ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 03 | March - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

AVIUM VIRUS OUTBREAK

Medical Microbiology

Angad Mahajan MBBS Final Year Student, Sri Guru Ram Das University of Health Sciences, Sri Amritsar.

Dr. Kirti Post graduate second year, Department of Conservative Dentistry & Endodontics Genesis Institute of Dental Science & Research, Ferozepur, Punjab.

Dr. Rudhra Koul Senior Lecturer, Department of Conservative Dentistry & Endodontics Genesis Institute of Dental Science & Research, Ferozepur, Punjab.

ABSTRACT

Avium virus is a type of influenza virus that primarily affects birds. It can cause a range of symptoms in birds, from mild to severe, including respiratory problems, diarrhea, and even death. In humans, Avium virus can cause a range of symptoms, from mild respiratory problems to severe pneumonia and even death. However, human cases are relatively rare and usually occur in people who have direct contact with infected birds, such as poultry workers or those who handle birds in live markets.

KEYWORDS

Avian influenza; Bird flu; Respiratory illness.

INTRODUCTION

Mycobacterium avium, commonly known as Avian influenza virus (AIV), is a zoonotic pathogen associated with a wide range of pulmonary and extrapulmonary manifestations in a range of host species like humans, animals, and birds.[9] The virus can be present in a combination of 16 hemagglutinin (HA) and 9 neuraminidase (NA) subtypes, including H5N1, H7N9, and H9N2 and many more. [13] The clinical manifestations in humans from all AIV infections have varied widely in severity, ranging from asymptomatic or from mild to severe illness resulting in death. [2]

PATHOGENESIS

1. Mode of transmission: H5N1 virus infects human cells through respiratory droplets, contaminated surfaces, or close contact with infected birds.
2. Attachment: The virus attaches to human cells, typically in the respiratory tract, via hemagglutinin (HA) protein. The virus penetrates the cell membrane and releases its genetic material (RNA).
4. Replication: The viral RNA is replicated inside the cell, using the host cell's machinery. A membrane protein, the M2 protein, is present in small quantities in influenza A viruses. By functioning as an ion channel, this protein regulates the internal pH of the virus, which is essential for uncoating of the virus during the early stages of viral replication. [4]
5. Transcription: The replicated RNA is transcribed into messenger RNA (mRNA), which carries genetic information. Some genotypes of the virus have acquired a potential N-linked glycosylation site at positions 154–156. Glycosylation at this site, adjacent to the receptor-binding and antigenic sites at the globular tip of the H5 influenza HA molecule, is capable of altering the receptor-binding profile, which may help the virus to evade the host antibody response. [8]
6. Translation: The mRNA is translated into viral proteins, including hemagglutinin (HA) and neuraminidase (NA). New viral particles are assembled using the newly synthesized proteins and RNA.
7. Release: Mature viral particles are released from the host cell through budding or cell lysis. Released viruses can infect other humans or birds, perpetuating the cycle.

EPIDEMIOLOGY

The AIV- A (H5N1) virus was first identified in southern China in 1996, leading to substantial outbreaks among poultry in Hong Kong in 1997, which resulted in 18 human infections. Although the 1997 avian epidemic was controlled, the A(H5N1) virus persisted in birds and resurfaced in 2003, spreading extensively among birds throughout Asia and subsequently reaching Africa, Europe, and the Middle East, where it caused poultry outbreaks and sporadic human infections. Since 2003, more than 22 countries have reported more than 900 sporadic human cases of A (H5N1) infection to WHO. [2] Explosive geographical expansion of the AIV continues to threaten human and animal health during and after the COVID-19 pandemic. Individuals from 17 countries across five continents have been infected by the five emerging (H5N8, H10N3, H3N8, H10N5, and H5N2) and four re-emerging (H5N1, H5N6, H7N9, and H9N2) subtypes of AIV since 2019. H5N1 viruses continue to diversify genetically, spread geographically, and infect humans, as illustrated by the first ever human infection in Victoria, Australia, in May, 2024, and a presumed novel transmission from dairy cattle to a dairy worker from Texas, USA, in April, 2024. [7] On 22 May 2024, the International Health Regulations (IHR) National Focal Point (NFP) for India reported to WHO a case of human infection with AIV- A(H9N2) virus detected in a child resident of West Bengal state in India. This is the second human infection of AIV- A (H9N2) notified to WHO from India, with the first in 2019. The child has recovered and was discharged from hospital. [6, 12]

