Teschovirus Encephalomyelitis and Porcine Teschovirus Infection

Enterovirus Encephalomyelitis,
Teschen Disease,
Talfan Disease,
Poliomyelitis Suum,
Benign Enzootic Paresis

Last Updated: July 2009

the Center for Food Security & Public Health
IOWA STATE UNIVERSITY®
College of Veterinary Medicine
Iowa State University
Ames, Iowa 50011
Phone: 515.294.7189
Fax: 515.294.8259
cfsph@iastate.edu
www.cfsph.iastate.edu

INSTITUTE FOR INTERNATIONAL COOPERATION IN ANIMAL BIOLOGICS
Iowa State University
College of Veterinary Medicine
www.cfsph.iastate.edu/IICAB/

Importance

Porcine teschovirus (PTV) is a picornavirus of swine that can cause a wide range of clinical signs. Most of the 11 serotypes are widely distributed and infect pigs asymptomatically or cause disease only in young animals. However, some strains of the most virulent serotype (PTV-1) cause teschovirus encephalomyelitis, a highly contagious, often fatal, neurological disease that affects pigs of all ages. Severe outbreaks were reported in Europe from 1929 to the 1950s, with the virus spreading to other continents; however, this disease disappeared from Western Europe after 1980 and has become very rare in other areas. It appears that the most virulent strains of PTV-1 have been replaced in most swine populations by less pathogenic strains.

Etiology

The viruses that cause teschovirus encephalomyelitis, as well as less pathogenic strains, belong to a single viral species called porcine teschovirus. This virus is classified in the genus *Teschovirus* in the family Picornaviridae. There are at least 11 distinct serotypes of PTV, PTV-1 through PTV-11. Some virulent strains of PTV-1 cause severe teschovirus encephalomyelitis (formerly called Teschen disease). Other strains of PTV-1, as well as other PTV serotypes, can cause milder disease or inapparent infections in pigs. These milder diseases have been given a variety of names including Talfan disease, benign enzootic paresis and poliomyelitis suum.

At one time, porcine teschoviruses were classified in the genus *Enterovirus*. When these viruses were reclassified, the former porcine enterovirus (PEV) serotypes PEV-1 to PEV-11 were placed into three groups of viruses, I through III. PEV-1 through PEV-7 and PEV-11 through PEV-13 were placed in group I, which is equivalent to the new species porcine teschovirus. PEV-1 through PEV-7 were renamed PTV-1 through PTV-7, and PEV-11 through PEV-13 were renamed PTV-8 through 10. A new serotype, PTV-11, was found recently. The remaining three porcine enteroviruses, PEV-8 (porcine enterovirus A), PEV-9 and PEV-10 (porcine enterovirus B) remained in the genus *Enterovirus*.

Species Affected

Porcine teschovirus infections are only known to occur in pigs.

Geographic Distribution

Mild or asymptomatic porcine teschovirus infections occur worldwide. In contrast, teschovirus encephalomyelitis is currently a rare disease, with most recent outbreaks reported in Madagascar and Central and Eastern Europe. Outbreaks of teschovirus encephalomyelitis were reported to the World Organization for Animal Health (OIE) by Belarus in 1996, 1999 and 2005, Moldavia in 2002–2004, Romania in 2002, Russia in 2004, Ukraine in 1996–2005, Latvia in 1997 and 2000–2002, Madagascar in 1996–2000, 2002 and 2004–2005, Uganda in 2001, and Japan in 2002. The outbreak in Japan in 2002 was confirmed by laboratory testing; in some other cases, it is not known whether the diagnosis was made on the basis of clinical signs alone. Teschovirus encephalomyelitis was last reported from a Western European country (Austria) in 1980. It is not known to occur in North America.

Transmission

Porcine teschoviruses can enter the body by ingestion, and multiply in the gastrointestinal tract and associated lymphoid tissues, including the tonsils. These viruses can be shed in the feces and oral secretions. Convalescent animals can excrete virus in feces for up to 7 weeks. Porcine teschoviruses are readily spread on fomites, and may be transmitted in inadequately heat-treated pig swill. These picornaviruses can be found in the environment for more than 5 months at 15ºC (59ºF) and can survive in liquid manure for prolonged periods.

Incubation Period

The incubation period for teschovirus encephalomyelitis is 1 to 4 weeks. In experimentally infected piglets, the highly virulent 'Zabreh' strain of PTV-1 produces clinical signs in 5 to 7 days.

