Other Bacterial Diseases

ASSOC. PROF. İNCI BAŞAK MÜŞTAK

ANKARA UNIVERSITY FACULTY OF VETERINARY MEDICINE

DEPARTMENT OF MICROBIOLOGY

AVIAN CHLAMYDIOSIS (Psittacosis/Ornithosis)

Etiology

Chlamydia psittaci

It is a Gram-negative, oval to rod-shaped, non-motile, non-spore-forming, and non-capsulated bacterium that lacks muramic acid in its cell wall.

The cell wall structure is similar to that of Gram-negative bacteria.

It is an **obligate intracellular microorganism**.

It cannot grow on non-viable media such as broth or agar, but it can grow in embryonated eggs, experimental animals, and cell cultures.

Epidemiology

Avian Chlamydiosis is mostly endemic among tropical and subtropical birds, particularly in regions such as Australia and South America.

Pigeons, turkeys, and ducks are the most susceptible species, while chickens are relatively resistant to infection.

Psittacine birds (parrots, budgerigars, canaries) exhibit different clinical manifestations of the disease.

Young birds are more susceptible than adults and may die if treatment is delayed.

The causative agent is shed into the environment through nasal discharges and feces of infected birds

Transmission occurs mainly via the respiratory route, but ingestion of contaminated food and water may also lead to infection. In addition, indirect transmission can occur through inanimate fomites, biting flies, lice, and mites.

Vertical transmission has not been detected

***Chlamydiosis* is a zoonotic infection**

Clinical Symptoms

The incubation period of Chlamydiosis varies from 5 to 60 days depending on the host's sensitivity, age, sex, pathogenicity, virulence of microorganism, route of entry and amount of the agent. The environmental conditions are also important for the incubation period

The disease is seen as acute, subacute, chronic and asymptomatic forms

Clinical symptoms are also variable

Depending on the region where the infection is located, it can cause

- **Digestive system** problems (enteritis, green diarrhea),
- **Respiratory system** problems (cough, nausea, pneumonia, air sac inflammation, seropurulent discharge from the eyes)
- Swelling in the eyes,
- Dyspnea,
- Sinusitis,
- Encephalitis and sometimes polyarthritis

Also;

- Stagnation,
- Loss of appetite,
- Weakness,
- Thirsting,
- Fever,
- Decrease in egg production problems can also be observed

In postmortem Examination

- Nasal inflammation,
- Pulmonary congestion
- Fibrinous Pneumonia,
- Airsacculitis
- Excessive secretion in trachea,
- Enlargement of the spleen and liver,
- Multifocal liver necrosis
- Pericarditis and peritonitis,
- Sero-fibrinous exudate in the breast
- Inflammatory reactions may be detected in extremittes

However it is not possible to observe all of these findings in an animal

Diagnosis

a) **Clinical and necropsy findings**: It is not possible to definitively diagnose the disease because of many bacterial (microplasmosis, coryza, salmonellosis, pastorelosis, listeriosis, etc.), viral (IB, ILT, ND, pox) and fungal infections (aspergillosis) can complicate the clinical picture
Laboratory examinations : Samples are taken from infected animals, including blood, nasal and ocular exudates, and feces.

a) Microscopy : Slides are prepared from the tissues and examined under a light microscope (1000x-1500x) by staining with HxE, Giemsa and modified Ziehl-Neelsen (Stamp) technique

Immunofluorescence (IFA) or in situ immunoperoxidase techniques can also be used to detect microbial antigens.

b) **Isolation**

c) **Serological tests:** ELISA, IFA, in situ immunoperoxidase, indirect complement fixation (ICF), agar gel diffusion (AGID), and latex agglutination (using purified chlamydial antigen-coated latex particles) can also be used. However, detection of an antibody titer in blood usually indicates a past infection rather than an active one. Detection of a high titer in conjunction with clinical signs in multiple animals is significant.

d) **Biotechnological methods:** Molecular techniques such as PCR, real-time PCR, and sequencing can be used to detect and characterize pathogens at the genetic level.

Treatment

Infected animals are immediately separated and used for diagnostic purposes.

Healthy animals are moved to clean flocks, and chlortetracycline is added to their feed (200–800 g/ton) and water (0.2–0.4 g/liter). This treatment lasts for 45 days.

Chlortetracycline, doxycycline, enrofloxacin can also be used in treatment. However, it should be noted that antibiotics cannot completely eliminate the infection, and reinfection may occur.

