



Aspergillosis in poultry

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Few fungal species are common pathogens in avian species, and *Aspergillus* is by far the most common mycosis of poultry.

Mycoses are relatively uncommon diseases in poultry but are often devastating to the host supporting the fungal infection. The ability of fungi to infect animals is incidental to their maintenance. Propagation and dissemination occur because of their saprobic lifestyle; infection is a dead end, except for dermatophytoses, because mycoses are not contagious.

Aspergillosis is by far the most commonly encountered mycosis of birds and is an economically important respiratory disease of poultry. Other fungal infections in poultry include candidiasis (fungal crop) infection of the digestive tract as well as dermatophytoses, which affects the integument and is the only contagious and zoonotic mycosis.

Introduction

Aspergillosis is defined as a disease caused by infection with the genus *Aspergillus*, which is composed of approximately 600 species. Manifestations of aspergillosis depend on the organ system involved and whether the infection is localized or disseminated.

Aspergillosis in birds usually presents as an infection of the lower pulmonary system with florid lesions in the lungs and air sacs. In young poultry, the disease is referred to as brooder pneumonia. Other synonyms include fungal or mycotic pneumonia, pneumomycosis, bronchomycosis, and "asper."

Less common manifestations relate to infections of the eye, brain, skin, joints, and viscera.

Aspergillosis is not a zoonotic or contagious disease; however, severely immunocompromised individuals are at risk for developing opportunistic infections, including aspergillosis.

Etiology and epidemiology

Aspergillus fumigatus is the most common cause of aspergillosis. However, several other mould species may be incriminated, such as *A. flavus*, *A. brasiliensis*, *Rhizopus* spp., *Mucor* spp., and on rare occasions, *Penicillium* spp.

High mortality rates can be seen in chicks that inhale large numbers of spores during hatching or when placed on bedding contaminated with mould spores. In older birds, infection is caused primarily by inhalation of spore-laden dust from contaminated litter, feed, or dusty range areas. In facilities with reoccurring infections, the air handling system(s) should also be investigated as a source of contamination.

When investigating an outbreak of Aspergillosis in chicks, it is important to establish if the chicks were exposed to the fungi/spores at the hatchery or on the farm or both. Infection acquired from the chick transport truck (especially the ventilation system) is less likely but must be ruled out.

Clinical findings and lesions

The most common symptoms of aspergillosis include dyspnea, tachypnea, gasping, fever, inappetence and emaciation.



Gasping is a common symptom in aspergillosis cases.

A neurological form with clinical signs that include torticollis and tremors can be present but is less common than the respiratory form. The lungs and air sacs are most frequently involved in chickens and turkeys.

Pulmonary lesions are commonly characterized by white to yellow plaques and nodules a few millimeters to several centimeters in diameter. In rare cases, birds may present with diffuse pulmonary congestion only. Occasionally, mycelial masses may be seen within the air passages on gross examination.

Common histopathologic lesions include granulomatous pneumonia, intralesional fungal hyphae, and heterophilic infiltrates.

In addition, plaques and nodules also may be found in the trachea, syrinx, liver, intestines, and occasionally the brain.

Morbidity can be underestimated in finishing flocks until processing, when airsacculitis can cause postmortem condemnation in poultry intended for the food supply.

An ocular form is seen in chickens and turkeys as mycotic keratitis, in which large plaques may be expressed from the medial canthus.

Morbidity and mortality

Aspergillosis is characterized by high morbidity and mortality in chicks and low morbidity and mortality in mature poultry. Morbidity can be underestimated in finishing flocks until slaughter inspection reveals pulmonary lesions. Mortality can be especially high (30-40% by day 10) in flocks exposed to high fungal counts through the bedding at chick placement.

Post-mortem and histopathological lesions

The lesions of uncomplicated pulmonary aspergillosis evolve over several days and diminish in a few weeks. Pulmonary lesions are commonly characterized by white to yellow plaques and nodules a few millimeters to several centimeters in diameter. In rare cases, birds may present with diffuse pulmonary congestion only.



*Fungal plaques in the air sacs and lungs of a broiler chick infected with *Aspergillus*.*

Ascites is a frequent sequela to pulmonary aspergillosis.

In advanced cases, the organism can sporulate on the surface of caseous lesions and the walls of the air sacs, resulting in greenish-grey mould growth.

Occasionally, mycelial masses may be seen within the air passages on gross examination. Localized tracheal aspergillosis with caseous fungal plaques obstructing the syrinx may also occur.

Lesions in the brain tissue are usually visible on the surface of the brain, affecting the cerebrum, cerebellum or both.

Common histopathologic lesions include granulomatous pneumonia, intralesional fungal hyphae, and heterophilic infiltrates. In addition, plaques and nodules also may be found in the trachea, syrinx, liver, intestines, and occasionally the brain.

An ocular form is sometimes seen in chickens as mycotic keratitis, in which large plaques may be expressed from the medial canthus.

Diagnosis

Diagnosis of aspergillosis is most frequently based on the clinical presentation of infected birds as well as the gross lesions. The presence of mould in the affected organs, as demonstrated by culture, may be used for confirmation, together with microscopic examination of fixed tissue. Samples can be taken by excising affected tissue, taking swabs of lesions, or plaques can be teased apart.

For culture, the sample should be placed on a media that supports fungal growth, such as Sabouraud-Dextrose agar or Rose-Bengal Chloramphenicol agar.

Histopathologic examination using a special fungal stain reveals granulomas containing mycelia.

Serological tests are of limited value due to the nonspecific nature of the organisms and is therefore not used.