CLINICAL MANIFESTATIONS IN HUMANS

The incubation period of HPAI H5N1 infection is typically short, lasting for approximately 7 days or less, with an average duration of 2–5 days. H5N1 infection can lead to severe respiratory illness, including pneumonia, acute respiratory distress syndrome (ARDS), and even death. Influenza-like illness with evidence of pneumonia has been observed in seven patients. All seven patients older than 13 years had severe disease (four deaths), whereas children 5 years or younger had mild symptoms with the exception of one who died with Reye's syndrome associated with intake of aspirin. Gastrointestinal manifestations, raised liver enzymes, renal failure and pancytopenia were unusually prominent. [6, 14] No human-to-human transmission in cases reported since 2022 and that most viruses currently circulating are unable to efficiently bind to receptors in the upper respiratory tract of humans.[5] In addition to respiratory symptoms, individuals infected with HPAI H5N1 may experience accompanying symptoms such as headache, muscle pain, sore throat, runny nose, and less commonly, conjunctivitis or bleeding gums. The virus has potential to affect various organs in the humans, including the lung, central nervous system (CNS), and digestive system. Severe cases of HPAI H5N1 infection have been associated with hospitalization due to the development of complications such as acute respiratory distress syndrome (ARDS) and multi-organ failure, such as respiratory and renal failure, pulmonary hemorrhage, pneumothorax, and pancytopenia. Fatal outcomes in HPAI H5N1-infected individuals have been associated with high viral loads, lymphopenia, and elevated levels of inflammatory cytokines and chemokines. [3]

LABORATORY DIAGNOSIS

The diagnosis of AIV infections, even highly pathogenic AIV (HPAI), represents a considerable challenge due to the lack of pathognomonic or specific clinical signs and their variation in different avian hosts plus the marked antigenic variation amongst influenza A viruses. Conventional laboratory techniques involve the isolation, identification and characterization (including virulence estimates) of the virus. While this has proven successful in the past and remains the method of choice, for at least the initial outbreak, the delays associated with conventional diagnosis are often considered unacceptable for the application of control measures, especially stamping out policies, and there is an overwhelming demand for rapid results. More and more, molecular biological techniques are being used and in particular

reverse transcriptase-polymerase chain reaction (RT-PCR) and real-time RT-PCR technologies are being employed for rapid diagnosis.[1] Appropriate samples for influenza tests should be rapidly taken and processed from patients with relevant exposure history within 10–14 days preceding the symptom onset. With routine diagnostic laboratory assays for seasonal influenza viruses, human infection with A(H5Nx) viruses should be positive for AIV, and negative for influenza B, A(H1), A(H1)pdm09 and A(H3) viruses. Such non-seasonal influenza type A virus isolates, or clinical samples that cannot be subtyped, should be sent to the respective NIC. If they are confirmed positive for H5 virus, the samples should be sent further along to a WHO Collaborating Centre for Reference and Research on Influenza (WHO-CCRRI) be subtyped, they should be shared with the national reference laboratory of the respective country.[11]

PREVENTION AND TREATMENT

The best way to prevent H5N1 bird flu is to avoid sources of exposure whenever possible. Infected birds shed AIV in their saliva, mucous, and faeces and respiratory secretions and other body fluids. People should avoid unprotected (not using respiratory and eye protection) exposures to sick or dead animals including wild or domesticated birds, poultry and other wild or domesticated animals. Wildlife agencies must regularly investigate reports of sick or dead animals. This type of reporting could help with the early detection of illnesses like West Nile virus or H5N1 bird flu. Eating uncooked or undercooked poultry or beef can be dangerous. Cooking poultry and eggs to an internal temperature of 165˚F kills bacteria and viruses, including AIV. Choosing pasteurized milk is the best way to keep oneself safe. Unpasteurized (raw) milk and products made from raw milk, including soft cheese, ice cream, and yogurt can be contaminated with germs that can cause serious illness, hospitalization, or even death. Treatment should be initiated as soon as possible with flu antiviral drugs for people with suspected or confirmed avian influenza A (H5N1) virus infection. Antiviral treatment (Neuraminidase inhibitors, M2 ion channel blockers, Influenza polymerase inhibitors) works best when started as soon as symptoms begin. It is important that people who have frequent exposure to infected or potentially infected birds or other animals get a seasonal flu vaccine, ideally 2 weeks before their potential exposure. This is because it can reduce the prevalence and severity of seasonal flu and might reduce the very rare risk of co-infection with a human seasonal virus and an avian virus at the same time. [10]

