COLIBACILLOSIS
( *Escherichia coli* Infections)

**DEFINITION**

Avian colibacillosis is an infectious disease of birds in which *Escherichia coli* is the primary or secondary pathogen. Infections include airsacculitis, cellulitis, omphalitis, peritonitis, salpingitis, synovitis, and coligranuloma.

**OCCURRENCE**

Colibacillosis occurs in all types and age groups of poultry as well as in other birds and many kinds of mammals. Most reported outbreaks in poultry have been in chickens, turkeys, and ducks. Many outbreaks occur in poultry raised under a low standard of sanitation, poor environmental conditions, or after a respiratory or immunosuppressive disease. Infection is more frequent in young than mature birds. Colibacillosis is common throughout the world.

**HISTORICAL INFORMATION**

Colibacillosis was first described in chickens in 1894. Since then, there have been numerous reports on colibacillosis in poultry and considerable research on the disease has been completed. Many investigators doubt that *E. coli* is a primary pathogen. Others are convinced that certain serotypes are primary pathogens and their opinion seems to prevail. Most investigators agree that *E. coli* frequently can be isolated from a variety of well-defined syndromes in poultry.

**ETIOLOGY**

The etiologic agent is *E. coli*. The O (somatic) antigen serotypes most commonly associated with disease outbreaks are O1, O2, O35, and O78. The K (capsular) antigens most commonly associated with virulence are K1 and K80. In the intestinal tract of normal poultry, nonpathogenic serotypes far outnumber pathogenic serotypes, with 10% to 15% of intestinal coliforms being potential pathogens.

**EPIDEMIOLOGY**

1. *E. coli* is present in the intestine of birds and mammals and is disseminated widely in feces. Birds are continuously exposed through contaminated feces, water, dust, and environment. Any time a bird's resistance to disease is impaired, pathogenic or facultative pathogenic strains may infect the bird. Sequestered *E. coli* in such sites as the intestine, nasal passages, air sacs, or reproductive tract may be a latent source of infection. Certain pathogenic serotypes may have the ability to infect a normal bird.

2. *E. coli* has been isolated from the eggs of normal hens. Its presence has been attributed to ovarian infection, oviduct infection, and to eggshell contamination followed by penetration. Chicks may hatch with a latent infection; however, active infection will typically only occur if some environmental stress or lesions initiates the disease process.

**CLINICAL SIGNS AND LESIONS**

A variety of syndromes from which *E. coli* has been isolated include:

1. **Airsacculitis**

   Respiratory signs occur and vary in severity. This syndrome may be associated with dusty litter, poor ventilation, stress, or adverse environmental conditions. It may accompany or follow vaccination or infection with mycoplasmas, infectious bronchitis virus, Newcastle disease virus, or laryngotracheitis virus.
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Thickened air sacs and in severe cases, caseous exudate in the air sac is present [Fig. 1; Colibacillosis; UC Davis]. There often is an accompanying adhesive pericarditis and fibrinous perihepatitis. Airsacculitis occurs chiefly in 3-7-week-old broilers, probably peaking at 5-6 weeks.

2. Pericarditis

Most serotypes of *E. coli*, after a septicemia, cause a pericarditis [Fig. 2; Colibacillosis; UC Davis]. A myocarditis and an alteration of the pericardial sac (opaqueness) are usually associated with this and the epicardium becomes edematous. Pericarditis can also be caused by chlamydiosis.

3. Omphalitis and yolk sac infection

*E. coli* is often isolated in pure culture from organs or the yolk sac of recently hatched birds having depression, septicemia, and variable mortality. With omphalitis the navel is swollen and inflamed [Fig. 3; Colibacillosis; NCSU] and the bird feels wet. Abnormal yolk material and peritonitis is typically seen on necropsy of birds with an *E. coli* infection of the yolk sac.

A great variety of other organisms such as species of *Aerobacter*, *Proteus*, *Klebsiella*, *Pseudomonas*, *Salmonella*, *Bacillus*, *Staphylococcus*, enteric *Streptococcus*, and *Clostridia* are frequently isolated from yolk sacs of embryos and navels of chicks, most likely as mixed infections.

4. Coliform septicemia of ducks (new duck syndrome; duck septicemia)

*E. coli*, *Salmonella*, and *Pasteurella anatipestifer* produce respiratory signs, airsacculitis, pericarditis, perihepatitis, and peritonitis. In outbreaks of *P. anatipestifer*, involvement of the respiratory tract and a dry, thin transparent covering over visceral organs are present. In coliform septicemia (*E. coli*) usually a moist, granular to coagulative exudate of varying thickness is present on abdominal and thoracic viscera and surfaces of air sacs. The spleen and liver are swollen and dark with bile staining of the liver.

5. Acute septicemia

An acute septicemic disease caused by *E. coli* resembles fowl typhoid and fowl cholera. Birds are in good flesh and have full crops suggesting acuteness of the disease. This can occur in young or mature birds. There are sudden deaths, and variable morbidity and mortality. Parenchymatous organs are swollen with congested pectoral muscles. Livers are green in color and may have small necrotic foci. There may be petechial hemorrhages, pericarditis, or peritonitis. Acute systemic disease may also be caused by various *Pasteurella*, *Salmonella*, *Streptococci*, and other organisms.

