An Overview on Porcine Epidemic Diarrhea Virus and its Progression in the United States Swine Industry

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Introduction:

The United States Swine Industry is currently experiencing a pandemic outbreak associated with Porcine Epidemic Diarrhea Virus (PEDV). PEDV is a member of the virus family Coronaviridae. Viruses in the Coronaviridae family are enveloped, positive-sense, single-stranded RNA viruses. Other important swine disease causing viruses in the family Coronaviridae are: Transmissible Gastroenteritis (TGE) and Porcine Respiratory Coronavirus (PRCV). Although TGE and PRCV are in the same family as PEDV there is no cross protection to PEDV from TGE or PRCV.

History:

PEDV was first identified in Great Britain in 1971. Currently PEDV is found in Hungary, Germany, China, Korea, Japan and as of April 2013 in the United States. China has seen the largest increase in prevalence since 2010 with the emergence of new strains. The current strain isolated in the United States is 99.4% homologous with a strain circulating in China.

PEDV has never been diagnosed in the U.S. until 2013 and is not considered a foreign animal disease. With PEDV not being listed as a foreign animal disease according to the World Organization for Animal Health (OIE), there are no restrictions placed on interstate movement and exporting of swine from the U.S.

Clinical Presentation:

The incubation period for PEDV is roughly 12-24 hours and once infected, clinical signs start to develop roughly 4-5 days post infection. Four week old pigs experimentally inoculated with an oral dose of $10^3$ PFU/mL of PEDV demonstrated signs of diarrhea 2-3 days post challenge and diarrhea persisted for 7-8 days once signs developed. In this same experiment, shedding was detected out to 35 days post infection by fecal PCR (1).

The clinical presentation in swine is similar to TGE. In suckling pigs you will see severe watery diarrhea, vomiting, dehydration and death. Mortality on suckling pigs ranges from 50-100% with the younger aged pigs being more susceptible. Sow herds experiencing a PEDV outbreak will see 100% mortality on pigs less than 1 week of age with a total piglet loss over a 2-4 week time period. In nursery/grower pigs you will see watery diarrhea, vomiting, depression, pigs off feed and a lower mortality around 1-3%. For mature sows and boars the clinical signs are the same as the nursery/grower aged pigs.
Transmission:

The main route of transmission is fecal to oral with infected swine. Other modes of transmission consist of contaminated clothing, equipment, rodents/birds and transport vehicles. Two studies looked at the prevalence of PEDV at culling stations and harvest facilities in the U.S.

The first study was done in North Carolina at four different cull ing stations. Four samples were taken at the truck end of the unloading chute and 3 out of 4 samples were PEDV positive. Ten samples were taken from pigs with loose stools and 6 out of 10 were PEDV positive (2). The second study was done at 7 harvest facilities in Central U.S. for a total of 669 trailers sampled. The number of samples taken at each site ranged from 89-102 samples. Results determined that 17.3% (range 2%-69.7%) of trailers coming into harvest facilities were contaminated with PEDV prior to arrival. The results also determined that 11.4% of non-contaminated trucks coming into the harvest facility were found to be PEDV positive upon leaving the facility. This indicated that every contaminated truck coming into a harvest facility lead to the contamination of 0.96 more trucks leaving the facility (3).

Transport vehicles are a significant risk of PEDV transmission to naïve swine sites in Minnesota. As veterinarians, we are working diligently with producers and truckers to find ways to improve biosecurity and reduce the spread of PEDV to negative swine herds.

PEDV Movement in the U.S.:

The index case for PEDV occurred on April 29, 2013 in Iowa. The farm observed clinical signs of vomiting and diarrhea in sows and piglets. Testing for TGE was negative. With persistence, the diagnostic laboratory was able to confirm a diagnosis of PEDV on May 13, 2013. Around that same time frame 2 other sow farms were experiencing clinical signs similar to TGE and eventually diagnosed with PEDV (another farm in Iowa and one in Indiana). Once PEDV was confirmed in the U.S., Iowa State University Veterinary Diagnostic Laboratory went back and retested ~850 samples starting from December 2012 up to April 2013. On the retest it was determined that the first PEDV positive sample occurred in Ohio on April 16, 2013.

By August, 2013 there were 462 positive PEDV cases in the U.S. and 17 states with confirmed positive cases. Minnesota was one of the 17 positive states with 41 positive cases. As of January 12, 2014 there are a total of 2,394 positive cases and 23 states with confirmed positive cases. The largest increase in the number of cases by week occurred during the week of January 5, 2013 with 188 new positive cases.

Currently Iowa has the highest number of cases at 882, followed by North Carolina at 319, and Minnesota at 294 (4). With the colder temperatures, the constant movement of pigs and with little changes in biosecurity at harvest facilities, the cases of PEDV continues to increase more dramatically every week. From the first cases in April 2013 to October 2013 the average reported new positive cases/week was at 31.9 cases/week compared to
November 2013 to January 2014 where the average reported new positive cases was at 125 cases/week.

**Control and Treatment:**

Currently in the U.S. there are no commercially approved vaccines for PEDV. Other countries have vaccines that possess minimal efficacy at reducing clinical signs associated with infection. As time goes forward biologic companies will continue to pursue vaccination as a means to help control PEDV. The best form of control is preventing herds from becoming infected with impeccable biosecurity.

The best form of treatment for all ages of pigs is providing electrolytes to promote hydration and metabolic stability during severe diarrhea. On sow farms the current treatment consist of whole herd exposure, alterations in weaning ages and a thorough clean up. In nursery and finishing sites the two most common ways to remove the virus from a site are: depopulating the entire site and extensively cleaning before new pigs are placed back into the barns or by practicing all-in-all-out with extensive cleaning and biosecurity implemented. As time goes on we continue to learn more and develop better ways to approach preventing and controlling PEDV. It is a long road ahead and only time, research and shared experiences will determine if we truly are on the right path at combating PEDV.

**References:**