AviPod
An Update for Poultry Professionals

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HAPPY NEW YEAR - 2025

Infectious Coryza - Diagnosis and Management

Avian infectious coryza (AIC), a highly opportunistic respiratory tract infection caused by *Avibacterium paragallinarum* (formerly known as *Haemophilus paragallinarum*) is one among the common diseases of poultry. Despite adoption of strong precautionary/prophylactic measures (i.e. vaccination practice), infection continues as complicated pattern of disease course worldwide that results in massive economic and production losses due to growth retardation, decreased egg production and mortality.

AIC is also called as roup, snot or contagious catarrh. Chicken is the natural host of the organism and are susceptible at all ages, however, susceptibility increases with age. It has been characterized as a disease of upper respiratory tract that affects growing layer birds (aged 8-12 weeks) with its increasing ability to affect even very young and tender aged broiler chicks i.e. between 3-6 weeks of age. India, being a major admirer of poultry products suffers tremendously with this insidious infectious insult every year, thus strives for some better optional measures to curtail this curse.

Infectious Coryza

Dear Readers,

Infectious coryza, an acute serious respiratory disease in poultry caused by *Avibacterium paragallinarum,* has exhibited notable trends in recent years impacting poultry health and production globally. The disease has been increasingly reported in various regions, even among vaccinated chickens, leading to substantial economic losses due to decreased feed consumption, egg production, growth and increased mortality. This suggests potential challenges with vaccine efficacy or the emergence of new serovars. The disease's impact is compounded in combination with other pathogens, emphasizing the need for accurate diagnosis and comprehensive health management strategies.

This issue of AviPod emphasises on different diagnostic procedures of Infectious coryza and its management through therapeutic and prophylactic measures including biosecurity.

We hope that the issue will be of use to you. Kindly scan the below QR code to share your valuable feedback and suggestions or else reach out to us *via* email at aviglo@intaspharma.com.

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Etiological Agent

- A. *paragallinarum* is a slow-growing and fastidious Gram-negative bacterium potentially pathogenic for poultry. It is bipolar-staining, non-motile rod with a tendency toward filament formation. The organism requires V-factor (nicotinamide adenine dinucleotide) for their growth *in vitro,* which is available in certain enriched medium (i.e., chocolate agar). It grows on blood agar (with a *Staphylococcus aureus* nurse colony) as dewdrop-like satellite colonies in a microaerophilic environment. Three serotypes (A, B and C) have been identified that are distributed throughout the globe. V-factor independent isolates have been described from South Africa and Mexico.
- First clinical course of the disease was recognized in 1930s and infective agent was isolated first in the year 1931 by De Blieck and named it *Bacillus hemoglobinophilus coryzae gallinarum.*

Schneider released first report to draw attention to the organisms that appear to resemble the *Avibacterium gallinarum.* Description of species *Pasteurella gallinarum* occurred in 1955 and the species *Avibacterium paragallinarum* was originally described and validly published by Blackall *et al* (2025).

- *A. paragallinarum* isolates serotyped by two different methods. Page classified in 1962 into three serovars (A, B and C) based on agglutination reaction and later these schemes were further divided in to nine Kume hemagglutinin serovars (A-1, A-2, A-3, A-4, B-1, C-1, C-2, C-3 and C-4) using hemagglutination-inhibition. However, a new B variants have been discovered which are different from standard strains and quite prevalent at the moment at varied places across the globe. Cross protection within Page serovars and Kume serogroups become difficult due to emergence of these new B variants.
- In India, apart from wide prevalence of serovars A and C, presence of serovar B could not be ruled out due to its close proximity to prominent poultry producing nations like Thailand, Bangladesh and others, however no confirmed authenticated report on its occurrence till to date are available.
- *A. paragallinarum* is delicate organism that is inactivated rather rapidly outside the host by environmental factors or can be easily destroyed by many disinfectants. Infectious exudate suspended in tap water is inactivated in 4 hours at ambient temperature; when suspended in saline, exudate is infectious for at least 24 hours at 22°C. Exudate or tissue remains infectious when held at 37°C for 24-48 hours; at 4°C, exudate remains infectious for several days. At temperatures of 45-55°C, these are killed within 2-10 minutes.

