



Tikrit University  
College of Veterinary Medicine

# Adenovirus Infections(HHS), (IBH), and (AGE).

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Lecturers link



## Adenovirus Infections

Hepatitis–hydropericardium syndrome (HHS), inclusion body hepatitis (IBH), and adenoviral gizzard erosion (AGE).

### Summary

The aviadenoviruses affecting fowl are further subdivided into 5 species (A–E) and 11 serotypes. the high mortality noticed in flocks suffering from HHS or IBH and the growth retardation in connection with IBH and AGE, result in very substantial economic losses. The adenovirus virion is a non-enveloped, icosahedral structure 70–90nm in diameter. The nucleic acid is double-stranded DNA.

### Public Health Significance:

public health implications are likely to be minimal. two different serotypes (FAdV-1 and FAdV-9) have been shown to be able to transduce human cell lines without productive replication.

### Replication

Adenovirus replication is divided into two well-defined phases. The early phase involves the entry of virus into the host cell and the transfer of the virus DNA to the nucleus, which is followed by the transcription and translation of the so-called early (E) genes. Afterwards, proteins coded by the early genes redirect cellular functions, in order to facilitate replication of the virus DNA and the consequent transcription and translation of the late (L) genes, coding for the virus structural proteins. Assembly of the viral proteins into complete virions is completed in the nucleus followed by disruption of the nuclear membrane and release of virus by destruction of the cell.

### Susceptibility to Chemical and Physical Agents

They are resistant to lipid solvents such as ether and chloroform, sodium deoxycholate, trypsin, 2% phenol, and 50% alcohol. They are resistant to variations in pH between 3 and 9 but are inactivated by a 1:1000 concentration of formaldehyde. They are inhibited by the DNA inhibitors IuDR and BuDR. Adenoviruses in general are inactivated in aqueous solution after exposure to 56°C for 30 minutes and heat stability is reduced by divalent ions. FAdVs show more variability and are apparently more heat resistant. Some strains survive 60°C and even 70 °C for 30 minutes.

## **Pathogenesis**

The relationship has been found between genotype and virulence but not between serotype and virulence. In comparison to other strains FAdV-1 produces a variety of tumors when inoculated into hamsters and transforms human and hamster cells.

The route of inoculation, the age and type of birds, the virus dose, and the type of virus has been extremely important in producing disease. Natural routes of infection induce mortality only in younger birds, whereas parenteral inoculation has to be applied in birds from three weeks of life onwards. Inducing high mortality via oral or eye/nostril infection is a distinctive feature of very virulent FAdV. Coinfection with IBDV or CIAV enhanced the pathogenicity of some FAdV.

## **Transmission:**

Vertical & Horizontal

## **Incubation Period:**

The incubation period depends on the age of birds and route of infection but can be very short (24–48 hours).

## **Clinical Signs:**

1-IBH is characterized by sudden onset of mortality peaking after 3–4 days and usually stopping on day 5 but occasionally continuing for 2–3 weeks.

2-Morbidity is low; sick birds adopt a crouching position with ruffled feathers and die within 48 hours or recover. Mortality might be only slightly elevated but occasionally it might reach values as high as 30%.

3- Higher mortality appears in younger birds less than three weeks of age.

5-signs of HHS are very much similar to IBH, with the overall disease being much more severe with mortality up to 80%. Due to the severity of the disease, some elevated mortality might be noticed in mature birds.

6-Growth retardation, reduced uniformity, and a higher selection rate are the reported clinical signs in broilers suffering from AGE

7-Increased weekly mortality of 0.2% and reduced laying performance were reported in layers.

8- Hatchability can be reduced.

## **Gross (P.M.) lesions:**

1- The main lesions of IBH are pale, friable, swollen livers. Small white foci can be seen on the liver and petechial or ecchymotic hemorrhages may be present.

