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Popular Article

Outbreak alert on H5N1 Bird flu

Munuru Srikanth[1]*, Shaik Sharmila begum[2], R.V. Geetha[3]
[1*]Department of Microbiology, Saveetha Institute of Medical and Technical Science, Tamil Nadu, Chennai, India.
[2] Department of Biotechnology, Dr. Lankapalli Bullayya College, Affliated to Andhra University, Visakhapatnam, Andhra Pradesh, India.
[3] Department of Microbiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, TamilNadu, India.
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Introduction

H5N1 bird flu has now become widespread in many wild birds, eventually infecting many domestic poultry and farms. Recently, the Center for Disease Control, US, also highlighted the same situation. This bird flu is caused by an avian influenza Type A virus, which was thought to infect wild birds primarily later in all the other animals. This virus almost infected 100 different species of wild avians, including wild aquatic birds. This infection has over time been transmitted to many domestic poultry birds and infected a few mammals too. It is known that most of the infected birds behaved asymptomatic or had mild symptoms that were not initially identified. Based on the pathogenic behavior, many studies have classified it into two types: low-pathogenic avian influenza (LPAI) and high-pathogenic avian influenza (HPAI). In LPAI, there is no risk of death and only mild symptoms are observed, whereas in HPAI, severe symptoms and a high mortality rate are observed. The structure of the avian influenza virus is an orthomyxovirus, 100-mm spherical-shaped virion enveloped with a nucleocapsid consisting of 8 single-stranded strands of RNA. A matrix protein lines the inside of the envelope, while glycoprotein peplomers, rod-shaped haemagglutinin (HA), homotrimers of class I membrane glycoproteins, and mushroom-shaped neuraminidase (NA), tetramers of a class II membrane protein, line the outside. Based on the HA and NA variations on the virion molecule, there

are a total of 15 HA subtypes and 9 NA subtypes, which leads to different combinations of both glycoproteins that form a specific strain. Apart from all other strains, there are five major strains that can infect humans: H5N1, H7N3, H7N7, H7N9, and H9N2. Comparatively with others, the H5N1 virulent strain is considered an extensive infective strain. During 2020, the number of HPAI virus subtypes started increasing, which showed a global outbreak in poultry and wild birds. Multiple HPAI A (H5N8) outbreaks began in 2020 in Europe, Africa, and Southeast Asia, and HPAI A (H5N1) and A (H5N5) virus outbreaks began in 2021 in Europe. In 2021, almost 54 countries reported the outbreak of Influenza A (H5N1) viruses, and many more strains with different N subunit moieties were found infecting animals.

Since 2023, there has been a rise in infections of H5N1 bird flu in poultry from countries like Asia (Israel, Japan, Korea, and Vietnam), Africa (Niger), and Europe (Belgium, Czech Republic, France, and Hungary). Germany, Russia, Sweden, Denmark, and Portugal). In 2024, it was found that Influenza A (H5N1) affected first-time infected cows and other mammals like sea elephants in Argentina, sea lions in Peru and Chile, and foxes in Canada, France, and other countries. An alert was announced to humans that exposure to this virus can increase sporadic human infections, mostly in people who get in contact with infected animals in poultry, farms, and wild forest areas. In a previous study, it was also shown that the H5N1 clade 2.3.4.4b virus showed direct contact and airborne transmissibility in ferrets (Restori *et al., 2024.*).

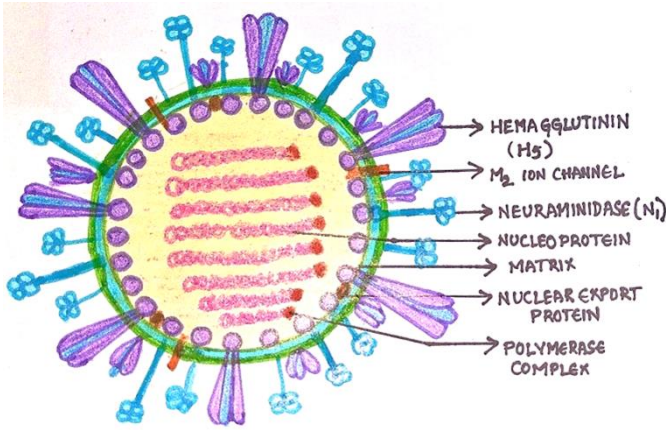

Figure 1*: Structure of Influenza A (H5N1)*

Transmission to humans

In general, the avian influenza virus doesn't infect humans, but in rare conditions, due to the high pathogenicity of the strain, there is a risk of disease transmission to humans. The most infective strains are A (H7N9), A (H5N1), and A (H5N6) viruses. This is transmitted through infected animals

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mucous, saliva, blood, body secretions, and fecal excretions; even the milk of the infected animal can cause the infection. The virus gets into a person through the eyes, nose, and mouth when the virus particles are in the air, like droplets or small aerosols. The symptoms of infections in humans are not very severe; mild symptoms were observed as conjunctivitis, upper respiratory infection symptoms, fever, cough, diarrhea, nausea, vomiting, sore throat, runny nose, shortness of breath, muscle or body aches, headaches, and fatigue.

