**Seneca Valley A virus (synopsis from various sources-March 2025**

## A. History

Senecavirus A (SVA), also known as Seneca Valley Virus, is a non-enveloped single-stranded RNA virus of the family Picornaviridae, the same virus family as Foot and Mouth Disease (FMD)

Since 2015, SVA cases have increased in Canada, the United States, Brazil, and China. (MB Pork). Cases have also been detected in Australia, Italy, New Zealand (Dr. Pineyro).

First major outbreaks: Brazil - fall 2014, Canada & US - summer 2015.
New, more pathogenic isolates as a result of recombination
SVV now global disease; Asia, North & South America

Originally described as Idiopathic Vesicular Disease (IVD), SVA first detected/published in 2002 at a lab in Maryland US. (Seneca Valley)

Retrospectively diagnosed in cases back to 1988. Interestingly, an Iowa farmer bulletin from the 1960's describes a seasonal (summer) vesicular disease, so the disease may predate the 1988 published confirmations.

Reports of IVD in Indiana (2004) and Manitoba (2008), where Seneca Valley A virus was detected. (Idiopathic vesicular disease in swine in Manitoba CVJ / VOL 49 / JANUARY 2008- see paper)

In 2012, a third report in US, 2014 Brazil (in area with FMD); reports in 2015 from Tennessee of neonatal mortality and vesicles in show pigs; 2016- multiple outbreaks and on-going since. Iowa State University (ISU) has been tracking cases since 2016:

*Could not find a public link/data after 2016*

**Seasonality**

A strong seasonal pattern is seen, with increased cases in the summer. (both clinical cases, and detections via routine surveillance without clinical signs).

Seasonality theories from Dr. Pineyro:

-feed- using more imported feed in early summer ahead of new crop year?

- on farm persistence- waning immunity, stress

- transport/slaughter- role of stress- no lesions observed when loaded and lesions seen on arrival.

## B. Significance

Although SVA itself is neither a reportable or notifiable disease, there is an obligation to report suspected vesicular foreign animal diseases under the federal Health of Animals Act. Any suspect vesicular diseases must be tested to rule out a reportable disease such as FMD (or Swine Vesicular Disease (SVD) or Vesicular Stomatitis (VS)). SVV results in lots of time in people and diagnostic costs to rule out FADs.

Clinical signs related to SVA cannot be distinguished from economically devastating vesicular foreign animal diseases like foot and mouth disease (FMD) without laboratory testing. (see EU FMD poster).

Shipment of pigs to any slaughter plant exhibiting clinical signs of disease can result in the temporary shutdown of processing at packing plants and the inability to export pigs to countries like the United States.

SVA is only infectious to swine and poses no disease or food safety threat to humans; SVV is not zoonotic.

WOAH guidance for suspect cases in countries free of FMD:

-FAD investigation by responsible veterinary authority (CFIA)

-Standard samples sent to an approved AH network lab & to National FAD lab

-Temporary movement restrictions implemented pending results

International (US) Export requirements for swine:

Veterinary inspection of source location for all movements except direct to slaughter

No evidence of FAD

Free of communicable disease for 60 days (swine)

If pigs transiting the border are found with vesicular lesions, the load will be rejected by USDA-APHIS and CFIA will be notified.

Since 2015 outbreak & subsequent spread of SVV, **it is essential to ensure no vesicular case caused by FMD is missed due to thinking it is "just" SVV. Therefor, every suspect vesicular lesion needs to be investigated to rule out FMD or other vesicular FADs. (SVD, VS)**

In the US mid-west, a significant number of vesicular disease cases are observed at US processing plants most summers, leading to:

-Multiple temporary "holds" on live animals at pork processing

-US states: FMD investigations & diagnostic testing

-Trace back to sources – US & Canadian assembly yards

-Increased vigilance on slaughter exports @ US border

Following a report of positives on Canadian pigs at US slaughter plants, or border detections/load rejections, there will be a CFIA investigation.

If lesions are present, there will be movement restrictions for all animals, animal products and by products, including feed, manure, bedding, dead stock, and samples will be taken.

Specific samples collected and submitted for Diagnostics – approx. 3 days. (but be prepared for up to 7 days!)

Producer required to report all losses, inform any visitors entering premises, control movements off/on farm

If considered a significant suspect (High Risk), a full quarantine will be put in place.

