

Aujeszky's Disease

Pseudorabies, Mad Itch

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the Center for
Food Security
& Public Health

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Importance

Aujeszky's disease (pseudorabies) is a highly contagious, economically significant disease of pigs. This viral infection causes central nervous system (CNS) signs and high mortality rates in young animals, and respiratory illness in older pigs. Other species may be infected when they come in contact with infected pigs, resulting in a universally fatal CNS disease. Aujeszky's disease can result in trade restrictions from regions where it is endemic. Eradication programs are underway or have been successful in many countries. In the United States, all states are now considered to be free of the virus in domesticated swine, and a surveillance program is ongoing. The presence of the virus in feral pigs remains a concern.

Etiology

Aujeszky's disease results from infection by Aujeszky's disease virus (ADV), also known as pseudorabies virus. This virus is a member of the genus *Varicellovirus*, subfamily *Alphaherpesvirinae* and family *Herpesviridae*. Only a single serotype is known; however, strain differences have been recognized using genetic assays, monoclonal antibody techniques and other methods. The ADV strains found in feral pigs in the United States appear to be attenuated, and usually result in subclinical infections if they are transmitted to domesticated swine.

Species Affected

Pigs are the natural host for Aujeszky's disease virus and the only animals to become latent carriers. However, the virus can infect nearly all domesticated and wild mammals including cattle, sheep, goats, cats and dogs. It does not infect humans or the tailless apes, and infections in horses are rare.

Geographic Distribution

Aujeszky's disease can be found in parts of Europe, Southeast Asia, and Central and South America including Mexico. The virus has also been reported from Cuba, Samoa and Rwanda. Until recently, Aujeszky's disease was endemic in the United States; however, a successful eradication campaign has eliminated the virus from domesticated swine. A surveillance program is now ongoing, and as of June 2007, all states are classified as status V (free). Aujeszky's disease virus remains present in feral pigs in the U.S., which is a concern for transmission to domesticated herds. Aujeszky's disease has also been eradicated from domesticated swine in a number of European countries, as well as Canada and New Zealand. Additional countries are conducting eradication programs.

Transmission

Aujeszky's disease virus is usually transmitted between pigs by the respiratory or oral routes. During acute infections, the virus is present for more than two weeks in the tonsillar epithelium, milk, urine, and vaginal and preputial secretions. Aujeszky's disease is usually spread directly between animals by nose-to-nose transmission; however, the virus can remain infectious for as long as seven hours in the air, if the relative humidity is at least 55%, and it may travel up to two kilometers as an aerosol. It can also be transmitted on fomites and in carcasses. Under favorable conditions, ADV can survive for several days in contaminated bedding and water. Venereal transmission is possible, and may be the most important method of spread in wild pigs. Piglets can be infected transplacentally.

Infected pigs can become latent carriers of ADV. The inactive virus is carried in the trigeminal ganglia in domesticated swine, and can become reactivated after stressors including transport, crowding, corticosteroid injections or farrowing. Latent virus has also been reported in the tonsils; however, it is uncertain whether the virus is truly latent at this site, or the tonsils are persistently infected at low levels. In feral swine, latent virus is found mainly in the sacral ganglia. Once the Aujeszky's disease virus has entered a herd or population, it continues to circulate indefinitely unless an eradication campaign is conducted.

Other animals usually become infected through close contact with infected pigs. Carnivores or omnivores have been infected after ingesting contaminated raw meat.

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Most species are dead-end hosts, but sheep and cattle may occasionally excrete some virus; rare lateral transmission has been reported in these species.

Incubation Period

The incubation period is usually 2 to 4 days in suckling pigs, and 3 to 6 days in weaned or adult pigs.

Clinical Signs

In pigs, the clinical signs vary with the age of the animal. In piglets less than a week old, fever, listlessness and anorexia are quickly followed by tremors, paddling, seizures or other symptoms of CNS involvement. Some piglets with hindleg paralysis may sit on their haunches in a "dog-like" position. Others may become recumbent and paddle, or walk in circles. Some piglets may die within hours with no symptoms. Mortality in this age group is very high; once neurologic signs develop, the animal usually dies within 24 to 36 hours. Similar signs occur in slightly older piglets, but the mortality rate is lower. Vomiting and respiratory signs have also been reported in the older age group.