Clinical Signs

The clinical signs of teschovirus encephalomyelitis, caused by highly virulent strains of PTV-1, typically include fever, anorexia, depression and incoordination, followed by painful hypersensitivity, paralysis and death within 3 to 4 days. Muscle tremors, stiffness or rigidity, nystagmus, seizures, changes in or loss of the voice, opisthotonos and clonic spasms of the legs may be seen. Some pigs may grind their teeth, smack their lips or squeal as if they are in pain. In the final stages of the disease, progressive paralysis develops, beginning in the hindquarters and ascending toward the head. During this stage, pigs may become hypothermic. Death is usually caused by paralysis of the respiratory muscles. Animals with milder clinical signs sometimes recover.

Other strains and serotypes tend to infect pigs subclinically; however, some isolates can cause neurological disease among young animals. The clinical signs typically consist of ataxia and paresis, which occasionally progresses to paralysis. Deaths can occur, but pigs with mild disease often recover. A few reports have linked porcine teschoviruses to a variety of other conditions such as pneumonia, pericarditis and myocarditis; however, there has been no consistent association with any syndrome other than neurologic disease.

Post Mortem Lesions

There are no characteristic gross lesions. In some cases, the cerebrospinal meninges and nasal mucosa may be congested.

Histopathologic lesions occur in the CNS, and are characterized by nonsuppurative polioencephalomyelitis with lymphocytic perivascular cuffing. Lesions can be found mainly in the gray matter of the cerebellum, diencephalon, medulla oblongata and ventral horns of the spinal cord. In very young animals, the dorsal horns of the spinal cord may be affected. Histopathologic lesions are also common in the dorsal root ganglia and trigeminal ganglia.

Morbidity and Mortality

Morbidity and mortality rates are high in teschovirus encephalomyelitis: up to 90% of the pigs may die within a few days. Swine of all ages can be affected with this form of the disease. Other serotypes of PTV, as well as mild strains of PTV-1, cause less severe clinical signs with variable morbidity and mortality. These milder forms usually occur in young animals. Pigs are frequently infected during weaning, when their exposure to other animals increases and maternal antibodies have declined. Younger piglets can also be affected, particularly when a serotype to which they have no immunity is introduced into the herd. Porcine teschoviruses are often isolated from asymptomatic pigs; these viruses are widespread, and are endemic in many herds.

Diagnosis

Clinical

Teschovirus encephalomyelitis may be suspected in herds with signs of encephalitis and high morbidity and mortality rates. Milder forms of neurological disease often occur in weanling pigs, and resemble many other diseases. Laboratory testing is necessary to diagnose both mild and severe forms of the disease.

Differential diagnosis

The differential diagnosis includes pseudorabies (Aujeszky disease), classical swine fever, Japanese encephalitis, hemagglutinating encephalomyelitis, bacterial meningoencephalitis including *Streptococcus suis* infection and hypoglycemia, as well as poisoning from salt (water deprivation), lead, insecticides or other toxins. Rabies, highly virulent strains of the porcine reproductive and respiratory syndrome (PRRS) virus and edema disease (*Escherichia coli* enterotoxemia) should also be considered.

Laboratory tests

Teschovirus encephalomyelitis can be diagnosed by virus isolation, serology, and the detection of viral nucleic acids or antigens. Histopathology provides supportive evidence.

Porcine teschoviruses can be isolated from the brain and spinal cord of pigs with teschovirus encephalo-myelitis. As these viruses are very common among swine, their recovery from tissues other than the central nervous system (CNS) is not diagnostic. Porcine teschoviruses can be isolated in porcine cells or cell lines, particularly cells from the kidney. The identity of the virus and its serotype can be confirmed with serological tests including virus neutralization, indirect immune-fluorescence, complement fixation and some enzyme-linked immunosorbent assays (ELISAs).

Reverse-transcription polymerase chain reaction (RT-PCR) assays can be used to detect PTV nucleic acids in clinical samples, but this technique may not be available in all laboratories. Teschovirus antigens may sometimes be detected in the CNS with immunohistochemistry; however, these antigens are very difficult to find.

Teschovirus encephalomyelitis or other PTV infections can also be diagnosed by serology. Microtiter virus neutralization or ELISAs are often used. A four–fold rise in the titer should be seen. Because antibodies to porcine teschoviruses, including PTV-1, are common among swine, a single titer is not diagnostic. Histopathology of the brain and spinal cord provides supportive evidence for the diagnosis.

Samples to collect

Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should

only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

The brain and spinal cord should be collected for all diagnostic tests except serology. Histopathologic lesions are found mainly in the cerebrum, cerebellum, diencephalon, medulla oblongata, and cervical and lumbar spinal cord. Virus isolation is most likely to be successful early in the course of the disease. Samples for virus isolation should be taken from pigs that died very recently or were killed for necropsy. Paired serum samples are also helpful.

