

Egg Drop Syndrome

*Egg Drop Syndrome 1976,
Duck Adenovirus A Infection,
Duck Adenovirus 1 Infection,
Adenovirus 127 Infection*

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**Institute for International
Cooperation in Animal Biologies**
*An OIE Collaborating Center
Iowa State University
College of Veterinary Medicine*



IOWA STATE UNIVERSITY®

**Center for Food
Security and Public Health**
College of Veterinary Medicine
Iowa State University
Ames, Iowa 50011
Phone: (515) 294-7189
FAX: (515) 294-8259
E-mail: cfsph@iastate.edu
Web: <http://www.cfsph.iastate.edu>

Importance

Egg drop syndrome, a viral disease of chickens and quail, is characterized by a decrease in egg production accompanied by a reduction in egg quality. This disease is primarily of economic importance, as the birds do not become ill.

Egg drop syndrome was first described in chickens in the 1970s. The causative virus, duck adenovirus A, has its reservoir in ducks and geese. The initial outbreak in chickens was probably caused by a contaminated Marek's disease vaccine grown in duck embryo fibroblasts. This virus infected breeding flocks and spread to other flocks through infected eggs. Although it was eradicated from most commercial breeders, duck adenovirus A became endemic in chickens in many parts of the world. Rare outbreaks of egg drop syndrome are also caused by virus transmission from ducks and geese, either directly or through contaminated water.

Until recently, duck adenovirus A was thought to be avirulent in ducks and geese. However, in 2001, this virus was isolated from an outbreak of respiratory disease in young goslings, and the disease was reproduced by experimental infection of 1-day old birds.

Etiology

Egg drop syndrome is caused by duck adenovirus A, a member of the genus *Atadenovirus* and family *Adenoviridae*. This virus has also been known as duck adenovirus 1 (DAdV-1) egg drop syndrome (EDS) virus, egg-drop-syndrome-76 (EDS-76) virus and adenovirus 127.

Species affected

Ducks and geese appear to be the natural hosts for duck adenovirus A. This virus has also been isolated from coots and grebes, and antibodies have been found in many avian species including gulls, owls, storks, swans, guinea fowl, and pigeons. Clinical disease has been reported in chickens, quail, and geese. Turkeys can be infected experimentally but remain asymptomatic.

Geographic distribution

Duck adenovirus A can be found worldwide in ducks and geese. Egg drop syndrome occurs in Europe, Asia, Africa, and Latin America, but has not been seen in the U.S. or Canada. Respiratory disease in goslings has been reported only from Hungary.

Transmission

Duck adenovirus A can be transmitted vertically in eggs; both the interior and the exterior of the egg contain virus. Chicks hatched from infected eggs may excrete the virus immediately. More often, the virus remains latent until the bird becomes sexually mature; it is then excreted in both eggs and droppings.

In egg drop syndrome, horizontal transmission is thought to be mainly by the oral route; however, respiratory disease in goslings was reproduced by intratracheal administration of the virus. Duck adenovirus A can also be spread on/in fomites including water. Some outbreaks have been attributed to contact with wild birds or water contaminated by feces from wild birds. Iatrogenic transmission is possible by needles. Transmission via insects is possible but unproven.

Incubation period

The incubation period for egg drop syndrome is highly variable. Mature, experimentally infected, Rhode Island Red hens produced abnormal eggs from 10 to 24 days post-inoculation. Birds infected vertically can remain asymptomatic until they begin laying eggs. In experimentally infected goslings, the incubation period for respiratory disease is 3 to 4 days.

Clinical signs

Egg drop syndrome has been reported in chickens and quail. The major symptoms are a variable decrease in egg production and the production of abnormal eggs.

In naive flocks, the first symptom is usually a loss of color in pigmented eggs, followed by thin-shelled, soft-shelled, and shell-less eggs. The shells may also be rough or "chalky." Shell-less eggs are not always found, as they may be eaten by the birds. Egg

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production usually drops 10% to 40%; however, eggs that are suitable for hatching/ setting remain fertile and hatch as usual. Although transient diarrhea and dullness may be seen before the eggshell changes occur, infected birds generally remain healthy.

Flocks with some pre-existing immunity usually experience a series of small disease episodes, with minimal symptoms. The overall effect is a small drop in production or a failure to achieve predicted production targets.

Until recently, geese were thought to be asymptomatic. However, in 2001, a severe acute respiratory disease associated with duck adenovirus A was reported in naturally infected goslings in Hungary. The disease affected goslings between 4 and 20 days of age. The symptoms included anorexia, depression, sneezing, coughing, dyspnea, and rales. This disease could be reproduced by intratracheal administration of duck adenovirus A to 1-day-old goslings without pre-existing antibodies. As of January 2006, this disease has not been reported in ducks.