**Canadian Situation:**

There were 19 vesicular disease investigations in 2024. Most of these are Confirmatory Negative (CN), a few are High Risk (HR). Notification of provincial pork boards or provincial CVO offices only required for the HR /suspect investigations. It is rare to have High Risk designation with SVA. For HR, animals must be sick, off feed, with blanching of coronary bands, vesicles on snouts, fever. (Sonja Laurendeau, CFIA)

Canada West Swine Health Intelligence Network (CWSHIN) surveillance:

Blister survey - Q1 2021 to Q3 2023 (Excludes assembly yards & abattoirs)

- Part of quarterly Clinical Impression Survey Covers 75% of commercial swine premises
- Low # of bacterial or other vesicular cases identified
- Blister Model shows high probability of freedom from viral vesicular diseases

**Conclusion that SVV, if present, is at a very low prevalence in Western Canada swine herds**

**United States situation:**

In the US there were 3000 investigations for vesicular diseases in 2020; 2000 in pigs. (Pineyro, 2024)
Seroprevalence in US swine herds (non-clinical)
-sows- 26% ELISA positive, 16% IFA positive, 73% negative
-Grow/Finisher- 8,75% ELISA positive, 5.7% IFA positive, 91% negative
Herd prevalence- 91 herds (US mid-west) sow herds- only 23% negative, G-F- 44% negative.

**Conclusion that SVV is widely circulating in US mid-west, over 40% sow herds positive, G-F herds less so.**

**C. Transmission**

Short incubation period (3–5 days)

Variable clinical signs with lethargy, lameness, and the formation of vesicles on the snout and feet which rupture and heal within 14–16 days.

Viremia (3–10 days), virus shedding lasting up to 21–28 days

In neonatal piglets, SVA is associated with sudden death, severe diarrhea, dehydration, and lethargy, which can lead to an increase in pre-weaning mortality rates ranging from 5% to 60%, and diarrhea lasting 1 to 5 days

*Between-animal transmission is believed to primarily occur through direct contact with vesicular fluids or lesions, which carry a high viral load, though the virus can also be found in fecal samples and urine. SVA can persist in the tonsils of infected pigs for months, with stress events such as transport or parturition triggering intermittent viremia and shedding. This phenomenon makes within-herd transmission particularly complex in the presence of carrier sows. Moreover, sow-to-piglet transmission can occur both*

*horizontally and, seemingly, vertically, since viremic newborn piglets have been observed in litters from positive sows, and the virus has been detected in colostrum and milk.* (Kikuti, et al Senecavirus A Incidence in U.S. Breeding Herds: A Decade of Surveillance Data Animals 2025, 15, 1650)- see article)

Both direct and indirect transmission likely play a role. Stress, particularly during transport, is also seen to be a factor in the spread of SVA. (MB Pork)

**Direct transmission** of SVA can occur through direct contact with ruptured lesions, infected manure, cuts, or abrasions. Active infection can last approximately 7 days and the clinical signs of the disease may persist from anywhere between 2 to 14 days. Viral shedding can last upwards of 28 days.

**Indirect transmission** can occur through contaminated clothing/footwear, pig handling equipment, livestock trailers, and/or deadstock removal equipment.

**The best defence against indirect transmission is through the use of common industry biosecurity practices.**

Rodents: Dr. Pineyro- mouse studies inconclusive- some shedding up to 2 weeks, but no disease and very low levels of virus in exposed mice. Good pest control recommended to avoid spread by rodent feces.

Feed-contaminated feed spiked with virus can be infective for up to 2 weeks and can induce disease in fed pigs. Pigs consuming feed are viremic in 2-3 days and shed virus in feces within a week.

Potential Sources (Duizer, Banff Pork Seminar)– Infected pigs, semen; Contaminated transports, feed; Possibly flies & mice (mechanical vectors)

**D. Clinical signs:**

Primary clinical sign is vesicles on snout and feet. May be painful lesions on oral mucosa with transient decreased appetite for 1-2 days. Foot lesions occur with or without lameness. Lesions progress quickly from papules to vesicles (day 3-6), to ruptured vesicles/erosions (day 7-14). By day 14 they are all healed. **If delay finisher herd visit for a week after reported to you, all will be healed, with no lesions to observe or sample. (Pineyro, 2024)**

**Pigs with SVA may not have a fever. (can be a useful tool to distinguish clinically from FMD, but lab diagnostics still required – but would go as CN samples.)**

**HINT:** use a hog snare to secure animal and do thorough physical exam including taking rectal temperature. This allows better inspection for blanching of coronary bands and any oral lesions. Fever expected with FMD. If temperature >39.5C higher concern of FAD. Rinse off feet to clean them for better examination, but do not use any disinfectants (can interfere with virus sampling) (Sonja Laurendeau, CFIA)

1. **Neonatal Pigs: endemic transient neonatal loss (ETNL) in piglets**

(CPC) - Increase mortality in litters less than 7 days of age

- Become infected shortly after birth (or infected at/before birth?)

-Diarrhea may or may not be associated with it

(MB Pork)- Increase in mortality in litters less than 7 days old

- Fever and lethargy

- Diarrhea

-Sudden and short-term increase in morbidity and mortality; estimates are 30-70% increase.

