



Animal and Plant
Health Inspection
Service

Veterinary
Services

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Novel Swine Enteric Coronavirus Disease (SEDC)

Case Definition

1. General disease/pathogen information

Novel swine enteric coronavirus disease (SECD) is a disease in swine caused by emerging porcine coronaviruses, including porcine epidemic diarrhea virus (PEDV) and porcine delta coronavirus (PDCoV). SECD is characterized by an acute, rapidly spreading viral diarrhea of pigs; no other species are known to be affected and it is not a public health threat. Pigs develop varying degrees of diarrhea and inappetence depending upon age of the pig infected.

1.1 Etiologic agent:

PEDV and PDCoV are members of the family *Coronaviridae*. Coronaviruses are divided into three known genera: *Alpha-*, *Beta-*, and *Gammacoronavirus*. A fourth genus, *Deltacoronavirus*, has been proposed. PEDV is an *Alphacoronavirus* and PDCoV is a *Deltacoronavirus*. Coronaviruses are positive-sense, enveloped, single-stranded RNA viruses. Different strains of PEDV exist with virulence dependent upon the spike (S) gene sequence. Virological information about PDCoV is limited.

1.2 Distribution:

PEDV was first reported in the United States in 2013 and quickly spread throughout the country. PEDV has also been reported in Canada and Mexico and is suspected in Central America, Colombia, Peru, and the Dominican Republic. PEDV is thought to be widespread throughout most regions of Western and Central Europe and Southeast Asian countries, including China and Japan. PEDV is currently a source of concern in Asian countries, where outbreaks are often more acute and severe than those observed in Europe. Severe outbreaks with high mortality are typically rare in Europe, but recently have been commonly reported in Asia. China has seen a large increase in outbreaks since 2010, and the emergence of new strains has been attributed to this increase.

PDCoV was first reported in China in 2012. It was subsequently detected in the United States in early 2014, followed by detections in Canada. PDCoV has not been reported in any other countries.

1.3 Clinical signs:

Severity of disease caused by PEDV is variable and dependent on the age and epidemiologic status of the herd. The primary, and often only, clinical signs are acute watery diarrhea and vomiting. PDCoV is thought to cause disease similar to PEDV, but to date, no conclusive studies have proved this.

1.3.1 Endemic herd: Persistent diarrhea in recently weaned pigs.

1.3.2 Naïve herd:

- Suckling pigs: vomiting, acute watery diarrhea, loss of appetite, dehydration, and metabolic acidosis with mortality typically between 50 and 80 percent.
- Feeder and grower pigs: clinical signs are variable and range from inapparent infections to diarrhea, anorexia, and depression. Mortality is low (1-3 percent) when present.

1.4 Incubation period:

Experimentally, the incubation period of PEDV has been demonstrated to be approximately 36 hours from inoculation until the appearance of clinical signs. When PEDV infected swine are introduced to a naïve premises, clinical signs typically appear within 4-5 days. Incubation period with PEDV is typically longer than with transmissible gastroenteritis. The incubation period of PDCoV is unknown.

1.5 Differential diagnosis:

Because of similar clinical presentation to other transmissible gastroenteritis, laboratory testing is required for identification.

1.5.1 Viral gastroenteritis: PEDV and PDCoV are clinically similar to, but antigenically distinct from, transmissible gastroenteritis virus (TGEV). Porcine rotaviruses are major causes in viral enteric diseases of piglets with similar clinical presentation. Porcine circovirus also causes diarrhea and is usually seen in 6-8 week and older pigs.

1.5.2 Bacterial gastroenteritis: *Clostridium spp*, *E. coli*, *Salmonella spp*, *Brachypira spp*, *Enterococcus durans*, *Lawsonia intracellularis*.

1.5.3 Parasitic gastroenteritis: *Coccidia*, *Cryptosporidium*, *Nematodes*.

1.6 Transmission and reservoir:

PEDV is most commonly introduced via fecal-oral contact with infected swine, but may also be introduced to a naïve premises by contaminated equipment, fomites, or people. It is possible that PEDV can persist on a premises where consecutive litters are infected and do not have immunity after weaning. Transmission of PDCoV is unknown, but thought to be similar to PEDV.

1.7 Epidemiology:

Morbidity rates in naïve swine can reach 100 percent in both suckling pigs as well as feeder and grower pigs. Mortality rates are extremely high in suckling pigs, reaching 50 to 80 percent, though both higher and lower rates have been reported. In growing and adult pigs, mortality rates are low (approximately 1 to 3 percent).

2. Laboratory criteria

Agent identification: Specific polymerase chain reaction (PCR) assays, immunohistochemistry, and virus isolation can be used to detect PEDV, PDCoV, and other emerging swine enteric coronavirus-infected animals, although virus isolation may be difficult. Samples to collect for testing include feces or intestinal contents, intestine, colon, and oral fluids. The best samples to collect are from live acutely-affected pigs within 24 hours of diarrhea onset. Necropsy samples must be taken as soon after death as possible.

