

Avian Influenza in Poultry Farms: Field Recognition, Outbreak Response and Control Strategies

*A. Pavan Kumar¹, B. Ramya² and P. Venkata Sai Kumar³

¹Ph.D Scholar, Department of Veterinary Pathology, College of Veterinary Science, Rajendranagar, Telangana, India

²Associate Professor, Department of Veterinary Pathology, College of Veterinary Science, Rajendranagar, Telangana, India

¹PG Scholar, Department of Veterinary Pathology, College of Veterinary Science, Rajendranagar, Telangana, India

*Corresponding Author's email: pavankumar.a465@gmail.com

Avian influenza, or bird flu, ranges from a mild respiratory infection to a rapidly fatal systemic disease of birds. Highly pathogenic H5N1 viruses have caused repeated outbreaks in Indian poultry since 2006, and clade 2.3.4.4b has spread through wild birds worldwide and reached mammals, including dairy cattle. There is no treatment in poultry. In India, control relies on early reporting, laboratory confirmation, culling, movement restrictions, disinfection and compensation under the national Action Plan.

Keywords: avian influenza; bird flu; H5N1; poultry; biosecurity; outbreak response; One Health

Introduction

Few poultry diseases make the news like bird flu, and farmers often lose as much from culling and market panic as from the virus itself. Fowl plague was described in Italy in 1878 and shown in the 1950s to be caused by an influenza virus [1]. The H5N1 lineage of current concern emerged in geese in Guangdong, China, in 1996 [1]. India's first H5N1 outbreak in poultry occurred in Maharashtra in 2006, and outbreaks have recurred since [2], with different lineages entering at different times, such as clade 2.3.2 in Tripura in 2011 [3]. Since about 2020, clade 2.3.4.4b H5N1 has spread through wild birds across most of the world, infecting many mammals and, in 2024, dairy cattle in the United States [4,5].

The Virus in Brief

Avian influenza viruses are influenza A viruses (family *Orthomyxoviridae*) with a genome of eight RNA segments [6]. Subtypes are named after two surface proteins, haemagglutinin (H1–H16 in birds) and neuraminidase (N1–N9). The virus changes through mutation and reassortment, in which co-infecting viruses swap gene segments, producing combinations such as H5N8 or H5N6 [1,6]. For control, viruses are classed by their effect in chickens [7]. Low pathogenicity avian influenza (LPAI), such as H9N2, which is widespread in India, causes mild respiratory disease or reduced egg production. High pathogenicity avian influenza (HPAI) causes severe, often fatal systemic disease and is defined by virulence tests in chickens or by the haemagglutinin cleavage-site sequence. HPAI viruses have so far arisen naturally only from H5 and H7 subtypes, and LPAI H5 and H7 viruses in poultry can mutate into HPAI, which is why these subtypes are watched closely [6,7].

How Avian Influenza Reaches a Farm

Wild water birds, especially ducks, geese, swans, gulls and shorebirds, are the natural reservoir. They usually carry LPAI viruses without illness and spread them along migration routes [1,8].

In India, domestic ducks need special attention: some H5N1 strains infect them with few signs, and free-ranging ducks sharing ponds and paddy fields with wild birds can bridge the virus to chickens [6,8]. The Action Plan therefore focuses surveillance on wetlands, duck flocks, live-bird markets and border areas, especially in the migratory season [2]. Infected birds shed large amounts of virus in droppings and respiratory secretions. Farms are most often infected through direct or indirect contact with wild birds and their droppings, particularly near water bodies. Contaminated water, feed, litter, crates, egg trays and vehicles, and people moving between farms and markets, also carry the virus. Egg transmission is unimportant, and incubation ranges from a few hours to a few days [6].

Recognising Avian Influenza on the Farm

Clinical signs

In chickens and turkeys, HPAI often appears as sudden heavy mortality, sometimes before any signs are noticed [6]. Survivors are dull with ruffled feathers. The head, comb and wattles may be swollen and bluish-purple, with haemorrhages on the shanks and feet, nasal discharge, laboured breathing and diarrhoea. Nervous signs such as tremors, twisted neck and loss of balance are more common in ducks and geese, and egg production in layers falls suddenly or stops. LPAI causes milder respiratory signs and egg drops, though losses can be heavy when, as often with H9N2, it combines with other infections [6].

Post-mortem and histopathology

If HPAI is suspected, carcasses should not be opened on the farm but packed safely and sent through official channels to a designated laboratory [2]. HPAI lesions reflect widespread vascular damage [6,8]: a swollen, oedematous head, comb and wattles; haemorrhages under the skin of the shanks, on the heart fat, on the proventricular lining and under the gizzard lining; pale or mottled pancreatic necrosis; and congested, oedematous lungs. Microscopically, HPAI causes multifocal necrosis and inflammation in the brain, heart, pancreas, lungs and lymphoid organs with damage to blood vessel linings [8]. This picture strongly suggests HPAI but cannot identify the subtype or replace molecular confirmation.