Predisposing Factors

- Coryza is commonly complicated by presence of a range of other pathogens such as fowl pox virus, infectious bronchitis virus, infectious laryngotracheitis virus, *Mycoplasma gallisepticum* (MG), *Mycoplasma synoviae* (MS), *Salmonella* spp. and *Pasteurella* spp. resulting in severe disease and significant economic losses.
- Increased susceptibility of broilers might be due to high production stress and other complicating factors such as environmental stress, poor housing, inadequate biosecurity practices, parasitism and inadequate nutrition.

Epidemiology

- AIC is most prevalent in winter, followed by summer and then rainy season. The disease is common in layers and breeders but it can affect broilers as well. Even though it can occur in birds of any age, it is more common mainly in laying period, as well as in brooding period when they are stressed. Disease is seen more frequently on chicken farms where facilities are never emptied of chickens. Presently coryza is a disease of considerable importance, especially on multiage egg production complexes. AIC had been reported from almost all countries around the world. It is considered a re-emerging disease in India due to frequent outbreaks in recent time despite vaccination.
- Reports suggest that in Kurnool district (Andhra Pradesh), infectious coryza was the second most important bacterial disease associated with mortality after Salmonellosis (Srinivasa *et al.,* 1989). A study in Morocco reported on 10 coryza outbreaks that were associated with drops in egg production of 14 to 41 percent and mortalities of 0.7 to 10 percent. A study of village chickens in Thailand has reported that

infectious coryza was the most common cause of death in chickens less than 2 months old and those over 6 months old.

Economic Impact

AIC can have a significant economic impact on poultry industry:

- **Reduced egg production:** Can cause marked (10 percent to more than 40 percent) drop in egg production in laying hens, particularly on multi-age farms. Egg production can also be delayed in young pullets with infectious coryza.
- **Increased condemnations:** Can lead to more chickens being condemned at processing plants due to airsacculitis.
- **Poor growth:** Decreased feed and water consumption retards growth in young birds and causes body weight loss.
- **Reduced feed conversion efficiency:** In broilers, due to inanition, feed conversion efficiency drastically declines, that mainly results in poor flesh development and extreme culling at tender age.

Transmission

Chronically ill or apparently healthy carrier birds are the major reservoirs of infection and readily transmit the agent to susceptible chickens, which makes infectious coryza very hard to control, especially on farms without an "all-in, all-out" flock practice.

- Transmission is *via* inhalation of infectious aerosol coughed into air or through ingestion of contaminated feed or water.
- Disease can also be transmitted by fomites, although it soon perishes outside of the host.
- Recovered birds are frequently carriers.

Pathogenicity

- AIC has an incubation period of 1-3 days and typically lasts 2-3 weeks.
- Capsule of *A. paragallinarum* plays a paramount role in process of virulency and colonization of bacteria within ciliated epithelial cells of host's nasal mucosa.
- Outer membrane proteins of the organism, which is similar to other bacteria such as Pasteurella seems to be associated with iron regulation process that further facilitates pathogen's metabolic pathway to accentuate pathogenic activity in host's body.
- Recent and valuable information acquired with regards to organism's characterization is a discovery of new protein system named Repeat-in-ToXin (RTX toxins) among A. *paragallinarum's* membrane vesicles (MVs), which gets released extracellularly during normal or stressed growth condition, and are found out to be contributing elements towards virulency and damage to host tissues.
- Apart from it, haemagglutinin antigen of the organism also plays an important role in pathogenicity besides acting as an immune sensitizing agent for host.
- At initial stage of infection, clinical symptom runs as sero-mucus discharge(s) mainly from nostrils and eyes, lately transforming into caseous flake like exudative deposits in subcutaneous tissue, around para-nostrils area as well as eyes, consequently resulting in sticky closures of eyes.
- Besides, primarily involving upper respiratory tract (URT), infection also transcend down to trachea, air

sacs as well as cause pneumonia in lungs in very extreme cases.

- In older and egg laying chicken, organism predominantly affects reproductive organs *viz;* ovary and salpinx and are responsible for poor egg quality and decreased egg production.
- In some of the rare clinical outcomes, concomitant infection with opportunistic pathogens like *M. gallisepticum* or other septicaemia causing organisms eventually lead to arthritis and septicaemia lesion.