Recommended actions if teschovirus encephalomyelitis is suspected

Notification of authorities

Teschovirus encephalomyelitis should be reported immediately to state or federal authorities. Milder serotypes and strains are common among swine; state authorities should be consulted to determine whether any reporting requirements exist.

Federal: Area Veterinarians in Charge (AVIC):

http://www.aphis.usda.gov/animal_health/area_offices/

State Veterinarians:

http://www.usaha.org/Portals/6/StateAnimalHealthOfficials.pdf

Control

Severe outbreaks caused by PTV-1 have been controlled by quarantines and movement controls, euthanasia of the herd, ring vaccination and tracing of contacts. Porcine teschoviruses can survive in the environment for months, and good cleaning and disinfection of the premises is necessary before restocking. Porcine teschovirus and related picornaviruses are resistant to heat, lipid solvents and some disinfectants but can be inactivated by sodium hypochlorite or 70% ethanol. These viruses have a wide pH tolerance, and can remain viable from pH 2 to 9. Viruses in manure can be inactivated by aeration, ionizing radiation or anaerobic digestion. Although vaccines for teschovirus encephalomyelitis were available in the past, they are no longer sold commercially.

The disease caused milder strains may be mitigated by introducing new breeding stock at least one month before breeding. This allows these animals to develop immunity to the strains that circulate in the herd, and is expected to reduce the incidence of disease in their young. No specific treatment is available.

Public Health

There is no indication that porcine teschoviruses are zoonotic.

Internet Resources

Food and Agriculture Organization of the United Nations (FAO). Manual for the Recognition of Exotic Diseases of Livestock
http://www.spc.int/rahs/

The Merck Veterinary Manual
http://www.merckvetmanual.com/mvm/index.jsp

U.K. Department of Environment, Food and Rural Affairs (DEFRA). Teschen Disease.
http://www.defra.gov.uk/animalh/diseases/notifiable/teschen/

World Organization for Animal Health (OIE)
http://www.oie.int

OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals
http://www.oie.int/international-standard-setting/terrestrial-manual/access-online/

OIE Terrestrial Animal Health Code
http://www.oie.int/international-standard-setting/terrestrial-code/access-online/

References

Alvarez R. Case study: Enteroviral polioencephalomyelitis in finishing–age pigs. Animal Disease Diagnostic Lab Newsletter [online], Fall 2001. Available at: http://128.210.150.19/newsletters/2001/fall/ep.shtml. Accessed 6 Jul 2009.

Garner G, Saville P, Fediaevsky A. Manual for the recognition of exotic diseases of livestock: A reference guide for animal health staff [online]. Food and Agriculture Organization of the United Nations [FAO]; 2003. Enterovirus encephalomyelitis. Available at: http://www.spc.int/rahs/. Accessed 1 Jul 2009.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. Porcine enteroviral encephalomyelitis. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/102100.htm. Accessed 12 Jul 2009.

Kaku Y, Sarai A, Murakami Y. Genetic reclassification of porcine enteroviruses. J Gen Virol. 2001;82(Pt 2):417-24.

La Rosa G, Muscillo M, Di Grazia A, Fontana S, Iaconelli M, Tollis M. Validation of rt-PCR assays for molecular characterization of porcine teschoviruses and enteroviruses. J Vet Med B Infect Dis Vet Public Health. 2006;53(6):257-65.

Pogranichniy RM, Janke BH, Gillespie TG, Yoon KJ. A prolonged outbreak of polioencephalomyelitis due to infection with a group I porcine enterovirus. J Vet Diagn Invest. 2003;15(2):191-4.

U.K. Department of Environment, Food and Rural Affairs [DEFRA] Teschen disease [online]. DEFRA; 2002 Dec.. Available at: http://www.defra.gov.uk/animalh/diseases/notifiable/teschen/. Accessed 13 Jul 2009.

Yamada M, Kozakura R, Kaku Y, Nakamura K, Yamamoto Y, Yoshii M, Miyazaki A, Tsunemitsu H, Narita M Immunohistochemical distribution of viral antigens in pigs naturally infected with porcine teschovirus. J Vet Med Sci. 2008;70(3):305-8.

World Organization for Animal Health (OIE). Manual of diagnostic tests and vaccines for terrestrial animals [online]. Paris: OIE; 2008. Teschovirus encephalomyelitis. Available at: http://www.oie.int/eng/normes/mmanual/2008/pdf/2.08.10_TESCHOVIRUS_ENCEPH.pdf. Accessed 21 Jun 2009.

Zell R, Dauber M, Krumbholz A, Henke A, Birch-Hirschfeld E, Stelzner A, Prager D, Wurm R. Porcine teschoviruses comprise at least eleven distinct serotypes: molecular and evolutionary aspects. J Virol. 2001;75(4):1620-31.