-- Ames conducts laboratory diagnosis for vesicular stomatitis in equine species and NVSL-FADDL conducts laboratory diagnosis for vesicular stomatitis in domestic and wild cloven-hoofed animals.

Some National Animal Health Laboratory Network (NAHLN) laboratories have been trained for serologic testing of equine species with vesicular stomatitis compatible clinical signs. Equine serum sample submission to NAHLN laboratories can occur once a vesicular stomatitis outbreak has been identified in the State and the laboratory has been activated for testing as outlined in the current version of the VSV Procedures Manual.

A. Virus Detection

NVSL isolates vesicular stomatitis viruses by inoculating tissue culture with vesicular fluid, epithelial tags from lesions, or swabs of lesions. Virus is also detected by an antigen capture Enzyme-Linked Immunosorbent Assay test, e.g., the ELISA (ACE). However, only NVSL-FADDL uses the ACE. Virus may be detected from the lesions of experimentally infected animals for up to 1 week after infection. Therefore, personnel will collect these essential samples as they become available.

B. Serology

Infected animals develop specific antibodies for vesicular stomatitis viruses within 4 to 5 days after infection. Antibodies produced in response to vesicular stomatitis New Jersey and Indiana-1 viruses can be identified by complement fixation (CF), competitive enzyme-linked immunosorbent assay (CELISA), or virus neutralization (VN) tests. Each serologic test differs in its ability to detect antibodies based on the type of antibodies produced, when the antibodies are detectible in the course of infection, and the length of time that detectible antibodies persists post-infection. The CELISA is often used as a screening assay since it has better sensitivity than the CF. However, the CELISA cannot be used to diagnose current infections because it can detect exposure to antibodies for years after natural infection. The CF is the preferred test for detecting current infection antibodies since it primarily measures antibodies that generally persist for only a few months. Yet, the CF lacks the sensitivity of the CELISA. This is why both assays are often used in combination to investigate suspect cases of VSV.

VII. EPIDEMIOLOGY

A. Human Health

Since VSV is considered a minor zoonotic disease, personnel handling potentially infected animals must take proper precautions. It can cause an acute influenza-like illness with symptoms such as fever, muscle aches, headache, and malaise. Because vesicular lesions are rare in people, the prevalence in humans may be underreported due to misdiagnosis or non-detection of the disease. Gloves must be worn when handling potentially infected animals and special care should be taken to prevent animal saliva and vesicular fluid from coming into contact with a handler's eyes, nose, mouth, or open wounds. Individuals who develop symptoms consistent with vesicular stomatitis should notify their physician about possible exposure to VSV.

B. Transmission

Transmission of VSV is not fully understood. However, animal-to-animal transmission by transcutaneous or transmucosal routes and mechanical transmission by arthropods and fomites is likely. Insects also may serve as vectors in the biological transmission of VSV. Biting flies are capable of becoming infected and transmitting VSV after an extrinsic incubation period both in natural and experimental infections. More specifically, sand flies (*Lutzomyia* spp.) and black flies (*Simulium* spp.) have been identified as significant species in endemic and epidemic transmission of VSV, respectively.

During outbreaks, researchers have found other species of biting and non-biting insects are often infected or contaminated with VSV. Virus isolates have been made from mosquitoes (*Aedes* spp.), biting midges (*Culicoides* spp.), and muscoid flies (*Musca domestica,* the house fly, and *Musca autumnalis,* the face fly). The role of other biting flies (e.g., horse flies, stable flies, or non-biting blowflies) has yet to be established.

Personnel providing guidance on prevention and control of vesicular stomatitis caused by VSV must therefore consider the potential for mechanical and biological transmission for any insect species found in and around premises with virus-shedding animals. They may consider insect control as a tool to prevent or limit disease spread.

VIII. TERMINOLOGY AND CASE DEFINITIONS

A. Terminology

All personnel must use appropriate and accurate terminology to ensure that all elements of a cooperative vesicular stomatitis investigation and control program are consistent.

1. **Case:** Any single animal that has been confirmed to be infected with VSV by compatible clinical signs and positive laboratory results.

