TECHNOTES

Volume 3, Issue 3

BIOSAFETY

LESSONS LEARNED ON VIRUS TRANSMISSION: A RETROSPECTIVE VIEW OF THE CANADA PEDV OUTBREAK

A newly published review article discusses the conclusions made by Canadian investigators about how porcine epidemic diarrhea virus (PEDV) may have been introduced to the first confirmed PEDV case farm in Ontario, Canada on January 22, 2014. The authors noted that Canadian investigators [2] had concluded that the outbreak of PEDV in Canada in January 2014 was associated with feed containing spray-dried porcine plasma (SDPP) contaminated with the virus. However, the authors discussed that since then, more has been learned about other critical factors related to the spread of PEDV and that the conclusions of previous investigations could be different if these critical factors had been considered.

Some of the other critical factors related to spread of PEDV discussed are as follows:

Figure 1 shows a timeline associated with the index farm case and other reports of PEDV positive environmental samples, indicating PEDV was present in wide-spread locations in Quebec and Ontario before the reported index case. The index case may not represent the first introduction of PEDV into Eastern Canada.

If the index farm case did not introduce PEDV into Eastern Canada, how could PEDV have been introduced?

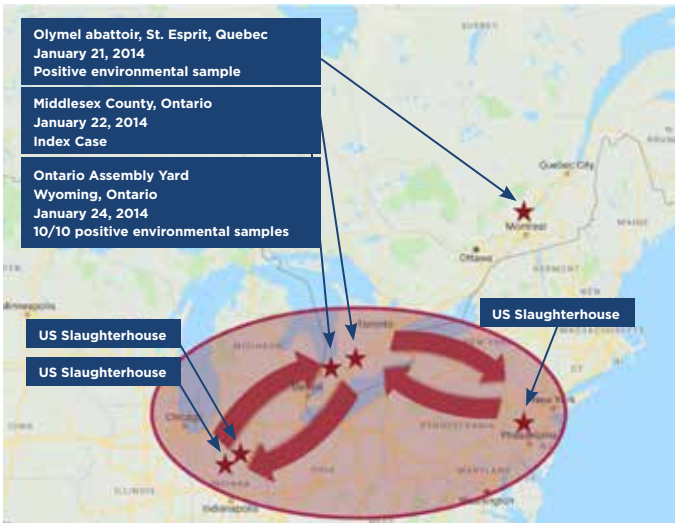
Livestock truck movement: Today it is well-known that trucks returning from pork slaughter plants can become contaminated with PEDV.

Current truck wash protocols are extensive with multiple steps to prevent the spread of PEDV. However, at the time of the PEDV outbreak, trucks were regularly transporting Canadian pigs to contaminated US slaughter plants (Figure 2).

In early 2014 when livestock trucks returned to Canada, regulations only indicated that the livestock trucks be cleaned of visible manure using a shovel and broom. Therefore, it is highly likely that trucks returning to Canada from US slaughter plants were contaminated with PEDV and could have easily transmitted PEDV into various locations in Canada. This is a more logical explanation for the wide-spread environmental contamination found at the Ontario assembly yard and at the Quebec pork slaughter plant. However, livestock truck movements were not considered in previous Canadian investigations.

FIGURE 1. TIMELINE: DETECTION OF PEDV IN EASTERN CANADA

FIGURE 2. US SLAUGHTERHOUSE LOCATIONS WITH OUTBREAK



When considering the timeline and the extent of environmental contamination at both the Quebec abattoir and Ontario Assembly Yard, trucks returning from US slaughter plants is a more plausible explanation for the introduction of PEDV into Canada.

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FDA DID NOT DETECT INFECTIVE PEDV IN THE RETAINED SAMPLES OR A BREACH OF GOOD MANUFACTURING PRACTICES (GMP'S) OF THE SDPP PRODUCT INVESTIGATED IN THE CANADIAN PEDV OUTBREAK.

Investigators of the Canadian PEDV outbreak suggested that a breach in good manufacturing practices (GMPs) could have resulted in PEDV contamination of the SDPP investigated. The FDA reviewed manufacturing records of the SDPP investigated by CFIA and did not identify a breach of GMPs or preventive controls. FDA officials also performed a pig bioassay with retained samples of the SDPP lot investigated by CFIA and reported that the SDPP lot did not contain infective PEDV even though PED virus genome could be detected by a PCR-test.

Published research reports that pigs fed virus genome positive SDPP at high levels in feed for extended periods of time did not become infected, confirming that PCR technique is not indicative of infectivity.

In the months before the Canadian PED outbreak, the plasma manufacturer regularly exported SDPP that was genome positive for PEDV to Brazil and to Western Canada from the same manufacturing plant, using the same GMPs as the SDPP investigated by CFIA. The amount of SDPP exported during this period was enough to feed 2.5–3.5 million pigs in Brazil and 3.5–4.0 million pigs in Western Canada. Neither region experienced a PEDV outbreak during that time period. This confirms that while SDPP may contain positive genome test results, this does not mean SDPP is capable of causing PEDV infection. This information confirms that the manufacturing process is robust and that SDPP is a safe feed ingredient.

HOW COULD THE PLASMA SAMPLE COLLECTED BY THE CFIA BECOME CONTAMINATED WITH INFECTIVE VIRUS?

Since the time of the outbreak, other studies show that PEDV added to spray-dried plasma does not survive more than 1–3 weeks. The SDPP investigated by CFIA was produced more than 10 weeks before the index farm case and over 13 weeks before CFIA collected the SDPP sample used in their study. This long timeline from manufacturing to testing the suspected SDPP sample suggests that the sample collected by CFIA became contaminated with infectious PEDV after the product left control of the manufacturer, either during transport or at the feed mill that made the feed containing the suspected SDPP. Also, within days of the report of the index case, all bags of the remaining SDPP inventory at the feed mill were sampled multiple times, initially by feed mill QA personnel and then by OMAFRA officials before CFIA collected the samples used in the bioassay. If feed and sampling biosecurity protocols were not as rigorous as those in place today, environmental contamination at the feed mill or by multiple sampling of the same SDPP bag(s) by 3 different groups creates the potential for contamination of the SDPP sample CFIA collected and examined in their bioassay with infectious PEDV .

BOTTOM LINE

The authors summarized the following factors that could change conclusions from earlier investigations.

- It is likely that PEDV was present in Canada before the index case.
- It is likely that minimal cleaning of livestock trucks returning from US slaughter plants resulted in the introduction of PEDV into Canada, leading to contamination of the Ontario assembly yard and the Quebec slaughter plant.
- It is likely that within Canada, livestock truck movements between the contaminated Ontario assembly yard, other common sites and the initial PEDV infected farms likely contributed to the spread of PEDV.
- There was no support for the suggestion that a breach in GMPs was responsible for the infective PEDV CFIA reported on the SDPP sample they collected.
- Multiple sampling of the SDPP at the manufacturing site could have contaminated the sample of SDPP tested by the CFIA with infective PEDV.
- The manufacturing process for SDPP includes validated inactivation steps and uses GMPs.
- OIE recognizes that SDPP is a safe feed ingredient when GMPs are followed.

APC

This publication is an open access review published in Transboundary Emerging Disease and can be accessed at: https://doi.org/10.1111/tbed.13496.
Other information about safety and efficacy of SDPP can be accessed at APCproteins.com