ADENOVIRUSES

BASICS

DEFINITION

Adenoviruses are double-stranded nonenveloped DNA viruses that are known to infect and cause disease in passerine birds, Psittacines, Columbiformes, Falconiformes, Strigiformes, and gallinaceous birds.

PATHOPHYSIOLOGY

Wide range of virulence; even within the same serotype. Subclinical infections are the most common, where birds remain latent and become persistent shedders for life. Outbreaks can result in considerable morbidity and mortality. Overall, younger and immunocompromised birds tend to have more severe infections. Concurrent diseases are common. Poor hygiene and high stocking densities may play a role in mortality. Cellular damage is caused by virus replication and viral structural proteins that are thought to be cellularly toxic.

SYSTEMS AFFECTED

Gastrointestinal: Falcons, finches, hawks, owls, pigeons, psittacine birds, turkeys.
Hemic/lymphatic/immune: Falcons, finches, pheasants, pigeon, psittacine birds, owls, pigeon, turkeys.
Hepatobiliary (necrosis): Pigeons, psittacine birds, falcons, hawks, owls.
Renal/urologic: Finches, pigeons, psittacine birds.
Reproductive: Chickens (egg drop syndrome).
Respiratory: Pheasants.
Respiratory: Quail.

GENETICS

Many outbreaks of adenoviruses in mixed collections of birds are likely caused by cross-species infection. At least one falcon adenovirus is believed to subclinically infect peregrine falcons and is more likely to cause disease in other species. The adenoviruses causing marble spleen disease in pheasants and hemorrhagic enteritis in turkeys are asymptomatically carried by waterfowl.

INCIDENCE/PREVALENCE

Falcons: Rare outbreaks have been described. Prevalence of infection in peregrine falcons may be high.
Hawks and owls: Two outbreaks have been described. Prevalence is unknown.
Pigeons: Outbreaks occur sporadically, prevalence is unknown, but subclinical infections are likely to be common.
Psittacine birds: Prevalence is variable. There have been extensive outbreaks in budgerigars and lovebirds. Individual infections and outbreaks in other psittacine birds are sporadic.
Chickens: Prevalence is variable, but can be high.
Turkeys: Prevalence is variable, but can be high.
Pheasants: Prevalence is variable.
Quail: High prevalence of infection.

GEOGRAPHIC DISTRIBUTION

Finches: Described in North America.
Falcons: Described in North America.
Hawks and owls: Described in the United Kingdom.
Pigeons: Worldwide.
Psittacine birds: Outbreaks have occurred on multiple continents, not all adenoviruses have been adequately characterised. The distribution of each adenovirus therefore is not fully known.
Chickens: Worldwide, but not in North America.
Turkeys: Worldwide.
Pheasants: Worldwide.
Quail: Worldwide.

SIGNALMENT

Finches: Adult finches, multiple species, both sexes.
Falcons: Nestling northern aplomado falcon, peregrine falcon, Taita falcon, orange-breasted falcon, adult American kestrel, both sexes.
Hawks and owls: Harris hawk, Bengal eagle owl, Verreaux's eagle owl, both sexes various ages.
Pigeons: Less than 1 year old, both sexes.
Psittacine birds: Most common in budgerigars, lovebirds, Senegal parrots and related species; occurs sporadically in other parrot species.
Chickens: Laying hens.
Turkeys: Growing birds of both sexes 6–12 weeks old.
Pheasants: 3–8 months old, both sexes.
Quail: 1–6 weeks old, both sexes.

SIGNS

Historical Findings

Finches: Unexpected deaths in a flock.
Falcons: Death after a short duration of non-specific signs.
Hawks and owls: Death without premonitory signs or a short duration of non-specific signs.
Pigeons: Type 1: Vomiting, watery diarrhea and depression, rapid spread through the loft, increased mortality; type 2: Multiple unexpected deaths.
Psittacine birds: Unexpected mortality in nestling parrots.
Chickens: Sudden drop in egg production, abnormally colored eggs, shell-less eggs.
Turkeys: Sudden onset of hemorrhagic enteritis and depression.
Pheasants: Dyspnea and death.
Quail: Sudden and dramatic increase in mortality, nonspecific signs of illness, increased respiratory effort and increased respiratory sounds.

