Vesicular Stomatitis Virus
Updates and Challenges

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Overview

• Organism
• History
• Transmission
• Epidemiology
• Economic Impact
• Prevention and Control
• Actions to Take
Vesicular Stomatitis

Etiologic agent(s): Vesicular stomatitis virus – serotypes New Jersey and Indiana

Diseases:
Vesicular stomatitis: vesicles, ruptured leaving ulcers on tongue, gums, lips

Host Range: cattle, horses, humans, fox, coyotes, rodents, insects, plants
VSV- Zoonosis

- Causes a “flu-like” illness in humans, fever, chills, malaise, muscle pain
- Veterinarians, livestock handlers and laboratory workers are at risk of infection
History

• Early 1800s
  – Horse illness resembling VSV

• 1927: Virus identified

• 1950s: Human infections recorded

• 1982-83: Outbreak in western U.S.
  – Previously, epizootic waves typical
  – Now an annual occurrence in U.S.
Vesicular Stomatitis

Transmission:

1) Insect vectors: viruses obtained from
   1) Sandflies (Lutzomyia spp.)
   2) Black flies (Simulidae spp.)
   3) Midges (Culicoides spp.)
   4) House flies (Musca domestica)
   5) Mosquitoes (Culex nigripalpus)
   6) Experimental inoculation: Grasshoppers (Melanoplus sanguinipes)

Inoculation into epithelial surface of tongue, through cuts in skin, contact with fomites

Other proposed sources: plants
Geographic Distribution

• Western hemisphere
  – North, Central, and South America

• Emergence in eastern hemisphere?
  – 2009: Bahrain, Laos (suspected)
  – 2009: Pakistan (limited regions)

• Southwest U.S.
  – Outbreaks in warmer regions

• Southeast U.S.: enzootic cycle
Seasonality

**Reservoir host(s):** possible sources/vectors include insects, plants, other animals

**Seasonal:** summer, early fall

**Point source:** viruses obtained from cases in outbreaks are genetically similar

**Geographic ranges:** overlapping ranges for NJ and Indiana, individual foci of infection for specific genotypes
Morbidity/ Mortality

- **Morbidity**
  - Range: 5 to 90%
  - Most animals seroconvert

- **Mortality**
  - Higher in adults
  - Death rare in cattle and horses
Clinical Presentation

- Horses & cattle: fever, excessive salivation, vesicles rapidly progressing to ulcers on tongue
- Cattle: vesicles on teats, coronary band
- Swine: vesicles and ulcers on coronary band, nose, tongue
- Lesions heal rapidly in 7 to 10 days
Clinical Disease

Vesicular Stomatitis

Foot & Mouth Disease

Photos by Dr. Brian Bohl (VS)
<table>
<thead>
<tr>
<th>Clinical Signs by Species</th>
<th>Foot &amp; Mouth Disease</th>
<th>Vesicular Stomatitis</th>
<th>Swine Vesicular Disease</th>
<th>Vesicular Exanthema of Swine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cattle</strong></td>
<td>Oral &amp; hoof lesions, salivation, drooling, lameness, abortions, death in young animals, &quot;panters&quot;; <em>Disease Indicators</em></td>
<td>Vesicles in oral cavity, mammary glands, coronary bands, interdigital space</td>
<td>Not affected</td>
<td>Not affected</td>
</tr>
<tr>
<td><strong>Pigs</strong></td>
<td>Severe hoof lesions, hoof sloughing, snout vesicles, less severe oral lesions: <em>Amplifying Hosts</em></td>
<td>Same as cattle</td>
<td>Severe signs in animals housed on concrete; lameness, salivation, neurological signs, younger more severe</td>
<td>Deeper lesions with granulation tissue formation on the feet</td>
</tr>
<tr>
<td><strong>Sheep &amp; Goats</strong></td>
<td>Mild signs if any; <em>Maintenance Hosts</em></td>
<td>Rarely show signs</td>
<td>Not affected</td>
<td>Not affected</td>
</tr>
<tr>
<td><strong>Horses, Donkeys, Mules</strong></td>
<td>Not affected</td>
<td>Most severe with oral and coronary band vesicles, drooling, rub mouths on objects, lameness</td>
<td>Not affected</td>
<td>Not affected</td>
</tr>
</tbody>
</table>

All vesicular diseases produce a fever with vesicles that progress to erosions in the mouth, nares, muzzle, teats, and feet.
Economic Impact

• 1928: California dairy herds
  – $97 to 202 lost per head

• 1995: New Mexico beef herd
  – $53 lost per head

• Losses due to:
  – Increased culling, increased mortality
  – Reduced milk production
  – Labor, medicine, veterinary costs
Laboratory Diagnosis