Clinical Signs

- Most prominent clinical sign is edematous swelling of face and distension of infraorbital sinus (Fig. 1) due to highly accumulation of cheesy like exudates in conjunctival sac. In adult birds, especially males, edema can extend to intermandibular space and wattles.
- There is oculonasal discharge, conjunctivitis with some adherence of eyelids, sneezing, dyspnea, coughing, respiratory noises and perhaps, diarrhoea.
- Usually there is a rapid onset and morbidity is high (that usually reaches up to 100 percent) in the flock. Feed consumption, egg production or growth are reduced noticeably. However, death loss is usually low unless the disease is complicated with other agents.

Fig. 1: Swollen face and infraorbital sinus

- There is considerable variation in severity and length of course in flock outbreaks.
- Respiratory signs usually persist for only a few weeks. Persistence of signs occurs when complicated by fowl pox, *M. gallisepticum, M. synoviae,* infectious bronchitis, *Pasteurella* spp., or infectious laryngotracheitis and unthrifty birds will become apparent.

Post Mortem Findings

- There is catarrhal inflammation of nasal passages and sinuses and nasal discharge often is apparent.
- One or both infraorbital sinuses may be distended with copious, greyish, semifluid exudate, which may become consolidated in later cases (Fig. 2).
- Birds died with chronic course at most of time, exhibit similar flaky material as big creamish white organized mass or as white chunks of exudative material either unilaterally or bilaterally at infra-orbital/supra-orbital sinuses.
- There is conjunctivitis, frequently with adherence of eyelids or with accumulation of cheesy exudate in conjunctival sac.

Fig. 2: Caseous material deposited in infra orbital sinus

- Oedema of face and occasionally of wattles is common.
- In complicated cases, there may be tracheitis, bronchitis, pneumonia or airsacculitis.

Diagnosis

- Typical history, signs and lesions are suggestive of infectious coryza, although other respiratory diseases of chickens must be ruled out.
- *A. paragallinarum* is present in sinus exudate and is easily demonstrated in stained smears. For collection of sample, a sterile cotton swab is to be

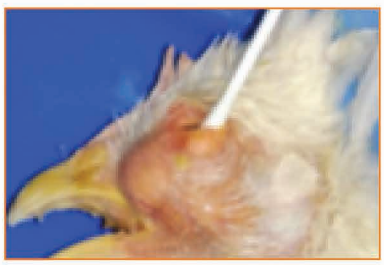

Fig. 3: Collection of swab from conjunctival sac of affected bird

inserted deep into sinus cavity (Fig. 3), where organism is most often found in its pure (uncontaminated) form. Ocular, nasal and tracheal or air sac exudates may also be taken on a sterile swab. Samples should be transferred to Brain Heart Infusion (BHI) broth media supplemented with nicotinamide adenine dinucleotide (NAD).

- Aseptically collected sinus exudate or other sample should be swab streaked on 5 percent sheep blood agar supplemented with 1 percent heat-inactivated, sterile-filtered chicken serum and then on same plate, an S-shaped streak of *Staphylococcus aureus* (a strain that causes hemolysis and release of V factor/NAD from erythrocytes) should be made, which will serve as a feeder colony. Culture should be incubated at 37°C under micro aerobic or anaerobic conditions with increased levels of CO_2 (5-10 percent) pressure for 24-48 hours. Tiny dewdrop satellite colonies of *A. paragallinarum* will grow adjacent to feeder colony (Fig. 4 and 5).

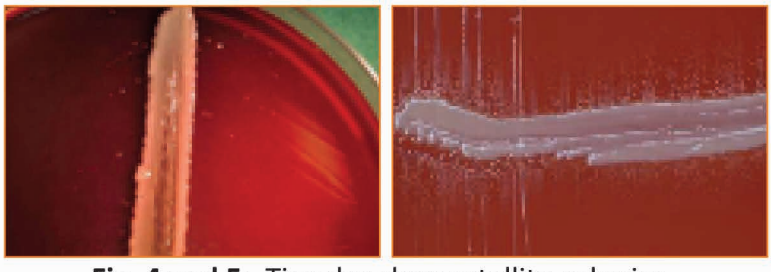

Fig. 4 and 5: Tiny dewdrop satellite colonies adjacent to feeder colony

- A smear of sinus exudate or culture should be made and Gram stained. It should reveal Gram-negative bipolar-staining and pleomorphic rod or coco-bacilli morphology with a tendency to form filament like arrangement with short chains (Fig. 6).

