

Highly Pathogenic Avian Influenza

Fowl Plague

Importance

Highly pathogenic avian influenza (HPAI) is a serious and often fatal infection in birds. An epidemic in poultry can cause significant economic damage. A 1983 outbreak in the northeastern United States resulted in losses of nearly \$65 million, the destruction of more than 17 million birds, and a 30% increase in retail egg prices. Complete eradication from a country appears unlikely; the causative viruses can spread to poultry from migratory waterfowl and other wild birds.

Etiology

Avian influenza results from infection by type A influenza viruses (family Orthomyxoviridae). Numerous avian influenza viruses exist, but only viruses that meet specific virulence requirements in the laboratory are designated highly pathogenic avian influenza. Two surface antigens, hemagglutinin (H) and neuraminidase (N), are used to classify the viruses into serotypes. Most of the isolates in recent outbreaks have been H5 or H7 viruses.

Species affected

Most birds are susceptible to avian influenza viruses, but the specific host range varies with the isolate. Infections have been seen in chickens, turkeys, pheasants, quail, ducks, geese, and guinea fowl. In some outbreaks, a virus may affect only one species of birds present on a farm. Avian influenza viruses can also be isolated from apparently healthy migratory waterfowl, sea birds, shore birds, imported pet birds, and ratites.

Geographic distribution

Highly pathogenic avian influenza viruses can be found worldwide. Recent outbreaks have occurred in Australia, England, Ireland, Scotland, Pakistan, South Africa, Mexico, and the United States.

Transmission

Avian influenza viruses appear to spread to poultry from migratory waterfowl. The feces and respiratory secretions contain large amounts of virus, which can infect a new host through the conjunctiva or respiratory tract. Avian influenza virus can spread by aerosols when birds are in close proximity, and might also be transmitted through shared drinking water. The virus appears to be present in eggs laid by infected hens; however, if embryos become infected, they would be unlikely to survive and hatch.

Fomites and infected birds can transmit the disease between flocks. In one outbreak in Pennsylvania, the virus may have been spread by garbage flies.

Incubation period

The incubation period is 3 to 7 days.

Clinical signs

The clinical signs of highly pathogenic avian influenza include marked depression with ruffled feathers, excessive thirst, inappetence, and watery diarrhea that progresses from bright green to white. In some cases, sudden death may be seen with few clinical signs.

In mature chickens, the combs are often swollen and may be cyanotic at the tip or contain ecchymoses and necrotic foci. The wattles are often swollen and may be cyanotic. Congestion, swelling, or hemorrhages can be seen on the conjunctivae, edema may occur around the eyes and on the neck, and the legs may have diffuse areas of hemorrhage. Coughing, sneezing, and nasal discharge may also be seen. Egg production in hens stops; the last eggs laid often have no shells. Death is common, but severely affected hens occasionally recover.

In broilers, the clinical signs may include severe depression, inappetence, facial and neck edema, neurologic signs including torticollis and ataxia, and death.

Similar symptoms are seen in turkeys, domestic ducks, and geese. In turkeys, the course of the disease is usually 2 to 3 days longer than in chickens. Swollen sinuses are seen occasionally in turkeys and frequently in ducks and geese.

Post mortem lesions

During necropsy, excessive fluid can flow from the nares and oral cavity. Subcutaneous edema may be present on the head and neck, and petechial hemorrhages may be found on the inside of the keel. The conjunctivae can be severely congested and may contain petechiae. Very small petechiae are sometimes found on the abdominal fat, serosal surfaces, and peritoneum; the pattern may resemble a splattering of red paint. The mucosa of the proventriculus, gizzard, and intestines may contain hemorrhages. The kidneys are often severely congested and occasionally plugged with white urate deposits. Either hemorrhagic tracheitis or a normal trachea with excessive mucus may be seen. In laying hens, the ovary can be hemorrhagic or degenerated with necrotic foci, the peritoneal cavity may contain yolk, and there may be severe airsacculitis and peritonitis. In young birds and birds with peracute disease, the only significant lesions may be dehydration and severe congestion of the muscles.

The post-mortem lesions in domestic turkeys and ducks are similar to those in chickens but may not be as severe.

Morbidity and Mortality

Morbidity and mortality often approach 100%. Any survivors are usually in poor condition and do not begin laying again for several weeks.

A vaccine for the H5 serotype has recently been licensed.

Diagnosis

Clinical

Highly pathogenic avian influenza should be suspected when severe depression, inappetence, and a drastic drop in egg production are followed by sudden deaths in the flock. Facial edema, swollen and cyanotic combs and wattles, and petechial hemorrhages on the internal organs support this diagnosis.