Confirming the Diagnosis

Signs and lesions are not enough, since virulent Newcastle (Ranikhet) disease looks almost identical. Following WOAHA guidance [7], oropharyngeal and cloacal swabs and tissues such as trachea, lungs, brain, heart and spleen are collected. Real-time RT-PCR for the matrix gene detects any influenza A virus, positive samples are tested with H5- and H7-specific assays, and cleavage-site sequencing shows whether the virus is highly pathogenic. Serology (haemagglutination-inhibition, agar gel immunodiffusion, ELISA) is used mainly for surveillance. In India, samples go through the State Animal Husbandry Department to the national referral laboratory, ICAR-National Institute of High Security Animal Diseases (NIHSAD), Bhopal [2]. Fowl cholera, infectious laryngotracheitis, infectious bronchitis, heat stress and poisoning should also be ruled out.

Outbreak Response and Control Strategies

Avian influenza in poultry cannot be treated. Human antiviral drugs are not used in flocks because they are impractical and could select resistant viruses that threaten human treatment [6], and supportive care makes little difference.

What the farmer should do immediately

1. Report sudden heavy deaths, swollen heads, bluish combs or a sharp drop in egg production to the nearest veterinary officer at once.
2. Stop all movement of birds, eggs, manure, feed bags, vehicles and people off the farm.
3. Do not sell, give away or eat sick or dead birds, or dump carcasses, and keep people, animals and wild birds away from them.
4. Wear gloves, a mask, eye protection and boots when handling sick or dead birds, and wash hands afterwards.

The official response under India's Action Plan

When HPAI is confirmed, the response follows the Action Plan for Prevention, Control and Containment of Avian Influenza (revised 2021) [2], summarised in Table 1.

Table 1. Main elements of the official response to a confirmed HPAI outbreak in India

Zone or stage	Approximate area or timing	Main actions
Infected zone	About 1 km around the outbreak site	Culling of all poultry; safe disposal of birds, eggs, feed, litter and manure; cleaning and disinfection
Surveillance zone	Up to about 10 km around the outbreak site	Restrictions on movement and sale of poultry; active surveillance of birds
Post-operation surveillance	After culling and sanitisation	Continued testing to confirm the area is free of infection
Restocking	Typically some months after the area is declared free	Repopulation of farms only after official clearance
Compensation	After culling	Payment to farmers for culled birds and destroyed material

Early reporting is essential. Hiding deaths or selling sick birds lets the virus outrun the control teams, and compensation exists so that reporting does not ruin the farmer.

Cleaning, disinfection and restocking

After culling and disposal, litter, manure and leftover feed are removed and destroyed, and surfaces are washed with detergent and disinfected. Once organic matter is removed, influenza viruses are easily killed by disinfectants and heat, but they survive for long periods in cold water and droppings [6]. Restock only after official clearance, with improved biosecurity in place.

Prevention: Keeping the Virus Out

Biosecurity

Biosecurity is the main defence. Keep wild birds out with bird-proof netting, cover feed and water, and clean up spilled feed. Do not keep ducks with chickens, keep poultry away from ponds and paddy fields used by waterfowl, and do not use untreated surface water. Fence the farm, keep a visitor register, provide separate boots and clothing, keep foot dips fresh, disinfect vehicles, crates and egg trays, and never bring unsold birds back from the market. Tighten all measures during the migratory season and when outbreaks are reported nearby.

Vaccination

Inactivated and vector vaccines against H5 and H7 viruses are used in several countries alongside surveillance [6]. They reduce disease, deaths and virus shedding but do not always prevent infection, so vaccinated flocks may carry the virus silently. Vaccines must match circulating strains, and vaccination complicates surveillance and trade unless DIVA tests (differentiating infected from vaccinated animals) are used [6,7]. India currently relies on surveillance and stamping out, without routine HPAI vaccination [2], and individual farms must not use unapproved vaccines.

Economic Impact

Losses go far beyond dead birds: culling, lost production before restocking, cleaning costs, compensation and surveillance, possible loss of export markets, and falls in chicken and egg demand that hurt farmers far from the outbreak. Because much of the market loss stems from fear rather than the virus, clear public communication is essential.

Public Health Significance

Avian influenza is a zoonosis, but human infection remains uncommon. According to the World Health Organization, people are infected mainly through direct contact with infected birds or

contaminated surroundings, for example during handling, slaughter or culling, or at live-bird markets [9]. The reported case fatality rate of human H5 infection has been higher than that of seasonal influenza, but current viruses have not shown sustained person-to-person spread, and there is no evidence that properly cooked poultry or eggs transmit H5 viruses [9]. The greater concern is the future: each mammalian infection, including the spread to dairy cattle, gives the virus a chance to adapt to people [4,5]. How close current viruses are to spreading efficiently in humans remains uncertain [5], making avian influenza a clear example of the One Health approach.

Conclusion

Avian influenza cannot be treated, and no single farm can vaccinate its way out of it. It is controlled where wild birds meet poultry, and by how quickly suspected cases are reported. Sudden heavy deaths, swollen heads, bluish combs or a crash in egg production should be reported at once, wild birds and ducks kept away from chickens, and official orders followed. For consumers, properly cooked chicken and eggs are safe.

Conflict of Interest

The authors declare no conflict of interest.

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