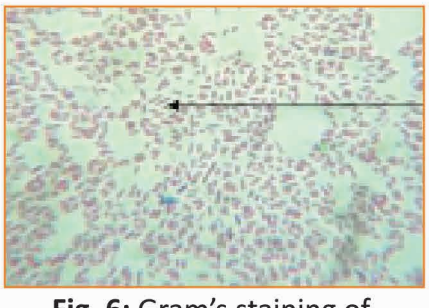

Fig. 6: Gram's staining of *A. paragallinarum* (arrow)

- Organism can be further identified by biochemical tests specific for *A. paragallinarum.* It can ferment sugars like glucose, sucrose, maltose and mannitol, and produce acid but do not ferment some of the sugars such as lactose and trehalose. It is negative for MR, VP, indole, catalase and some other tests. A non-pathogenic species, *Avibacterium avium, (Hemophilus avium)* may be cultured from the sinus, either alone or with *A. paragallinarum. A. paragallinarum* is catalase negative and the non-pathogenic species is catalase positive.
- Another efficient diagnostic procedure is to inoculate sinus exudates or culture into two or three young normal chickens by infraorbital sinus (intra sinus). Typical signs and lesion associated with coryza may develop in 24-28 hours or longer (3-5 days); however, incubation period may be delayed up to 1 week if only a few organisms are present in the inoculum.
- Although isolation of bacterium along with biochemical characterization used to be set procedures to confirm presence of *A. paragallinarum,* it is a challenging set of requirement as the organism is fastidious, slow-growing and needs several days for confirmation.
- Improvement in molecular diagnostics has largely curtailed the awaiting time for disease reporting in matter of hours to begin suitable therapeutic regimen in shortest possible time point. Polymerase chain reaction (PCR) test that is specific for *A. paragallinarum,* has now become largely indispensable to its identification with having advantages closely accurate to conventional techniques i.e. culture, with much

rapidity that avoids false negativity.

- Host's based diagnostics include detection of antigen/serovar specific antibody in circulation. For this, Haemeagglutination-Inhibition (HI) test is an important test and is in wide use. Immunodiffusion tests also can be used to detect *A. paragallinarum* antibodies in serum. Both tests are serotype specific.
- Differential diagnoses should be made for fowl cholera, mycoplasmosis, laryngotracheitis, Newcastle disease, infectious bronchitis, avian influenza, avian metapneumovirus (swollen head syndrome), ornithobacterosis and vitamin A deficiency.

Therapeutic Measures

Despite having tremendous success to curtail the disease through means of vaccination practices, the current commercially available vaccines at many places are not fully competent to confer protection against the disease. Therefore, in such cases, disease resulted in gradual and massive outbreaks. To this situation, early antimicrobial treatment and supportive care can help infected birds to recover and counteract such consequent losses to vaccine failures. Immediate administration of medication *via* drinking water is recommended until medicated feed is available.