6. Enteritis

Enteritis caused by *E. coli* is considered rare but pathogenic attaching effacing *E. coli* have been reported. Diarrhea and dehydration are noted on clinical examination. At necropsy there is enteritis, often with excessive fluid in the intestines. *E. coli* may be isolated from parenchymatous organs.

7. Salpingitis

This lesion may occur following entry of coliform bacteria from the vagina in laying hens. It is also likely to develop when the left greater abdominal air sac becomes infected by *E. coli*, causing a chronic salpingitis. Affected birds usually die during first 6 months postinfection and never lay. The oviduct is distended with exudate [Fig. 4; Colibacillosis; UC Davis] that may be cheesy and has a foul odor. No specific signs are noted but there may be an upright (penguin) posture.

8. Coligranuloma (Hjärre’s disease)

Signs vary in this uncommon disease of chickens and turkeys. Nodules (granulomas) occur along the intestinal tract, and mesentery, and in the liver [Fig. 5; Colibacillosis; Cornell U]. The spleen is not
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involved. The lesions resemble those of tuberculosis. The agent is a mucoid coliform, possibly not *E. coli*. Granulomas of the liver have many causes, which would include the anaerobic genera *Eubacterium* and *Bacteroides*.

9. Synovitis and osteoarthritis

Affected birds are lame or recumbent. There is swelling of one or more tendon sheaths or joints. Synovitis and/or osteoarthritis are frequently a sequel to a systemic infection. With synovitis many birds will recover in about 1 week. Osteoarthritis is a more severe and chronic condition where the joint is inflamed and the associate bone has osteomyelitis. These severe chronic infections make birds unwilling or unable to walk and necropsy findings often include dehydration and emaciation. Synovitis-arthritis may also be caused by reovirus, or species of Mycoplasma, *Staphylococci*, and *Salmonella*.

10. Panophthalmitis and meningitis

Occasional birds have a hypopyon and/or hyphema, usually in one eye, which is blind. Likewise, meningitis is a rare sequela to *E. coli* septicemia.

11. Cellulitis (Infectious process)

This is an *E. coli*-related condition occurring with apparently increasing prevalence in broiler chicken flocks in the United States, some European countries, and Canada. It is recognized primarily as an inspection finding at slaughter, with no abnormality having been noted in live birds. The USDA Food Safety and Inspection Service designates cellulitis as “infectious process” or “IP”. Gross lesions include variable yellowing and dimpling of the skin ventral to the vent and over the ventrocaudal aspect of the breast extending in severe cases over the thighs [Fig. 6; Colibacillosis; UC Davis]. On incising the skin a leathery grayish-yellow membrane of inspissated exudate [Fig. 7; Colibacillosis; UC Davis] is noted in the subcutis. Frequently this sheet of exudate can be removed through the incision. Histologically there is extensive deep dermatitis in the affected areas involving both dermis and subcutis. The inflammatory reaction includes edema and heterophil infiltration in active areas, whereas there is accumulation of a walled-off causative sheet of exudate surrounded by a zone of giant cells in more chronic areas of involvement. Cocccobacillary bacteria can be seen in microcolonies within the exudate and *E. coli* is recovered quite consistently on culture. One recent study also demonstrated *Streptococcus dysgalactiae* in the exudate. This condition may affect up to 5% of entire flocks at slaughter resulting in extensive trim-out, downgrading, or whole-carass condemnation. Total population prevalence ranges from 0.12 to 0.16%. The pathogenesis of cellulitis has yet to be determined but there is a correlation with certain broiler breeds, poor feathering, sex (males more susceptible), skin scratches, increased stocking density, litter type and diet.

DIAGNOSIS

Diagnosis of primary colibacillosis is based on the isolation and typing of a coliform into one of the serotypes recognized as pathogens. Diagnosis based merely on the isolation of *E. coli* is of questionable validity. The possibility of other infections (viruses, bacteria, fungi, chlamydia, and mycoplasmas) should have been eliminated through culture or other means. When *E. coli* is isolated secondary to some other primary disease, it should be diagnosed as secondary colibacillosis.

CONTROL

1. Measures should be taken to minimize eggshell contamination of newly laid eggs. Eggs should be disinfected on the farm prior to storage and should be stored under ideal conditions. Scrupulous hatchery sanitation, disinfection, and/or fumigation procedures should be practiced.

2. A vigorous sanitation program should be followed in raising poultry.
3. Insofar as is possible, all disease, parasitisms, and other stresses on a flock should be minimized. Dust should be controlled.

4. Only feeds free of fecal contaminations should be fed to poultry. Pelleted feeds are more likely to be free of contamination.

TREATMENT

Many different antibiotics and drugs have been utilized for treatment. These have included tetracyclines, neomycin, sulfa drugs and others. Antibiotic sensitivity testing is advisable where applicable. Treatment is usually effective if given early.