- Clinical signs usually resolve quickly (7-10 days) and most piglets completely recover

- Morbidity and mortality can range from 30% to 70% for short periods of time.

**(**Glen Duizer, Banff Pork Seminar**)**

**-**Epidemic Transient Neonatal Loses (ENTL)
-Increased neonatal mortality by 30%-70% in affected herds
(Note: increases by 30-70%, not to 30-70%- so increase from 8-10% to 13%)

(Dr. Pineyro)-Weakness, lethargy, diarrhea, hyperemia, death.

-Patchy distribution- 1 farrowing crate infected, ones next to it healthy.

-Signs in piglets: diarrhea (erosive colitis, atrophic enteritis), vesicles in mouth, ecchymosis in oral cavity (may be detected when teeth clipping), hemorrhages on ears; blanching, hemorrhage, bruising of front foot pads.

- May have mild neurological signs but mode is unknown:
    - piglets may be hypoglycemic, anorexic, decreased milk intake.
    - not viral encephalitis, but virus does replicate in choroid plexus.

Transmission from sow to piglets. Seropositive sows with no clinical signs still can shed virus. **First noticed signs in a herd may be sick piglets**. In these cases, likely an earlier outbreak in sows with mild signs; may have been off feed for 1-2 days, hard to see hoof lesions, mild signs missed.

2. **Breeders, Growers and Finishers**: (Merck Manual)
    - Loss of appetite (lesions in oral cavity)
    - Fever (not consistently, or transient)
    - Lethargy
    - Intact or ruptured vesicles (blisters) on snout, mouth, feet or teats
    - Lesions on feet surrounding the coronary bands
    - Ulceration of hoof wall
    - Deep nail bed hemorrhages
    - Lameness ranging from slight discomfort to movement refusal
    - Loose foot pads which may lead to loss of hooves

-Vesicles (intact or ruptured) on the snout, mouth, feet around the coronary band or teats. Ulcerative lesions on the feet or nail bed Acute lameness that quickly spreads to other pigs. Lethargy, decreased appetite and minimal feed intake. Loose foot pads which may lead to loss of hooves. (MB Pork)

(Glen Duizer, Banff Pork Seminar-2024)

**Older animals**

- Vesicles (blisters) on nose, mouth & coronary bands.
- Develop in 3-6 days, with stressors, as soon as 18 hours.
- Recovery 2-14 days, evidence of recurrence with stress.
- Viral shedding - 7 days
- Antibodies – persist for 60 days

**Herds with clinical signs:**

- 5% test PCR positive
- Up to 35% serological positive
- Short outbreaks < 30 days, typically < 15 days

**E. Diagnostics:**

**CFIA laboratory testing:**

Reliable ELISA tests to detect specific antibodies in serum.

- NCFAD test- reference paper- *Validation of a competitive ELISA and a virus neutralization test for the detection and confirmation of antibodies to Senecavirus A in swine sera*- see paper)
  - Specificity 98.2%
  - Sensitivity 96.9%
- Multiplex RT-PCR to differentiate SVV from other vesicular diseases (FMD, SVD, VS). NCFAD runs this on suspect and rule out samples (HR and CN). Laboratory results available to producer and vet (on request directly from CFIA, or forward by producer) as a Client Information Sheet (CIS).
- Client Information Sheet will include PCR and ELISA results for FMD, SVD, VS and SVA

Pineyro- Diagnostics in a barn/clinical setting are challenging:

- In severe cases- get ulceration and sloughing of coronary band. Ruptured vesicles may have purulent debris (secondary infections).
- Histology- tonsils- may show lymphoid depletion. Virus can be detected in tonsil. (PCR option on healed animals with CIS ruling out FAD)
- Piglets- U of Minnesota has detected SVA in processing fluids up to 11 weeks after an SVA outbreak. These tests are not validated in most labs yet.
- Assumed virus is cleared after 11 weeks.

**Samples**

Vesicular lesions are best- fluid or scrapings. But hard to find. If get vesicular fluid-chilled or frozen for PCR.

Dr. Pineyro describes a South Dakota 1200 head finisher barn with 80-90% showing vesicular lesions. Four days later, almost no lesions. However, they scraped healed lesions and got positives on PCR and VI. In above case, brought back 6 whole finisher pigs and collected all possible samples: variable and inconsistent lesions:

-blanching, ecchymosis, ulceration, 1 vesicle. One with sloughing of hoof.

-lymphoid tissue good for detecting virus.

Other samples for post outbreak sampling: swabs and blood; none ideal

-serum, nasal swabs, rectal swabs, tonsil swabs, lymph nodes.

Serum- viremia less than 10 days.

Detection of antibodies: (University of Minnesota Diagnostic Lab)

- Neutralizing antibodies – detectable 3-5 days post-exposure
- IgM – detectable from 5 days to 21 days post-exposure
- IgG – detectable 7-10 days post-exposure

Pigs shed virus for 4 weeks. Cannot detect later than that. When shedding detect in nasal swabs, oral fluids, fecal swabs.