Symptoms in animals

AI infection showed respiratory symptoms in poultry, including sneezing, coughing, nasal and ocular discharge, and enlarged infraorbital sinuses. It was also observed that AI infection is associated with some secondary bacterial pathogens, which leads to chronic inflammation in the lungs. In a few high-pathogenic Avian influenza viruses

Preventions

- Avoiding direct contact with wild birds as strain is asymptomatic in birds' identification of infected ones is a bit hard.
- If infected poultry birds and domestic animals, identification and isolation of infected birds and animals from the healthy ones is necessary.
- Maintaining proper protective contact with infected animals as it is transmitting to humans too.
- Educating the workers and caretakers about the risk of infection and implementing good handling practices, proper protective clothing like gloves, masks, and goggles, proper discarding procedures, and proper sterilization methods.
- Spreading awareness among people who are meat eaters to cook meat at 212˚F before consuming it because there is a high risk of disease if meat is partially cooked.
- Consuming milk and other dairy products without proper pasteurization leads to severe illness (Guan *et al.*, 2024).
- People who pet birds should be careful, follow proper handling techniques, and exercise caution while handling animal secretions.
- If a person found to be infected with the flu, self-isolation and following good medication prescribed by a health officer are essential.
- There is no specific vaccine developed for this Asian Influenza; many research institutions are working hard to develop an effective vaccine for the disease.

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- Antiviral drugs can help cure the disease, but proper diagnosis and monitoring should be given to the patient as the infection is trending new. Alleviation of symptoms was observed with antiviral therapy using either a cap-dependent endonuclease inhibitor (baloxavir) or a neuraminidase inhibitor (oseltamivir, peramivir, or zanamivir) (Kumari *et al.*, 2023).

Diagnosis

Based on symptoms and exposure, one can assume and suspect the infection, but to confirm the presence of the infection, one should undergo rRT-PCR by collecting a sample from the upper respiratory region, like the nose and throat, with a swab. There are many sources for the isolation of Influenza virus particles, like the trachea, lungs, air sac, intestine, and sinus exudates, but isolation from the egg embryo of the infected bird is a standard traditional method for culturing (Woolcock *et al*. 2008).

Development of Vaccines

An influenza A (H7N9) candidate viral vaccine (CVV) has been generated by the CDC or another public health partner that vaccine producers can utilize to create a flu vaccine. Candidate viral vaccines like CBER-RG7C (CCBER/FDA, USA), IDCDC-RG56N (CDC, USA), CBER-RG7D (CBER/FDA, USA), NIBRG-375 (NIBSC, UK), IDCDC-RG56B (CDC, USA), IDCDC-RG32A (CDC, USA), IDCDCRG32A.3 (CDC, USA), NIBRG-267 (NIBSC, UK), CBER-RG4A (CBER/FDA, USA), NIBRG-268 (NIBSC, UK), NIIDRG-10.1 (NIID, Japan), IDCDC-RG33A (CDC, USA), and SJ005 (SJCRH, USA) were developed using a reverse genetics approach (*Source: CDC & WHO).* Many new influenza virus vaccine formulations have been generated in recent days. It was predicted that a multivalent formulation will produce widely protective immune responses against influenza viruses that are seasonal as well as pre-pandemic. Multivalent combinations of HA and NA (H1, H2, H3, H5, H7, N1, N2) proteins were used to vaccine mice. Mice immunized with multivalent COBRA vaccines were protected against viruses of many subtypes, and the immunizations produced antibodies that were able to identify a wide range of strains (Uno *et al.*, 2024). Many vaccine development steps are initiated; MDCK cell subline 2B6 is used to increase titer and the production of the H1N1, H3N2, BV, and BY influenza viruses (Yang *et al.*, 2024). (Zinnecker *et al.*, 2024)

Conclusion

Avian influenza, i.e., bird flu, was previously known and identified, but its virulent behavior over the host was not much observed. In recent times, the pathogenic tendency of its strains has been increasing, which is infecting poultry birds, dairy animals, and even humans. The sudden rise in cases

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imposed an alert on the disease. In worse situations of infection, the use of antiviral drugs can help the infected get out of the disease. Many research institutions are striving to develop an efficient vaccine for high-pathogenic strains of the avian influenza virus. As there is no specific drug or vaccine established for the current transforming strains, prevention is the best way to get away from these infections.

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Source: Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases (NCIRD).

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