3. Case definition

3.1 Suspect herd: A swine herd in which one or more age groups are affected with acute, contagious, watery diarrhea.

3.2 Presumptive positive case: A pig that has tested positive for PEDV, PDCoV, or other emerging swine enteric coronavirus by PCR, virus isolation, and/or viral genetic sequencing, with either non-specific, unknown, or no clinical signs/history consistent with SECD.

3.2.1 Presumptive positive herd: A swine herd with one or more presumptive positive cases. Presumptive positive herds will be subject to further inquiry for confirmation.

3.3 Confirmed positive case: A pig that has:

- Tested positive for PEDV, PDCoV, or other emerging swine enteric coronavirus by PCR, virus isolation, and/or viral genetic sequencing; **AND**
- Has a history of clinical signs consistent with SECD, or is from a swine herd with a history of clinical signs consistent with SECD.

3.3.1 Confirmed positive herd: A swine herd with one or more confirmed positive cases.

4. Reporting criteria

A Federal Order states that anyone, including producers, veterinarians, laboratory personnel, or others with knowledge of the disease, who identifies a new occurrence of PEDV, PDCoV, or other novel enteric coronavirus must report the occurrence to State and Federal authorities. A new occurrence may be the initial detection or a reoccurrence of previously detected disease. This includes both presumptive positive and confirmed positive cases (definitions 3.2 and 3.3) with laboratory-based evidence of virus detected from samples originating from swine herds in the United States or its Territories. If a sample is submitted to a National Animal Health Laboratory Network (NAHLN) laboratory for testing and is found positive, duplicate reporting by the herd owner, producers, veterinarians, and others with knowledge of the disease is not required.

Reporting should follow existing channels to the State animal health official (SAHO) or Federal Assistant District Director (ADD). For laboratories, reporting of all test-positive animals will also be submitted electronically to the Laboratory Messaging System (LMS). Reporting will include: premises identification number (PIN) or an alternative premises identifier; date of sample collection; type of herd being sampled (sow, nursery, finisher); test methods used to make the diagnosis; and test results. The case must be reported as soon as the herd is believed infected because of laboratory test-positive samples or other knowledge of herd infection, except when positive samples are reported by NAHLN laboratories, as above. Laboratory characterization and reporting of undetermined viruses should occur within two weeks of submission, if possible.

5. Surveillance and control procedures

Passive surveillance efforts by USDA-APHIS, State veterinarians, university personnel, State animal health officials, USDA-accredited veterinarians, and industry representatives are in place to detect any presence of SECD in the United States. Methods of control include strict biosecurity and sanitation practices. There are no commercial PEDV or PDCoV vaccines approved for use in the United States. Current commercial PEDV vaccines produced in

Southeast Asia do not induce effective lactogenic immunity to the Chinese-like PEDV. Immunity can be induced via feedback of intestinal contents and feces to sows and replacement gilts. However, immunity is not lifelong and reoccurrences are common.

References

- Iowa State University. Porcine Epidemic Diarrhea (PED) Diagnostic Testing. Available at: <http://vetmed.iastate.edu/vdpam/disease-topics/porcine-epidemic-diarrhea-ped-diagnostic-testing> Accessed 5/20/2013.
- Li, G., Chen, Q., Harmon, K. M., Yoon, K. J., Schwartz, K. J., Hoogland, M. J., ... & Zhang, J. (2014). Full-Length Genome Sequence of Porcine Deltacoronavirus Strain USA/IA/2014/8734. *Genome announcements*, 2(2), e00278-14.
- Li W, Li H, Liu Y et al. (2012). New variants of porcine epidemic diarrhea virus, China, 2011. *Emerg Inf Dis*. 18(8): 1350-1353.
- Na Ayudhya, S. N., Assavacheep, P., & Thanawongnuwech, R. (2012). One World–One Health: The Threat of Emerging Swine Diseases. An Asian Perspective. *Transboundary and Emerging Diseases*, 59(s1), 9-17.
- Pospischil A, Stuedli A., Kiupel M. (2002). Update on porcine epidemic diarrhea. *J Swine Health Prod*. 10(2): 81-85.
- “Porcine Epidemic Diarrhea.” (2012). In The Merck Veterinary Manual (online). www.merckmanuals.com/vet.
- Woo, P. C., Lau, S. K., Lam, C. S., Lau, C. C., Tsang, A. K., Lau, J. H., ... & Yuen, K. Y. (2012). Discovery of seven novel mammalian and avian coronaviruses in the genus Deltacoronavirus supports bat coronaviruses as the gene source of Alphacoronavirus and Betacoronavirus and avian coronaviruses as the gene source of Gammacoronavirus and Deltacoronavirus. *Journal of virology*, 86(7), 3995-4008.
- World Animal Health Information Database (WAHID) Interface. http://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home Accessed 5/1/2014.