Protection and Control

General and specific precautions are continuously applied.

Any bird that has not passed control and inspection cannot be introduced directly into the flocks.

Poultry should be kept isolated from all types of live animals and inanimate materials.

Proper disinfection must be carried out. For this purpose, quaternary ammonium compounds (1:1000), lime slurry (1:100), and formaldehyde can be used.

Zoonotic importance

In humans, the disease can be transmitted through contact with birds of the Psittacidae family, pigeons, or infected or asymptomatic pet animals.

Serious human cases have been reported in Germany and France.

Transmission from birds to humans occurs mostly via the respiratory route; however, individuals working in the poultry industry, laboratories, or in the slaughter and processing of animals may also become infected.

In humans, the disease may present with symptoms such as; lymphadenopathy,

- fatigue,
- muscle aches,
- chills,
- In some cases: pneumonia or encephalitis may develop.
- However, infection can also be asymptomatic.

TUBERCULOSIS
(*Avian tuberculosis)*

Etiology

Mycobacterium avium complex (MAC) :

- *M. avium* subsp. *avium (serotype 1,2,3)*
- *M. avium subsp. hominissuis*
- *M. avium subsp. paratuberculosis*
- *M. avium subsp. sylvaticum*

M. tuberculosis

M. genavense

M. intracellulare

M. gordonae

Gram positive, non-spore, immotile and acid-alcohol resistant

The agent is briefly inactivated at 65-70°C in 10 minutes, 2% formol, 5% carboxylic acid and 3% chlorinated antiseptics

Epidemiology

- Poultry tuberculosis is seen especially in chickens and turkeys, geese, ducks, pigeons, etc. and other poultry species.
- Sometimes the agent is also isolated from humans
- The primary source of the infection is usually wild birds
- Ulcerative tuberculosis lesions developing in the intestines of poultry, and the shedding of bacteria in feces, constitute the primary source of infection.
- Lesions in the trachea can contaminate the environment via droplets.
- The bacteria are highly resistant to environmental conditions.
- Contaminated environments, especially soil and litter, are the most important sources for transmission
- Mycobacteria are relatively resistant to disinfectants and antibiotics, and they can remain viable in contaminated soil for up to four years.

Symptoms

The infection is seen in chronic form and does not show any symptoms for a long time in animals. For this reason, there is not a certain incubation period.

The sypmtoms that seen in infected animals; **atrophy of the breast muscles and chronic weight loss.** Animals may appear healthy on visual inspection. However, clinical examination reveals weight loss. On palpation, a thin chest and cachexia can be detected.

Although the animals' appetite remains normal, body weight continues to decrease.

In some poultry, deaths may occur without any clinical signs.

The keel bone is prominent, and on palpation, it has a "knife-edged" appearance

Respiratory infections are more common in ducks.

In postmortem Examination

- Varying-sized, irregular, greyish-yellow or greyish-white nodules in various organs (liver, spleen, intestines, bone marrow, kidneys, etc.) are important necropsy findings for the diagnosis of infection.
- Granulomas are generally found in the subserosal regions of the liver, spleen, and intestinal tract.
- Hepatomegaly, splenomegaly, and enlarged, thickened intestines are observed.
- Tuberculosis lesions are characterized by grey-yellow or greyish-white nodules, ranging in size from pinhead to several centimeters, typically adhering to and spreading around the intestines.
- Lesions in the liver and spleen cause enlargement of the organs, which may lead to bleeding due to organ rupture.
- In advanced cases, tubercles are most commonly detected in the bone marrow of the femur.

Diagnosis

Clinical and necropsy findings: Avian tuberculosis can be complicated by aspergillosis, coligranuloma, intestinal coccidiosis, lymphoid leukosis, Marek's disease, typhoid, and neoplastic diseases.

Laboratory examinations

- **Bacterioscopy:** Slides are prepared from the organs sent to the laboratory and stained using the Ziehl–Neelsen method.
- **Culture:** Microorganisms can be isolated from organ samples using conventional culture techniques.
- **Serology:** Various serological methods can be employed for diagnosis.
- **Allergy testing:** One of the diagnostic methods used for detecting tuberculous animals is the tuberculin test.
- **Animal experiments:** Experimental infection studies can also be conducted to confirm pathogenicity and study disease progression.