Recommendations: animals euthanized 4-10 days post-infection- virus found in most tissues.

- 5 weeks PI tonsils still had virus. For up to 4-5 weeks, oral fluids, processing fluids may be sample source due to viral shedding.
- Virus persists in lymphoid tissue (may not ever be cleared- source of on-going infection on a farm??)

Dr. Pineyro- PCR is the most available test. High degree of virus homology between USA and Brazil.

-original reference isolate 001 (2002)- current circulating US strains are still 96-97%homologous to that original strain.

-PCR on oral flids, nasal swabs, serum, lymphoid tissue, rectal swabs all work. (virus shedding)

- time is of the essence- the earlier the better

- other options for direct virus detection include in situ hybridization, Virus Isolation (VI) (gold standard, cytopathic effect in 24-48 hours), EM

Indirect detection- measure humoral response- virus was present.

ELISA (various), IFA, VN- hardest to detect.

Clinical example from Dr. Pineyro: swine breeding farm, attending 2 weeks after disease reports- looked for antibodies in sows that had shown clinical disease and in their piglets:

-very little antibody detection in sera, but virus was still shed in feces and had positive tonsil swabs.

-piglets shedding virus for 4-5 weeks- fluids and feces. (oral fluid testing- effective up to 1 week post infection experimentally, but not fully validated))

IgG detected in sows with or without clinical signs. Piglet maternal antibodies decline after 4-5 weeks. Impacts on pre-weaning mortality are short-lived. (is this related to maternal antibodies? -theory)

ELISA- vp1, vp2, vp3 antibodies. Vp2 is strongest. Antibodies persist up to 60 days.

VP-1- AB detected for 28-33 days PI

VP3- not good evaluation

NOTE: test used by NCFAD uses VP-2- detected up to 60 days PI.

So currently, can do PCR on lesions, tonsils, fecal, nasal, tissues

- Processing fluids and oral fluids promising but not validated yet (Oct 2024)

From Sonja Laurendeau, CFIA and discussion with provincial labs:

- **Provincial laboratories may not accept animal tests from animals with vesicular lesions unless accompanied by CIS confirming they have been tested by CFIA and an FAD has been ruled out.**
- **Samples can be taken from asymptomatic animals for surveillance.**

**For herd diagnostics** (Is herd infected with or free of SVV?)

- recommend 60 rectal swabs submitted for PCR. If first round negative, repeat in 4-6 weeks to "prove" negative status.
- if SVV present this should detect it.
-samples can be submitted as surveillance samples to provincial veterinary lab, indicating samples are from non-clinical animals (ie no vesicular lesions)

**Environmental surveillance:**

RT- PCRs specific for key isolates of SVV from both environmental & animal samples
-ongoing environmental sampling in some assembly yards (Manitoba)

**F. Treatment & Elimination**

**There are no treatment options, including vaccination, available for SVA.**

Effective vaccine types developed through research, but no commercial vaccine is produced.

(Dr. Pineyro) Vaccine shown to induce immune response- not commercially available.

Feedback has been tried but of questionable impact.

**Decontamination** of infected surfaces is essential to the elimination of SVA.

Disinfectants that have been found effective against SVA are accelerated hydrogen peroxide® as well as Virkon®. Be sure to follow all label directions for concentration and contact time.

At 25°C, bleach (5.25%, 1:20 dilution) is also highly effective against SVA on aluminum, rubber, plastic, stainless steel, and cured cement after a 10-to-15-minute contact time. (MB Pork)

Quaternary ammonias- moderate control;

Phenols-poor.

No validated research on heat treatment, time and temperature to inactivate virus.

**Prevention of introduction is key. Routine biosecurity practices are effective.**

Highest risk of introduction is via cull sow movement, deadstock removal and employee entry.

**Manitoba Response- 2022**

Coordinated & collaborative approach involving Manitoba Pork Council, Manitoba Agriculture, Regional CFIA & affected assembly yards, with streamlined communications among these. Rapid shared notification of trace back from US Border or Processing Plant allowed effective action.

Utilized existing programs & resources such as Traceability (PigTrace, Manitoba PID), Manitoba Animal Disease Investigation program, CFIA regional Animal Health & NCFAD diagnostics.

Transport biosecurity is critical.

2022 SVV Action Plan for Manitoba included:

- Individual animal inspection before export or shipping
- 48 hour or less holding times at Assembly Yards.
- Routine Assembly Yard C&D
- Quarterly High traffic surveillance
- Segregated cull sow transports
- Rapid reporting for traceability
- Trace back herd assessment & environmental testing
- Education & awareness (see attached MB Pork Brochure)