Cross-Canada Disease Report
Rapport des maladies diagnostiquées au Canada

Canada

Porcine epidemic diarrhea in Canada: An emerging disease case study

Harpreet S. Kochhar

The first case of Porcine Epidemic Diarrhea (PED) in Canada was confirmed in a swine herd in southwestern Ontario in January 2014. This finding came almost 9 months after the initial detection of PED in the United States, which was in May 2013 (1). It is of great concern for Canadian swine farmers and pork producers that this disease, which has spread to over 30 States in the US, has now been detected in a total of 67 farms in Canada. While the majority of reported cases are in the province of Ontario, PED raises issues across the country about how to prevent or manage diseases, given that they recognize no boundaries and are on an upward trend with the integrated farming, production, and processing between countries such as the USA and Canada, which share extensive borders.

Porcine epidemic diarrhea was first recognized as a devastating enteric disease in feeder pigs resembling transmissible gastroenteritis (TGE) in the United Kingdom in 1971 (2). The etiological agent is an enveloped single-stranded positive-sense RNA virus, belonging to the family *Coronaviridae* and genus *Alphacoronavirus* (3). Several European and Asian countries experienced PED outbreaks in the 1980s and 1990s, with the outbreaks being more acute and severe in Asian countries compared with countries in Europe (3). Japan, Korea, Thailand, and China experienced acute and large-scale outbreaks in suckling pigs, with mortality ranges from 50% to 90% (3). Since 2010, China has seen a large increase in outbreaks attributable to the emergence of a number of new strains (1).

Porcine epidemic diarrhea is characterized by acute watery diarrhea, malaise, vomiting, and high mortality in nursing pigs. It also affects older pigs, finishers, and farrowing herds, with very low mortality and the clinical signs being variable ranging from inapparent infections to diarrhea, anorexia, and depression. As with TGE, PED is considered a production-limiting disease, and spreads through a fecal/oral route directly via contact with infected swine or through indirect contact with contaminated fomites (equipment, humans, etc.) There have been some recent reports of contaminated feed being a potential route of infection (4,5).

In Canada, PED represents the emergence of a disease that has had a profound effect on the swine industry but is not considered notifiable or reportable at the federal level. Provincial governments and industry partners, along with provincial pork associations, have been at the forefront in managing PED, with support from federal partners, including the Canadian Food Inspection Agency (CFIA) and Agriculture and Agri-Food Canada (AAFC). As soon as the disease was detected and confirmed south of the border, Canadian pork producers were on high alert. The focus was on preventing the entry of the disease into Canada, and several key steps were taken over the following 9 months before the disease appeared in Canada.

First, the Canadian Swine Health Board (CSHB), along with the CFIA, provincial governments, and the swine industry started implementing extensive education programs to increase awareness of the disease and promote biosecurity protocols among producers as per the National Swine Farm-Level Biosecurity Standard (developed by the CSHB and reviewed by the CFIA). Biosecurity still remains the best and first line of defense for producers to prevent introduction and spread of PED virus (PEDV). Second, at the federal level, the CFIA and the Canada Border Services Agency worked diligently at border entry points to ensure that trucks transporting pigs between Canada and the US were properly cleaned and disinfected. Third, a standardized polymerase chain reaction (PCR) protocol was developed and shared with all provinces through the Canadian Animal Health Laboratory Network, to ensure that testing capability and capacity would be available in laboratories across Canada. Finally, to coordinate these efforts, the office of the Chief Veterinary Officer for Canada instituted regular conference calls to share information with stakeholders, including industry partners, provincial Chief Veterinary Officers, and other entities (e.g., the CSHB and laboratories). The measure of success of all of these efforts was the ability of Canada to remain PED-free for 9 months after its detection in swine herds in the US, despite the frequency of cross-border traffic.

After the first Canadian case of PED was detected in a swine farm in Ontario, further surveillance sampling was conducted

at various locations such as assembly yards, transport trucks, abattoirs, and other strategic points. The number of cases in the province of Ontario increased in different counties and the count was reported diligently by the provincial authorities (6). Then, a case of PED was detected in a farm in Prince Edward Island, followed by cases in Québec and Manitoba. Further spread was prevented through the swift response of the provincial governments and various other stakeholders of the swine industry. Laboratories continue to process surveillance and suspect samples submitted by all provinces and the 3 provinces with minor outbreaks have not seen any further spread in the swine farms. While the number of cases was increasing in February–March 2014, epidemiological investigations and surveillance activities continued in Ontario. It was during this epidemiological investigation that provincial veterinarians saw a possible linkage between swine feed and cases of PED.

