

Avian Influenza: Wild Birds Spread the Virus

Imran Al¹, Ritesh Patel¹, Ajay Mutkule¹ and Ranjan Kumar Singh², Pravin Kumar³

¹Department of Veterinary Pathology,

²Department of Animal Genetics and Breeding, ³Department of Animal Nutrition

Bihar Veterinary College, BASU, Patna-14

Introduction:

Avian influenza, commonly referred to as bird flu, is a highly contagious viral infection primarily affecting birds. However, certain strains of the avian influenza virus have the capability to infect humans and other mammals, leading to varying levels of illness. This disease is caused by influenza A viruses, which primarily circulate among avian populations but can sporadically cross species barriers to infect humans and other animals. The Orthomyxoviridae family encompasses important genera such as influenza A, B, and C viruses, as well as thogotovirus (Cox et al., 2000). Influenza A viruses are further classified into subtypes based on the antigenic properties of their hemagglutinin (HA) and neuraminidase (NA) surface glycoproteins. There is significant variability among these subtypes, with less than 30% amino acid conservation (Fouchier et al., 2005). Currently, 16 HA and 9 NA subtypes have been identified. Influenza A viruses are unique among influenza types (A, B, and C) as they have ability to infect various animal species, including birds, humans, swine, and horses. Avian influenza (AI) viruses, categorized under influenza A, pose substantial economic threats to the poultry industry and potential health risks to humans (Swayne et al., 2003). The ability of these viruses to infect multiple species highlights their zoonotic potential and the importance of surveillance and control measures in both animal and human populations.

Transmission:

Wild birds play a critical role as natural hosts and reservoirs for avian influenza viruses, influencing disease evolution, maintenance, and transmission dynamics. Among wild birds, migratory species are particularly important contributors to virus dissemination. The complexity of bird-to-bird transmission varies depending on factors such as virus strain, bird species involved, and environmental conditions. The quantity of viral particles released by infected birds, particularly

through respiratory or intestinal routes, is linked to the potential for virus spread. Highly pathogenic viruses can lead to rapid avian mortality but may result in lower viral particle excretion, thereby limiting transmission to susceptible hosts compared to less pathogenic strains. Avian influenza virus shedding occurs primarily in feces, which can contaminate water sources and facilitate transmission via fecal-oral or fecal-cloacal routes. For instance, Webster et al. (1978) estimated a significant number of infectious virus particles per gram of feces from infected ducks. This contamination can affect lake or pond water, with the virus remaining infectious for several days at moderate temperatures (Hinshaw et al., 1980).

Risk Factor:

Risk factors for avian influenza in poultry include various elements related to disease spread and transmission:

Disease Situation in Neighboring Areas: The prevalence of avian influenza in neighboring regions or countries can increase the risk of disease introduction through movements of infected birds or contaminated materials.

Previous AI Outbreaks and Adjacent Regions: States or districts with a history of avian influenza outbreaks and their adjacent areas are at higher risk due to potential residual virus circulation or reintroduction.

Domestic Duck and Backyard Bird Populations: High densities of domestic ducks and backyard birds can facilitate virus amplification and spread, particularly in settings with poor biosecurity measures.

Live Bird Markets (LBMs): The number and activity of live bird markets, especially those with inadequate biosecurity, can serve as hubs for virus transmission among different bird species and contribute to the dissemination of avian influenza.

Proximity to Migratory Bird Habitats: The proximity of poultry farms or live bird markets to national sanctuaries, wetlands, lakes, or flyways used by migratory and wild birds increases the risk of virus introduction and transmission between wild and domestic bird populations.

Captive Bird Facilities: Facilities housing captive birds, such as zoos or aviaries, can act as potential reservoirs for avian influenza viruses and pose a risk of transmission to wild or domestic bird populations.

Flyways of Migratory Birds: Areas along major migratory bird flyways are at higher risk of avian influenza introduction, as migratory birds can carry and spread the virus over long distances during seasonal movements.

Pathology:

In poultry, avian influenza viruses predominantly target respiratory and gastrointestinal epithelial cells upon infection. The severity and clinical manifestations of avian influenza in poultry can vary widely based on multiple factors, including the specific virus strain involved and the species of the infected host.

□ Respiratory Manifestations:

Avian influenza viruses commonly cause respiratory signs and symptoms in infected poultry. These may include:

Coughing and Sneezing: Infected birds may exhibit frequent coughing and sneezing, which are indicative of upper respiratory tract involvement.

Nasal Discharge: Some birds may develop nasal discharge, which can range from clear to mucoid or purulent, depending on the severity of infection.

Difficulty Breathing: Severe respiratory infections can lead to dyspnea (difficulty breathing) due to inflammation and damage to the respiratory epithelium.

Rales and Respiratory Distress: Birds with more severe infections may exhibit rales (abnormal respiratory sounds) and respiratory distress, characterized by open-mouthed breathing and increased respiratory effort.

☐ **Gastrointestinal Manifestations:**

Avian influenza viruses can also affect the gastrointestinal tract, leading to symptoms such as:

Diarrhea: Infected birds may experience watery or mucoid diarrhea, often accompanied by dehydration.

Decreased Feed Intake: Sick birds may show reduced appetite and decreased feed consumption, leading to weight loss and decreased egg production in laying hens.

Vomiting: Severe gastrointestinal infections can cause vomiting in affected birds.

☐ **Systemic Disease:**

In some cases, avian influenza can progress to systemic disease, affecting multiple organ systems:

Depression and Lethargy: Infected birds often appear depressed and lethargic, with reduced activity levels.