Differential diagnosis

The differential diagnosis includes velogenic viscerotropic Newcastle disease (VVND), infectious laryngotracheitis, and acute bacterial diseases including fowl cholera and *Escherichia coli* infections.

Laboratory tests

Avian influenza is usually diagnosed by virus isolation in embryonated fowl eggs. The presence of virus can be confirmed by agar gel immunodiffusion (AGID) tests, enzyme-linked immunosorbent assays (ELISAs), or reverse-transcription polymerase chain reaction (RT-PCR) tests. The isolate is subtyped with antisera against the hemagglutinin and neuraminidase antigens. Highly pathogenic strains are identified by their lethality in susceptible chickens and molecular considerations.

Serology can also be helpful in diagnosis. ELISA and AGID tests are available. However, not all species of birds make precipitating antibodies. Hemagglutination inhibition tests are also used, but are subtype specific and may miss some infections.

Samples to collect

Before collecting or sending any samples from animals with a suspected foreign animal disease, contact the AVIC. These samples should only be sent under secure conditions, by authorized personnel, and to authorized laboratories to prevent the spread of disease. Some isolates of the avian influenza virus may be zoonotic; samples should be collected and handled with all appropriate precautions.

For virus isolation from live birds, tracheal and cloacal swabs should be collected. If this is not feasible, samples of fresh feces may also yield virus. Oronasal and cloacal swabs or intestinal contents should be taken from dead birds. The trachea, spleen, lung, air sac, kidney, liver, heart, intestines, and brain may also be sampled. Samples should be taken from several birds, as many may not yield virus.

For transport to the laboratory, the swabs should be placed in phosphate buffered saline with antibiotics. With large numbers of samples, the cloacal swabs from up to five birds may be pooled in one tube of broth. Alternatively, samples of tissues (approximately 0.5 cm³ each) can be collected and placed into the virus transport medium. The samples should be sent to the laboratory on wet ice. If shipment will be delayed for more than 24 hours, the specimens should be quick-frozen and not allowed to thaw during shipment. Blood should also be taken from several birds for serology.

Recommended actions if highly pathogenic avian influenza is suspected

Notification of authorities

Highly pathogenic avian influenza must be reported promptly to state or federal authorities upon diagnosis or suspicion of the disease. Federal: Area Veterinarians in Charge (AVICS) http://www.aphis.usda.gov/vs/area_offices.htm

State vets: <http://www.aphis.usda.gov/vs/sregs/official.html>

Quarantine and Disinfection

To control an outbreak of highly pathogenic avian influenza, the premises must be thoroughly cleaned and disinfected. Insects and mice on the premises should be eliminated, then the flock depopulated and the carcasses destroyed by burying, composting, or rendering. Once the birds have been killed, the manure and feed should be removed down to a bare concrete floor. If the floor is earthen, one inch or more of soil should also be removed. The manure can be buried at least 5 feet deep. It may also be composted for 90 days or longer, depending on the environmental conditions. The compost should be tightly covered with black polyethylene sheets to prevent entry of birds, insects, and rodents. Feathers can be burned; alternatively, they may be removed and the area wet down with disinfectant.

High-pressure spray equipment should be used to clean all equipment and building surfaces. Once all surfaces are clean and free of all organic material, the entire premises should be sprayed with an approved residual disinfectant. Cresylic or phenolic disinfectants are usually effective.

Public health

Avian influenza viruses were once thought to be nonpathogenic for humans; however, in 1997, six people died and 18 were infected with a H5 avian influenza virus in Hong Kong. Prior to this outbreak, only a single human infection with a H7 avian influenza virus had been reported.

Avian influenza viruses may also be involved in the production of new mammalian strains of influenza virus through genetic reassortment.

For More Information

World Organization for Animal Health (OIE)

<http://www.oie.int>

OIE Manual of Standards

http://www.oie.int/eng/normes/mmanual/a_summry.htm

OIE International Animal Health Code

http://www.oie.int/eng/normes/mcode/A_summry.htm

USAHA Foreign Animal Diseases book

http://www.vet.uga.edu/vpp/gray_book/FAD/

References

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"Highly Pathogenic Avian Influenza." In *Manual of Standards for Diagnostic Tests and Vaccines*. Paris: World Organization for Animal Health, 2000, pp.212-220.

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<<http://www.aphis.usda.gov/oa/pubs/avianflu.html>>.

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