In weaned pigs, Aujeszky's disease is mainly a respiratory illness, with symptoms of fever, anorexia, weight loss, coughing, sneezing, conjunctivitis and dyspnea. Respiratory disease may be complicated by secondary bacterial infections. CNS signs are occasionally seen. Weaned pigs tend to recover after 5 to 10 days. In adults, the infection is usually mild or inapparent, with respiratory symptoms predominating. However, some adult pigs may develop more severe respiratory signs that can progress to pneumonia. In sporadic cases, neurologic signs that vary in severity from mild muscle tremors to convulsions can occur. Pregnant sows may reabsorb infected fetuses, abort or give birth to weak, trembling neonates; affected litters can contain a mixture of normal piglets, stillborn piglets and weak piglets.

Infections in feral swine tend to be asymptomatic, as these animals appear to be infected with attenuated viruses and are typically infected as adults.

In cattle and sheep, Aujeszky's disease is almost always fatal within a few days. The first symptom is intense pruritis concentrated in a patch of skin; this is usually manifested as severe licking, rubbing or gnawing. Self-mutilation is common. Affected animals become progressively weaker, and eventually recumbent. Convulsions, bellowing, teeth grinding, cardiac irregularities and rapid, shallow breathing are common. The clinical signs are similar in dogs and cats, and a combination of neurologic signs, pharyngeal paralysis and profuse salivation may resemble rabies. Affected animals typically die within 1 to 2 days.

Post Mortem Lesions

In pigs, post-mortem lesions are often subtle, absent or difficult to find. Many pigs have serous or fibrinone-

crotic rhinitis, but this may be visible only if the head is split and the nasal cavity opened. Pulmonary edema, congestion or consolidation is sometimes found, and secondary bacterial pneumonia can result in more obvious gross lesions. The lymph nodes may be congested and contain small hemorrhages. Affected pigs may also have necrotic tonsillitis or pharyngitis, congested meninges, or necrotic placentitis. Necrotic foci can occur in the liver; this is particularly common in very young piglets.

Microscopic examination of the white and gray matter typically reveals nonsuppurative meningoencephalitis. Mononuclear perivascular cuffing and neuronal necrosis may be seen, and the meninges are usually thickened from mononuclear cell infiltration. Additional microscopic findings may include necrotic tonsillitis, bronchitis, bronchiolitis and alveolitis. Focal necrosis is common in the liver, spleen, adrenal glands and lymph nodes of affected fetuses.

In species other than pigs, the only lesions may be areas of edema, congestion and hemorrhage in the spinal cord. These lesions are usually found in the portion of the spinal cord that innervates the area of pruritis. Microscopically, there is cellular infiltration and neuronal degeneration. CNS lesions similar to those found in pigs, but milder, are often found.

Morbidity and Mortality

Aujeszky's disease is most common in pigs. In this species, up to 100% of the pigs in a herd may become infected. The mortality rate decreases with increasing age; it may be as low as 1 to 2% in grower and finisher pigs, 5-10% in weaner pigs, up to 50% (or higher) in nursery pigs, and as high as 100% in animals less than a week old. Approximately 20% or fewer sows abort. Feral swine tend to become infected with attenuated strains as adults, and neither illness nor deaths are usually seen. Sporadic cases occur in other species in close contact with pigs. In these species, Aujeszky's disease is always fatal.

Diagnosis

Clinical

Aujeszky's disease should be suspected in pig herds with high mortality and CNS symptoms in young piglets, and lower mortality and respiratory signs in older animals. In other species, it should be suspected when intense pruritis and CNS signs are present.

Differential diagnosis

In pigs, the differential diagnosis includes porcine polioencephalomyelitis, classical or African swine fever, hemagglutinating encephalomyelitis infection, streptococcal meningoencephalitis, swine influenza, erysipelas, Nipah virus infection, salt poisoning, hypoglycemia, poisoning by organic arsenic or mercury, and congenital tremor. Diseases that result in abortions may also be a consideration. In species other than pigs, rabies and scrapie must be considered.

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Laboratory tests

Aujeszky's disease can be diagnosed by virus isolation, detection of viral DNA or antigens, and serology. Aujeszky's disease virus can be isolated on a number of cell lines; porcine kidney (PK-15) cells are most often used. ADV can be identified in the cultures with immunofluorescence, immunoperoxidase or virus neutralization assays. Latent virus can be difficult to isolate. Alternatively, polymerase chain reaction (PCR) assays can identify viral DNA in secretions or organ samples. A fluorescent antibody test has been used to detect viral antigens in tissue samples and nasal swabs.