Post mortem lesions

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In egg drop syndrome, the lesions are minimal and are confined to the reproductive tract of hens. In these birds, there may be inactive ovaries, atrophy of the oviducts, and edema and white exudates in the uterus (shell gland). Laid eggs may be paler than normal, rough, thin-shelled, soft-shelled, or shell-less.

Histopathologic changes can be seen in the oviduct and uterus (shell gland). There may be severe degeneration and desquamation of the epithelial cells, atrophy of the uterine glands, and infiltration of heterophils, lymphocytes, and plasmacytes. Intranuclear inclusion bodies may be found in the epithelial cells of the uterus, isthmus, and vaginal gland region.

Respiratory disease in goslings

In a flock of naturally infected goslings, the most obvious lesion was a plug of gelatinous to firm, white, opaque material in the trachea. Edema and slight congestion were seen in the trachea and lungs. Other reported lesions include ecchymoses on the epicardium and mottling in the liver. Acute tracheo-bronchitis and circumscribed catarrhal pneumonia were described in experimentally infected birds.

Histopathologic abnormalities included fibrin and cellular debris in the tracheal and bronchial lumina; the epithelium was hyperplastic and metaplastic. The superficial cells contained swollen nuclei with amphophilic inclusion bodies. The lungs were congested and contained lympho-histiocytic and heterophil granulocytic infiltration in the septae and in the lumina of the small air spaces. No significant lesions were seen in other tissues.

Morbidity and Mortality

Outbreaks of egg drop syndrome usually last 4 to 10 weeks. A 10% to 40% drop in egg production can be expected in naive chicken flocks; in flocks with some immunity,

the decrease may be as little as 2% to 4%. In two outbreaks in quail, the decrease in egg production was 10% and 50%. Deaths are not expected in either species.

Respiratory disease has been reported in 4 to 20 day old domesticated geese. This disease was seen only in very young birds from a naive flock; its rarity may be explained by the high prevalence of antibodies in goose populations and the presence of maternal antibodies in young birds during the period of susceptibility. In goslings with respiratory disease, the mortality rate was 5% to 7%.

Diagnosis

Clinical

Poor eggshell quality and a decrease in egg production, in an otherwise healthy flock, are strongly suggestive of egg drop syndrome. This disease can also manifest as a small decrease in egg yields or a failure to reach expected production levels. Respiratory disease caused by duck adenovirus A may be suspected in young goslings from naive flocks.

Differential diagnosis

Nutrition and other management factors should be considered in the differential diagnosis for egg drop syndrome. Decreased production and poor shell quality can also occur with diseases such as infectious bronchitis, Newcastle disease or avian influenza; however, birds with these diseases usually become ill. The differential diagnosis for respiratory disease in geese includes numerous other viral, bacterial, and fungal diseases.

Laboratory tests

Duck adenovirus A can be isolated in embryonated duck or goose eggs, and in cell cultures. Susceptible cell lines include duck and chick embryo liver, duck kidney, and fibroblast cells. The virus may be isolated directly from the reproductive tract of affected hens. Alternatively, abnormal eggs may be fed to naive hens; virus isolation is attempted from the shell gland of these hens when they produce abnormal eggs.

Viral antigens can be detected with polymerase chain reaction (PCR) or antigen-capture (enzyme-linked immunosorbent assay (ELISA) techniques. Immunofluorescence has been used in some studies.

Serologic tests include hemagglutination inhibition using fowl RBC, ELISA, and serum neutralization. The double immunodiffusion test has also been used.

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.

Reproductive tissues including the uterus (shell gland) should be collected from affected hens. Abnormal eggs should also be submitted. Paired serum samples can be collected for serology.

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In goslings with respiratory disease, the virus could be found in the lungs, trachea, liver, and intestines.

Recommended actions if egg drop syndrome is suspected

Notification of authorities

Egg drop syndrome should be reported immediately to state or federal authorities upon diagnosis or suspicion of the disease.

Quarantine and disinfection

Quarantine and disinfection are necessary, as duck adenovirus A is contagious by either direct or indirect contact. This virus can also be transmitted vertically; both the interior and the exterior of the egg contain virus.

Adenoviruses are resistant to many commonly used disinfectants. They are also relatively tolerant of heat and pH changes. Iodophor and aldehyde disinfectants can be effective if they are allowed to contact the virus for prolonged periods. Potentially contaminated water should be chlorinated before use. Composting infected chicken carcasses for 20 days completely inactivates the virus.

Inactivated vaccines are available. These vaccines decrease virus shedding but do not prevent infection.

Public health

There are no reports of human infections or disease.

Internet Resources

- IVTV Universal Virus Database
<http://www.ncbi.nlm.nih.gov/ICTVdb/ICTVdb>
- International Veterinary Information Service (IVIS)
<http://www.ivis.org>
- The Merck Veterinary Manual
<http://www.merckvetmanual.com/mvm/index.jsp>

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