Feed testing by the Ontario Ministry of Agriculture and Food revealed that a particular lot of US-origin spray-dried blood plasma (SDBP) used in feed pellets distributed by 1 particular company contained PEDV genetic material. This initiated an investigation by the CFIA, along with provincial counterparts, to address concerns that feed could cause transmission of the virus. The CFIA coordinated the trace-back and trace-forward activities to identify the lots of feed and their association with the appearance of PED at farms in Ontario. This was complemented by the voluntary withdrawal and recall of the implicated feed by the manufacturer.

The CFIA also conducted a controlled bioassay study (4), which showed that the tested SDBP did contain infectious PEDV. This was demonstrated through the experimental inoculation of piglets, although feeding the pellets containing that SDBP to piglets did not elicit a similar disease response as in the experimentally inoculated piglets.

Provincial veterinarians are preparing a more detailed analysis (to be published shortly) of the contaminated SDBP in feed as a potential source of introduction of PED. The weight of the epidemiological evidence so far, however, supports the fact that the source of infection for most of the early cases in Ontario and for the single case in PEI in January 2014, was the pelleted swine feed. All of the suspect feed contained a specific lot of SDBP imported from the US. Another experimental study also provided initial proof of concept that the contaminated complete feed can serve as a vehicle for PEDV infection of naïve pigs (5). It still remains unclear; however, how important spray-dried porcine plasma or pelleted swine feed in general is in the epidemiology of PEDV.

While swine producers continued to manage PED at the farm level with support from provincial and federal partners, international markets reacted to the detection of PED in Canada. The European Union, Japan, Korea, Mexico, Columbia, and other countries required certification to provide assurance that live swine and swine products were not coming from farms associated with PED. Several iterations of bilateral negotiations with these countries by the CFIA have resulted in a continuation of trade, through the addition of the PCR test in advance of shipping live swine. Since the emergence of PED in North America, the debate at the World Organization of Animal Health (OIE) has intensified to assess whether it should be considered a reportable disease. The OIE has assembled an *ad hoc* working group to look at the case definition and further assess it at the level of a scientific commission to consider all the facts and proofs related to this disease.

In summary, Canada has successfully managed the initial phase of PED introduction in the country through a coordinated effort of industry associations and provincial and federal partners, as well as the pork industry in general. Since May 2014, the numbers of confirmed cases being reported at swine farms in Canada have diminished significantly. Not only has Canada been successful in limiting the spread of the disease but it has also provided farmers with options of an iPED vaccine for use and support through Growing Forward 2 investments in the pork sector. The fall and winter of 2014 will be an acid test to see if the protocols and precautions put in place, as well as the tools available to pork producers, are sufficient to protect the swine population from further spread and to contain and manage the disease at the affected farms. The lessons learned from the recent experience with PED also begs the question, "How can we manage emerging diseases, which are far more of a threat now with changes in climate, shrinking borders, industries integrated between countries, and the movement of people and equipment?" The answer lies in our ability to prepare ourselves in advance and to be vigilant about the animal health threats to Canadian livestock.

References

1. Huang Y-W, Dickerman AW, Pineyro P, et al. Origin, evolution, and genotyping of emergent porcine epidemic diarrhea virus strains in the United States. MBio 2013:e00737–13.
2. Pensart MB, de Bouck P. A new coronavirus-like particle associated with diarrhea in swine. Arch Virol 1978;58:243–247.
3. Song D, Park B. Porcine epidemic diarrhoea virus: A comprehensive review of molecular epidemiology, diagnosis, and vaccines. Virus Genes 2012;44:167–175.
4. Pasick J, Berhane Y, Ojkic D, et al. Investigation into the role of potentially contaminated feed as a source of first-detected outbreaks of porcine epidemic diarrhea in Canada. Transbound Emerg Dis 2014;61:397–410.
5. Dee S, Clement T, Schelkopf A, et al. An evaluation of contaminated complete feed as a vehicle for porcine epidemic diarrhea virus infection of naïve pigs following consumption via natural feeding behavior: Proof of concept. BMC Vet Res 2014;10:176– 179.
6. Ontario Ministry of Agriculture, Food and Rural Affairs. News Release 23 January 2014: Porcine Epidemic Diarrhea Investigation; Province Taking Steps to Protect Pork Industry. Available from: http://news.ontario.ca/omafra/en/2014/01/porcine-epidemic-diarrhea-investigation-in-ontario.html Last accessed September 8, 2014.

Dr. Harpreet S. Kochhar, DVM, MVSc. PhD, Chief Veterinary Officer for Canada/Executive Director, Animal Health Directorate, Canadian Food Inspection Agency, 59 Camelot Drive, Ottawa, Ontario K1A 0Y9.

Address all correspondence to Dr. Harpreet Kochhar; e-mail: harpreet.kochhar@inspection.gc.ca