Serologic tests for Aujeszky's disease include virus neutralization, latex agglutination and enzyme-linked immunosorbent assays (ELISAs). ELISAs and virus neutralization are the prescribed tests for international trade. ELISAs can distinguish vaccinated from infected pigs, if gene-deleted vaccines are used. Serology may not be helpful in species other than pigs; these animals often die before mounting an antibody response.

Samples to collect

In live pigs, nasal swabs should be taken for virus isolation. ADV can also be isolated from oropharyngeal fluid or biopsies of the tonsils. The brain and tonsil are the preferred organs for virus isolation from pigs at necropsy. In addition, the virus can sometimes be found in other tissues including the lung, spleen, liver, kidney, lymph nodes and pharyngeal mucosa. Aujeszky's disease virus is difficult to find in latently infected pigs; virus isolation is most likely to be successful from the trigeminal ganglion in domesticated pigs and the sacral ganglia in feral pigs.

In species other than pigs, the section of the spinal cord that innervated the pruritic area should be collected. The pruritic area of the skin, together with the subcutaneous tissues, should also be submitted. Samples for virus isolation should be sent to the laboratory under cold conditions.

Serum should be collected for serology. Serologic tests for Aujeszky's disease screening can also be performed on meat juice.

Recommended actions if Aujeszky's disease is suspected

Notification of authorities

Aujeszky's disease should be reported immediately to state or federal authorities upon diagnosis or suspicion of the disease.

Federal: Area Veterinarians in Charge (AVIC):
http://www.aphis.usda.gov/animal_health/area_offices.htm
State Veterinarians:
<http://www.aphis.usda.gov/vs/sregs/official.html>

Control

Aujeszky's disease is usually introduced into a herd when it is exposed to infected pigs. Protective measures in an endemic region include isolation and testing of new breeding animals, and biosecurity measures to prevent entry on contaminated fomites, people and roaming animals including rodents and birds. In addition, domesticated herds must be kept separate from feral swine. One study suggests that the virus carried in feral swine is mainly spread by venereal transmission, and measures such as a "double fence" may be sufficient to protect a herd from this source. Vaccination can also aid in disease control. The currently available vaccines protect pigs from clinical signs and decrease virus shedding, but do not provide sterile immunity or prevent latent infections. Attenuated, inactivated and gene-deleted marker vaccines are available; the gene-deleted vaccines allow vaccinated pigs to be distinguished from pigs infected with field viruses. DNA vaccines are in development.

Disinfection is important in controlling the spread of Aujeszky's disease. ADV is susceptible to orthophenylphenols and quaternary ammonium compounds. It is also inactivated by sunlight, drying, and high temperatures.

Aujeszky's disease can be controlled in a region by quarantine of infected herds, vaccination and the removal of latently infected animals. Strategies to eradicate the disease from a herd include test and removal, offspring segregation, and depopulation. In the test and removal strategy, the breeding herd is tested monthly, with the removal of animals that test positive. This technique works best when there is a relatively low prevalence of infection in the herd. It can also be combined with vaccination. One difficulty with the test and removal strategy is that it may be difficult to detect latently infected animals. In the offspring segregation technique, the breeding herd is vaccinated, and young weaned piglets are removed and raised to adulthood at another site. These pigs are tested periodically, and any positive animals are removed. The original herd is eventually depopulated and replaced with Aujeszky's disease-free animals. Depopulation and repopulation is the most drastic technique. The premises are cleaned, disinfected and left empty of pigs for 30 days.

Public Health

The symptoms of Aujeszky's disease have not been seen in humans. Seroconversion does occur.

Internet Resources

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>
United States Animal Health Association.
Foreign Animal Diseases
http://www.vet.uga.edu/vpp/gray_book02/fad/index.pdf

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United States Department of Agriculture (USDA)
Pseudorabies Eradication Program
<http://www.aphis.usda.gov/vs/nahps/pseudorabies/index.htm>

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

OIE Manual of Diagnostic Tests and Vaccines for
Terrestrial Animals
http://www.oie.int/eng/normes/mmanual/a_summry.htm

OIE Terrestrial Animal Health Code
http://www.oie.int/eng/normes/mcode/A_summry.htm

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* Link defunct as of 2006