2. **Case-Positive Premises:** A location with one or more cases is a case-positive premise. Personnel must examine all susceptible animal species and collect samples from a representative number exhibiting vesicular stomatitis compatible clinical signs. Personnel do not need to test clinically normal animals at a positive premise in an outbreak situation. Personnel will submit equine samples to NVSL-Ames. Personnel will submit samples from all other

domestic and wild cloven-hoofed animals to NVSL-FADDL. If multiple species (equine and ruminant or swine) are exhibiting clinical signs at a single premise, personnel will send all samples, including equine samples, to NVSL-FADDL.

3. **Compatible Clinical Signs:** Clinical signs consistent with VSV infection and for which there is no other likely cause as determined by history and epidemiology.

4. **Index Case:** The first case of a disease in a group to be brought to the attention of the clinician.

5. **Investigation:** Personnel must take care to refer to any suspect situation as an investigation and not a case until laboratory results confirm a case.

B. Case Definitions

1. Index Case for the United States

The determination of the index case for the country will be made after consulting with the Foreign Animal Disease Diagnostician (FADD), the Area Veterinarian In Charge (AVIC), the State Animal Health Official (SAHO), the Regional Director, National Center for Animal Health Emergency Management (NCAHEM) staff, appropriate NVSL personnel, and the VS Deputy Administrator.

The index case for the country will be based on compatible clinical signs and appropriate laboratory confirmation, which may include any one or more of the following:
a. Virus isolation
b. Four-fold change in CF titer in paired sera collected at least 7 days apart
c. Four-fold increase in VN titer in paired sera collected at least 7 days apart.

2. Index Case for Subsequent States

Once the index case for the country is identified, index cases for additional States may be determined based on the following criteria that describes the presence of compatible clinical signs and any one or more of the following:
a. Virus isolation
b. Positive antigen capture ELISA result
c. Four-fold change in CF titer in paired sera collected at least 7 days apart
d. Four-fold increase in VN titer in paired sera collected at least 7 days apart

e. A CF titer of ≥1:40.

Once an index case for one species is identified in a State, subsequent species identified in that State must only meet the subsequent case definition, not the index case definition, to be considered a positive case.

3. Subsequent Cases in a Vesicular Stomatitis-Affected State

In a case-positive State, subsequent cases will be based on the presence of compatible clinical signs and any one or more of the following:
a. Virus isolation
b. Positive antigen capture ELISA result
c. Four-fold increase in VN titer in paired sera collected at least 7 days apart
d. A positive CF antibody test result ≥1:5 .

Once a vesicular stomatitis-affected State has exceeded 21 days past the release of the last quarantine, if a new positive animal is identified, the index case for the State definition must be used to call that animal a positive case if the vesicular stomatitis outbreak is still underway. If the outbreak is declared over, the index case for the country definition must be used. If, however, a new positive animal is detected within 21 days of the release of the last quarantine in the State, it must only meet the criteria of a subsequent case to be declared positive.

IX. CONTROL, DISEASE REPORTING, AND QUARANTINE RELEASE

A. Policy

The overall goal is to immediately investigate and diagnose every case of vesicular disease, thereby:

1. Preventing the spread of vesicular stomatitis (caused by VSV) to new areas
2. Mitigating any adverse effects of vesicular stomatitis on the local economy
3. Maintaining free and open trade to the greatest extent possible.

Vesicular conditions in cattle, swine, camelids, or other FMD-susceptible livestock must be investigated as a possible foreign animal disease (FAD). Vesicular conditions in equids, whether or not associated with vesicular conditions occurring in other species, must be investigated as a possible FAD because the occurrence of clinical disease caused by VSV may have significant trade implications for the United States. Determining specific geographical

locations of the disease and taking swift action to prevent its spread can limit negative trade impacts.

B. Control Strategy

1. VS Assistance and the Role of SAHOs

The SAHOs of States in which outbreaks occur are responsible for implementing disease control measures. SAHOs must make ongoing decisions on disease control measures in consultation with the AVIC, the VSV Situation Unit Leader, the Regional Director, the Associate Deputy Administrator for NCAHEM, and the VS Deputy Administrator.