Physical Examination Findings

Hawks and owls: Birds die before they can be presented for examination.
Pigeons: Type 1: Vomiting, watery diarrhea, depression, weight loss; type 2: N/A.
Chickens: Abnormally colored eggs, shell-less eggs. Chickens appear normal.
Turkeys: Bloody diarrhea and depression.
Pheasants: Dyspnea, cyanosis.
Quail: Nasal discharge, open-mouthed breathing, respiratory sounds.
All other species: N/A

CAUSES

Three genera of adenoviruses (*Aviadenovirus*, *Siadenovirus*, and *Atadenovirus*) have been shown to cause disease in birds. The signs associated with infection depend on the organ targeted by the virus and the host's immune response.

RISK FACTORS

Failure to quarantine new birds. Housing multiple species together in the same collection. High stocking densities. Concurrent infections (circovirus, aspergillosis, coccidiosis, Marek's disease virus, etc.). Pheasants, turkeys, chickens: exposure to waterfowl.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

All species: Other systemic viral infections, septicemia, gross management errors.

CBC/BIOCHEMISTRY/URINALYSIS

In birds experiencing hepatitis, elevations in the AST, SDH, GLDH are expected.

OTHER LABORATORY TESTS

Dependent on strain of virus. Virus neutralization assay. Antibodies can be detected by hemagglutination inhibition and enzyme-linked immunoassays.
PCR (DNA probes).
Virus isolation and electron microscopy.

IMAGING

Possible hepatomegaly and splenomegaly enlargement.

DIAGNOSTIC PROCEDURES

N/A

PATHOLOGIC FINDINGS

Intranuclear inclusion will be observed in infected tissues.
Finches: Grossly, liver and spleen enlargement. Microscopically, multiple round-to-irregular pale tan (necrotic) foci. Hepatic, splenic, and intestinal mucosal necrosis with varying numbers of large intranuclear basophilic to amphophilic inclusion bodies.

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ADENOVIRUSES (CONTINUED)

Falcons: Grossly, liver and spleen enlargement. Microscopically, hepatic and splenic necrosis with a mild-to-moderate lymphoplasmacytic inflammatory response. Varying numbers of large intranuclear basophilic to amphophilic inclusion bodies are present.
Hawks and owls: Grossly, liver and spleen enlargement. Microscopically, hepatic necrosis and mild-to-moderate inflammatory response, splenic necrosis, and proventricular and ventricular necrosis resulting in ulceration. Varying numbers of large intranuclear basophilic to amphophilic inclusion bodies are present in all affected tissues.
Pigeons: Type 1: Grossly, fibrinous and hemorrhagic enteritis, variable liver enlargement with necrotic foci. Microscopically, villus atrophy of the duodenum, characteristic inclusion bodies are found in intestinal epithelial cells. Hepatic necrosis may occur, but it is infrequent. Inclusion bodies are infrequently found in the liver. Type 2: Grossly, hepatic and possibly splenic enlargement are seen. There may be multifocal discoloration of the liver. Microscopically, there is a moderate to massive necrosis of the liver with intranuclear eosinophilic inclusion bodies.
Psittacine birds: Lesions depend on the virus and species of bird. Grossly, there may be evidence of one or more of: conjunctivitis, hepatitis, pancreatitis, enteritis, and splenic enlargement. The virus causes necrosis of the affected tissues, which will be accompanied by inflammation depending on how long the bird lives after the lesions develop. Intranuclear inclusions are generally common, but may be difficult to find. Inclusions in the tubular epithelial cells of the kidneys may be incidental findings in birds dying of other causes.
Chickens: Grossly, inactive ovaries and atrophied oviducts. Microscopically, severe chronic active inflammation of the shell gland with intranuclear inclusion bodies in the epithelial cells. Microscopically, there is expansion of the histiocytic population surrounding the sheathed arteries of the spleen with lymphoid necrosis with pannuclear inclusion bodies. Digestive tract lesions include epithelial sloughing, hemorrhage within the villi and the submucosa, a variable degree of inflammation which can include heterophils and mononuclear cells and the presence of intranuclear inclusion bodies. Lesions are most severe in the duodenum.
Turkeys: Grossly, well muscled but pale, may have still been eating, hemorrhage into the intestine, hepatomegaly and splenomegaly. Lesions resemble those seen in the chicken, but do not involve the digestive tract.
Pheasants: Pulmonary edema and enlarged mottled spleens. Lesions resemble those seen in the chicken, but do not involve the digestive tract.
Quail: Exudate in the nasal passages and in the trachea with tracheal mucosal thickening. Exudate may extend into the mainstem bronchi. Microscopically, there is necrosis and sloughing of the tracheal epithelium and the presence of intranuclear inclusion bodies and nuclear enlargement. There will be varying degrees of inflammation, which may be complicated by secondary bacterial infections. Multifocal hepatic necrosis may also occur.