Differential diagnoses include:

- Infectious Bronchitis Virus (IBV)
- Newcastle Disease (NCD)
- mycobacteriosis
- colibacillosis
- other mycoses (e.g., ochroconosis, zygomycosis)
- oncogenic tumours (e.g., Marek's Disease, Avian Leukosis)
- nutritional encephalomalacia
- gasping secondary to live respiratory vaccine reaction



Ocular aspergillosis



Mycotic encephalitis

Immunity

Evidence for immunity against aspergillosis in poultry is lacking; however, research done in turkeys experimentally infected with *A. fumigatus* has shown that they recover from the lesions of pulmonary aspergillosis in 4—5 weeks if not re-exposed to the agent.

No vaccine is available to vaccinate birds against *Aspergillus*, and natural recovery from aspergillosis does not appear to confer protection.

Treatment

Treatment against aspergillosis in poultry flocks is largely ineffective, and all efforts should focus on preventing exposure to contaminated materials and environments.

Although certain drugs have been used for the treatment of mammalian aspergillosis, they are mostly not cost-effective for poultry.

Spontaneous recovery can occur if re-exposure to the mould is prevented.

Mitigation strategies can include:

- removing the birds from the contaminated environment;
- removal of contaminated material(s) to limit further exposure;
- trying not to disturb the contaminated material(s) to limit further aerosolization of spores; and
- increased ventilation or air exchange rates to minimize the severity of the outbreak possibly.

Strict adherence to cleaning and disinfection procedures for any contaminated environment (e.g., hatchery, barn, etc.) will minimize the risk of future outbreaks.

Prevention

Prevention is the preferred means of control. Two critical areas of control are the hatchery environment as well as the poultry house, specifically the bedding. Due to the incubation temperatures of hatcheries (approximately 37°C), limited airflow and substrate in the form of chick fluff, hatcheries present the ideal environment for fungi to proliferate.

Hence hatcheries must follow a comprehensive anti-fungal disinfection program, including frequent fogging with products containing an anti-fungal such as miconazole, enilconazole, imazalil, etc., and should be done at least once weekly in all areas of the hatchery (egg room, pre-heating room, setters, hatchers, plenums, passages, take-off room, air ducts etc.).

Grossly contaminated or cracked eggs should not be set for incubation because they enable bacterial and fungal growth. Affected eggs may explode and disseminate spores throughout the hatching machine.

Hatchery surveillance is most commonly done through testing of fluff from chicks taken prior to hatching. Due to the ubiquitous nature of yeasts and moulds, an acceptable upper limit (for example, 500 CFU per gram of fluff) must be established. Testing the environment through fungal air exposure plates can also be done in addition to fluff testing. Nest box hygiene on breeder farms must also be excellent, removing dropping and frequently replacing shavings as needed. Nest box shavings should be treated with a disinfectant. Floor eggs should not be incubated but sold or discarded.

If exposure to *Aspergillus* did not occur at the hatchery, another likely source is on-farm exposure to fungi in the bedding after chicks were placed. Measures should be aimed at preventing this by buying bedding (for example, shavings, straw, sunflower or rice husks) from reputable suppliers who follow best practices in preventing mould contamination. These include not letting bedding get wet prior to placement on the farm, using wood with a low moisture content and using well-insulated packaging to prevent the product from getting wet. A bedding supplier to poultry farms should follow a continuous surveillance program by frequently testing bedding for yeasts and moulds at a laboratory.

References

1. Diseases of Poultry. Swayne, *D et al.* 14th Edition. 2019
2. MSD Vet Manual. Aspergillosis in poultry. Kromm, M et al. 2020

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MULTIPLE-CHOICE QUESTIONS

QUESTION 1

Which one of these is not one of the five kingdoms of life?

- a) Plants
- b) Animals
- c) Fungi
- d) Insects
- e) Protista

QUESTION 2

The most common fungal infection of poultry is:

- a) *Candida*
- b) Dermatophytoses
- c) *Aspergillus*
- d) *Rhizopus*
- e) *Mucor*

QUESTION 3

Which statement is true?

- a) Neurological involvement is common in *Aspergillus* infections
- b) Chicks are more susceptible to *Aspergillus* than adult birds
- c) Treatment of birds against *Aspergillus* has a high success rate
- d) None of the above
- e) All of the above

QUESTION 4

Which is not a common symptom of *Aspergillosis* in poultry?

- a) Gasping
- b) Tachypnoea
- c) Dyspnea
- d) Emaciation
- e) Septic arthritis

QUESTION 5

Which statement is true:

- a) Gasping is pathognomic for *Aspergillosis* in poultry
- b) Infectious Coryza is a differential diagnosis for *Aspergillosis*
- c) *Aspergillus* is a zoonosis
- d) All of the above
- e) None of the above

QUESTION 6

Chicks are commonly exposed to *Aspergillus* through:

- a) The hatchery environment
- b) Direct contact with rodents
- c) Bedding
- d) a and b
- e) a and c

QUESTION 7

Diagnosis of *aspergillosis* is most commonly done through:

- a) ELISA test
- b) PCR test
- c) Symptoms and gross lesions
- d) Gel electrophoresis
- e) RSPA test

QUESTION 8

Which statement is true?

- a) *Aspergillus flavus* is the most common source of *aspergillosis* in poultry
- b) Bird-to-bird transmission is an important source of the spread of *Aspergillus*
- c) Dry bedding presents a bigger fungal risk to birds than moist bedding
- d) All of the above
- e) None of the above

QUESTION 9

The most important species of *Aspergillus* in poultry is:

- a) *A. fumigatus*
- b) *A. flavus*
- c) *A. brasiliensis*
- d) *A. terreus*
- e) *A. nidulans*

QUESTION 10

Which statement is true?

- a) Fungi are ubiquitous organisms
- b) Prevention is the preferred means of *Aspergillus* control
- c) Ascites may be seen secondary to *Aspergillosis* in poultry
- d) b and c
- e) a, b and c



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