Treatment

No medication is used.
Euthanasia is generally recommended for the affected animals.

Protection

Control of avian tuberculosis in poultry requires the removal of affected animals and contaminated equipment. Its occurrence has decreased in commercial flocks. However, it can still be encountered sporadically in small-scale farms and hobby-raised birds.

STAPHYLOCOCCAL INFECTIONS

Etiology

S. aureus

- Gram-positive, cocci, non-motile, and non-spore-forming
- Seen as clusters on solid media and short chains in broth
- Facultative anaerobe; forms β-hemolytic, smooth, 1–3 mm, pigmented (white to orange) colonies on 5% blood agar within 18–24 hours
- Catalase- and gelatinase-positive
- Ferments glucose and mannitol

Epidemiology

All poultry species are susceptible to staphylococcal infections.

Transmission plays a minor role in the epidemiology of the disease because *Staphylococcus* species, which are found on the skin and mucous membranes of healthy animals and in the environment, are ubiquitous.

These agents are commonly present in poultry incubation, rearing, slaughterhouse, and processing environments.

Infection occurs when the natural defenses of the host are weakened.

S. aureus can enter the internal tissues through compromised barriers and cause localized infections such as osteomyelitis.

In newly hatched chicks, omphalitis and other infections may occur.

Septicemic staphylococcal infections and acute deaths can be observed in immunosuppressive conditions resulting from damage to the Bursa of Fabricius or thymus, leading to impaired host defense.

Symptoms

- The incubation period in staphylococcal infections is short.
- Unless the problem in vaccination and management procedures, heavy contamination of the environment, production regions and poultry animals the morbidity and mortality are generally low
- Clinical and necropsy findings vary according to the location of the infection
- Arthritis,
- Tenosynovitis
- Gangrenous Dermatitis
- Yolk Sac Infection
- Subdermal apses
- Spondilitis
- Osteomyelitis

Arthritis, Tenosynovitis

It is seen in chicks (7–12 weeks) and turkeys (9–16 weeks).

Extremities, usually the shoulder or tibiotarsal region, are hot, edematous, and painful.

Infected animals are depressed, lame, and walk reluctantly.

When pharyngeal extremities are affected, subdermal staphylococcal plantar abscesses **(bumblefoot)** may occur.

Edematous and fibrinous exudate can accumulate around synovial membranes and tendons, sometimes leading to necrosis and caseous exudate.

Petechiae or hemorrhages may appear early, and chronic infection may develop due to fibrous tissue formation.

Gangrenous Dermatitis

Gangrenous dermatitis can be seen in birds of all ages, but it is most common in broiler chicks.

The wing tips and dorsal pelvis are the most frequently affected areas. Lesions appear dark, wet, and gangrenous, often accompanied by crepitation.

Staphylococcus infections are usually associated with *Clostridium perfringens* type A, which may act as the primary pathogen.

Immunosuppression resulting from damage to the Bursa of Fabricius predisposes growing chicks to infection.

Yolk Sac Infection

Staphylococcus-related hatching infections are common and can cause high mortality within the first few days after hatching.

Affected chicks often have moist abdomens and deteriorate rapidly.

The yolk sacs are enlarged, and the color and consistency of their contents are altered.

Spondilitis and Osteomyelitis

S. aureus can cause abscesses with periostitis and osteomyelitis in the 5th–7th thoracic vertebrae.

Continuous pressure from these lesions may lead to paresis or paralysis of the spinal cord.

Osteomyelitis can also affect the femoral head, tibiotarsus, and occasionally other bones.

Staphylococcal Septicemia, Endocarditis and Granuloma

Septicemia results from the dissemination of multiple local staphylococcal foci.

It is rare and may cause sudden death.

A hemorrhagic appearance or conjunctival bleeding can be observed in carcasses.

Necrotic foci may also be present in the liver, spleen, lungs, and myocardium.

In chronic infections, granulomas form and weight loss is common.

Endocarditis can also be observed during necropsy, particularly affecting the left atrioventricular valves.

Following experimental intravenous infections, vomiting may occur even in the absence of macroscopic lesions.

Diagnosis

It can be complicated by infections caused by *E. coli*, *S. G*allinarum and other *Salmonella* species, *P. multocida*, and *M. synoviae*.

Treatment

Antibiotics such as Amoxicillin, Tetracycline, Erythromycin, Cephalosporins, Novobiocin, Fluoroquinolonescan be used successfully in *S. aureus* infections. However, antibiotic susceptibility testing should always be performed.