VS will assist the States in meeting declared goals. The level of VS' assistance depends on the geographical reach of the outbreak. If a vesicular stomatitis outbreak is in a single State, the AVIC will support field operations using area resources. If an outbreak is extends throughout a region, the Regional Director will support field operations using regional resources. The NCAHEM staff will coordinate any additional needed resources and support a national response.

2. Movement Controls and Premises Quarantines

a. Animals, Personnel, and Equipment

1) Examine or observe all animals on the premises and recommend isolation of all clinically affected animals from other susceptible animals if possible. Use separate feed bins, water troughs, pens, pastures, or barns if they are available.

2) Quarantine or stop all movement of livestock susceptible to VSV on any premises under investigation. These premises will be provisionally quarantined pending the results of diagnostic tests. These measures ensure that no VSV susceptible animals leave the premises.

3) Quarantine all affected and susceptible livestock on each case-positive premises.

4) Milk is not a vehicle for transmission of VSV unless contaminated by vesicular fluid from teat lesions. As a safeguard, no raw milk will be consumed from animals on the premises. Since milk or semen can be a vehicle for spread of FMD, if FMD is suspected as a result of the FAD

investigation, a decision should be made to halt all movement of milk or semen from the premises until FMD is ruled out. Such a decision would be made following consultation with the FADD, AVIC, SAHO, Regional Director, NCAHEM staff, and appropriate NVSL personnel.

5) Thoroughly clean and disinfect all equipment and vehicles at high-risk for spreading the disease before removing them from the case-positive premises. Such equipment and vehicles would include those that could be contaminated with vesicular fluid, providing a route of exposure to susceptible animals in feed bins or water troughs.

6) Advise owners, employees, or others residing on or visiting a case-positive premises not to visit other premises, if possible, where there are susceptible animals. If individuals must visit other premises, clean outerwear that has not been in contact with susceptible species or potentially contaminated equipment must be worn and shoes must be disinfected.

b. Vector Control

Insects are significant vectors in the biological and mechanical transmission of VSV. There are several methods of vector control.

1) Eliminate all potential mosquito breeding areas (e.g., used tires, stagnant water receptacles). Remove manure, wet hay, and stacks of decaying vegetative matter to minimize larval development for non-biting flies. Remove all carcasses as other non-biting flies may develop in carrion.

2) Land owners must work with appropriate State authorities to investigate water sources for the larvae of biting flies. Black flies breed in moving water such as streams or irrigation ditches. Biting midge larvae develop in seeps, run-offs, or moist areas with high amounts of organic matter. Mosquito larvae develop in non-flowing pools of water, ranging in size from small containers to larger impoundments such as ponds, marshes, and swamps. Some aquatic breeding sites can be eliminated; however, others may be too large to effectively control.

3) Owners must protect animals from unnecessary exposure to potential vectors. If animals are pastured in an area likely to have black flies, mosquitoes, and biting midges, animals must be moved to areas where

exposure is minimized. Placing animals inside barns has been proven effective. Installing screens on windows and stalls will likely enhance protection from biting insects. The use of ultraviolet fly traps (e.g., bug zappers) or fly strips may also be effective in reducing vector populations in enclosed spaces.

4) Chemical control methods discourage contact and engorgement by biting insects. The most effective methods involve topical application of synthetic chemicals of the class of pyrethroids (e.g., permethrin). These chemicals are marketed under a variety of trade names and can be applied topically with wipes or sprays. It is important to treat all regions of an animal's body, particularly the underside, ears, and legs when applying pyrethroids. Repeat applications as instructed depending on the product used.

5) Non-biting flies can be controlled by using insecticidal baits. These baits can be used both inside and outside buildings. Instructions on product labels must be followed explicitly when dispensing fly baits.