- Virus isolation
- Viral antigen detection
  - Vesicular fluid or epithelium
  - ELISA, complement fixation, virus neutralization
- Antibody tests
  - Paired serum samples
  - ELISA, complement fixation, virus neutralization
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
Vaccination

- Vaccines used in some endemic regions of Central, South America
- Vaccines may be available during an outbreak
  - Efficacy is unknown
- Contact state veterinarian for availability information
Disinfection

• Easily inactivated
  – Area must be free of organic matter
  – Contact time of at least 10 minutes

• Disinfectants
  – Phenolic, halogen-based disinfectants
  – Soda ash, 2% iodophores
  – Chlorine dioxide, 1% chlorine bleach
  – 1% cresylic acid
  – Quaternary ammonium
Prevention

• Advised not buy from positive herds for 3 months post-infection
• Avoid grazing at peak insect feeding hours
• Segregation and isolation necessary for controlling spread
• Sanitation
• Insect control programs
## Recent Outbreaks

<table>
<thead>
<tr>
<th>Year</th>
<th># States Affected</th>
<th>States</th>
<th># Infected Premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>3</td>
<td>CO, NM, TX</td>
<td>294</td>
</tr>
<tr>
<td>2005</td>
<td>9</td>
<td>AZ, CO, ID, MT, NE, NM, TX, UT, WY</td>
<td>445</td>
</tr>
<tr>
<td>2006</td>
<td>1</td>
<td>WY</td>
<td>13</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
<td>NM, TX</td>
<td>5</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>AZ</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>CO, NM</td>
<td>36</td>
</tr>
</tbody>
</table>
2014 VSV Epidemic

Weekly VSV situation Reports, Maps, and disease information available on the USDA-APHIS website

State-specific updates available at the Texas Animal Health Commission and Colorado Department of Agriculture websites
Timeline

May 23, 2014: VSV equine premises TX

October 13: Last confirmed released From quarantine in TX

December 22: Last confirmed released From quarantine in NE

January 29: Last confirmed released From quarantine in CO

July 17: VSV equine Premise CO

November 22: VSV bovine premise, NE

January 6, 2015: VSV Equine premise AZ

March 13: Last confirmed released From quarantine in AZ

<table>
<thead>
<tr>
<th>Cumulative Positive Species</th>
<th>Arizona</th>
<th>Colorado</th>
<th>Nebraska</th>
<th>Texas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Equine Species</td>
<td>3</td>
<td>495</td>
<td>0</td>
<td>89</td>
<td>587</td>
</tr>
<tr>
<td>Positive Bovine Species</td>
<td>0</td>
<td>48</td>
<td>4</td>
<td>8</td>
<td>60</td>
</tr>
<tr>
<td>Positive Porcine Species</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Positive Ovine Species</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Positive Caprine Species</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Positive Other Species</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Positive Animals</td>
<td>3</td>
<td>543</td>
<td>4</td>
<td>97</td>
<td>647</td>
</tr>
</tbody>
</table>
2014 Epidemic

Photo by Dr. Tim Fox, VS-Colorado

USDA
United States Department of Agriculture
2014 Epidemic

Photo by Dr. Richanne Lomkin (VS-CO)
2014 Epidemic

Photos by Dr. Carl Heckendorf (CDA)
2014 Epidemic

Photos by Dr. Brian Bohl (VSV-TX) and Dr. Susan Culp (TAHC)
VSV Response

• Passive surveillance by private practitioners
• Quarantine/hold order on suspect premises
• FADD sample collection on lesioned animals only
  – Collection of serum, swabs, tissue tags
  – Equine samples to NVSL-Ames; ruminants/pig samples to FADDL
• Due to zoonotic potential—appropriate protective equipment (i.e. gloves)
• Premises quarantined 21 days after lesions have healed
• Re-examine at release date to confirm lesion healing and no new cases, then release
Response

• Education and outreach
  – Recommendations to owners of affected premises on mitigation to reduce with herd spread
  – Information on USDA-APHIS, TAHC, CDA websites
  – News announcements and facebook updates made available by TAHC and CDA

• Research Opportunities
  – Virus isolation from many premises
  – Epidemiology questionnaire administered for premises risk factors
  – CEAH case-control study for horse-level risk factors
VSV- Virology Wrap Up

- Vesicular lesions of VS are similar to those of foot and mouth disease in swine and cattle
- FMDV does not infect horses, VSV does
- Reason for performing diagnostic tests for VS including RT PCR and CF serology
- VSV SN tests for export
- Control measures include quarantine, travel restriction, fly control
- Epidemiology is not well known
Future

- VSV has been delisted
  - Remains reportable at the state level
  - Rely on accredited veterinarians to collect samples
  - Diagnostic testing will now be charged to owners vs. National Veterinary Service Laboratory
  - Movement restrictions based on suspected case

- Quarantine period shortened accredited veterinarian bigger role
Acknowledgements

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Questions