Vesicular Stomatitis: Epidemiology of the 1995 and 1997 Outbreaks in Colorado

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Vesicular stomatitis is usually a mild, self-limiting disease in the horse, characterized by oral vesicles, ulcers or crusting of the muzzle, and difficulty eating. Horses are commonly subclinically affected during outbreaks. The exposure of horses to vesicular stomatitis virus may occur in nonoutbreak years in areas where vesicular stomatitis is common. Authors’ addresses: Dept. of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523 (Mumford, Traub-Dargatz, and Salman); the U. S. Dept. of Agriculture: Animal & Plant Health Inspection Service:Veterinary Services, 755 Parfet St., Suite 136, Lakewood, CO 80215 (McCluskey); and the National Veterinary Services Laboratory, 1800 Dayton Rd., Ames, IA 50010 (Schmitt). © 1998 AAEP.

1. Introduction
Vesicular stomatitis (VS) is a viral disease of horses and other livestock. It occurs sporadically in outbreaks in the Western U. S. In horses, the disease initially presents as vesicles or ulcers on the tongue, lips, nares, coronary bands, mammary glands, or external genitalia. Oral lesions are typically manifested as drooling or unwillingness to eat; and horses with coronary band lesions are often lame. The disease severity varies widely among affected horses; it is generally mild and self-limiting but can result in profound weight loss or hoof wall deformation (as a sequela to coronary band lesions). Treatment typically is limited to supportive care.

The Office Internationale des Epizooties (OIE) considers VS a List A disease, and therefore it is subject to strict local, national, and international regulations. Premises with horses or other livestock suspected of being infected with VS virus are required to be investigated by field Veterinary Medical Officers from the U. S. Department of Agriculture: Animal & Plant Health Inspection Service (USDA: APHIS):Veterinary Services in that state, and if horses or other livestock are determined to be positive for VS, then the premises are quarantined. Despite the regulatory significance of VS, basic questions concerning the method of spread among and between animal species, potential reservoirs, interoutbreak hosts (mammalian, insect, or possibly plant), factors relating to the occurrence of outbreaks, and factors controlling disease severity in individual animals remain unanswered.

Recently, researchers from several institutions have begun to collaborate with the National Veterinary Services Laboratory (NVSL) in Ames, Iowa and branches of the USDA:APHIS:Veterinary Services in
Colorado, New Mexico, and Arizona. Through these efforts, information about the VS outbreaks of 1995 and 1997 is being gathered both prospectively and retrospectively, and epidemiological insight about the disease has begun to be gained. Both studies summarized here were conducted on premises in Colorado.

2. Background: The 1995 and 1997 VS Outbreaks
In 1995 and 1997, outbreaks of VS occurred in livestock in the Western U.S. In 1995, 1162 premises in 41 states were investigated for suspect VS in livestock, and horses and cattle on 367 premises in New Mexico, Colorado, Utah, Arizona, Wyoming, and Texas were determined to be infected with the New Jersey serotype of the VS virus. One llama was also determined to be positive for the VS virus in 1995. No animals were reported to be clinically positive for VS in 1996, but in 1997 another outbreak of VS occurred, involving 689 premises in 40 states. During this outbreak, horses and cattle on 380 premises in Arizona, Colorado, New Mexico, and Utah were determined to be infected with the New Jersey or Indiana serotypes of the virus. In 1997, of 689 premises investigations, 581 resulted from reports of horses exhibiting clinical signs of VS, and the index case in both the 1995 and 1997 outbreaks was a horse. In 1995 and 1997, 78% and 97% of the premises had horses as the primary animal species positive for VS, respectively.

3. Objectives
A. Study 1
Study 1 was conducted from July through November, 1996. The objectives were (a) to retrospectively determine potential risk factors associated with VS in Colorado during the 1995 outbreak, and (b) to determine the persistence of VS virus in Colorado livestock by means of laboratory tests in 1996.

B. Study 2
Study 2 was conducted from September through November, 1997. The objectives were to describe the serological responses over time of individual horses with and without overt clinical signs of VS during an outbreak.

4. Materials and Methods
A. Study 1
In 1996 (during the interoutbreak period), visits were made to Colorado premises that had been investigated for suspect VS during the 1995 VS outbreak and found to have VS virus-positive animals or no VS virus-positive animals. Visits were also made to premises neighboring other premises that had VS virus-positive animals during the 1995 outbreak. During these visits, comprehensive data on premises layout and management were collected by the use of a questionnaire. Serum samples and oral swabs collected from horses, cattle, and sheep residing on study premises in 1996 were submitted to the NVSL for determination of serum antibody titer against the New Jersey VS virus serotype, and for virus isolation, respectively. Signalment and management data were collected from each sampled animal.

B. Study 2
Colorado premises included were those investigated by the USDA:APHIS:Veterinary Services veterinarian during the 1997 VS outbreak and considered to have at least one VS virus-positive horse based on clinical evaluation and laboratory confirmation. On these premises, blood samples and oral swabs from all horses showing clinical signs of VS, as well as from selected healthy horses, were collected and sent to the NVSL for determination of serum antibody titer against both the Indiana and New Jersey VS virus serotypes, and for virus isolation, respectively. Follow-up serum and oral swabs from the horses were collected in 10–14 days, and then again in ~30 more days.