6) Care must be taken to avoid transferring insects from one premises to another by personnel and fomites. For example, vehicle windows should remain closed to avoid transferring insects.

c. Cleaning and Disinfecting

If animals have been moved from infected premises and have contaminated loading facilities, equipment, conveyances, etc., these surfaces must be cleaned and disinfected.

d. Premises Quarantines

1) Quarantine all case-positive premises until 21 days after the last animal's lesions have healed, and other susceptible animals on the premises have been examined and found free of lesions. Lesions are considered healed when VSV-related erosions or ulcers have been completely covered by epithelium. In large herds, a thorough physical examination of each animal is not necessary, but a representative population of each species and separated groups on the premises must be examined.

2) Once lesions in all affected animals are healed, the 21-day quarantine countdown period can begin on a case-positive premises. If lesions are

detected in a previously unaffected animal at any time during the 21-day countdown, the quarantine must remain in place. A new 21-day countdown cannot begin until the lesions have sufficiently healed in the newly detected case.

3) If lesions in an individual positive animal are taking longer than expected to heal for any reason (i.e., advanced age, metabolic syndromes, or other medical issues), then the FADD examining the lesions will notify the Situation Unit Leader. The Situation Unit Leader and regional epidemiologist will assess the situation on a case-by-case basis and determine the appropriate start date for the 21-day countdown to quarantine release.

e. Premises Quarantine Release

A regulatory veterinarian will follow up on investigations with visits as appropriate to case-positive premises to establish eligibility for quarantine release. The SAHO, or his or her designee, will approve all quarantine releases based, in part, on the regulatory veterinarian's inspection of all affected and susceptible animals on the premises. If the regulatory veterinarian finds any lesions compatible with vesicular stomatitis that are not yet healed, he or she must visit again to establish eligibility for quarantine release.

3. Monitoring and Disease Reporting

a. Animal Tracing and Investigations

1) Consider investigating any susceptible animals for vesicular stomatitis that have moved from the case-positive premises to any other premises within 10 days preceding the onset of clinical signs. If new animals have been introduced within 10 days of a premises being identified as case-positive, the investigation may benefit from a traceback to locate other infected premises. Trace forward may be beneficial if animals have been moved from an infected premises within a 10-day window before or after a premises was determined to be infected.

2) When an FADD suspects vesicular stomatitis infection during a visit, they must relay their observations to the AVIC or SAHO according to procedures outlined in VS Memorandum No. 580.4: "Procedures for the Investigation of Potential Foreign Animal Disease/Emerging Disease Incidents (FAD/EDI)".

3) All personnel must take biosecurity measures in all investigations of suspect premises. Personnel must wear protective, disposable gloves while examining animals, change into clean outerwear clothing before visiting another livestock premises, and disinfect their shoes upon entering and exiting the premises, according to indicated procedures.

4) Veterinary practitioners working within an infected State must recognize that they can be at risk for spreading the disease. They must take appropriate precautions to avoid contamination of non-infected premises. Infected premises must be visited at the end of the day where practical. In a group of practitioners, one practitioner must handle all the cases from infected premises. Veterinary practitioners who treat infected or exposed animals on a premises must not subsequently go to another premises with susceptible animals without first disinfecting potentially contaminated materials (including hands, clothing, vehicles, and equipment). The cleaning and disinfecting protocol must be strictly followed.

b. Disease Reporting

Accredited veterinary practitioners, State officials, and Federal officials share responsibility for immediately investigating and reporting every suspect vesicular disease. Regulatory veterinarians will conduct an epidemiological investigation following a positive diagnosis of VSV infection. Regulatory veterinarians must also provide to owners or operators of quarantined premises information about vesicular stomatitis, its control, and owner responsibilities.

X. ADDITIONAL SOURCES FOR DISEASE INFORMATION

APHIS, VS Fact Sheet, "Vesicular Stomatitis," dated March 2007

APHIS Picture Card: "Vesicular Stomatitis...or Foot-and-Mouth Disease"

APHIS, VS Memorandum No. 580.4, "Procedures for the Investigation of Potential Foreign Animal Disease/Emerging Disease Incidents (FAD/EDI)," dated August 18, 2010

Procedure Manual for Vesicular Stomatitis Viruses (VSV), APHIS, dated January 2008.