2-Swollen kidneys frequently coincide with glomerulonephritis

- 3-Atrophy of the bursa and thymus, aplastic bone marrow, and hepatitis
- 4-gross lesions peaked between 4–10 days postinfection.
- 5-Broilers are more susceptible with higher mortality due to the severe metabolic imbalance and the heavy destruction of the pancreas in addition to the liver.
- 6- HHS gross lesions in the liver and kidneys are similar to IBH except that they are more severe.
- 7-accumulation of clear, straw-colored fluid in the pericardial sac, pulmonary edema, swollen and discolored liver, and enlarged kidneys with distended tubules showing degenerative changes.
- 8-Petechial hemorrhages and focal necrosis are present in the heart and liver
- 9-Multifocal necrosis in the pancreas is reported in severe outbreaks of HHS
- 10-Ascites might be noticed in severely infected birds.
- 11- Atrophy of thymus and bursa in the case of HHS and IBH.
- 12- AGE is characterized by distended gizzards with hemorrhagic fluid and multiple black patchy erosions within the koilin layer
- 13- Gizzard erosions from 3–18 days post- inoculation.

### **Histologic changes (Microscopic Lesions):**

- 1-Intranuclear inclusion bodies are seen in organs with lesions; in cases of IBH and HHS in the liver, pancreas, kidneys, gizzard, and intestine. They are mainly basophilic, large, round, or irregularly shaped with a clear, pale halo, or, occasionally, eosinophilic without virus particles in intranuclear bodies developing at a later stage.
- 2-Glomerulonephritis characterized by an increase in the glomerular area and the average glomerular cell count was noticed during a severe outbreak of IBH
- 3-Pancreatic necrosis might also be seen and in some cases gizzard erosions are reported.
- 4-Myocarditis and hemorrhages in the heart
- 5-Atrophy of follicles of the bursa of Fabricius and a loss of lymphocytes with hemorrhages
- 6-Depletion of B and T cells in lymphoid organs.
- 7- Gizzard erosions coincide with intranuclear inclusion bodies in glandular epithelial cells with necrosis of the koilin layer, and infiltration of the lamina propria, submucosa, and muscle layers by macrophages and lymphocytes
- 8-Intranuclear inclusions have also been demonstrated in necrotic pancreatic acinar cells
- 9-Pancreatitis, hepatitis, cholecystitis, and cholangitis, indicating infection spread through a number of digestive organs beyond the gizzard can be seen

## Diagnosis:

- 1-Clinical signs and gross and histologic lesions.
- 2-virus isolation
- 3- PCR.
- 4-Serology

## Differential Diagnosis

- 1- IBD,ND,IB,Reo
- 2- Black head
- 3- Metabolic diseases
- 4- Toxins and acidosis

## Treatment

- 1-Antibiotics:
- 2-Anti-inflammatory:
- 3-Supplements:
- 4- Diuretics:

## Prevention and Control (Intervention Strategies):

- 1- Eliminating reservoirs
- 2- Good management practices, with emphasis on sanitation
- 3- Biosecurity
- 4- Water fountains should be self-cleaning, and feeders should be covered to prevent contamination as much as possible.
- 5- Free-flying birds, rodents, and other animals can be excluded.
- 6- All housing and equipment should be cleaned and disinfected before repopulation.

## 7-Vaccination:

- Considering vertical transmission breeders are within the focus of vaccination and a certain antibody level is requested for complete protection of progenies
- Infection could occurred despite vaccination of breeders 1–3 times between 9–18 weeks of age, with a live vaccine consisting of FAdV-8b and adequate protection against CAV and IBDV.
- In addition to a FAdV homologous to the vaccine, a heterologous strain was sometimes isolated from diseased birds, indicating a lack of cross- protection. Contrary to this, an inactivated oil-emulsion FAdV-4 vaccine induced a high level of protection against various serotypes, not only

in vaccinated/ challenged SPF birds but also in broilers originated from vaccinated breeders

- Complete protection against IBH could be induced in progenies obtained up to 50 weeks of life of a grandparent stock vaccinating at 10 and 17 weeks of life with an inactivated vaccine containing isolates of species FAdV-D and FAdV-E
- Structural proteins fiber 2 or penton base of FAdV-4 expressed as recombinant proteins induced a high level of protection against HHS
- Contrary to IBH and HHS, maternal antibodies seem to be less protective in preventing AGE.
- A nonvirulent FAdV-1 strain administered as live vaccine orally to day-old birds induced complete protection following challenge three weeks later with a virulent field isolate