TREATMENT

NURSING CARE
Supportive care with fluids, supplemental heat, and assist feeding. Broad-spectrum antibiotics to prevent secondary bacterial infections. Hepatoprotectants.

DIET
N/A

CLIENT EDUCATION
N/A

SURGICAL CONSIDERATIONS
N/A

MEDICATIONS

DRUG(S) OF CHOICE
N/A

CONTRAINDICATIONS
N/A

PRECAUTIONS
N/A

POSSIBLE INTERACTIONS
N/A

ALTERNATIVE DRUGS
N/A

FOLLOW-UP

PATIENT MONITORING
N/A

PREVENTION/AVOIDANCE
Falcons: Do not raise other species of falcons with peregrine falcons.
Chickens, turkeys, pheasants: Avoid contact with waterfowl.
Chickens: Disease has been eradicated from laying stock. Infection is prevented by strict quarantine and hygiene methods. Inactivated vaccines have been developed and used effectively.
Turkeys: Vaccination by water administration.
Quail: Strict biosecurity measures.

POSSIBLE COMPLICATIONS
Secondary infections.

EXPECTED COURSE AND PROGNOSIS
Finches: Overall low level or sporadic mortality; symptomatic birds high mortality.
Falcons: Clinically diseased birds high mortality.
Hawks and owls: The only known infected birds died.
Pigeons: Type 1: High levels of morbidity (up to 100%), low mortality unless secondary *Escherichia coli* infections occur. Type 2: Sporadic mortality, most birds that develop the disease die.
Psittacine birds: Birds with clinical systemic disease have a high mortality. Likely that there are many subclinically infected birds. Nestling deaths may occur in subsequent clutches.
Chickens: A 10–40% reduction in egg production.
Turkeys: Average mortality of 10–15%, but may be higher. Secondary *E.coli* infections may increase the morbidity and mortality.
Pheasants: Flock mortality ranges from 2% to 15%.
Quail: Mortality rates may exceed 50% of susceptible birds.

MISCELLANEOUS

ASSOCIATED CONDITIONS
N/A

AGE-RELATED FACTORS
N/A

ZOONOTIC POTENTIAL
N/A

FERTILITY/BREEDING
N/A

SYNONYMS
N/A

SEE ALSO
Colibacillosis
Herpesvirus (Columbid Herpesvirus 1 in Pigeons and Raptors)
Herpesvirus (Duck Viral Enteritis)
Herpesvirus (Passerine Birds)
Herpesvirus (Psittacid Herpesviruses)
Liver Disease
Also individual named viral diseases
Appendix 3: Laboratory Testing

ABBREVIATIONS
AST—aspartate aminotransferase
GLDH—glutamate dehydrogenase
PCR—polymerase chain reaction
SDH—sorbitol dehydrogenase

INTERNET RESOURCES

N/A

Suggested Reading

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