Neurological Signs: Certain avian influenza strains can cause neurological symptoms such as tremors, ataxia (loss of coordination), and paralysis.

Organ Failure: Severe infections may result in organ failure, including lung failure due to severe pneumonia, liver or kidney failure, and ultimately death.

☐ **High Mortality Rates:**

The mortality rate associated with avian influenza can be significant, especially with highly pathogenic strains. Mortality rates may vary depending on factors such as the virus subtype, host species, and environmental conditions. In outbreaks caused by highly pathogenic avian influenza viruses (e.g., H5N1 or H5N8), mortality rates can reach up to 100% in affected flocks within a short period.

Economic Importance:

The global poultry industry, which has been rapidly expanding, faces significant economic repercussions from avian influenza outbreaks. Highly pathogenic avian influenza (HPAI) viruses are particularly detrimental, leading to high mortality rates in affected poultry flocks. This results in direct financial losses due to bird culling, decreased bird value, and disruptions in production. However, beyond direct production losses, trade restrictions and reduced consumer demand due to avian influenza outbreaks contribute further to economic strain across multiple sectors of the poultry industry. From the perspective of poultry farmers, while the losses from HPAI are substantial, the actual probability of infection affecting their flocks may be relatively low.

As of 2023, the economic importance of avian influenza outbreaks in the poultry industry remains significant. HPAI outbreaks continue to pose substantial financial burdens due to direct losses from bird mortality and decreased market value, as well as indirect impacts from trade disruptions and reduced consumer confidence. The ongoing challenge for poultry producers and public health authorities is to implement comprehensive control strategies that address both the immediate economic consequences and the broader implications for global trade and food security.

Diagnosis:

The diagnosis of avian influenza in poultry involves a combination of clinical evaluation, laboratory testing, and epidemiological investigation. Common diagnostic methods include virus isolation, serological tests (e.g., ELISA), PCR-based assays for viral nucleic acids, and post-mortem examinations to detect characteristic lesions.

In India, avian influenza diagnostic testing is conducted at five regional disease diagnostic laboratories located in Bengaluru, Pune, Jalandhar, Kolkata, and Guwahati, along with a central disease diagnostic laboratory at IVRI Izatnagar. However, ICAR-NISHAD Bhopal serves as the national reference laboratory specifically designated for confirming avian influenza infections. To initiate testing, samples such as oropharyngeal or cloacal swabs must be carefully packaged, labeled, and sent to ICAR-NISHAD for definitive confirmation of outbreak cases. This centralized approach ensures standardized testing procedures and accurate diagnosis of avian influenza, facilitating timely and effective disease control measures in affected regions of India.

Prevention And Control:

The Government of India has established a comprehensive procedure to address suspected avian influenza outbreaks, which involves several key steps to ensure prompt response and effective containment. Upon receiving initial information, a Chief Veterinary Officer/District Animal Husbandry Officer (CVO/DAHO) conducts an immediate site visit. Diagnostic kits are provided to Veterinary Officers/Disease Investigation Officers (DIO), who carry out preliminary and clinical investigations while using personal protective equipment (PPE). Samples are collected and promptly dispatched for confirmation at the National Institute of High Security Animal Diseases (NIHSAD) in Bhopal. Simultaneously, an "Alert Zone" is identified, and corresponding restrictions are imposed pending test results. A designated veterinary officer is appointed as the "Designated Officer" for managing the outbreak response. Upon confirmation of avian influenza, the state government initiates control and containment measures. A containment operation is conducted, followed by the demarcation of surveillance and infected areas. The immediate one-kilometer radius around the confirmed site is declared the "Infected Zone," with a ten-kilometer radius designated as the "Surveillance Zone." The state government, in consultation with the Government of India, has flexibility to adjust zone radii based on infection spread. Stringent measures are implemented, including a ban on poultry movement, closure of poultry and egg markets/shops, and restrictions on wild and stray bird access. These measures encompass bird destruction/culling, safe disposal of carcasses and infected materials, premises and implement disinfection, and implementation of the Post Operation Surveillance Plan (POSP). Compensation is provided to affected farmers for culling losses, and restocking in culling zones occurs after three months following sanitization certification post-POSP completion.

Challenges with avian influenza vaccination arise due to difficulties in differentiating between vaccinated and infected individuals (seropositivity). Constraints on meat export also discourage widespread avian influenza vaccination. Innovative approaches such as reverse genetics and universal influenza vaccines are crucial for preventing potential pandemics in the future.

Conclusion:

The current threat posed by Avian Influenza to the poultry industry is significant, mainly driven by the causative agent, the Influenza A virus of the Orthomyxoviridae family. The disease's widespread prevalence carries severe consequences for trade and has profound economic implications. Traditionally, control measures such as stamping out or culling are implemented,

with vaccination often viewed cautiously due to its potential negative impact on trade dynamics. Although vaccination remains vital for preventing influenza spread, its effectiveness against pandemic strains is limited. Developing new vaccines tailored to specific viral variants is time-consuming and resource-intensive. To address this challenge, there is a pressing need for the development of a universal influenza vaccine. A universal vaccine would offer comprehensive and long-lasting protection against a broad spectrum of influenza viruses, transcending seasonal variations and antigenic shifts. By providing robust immunity against diverse strains, a universal vaccine has the potential to revolutionize influenza control strategies and mitigate the socio-economic impacts of outbreaks.