Prevention

Good management and proper feeding practices are essential.

Treatment

Antibiotics such as Amoxicillin, Tetracycline, Erythromycin, Cephalosporins, Novobiocin, Fluoroquinolonescan be used successfully in *S. aureus* infections. However, antibiotic susceptibility testing should always be performed.

Prevention

Good management and proper feeding practices are essential.

Zoonotic importance

Methicillin resistance is observed in *Staphylococcus* species.

This resistance is rapidly increasing both in our country and worldwide.

MRSA can cause severe infections in both humans and animals and is a pathogen that is difficult to treat.

Methicillin resistance can also be transferred to other bacteria via gene transfer.

CLOSTERIDIAL INFECTIONS

- Gram-positive bacteria
- Rod-shape,
- Anaerobic,
- Most of which are spore-forming, cause infectious diseases in many poultry species.

The main infections include;

- Botulism,
- Necrotic enteritis,
- Gangrenous dermatitis,
- Ulcerative enteritis,
- Infections of the umbilicus and yolk sac.

BOTULISMUS
(Botulism, Botulismus, Botulisme)

- ***Clostridium botulinum***
- Types A and C are responsible for the disease.
- All species of poultry are susceptible to disease.
- Botulism toxins affect the terminals of peripheral nerves and cause paralysis in poultry. Similar symptoms are observed in all birds.
- The most prominent signs are respiratory difficulty, muscle weakness, and paralysis. Paralysis typically starts in the legs and gradually progresses to the wings, neck,and eyelids. In the paralyzed regions, the muscles are flaccid rather than contracted. Affected birds are usually observed sitting and unable to move.
- No specific lesions are seen on necropsy.
- Good management and hygiene conditions in flocks are the main rule for the protection of the disease.

GANGRENE DERMATITIS

- ***C. septicum*** and ***C. perfringens*** **type A** alone or in combination with *Staphylococcus* spp., *E.coli* and *P. multocida*
- The hosts of the disease are chickens and turkey
- The occurrence of multiple deaths within a flocks indicates *Clostridium* infection. In most cases, no clinical signs are observed.
- Infected birds may show depression, loss of appetite, weakness in the legs, ataxia, subcutaneous crepitant edema, fever, and sometimes septicemia.
- In necrospy examination, skin lesions that initially appear dark red and later turn to a greenish-purple color with exudation are observed. The affected areas are mostly the breast, abdomen, wings, thighs, and legs. The muscles lose their normal color, and edema and gas formation can be seen between muscle groups. Enlargement and dark discoloration of internal organs are also observed. The carcasses emit a foul odor and decompose rapidly.
- Since the agent is found everywhere and on all surfaces, the most important preventive measures are the regular disinfection of surfaces and the rapid removal of dead birds from the flocks.

ULCERATIVE ENTERITIS

- The agent is ***Clostridium colinum***
- Ulcerative enteritis can occur in many poultry species, and quails are the most susceptible.
- Predisposing factors play an important role in the occurrence of the disease; these include coccidiosis, infectious bursal disease, chicken anemia virus, and poor hygiene.
- Under natural conditions, chickens become infected by consuming feed or water contaminated with the feces of infected birds.
- Sudden death may occur without any symptoms, with only weight loss being observed. In quails, watery, whitish diarrhea is frequently seen, and as the disease progresses, a hunched back posture, ruffled feathers, bloody diarrhea, depression, and weakness are observed.
- Severe emaciation is common in chronic cases.

- Necropsy findings vary depending on the course of the disease.
- Small, rounded, superficial ulcers with hemorrhagic edges are initially seen in the ileum, cecum, and colon during chronic infections. These lesions later coalesce and extend into the serosa.
- Perforation of the intestine and peritonitis may occur.
- Necrotic lesions of varying sizes and yellow to gray coloration are observed in the liver. The spleen is usually enlarged and hemorrhagic.
- Mortality can reach up to 100% in quails. It is 2-10% in chickens. The disease is not observed in waterfowl.
- Prevention and control of the disease rely on maintaining good hygiene, minimizing stress, controlling predisposing infections and promptly removing infected birds.

Treatment

Antibiotics effective against Gram-positive bacteria are highly effective.

Protection

Improvement of general management and hygiene conditions is the main principle of prevention.