Serum samples were screened using a competitive enzyme-linked immunosorbent assay (cELISA) test. Samples positive on cELISA were then tested by serum neutralization (SN) and complement fixation (CF; study 1) or CF alone (study 2). Oral swabs from seropositive horses were tested by using virus isolation.

Premises data were collected by the use of a questionnaire as part of the federally mandated VS outbreak premises investigation. These data included information on housing, management, and layout of the premises. In addition, a questionnaire addressing the management and signalment of each individual horse sampled was administered during a telephone interview with the premises owner. After the final blood collection, a second questionnaire addressing the progression and management of the outbreak on the premises was administered during a second telephone interview.

5. Results
A. Study 1
No statistical association was detected between the risk factors evaluated (including housing type available, proximity to running or standing water, and potential contact between horses and insects, rodents, or wildlife) and either the premises status in 1995 or the individual animal’s SN status in 1996.

Of the 93 premises visited in 1996, 52 had VS-positive animals in 1995, 33 had no VS-positive animals in 1995, and eight were neighboring. A total of 228 animals were sampled on 52 of the 93 premises, and the average age of the animals was 9 years (range from 6 months to 30 years). None of the animals sampled in 1996 showed any clinical signs of VS. On 67% of the 52 premises where animals were sampled, at least one animal was positive.
determined to be seropositive for VS virus (New Jersey serotype) on the SN test in 1996. On the premises, 31% of the animals sampled were SN positive for VS virus (37% among horses sampled and 14% among cattle sampled). Of the 71 SN-positive animals, 16 had CF titers that were suspect (titer of 1:5 or 1:10) or positive (titer of >1:10). A total of eight animals from control premises were SN positive for VS virus in 1996.

B. Study 2

Three premises with VS-positive horses in 1997 were included in study 2. A total of 25 horses were enrolled in this study, with an average of eight horses sampled on each location (range 5–14 horses). An average of 13 horses resided on each of the three premises (range 6–19 horses). The index case on each was as follows: location 1, a 27-year-old gelding; location 2, a pregnant, lactating, 5-year-old mare; and location 3, an 8-year-old gelding.

Of the 25 horses included, 18 (72%) were VS seropositive on the initial CF test. Of these 18, seven (39%) showed clinical signs of VS (Table 1). The CF seroprevalence was 2, 4, and 5 times higher than the clinical prevalence at the three sampling periods, respectively (Table 2).

At premises 1, CF antibodies to VS virus serotype Indiana were detected in samples from affected horses. At premises 2 and 3, CF antibodies to VS virus serotype New Jersey were detected in samples from affected horses.

The most commonly reported clinical signs in affected horses were difficulty eating, vesicles on the tongue, lesions on the lips or muzzle, and drooling. The average duration of clinical signs in affected horses was 8 days.

6. Discussion

The results of these two studies suggest that subclinical VS virus infection in horses is common during outbreaks of VS, as has recently been reported. This is significant because, as a result of the mobility of the equine population, these subclinically infected horses could potentially transmit the disease to horses residing outside typical outbreak areas in the U.S. The international transport of horses seropositive for VS virus, however, is often restricted during VS outbreaks, regardless of the clinical status of the horse.

In study 1, the identification of some horses with CF titers in 1996 indicates that horses may be exposed to the VS virus in nonoutbreak years. Similarly, Howard identified CF-seropositive animals (cattle) in 1996 in Arizona. These findings may also result from cross-reactivity among antibody subtypes (immunoglobulins IgG and IgM) in the CF test.

In study 1, the VS seroprevalence rates in areas of Colorado where VS is common were greater among horses than among cattle in 1996. Descriptive data from the 1995 outbreak and preliminary data from the 1997 outbreak suggest that more horses than cattle are also identified with clinical signs of VS. This could also be a result of more frequent detection or reporting of the disease by horse owners than by cattle owners.

As the epidemiology of the VS virus continues to be explored, additional insight into the management of outbreaks and the prevention of spread of the disease will be gained.

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References and Footnotes


Table 2. Average cELISA and CF Seroprevalences of VS in 25 Horses During Study 2

<table>
<thead>
<tr>
<th>Average VS Parameter</th>
<th>Initial Visit</th>
<th>Follow-Up Visit</th>
<th>Final Visit</th>
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<tbody>
<tr>
<td>Seroprevalence (ELISA)</td>
<td>63</td>
<td>61</td>
<td>57</td>
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<tr>
<td>Seroprevalence (CF)</td>
<td>57</td>
<td>51</td>
<td>38</td>
</tr>
<tr>
<td>Clinical prevalence</td>
<td>29</td>
<td>13</td>
<td>7</td>
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* A CF titer >1:5 was considered positive. All CF-positive horses also tested positive on the cELISA test.

Table 1. No. of Horses Seropositive or Seronegative for CF with Clinical Signs of VS During Study 2

<table>
<thead>
<tr>
<th>Clinical Signs</th>
<th>CF Status</th>
<th>Premises 1</th>
<th>Premises 2</th>
<th>Premises 3</th>
<th>Total</th>
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<tr>
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<tr>
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</tr>
<tr>
<td>Total</td>
<td></td>
<td>6</td>
<td>14</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

* A CF titer >1:5 was considered positive. All CF-positive horses also tested positive on the cELISA test.

**These horses were considered to have clinical VS virus infections.

†These horses were considered not to be infected with VS virus.

‡These horses were considered to have subclinical VS virus infections.