- *A. paragallinarum* isolates are reported to be sensitive to Penicillin and few new generation Penicillin groups of compounds, and macrolide like Tylosin. Other macrolide antibiotics such as Erythromycin, third generation fluoroquinolone antibiotics like Enrofloxacin are also found to be partially effective against some isolates. Most of the isolates have shown resistance mainly against sulphonamides and partly to amino-glycosides (more specifically to Streptomycin) and tetracycline group of compounds with rare sensitivity to Gentamycin and Oxytetracycline compound, respectively in many cases.
- **Levofloxacin** is a third generation fluoroquinolone with broad-spectrum activity against most strains of Gram-positive and Gram-negative, anaerobic bacterial pathogens including *A. paragallinarum* responsible for respiratory tract and has an excellent activity against Mycoplasma. It is referred to as **"respiratory quinolones",** which exhibited modest activity towards important respiratory pathogens. There is no maximum residual limits (MRLs) level and withdrawal period fixed for Levofloxacin by regulatory agencies for birds.
- Levofloxacin exerts its bactericidal activity by inhibiting bacterial DNA synthesis. It promotes breakage of DNA strands by inhibiting DNA gyrase in susceptible organism, which inhibits relaxation of supercoiled DNA. It is highly bioavailable (99 percent) after oral administration and quickly reaches peak serum level (within 1.5 hours). Peak plasma concentration (C_{max}) is 6.81±0.85 µg/ml. Levofloxacin distributes well to target body tissues and fluids in respiratory tract, skin and kidney, elimination half-life is approximately 6-8 hours. Levofloxacin uptake by cells makes it suitable for use against intracellular pathogens. It undergoes limited metabolism and primarily excreted by kidney mainly as active drug. Levofloxacin and mucolytic agent (Bromhexine) combination **(PULMOLIV-BH)** @ 10 mg/ kg b. wt. or 1 ml/ 10 kg b. wt. orally once daily for 3-5 days is found to be highly efficacious for controlling the disease. Bromhexine reduces mucous viscosity and increases mucous clearance, improves breathing and reduces cough.
- Application of an appropriate eye cream is also advisable to birds with eye symptoms.
- Supportive care with immonomodulator such as **Immutas WS** or **Immutas Plus** (400 ml/1000 birds in drinking water or 400 g/ton of feed) helps to improve immune status, alleviate clinical signs and decrease morbidity and mortality.

Prevention and Control

- **Vaccination**
  - Usually, vaccination with two doses of inactivated infectious coryza vaccine at approximately four weeks apart before birds are 20 weeks old extends a long-term immune protection, which lasts for around 30-40 weeks after vaccination. First vaccination should be given at 6-8 weeks of age.
  - However, vaccine is protective against *A. paragallinarum* when serovars of vaccinal strains are matched with local/field strains as commercially available trivalent inactivated vaccine produced from standard internationally recognized strains did not completely protect chickens against three serovars of *A. paragallinarum* field isolates. An indigenous (autogenous) coryza vaccine containing prevalent serotypes appear to be more effective in controlling the disease.
- **Biosecurity and sound management practices**
  - All-in/all-out flow of birds are important disease prevention measures.
  - A Broad spectrum disinfectant [**3DX-P** containing Didecyle Dimethyl Ammonium Chloride (DDAC), N-Alkyl-N-benzyle-N,N-dimethyl benzyle ammonium chloride and Poly (hexamethylene) biguanide hydrochloride] having bactericidal, virucidal, fungicidal and sporicidal activity is helpful for effective terminal decontamination, equipment/surface sanitation, water sanitation or aerial spray when used as per recommended mixing rate.
  - Premises should be kept vacant for 2-3 weeks after thorough cleaning and disinfection before restocking with 1-day-old or other coryza-free chickens. As much as possible, they should be raised in quarantine.
  - Replacement chickens should be raised on the same farm or obtained from clean flocks. If replacement pullets are to be placed on a farm that has a history of infectious coryza, vaccination helps prevent and control the disease.
  - Proper ventilation, avoidance of overcrowding and wet litter are also important factor.
  - Proper nutritional support along with immunomodulatory compound (**IMMUTAS**) is an utmost requirement.

Conclusion

Infectious coryza is a well-recognized and commonly encountered highly contagious upper respiratory tract disease of poultry caused by bacterium *A. paragallinarum.* Occurrence of outbreaks has emphasized that the disease can be significant in meat chickens as well as layer chickens. Severe economic losses occur due to growth retardation, decreased egg production, feed conversion efficiency, increased condemnation and mortality especially when it is complicated by viral, mycoplasmal or other bacterial common respiratory tract infections. AIC can be controlled through a combination of prevention, treatment, biosecurity and sound management practices. Commercially available vaccines does not protect birds from local /field strains. Autogenous coryza vaccine would be a novel preventive measure. Early antimicrobial treatment can help infected birds recover. Excellent bioavailability, large volume of distribution, high C_{max} and pharmacokinetic-pharmacodynamic hybrid efficacy predictors for Levofloxacin indicated that administration of Levofloxacin orally might be highly efficacious against infectious coryza. All-in/all-out flow of birds and sound biosecurity measures using disinfectant/sanitizer having bactericidal, virucidal, fungicidal and

sporicidal activity is helpful for effective control. Diet rich in nutrients as well as immunomodulatory compound should be implemented in order to boost immune system and prevent infections.

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