CONCLUSION

Avian influenza, particularly the H5N1 subtype, poses a significant threat to human health, with high mortality rates and potential for pandemic spread. Understanding the clinical manifestations, diagnosis, treatment, and prevention strategies is crucial for healthcare professionals and public health officials. While antiviral medications and supportive care can improve patient outcomes, early detection and isolation are critical to preventing transmission. Continued research and surveillance are necessary to stay ahead of this evolving virus and mitigate its impact on global health.

REFERENCES

1. Alexander DJ. Avian influenza - diagnosis. Zoonoses Public Health. 2008; 55(1):16-23. doi: 10.1111/j.1863-2378.2007.01082.x.
2. Branda F, Ciccozzi M, Scarpa F. H5N1 avian influenza: tracking outbreaks with real-time epidemiological data. Lancet Infect Dis. 2024 Aug;24(8):e480-e481. doi: 10.1016/S1473-3099(24)00414-6.
3. Charostad, J., Rukerd, M.R.Z., Mahmoudvand, S., Bashash, D., Hashemi, S.M.A., Nakhaie, M. and Zandi, K., 2023. A comprehensive review of highly pathogenic avian influenza (HPAI) H5N1: An imminent threat at doorstep. *Travel Medicine and Infectious Disease*, p.102638.
4. de Jong MD, Hien TT. Avian influenza A (H5N1). J Clin Virol. 2006 Jan;35(1):2-13. doi: 10.1016/j.jcv.2005.09.002.
5. European Food Safety Authority, European Centre for Disease Prevention and Control, European Union Reference Laboratory for Avian Influenza, Alexakis, L., Fusaro, A., Kuiken, T., Mirinavičiūtė, G., Ståhl, K., Staubach, C., Svartström, O. and Terregino, C., 2024. Avian influenza overview March–June 2024. *EFSA Journal*, *22*(7), p.e8930.
6. Indian Ministry of Health and Family Welfare. (2024). Press release on Avian influenza outbreak.
7. Kang, M., Li, H.P., Tang, J., Wang, X.Y., Wang, L.F., Baele, G., Lou, J.T., Lemey, P. and Su, S., 2024. Changing epidemiological patterns in human avian influenza virus infections. *The Lancet Microbe*.
8. Li KS, Guan Y, Wang J, Smith GJ, Xu KM, Duan L, Rahardjo AP, Puthavathana P, Buranathai C, Nguyen TD, Estoepangestie AT, Chaisingh A, Auewarakul P, Long HT, Hanh NT, Webby RJ, Poon LL, Chen H, Shortridge KF, Yuen KY, Webster RG, Peiris JS. Genesis of a highly pathogenic and potentially pandemic H5N1 influenza virus in eastern Asia. Nature. 2004 Jul 8; 430(6996):209-13. doi: 10.1038/nature02746.
9. Mariappan AK, Mathesh K, Muthu S, Bhatt M, Sharma M, Saikumar G, Dhama K. Pathological and molecular identification of Mycobacterium avium infection in a loft of domestic pigeons (Columba livia var. domestica) from India. Brazilian Journal of Microbiology. 2023 Sep; 54(3):2521-6.
10. Prevention and Antiviral Treatment of Avian Influenza- A Viruses in People-Centers of Disease Control and Prevention (CDC) https://www.cdc.gov/bird-flu/prevention/index.html
11. Testing and diagnosis of avian influenza European Centre for Disease Prevention and Control https://www.ecdc.europa.eu/en/infectious-disease-topics/z-disease-list/avian-influenza/prevention-and-control/testing-and-diagnosis
12. World Health Organization (WHO). (2024). Avian influenza situation update.
13. Xu, X., Subbarao, K., Cox, N.J. and Guo, Y., 1999. Genetic characterization of the pathogenic influenza A/Goose/Guangdong/1/96 (H5N1) virus: similarity of its hemagglutinin gene to those of H5N1 viruses from the 1997 outbreaks in Hong Kong. *Virology*, *261*(1), pp.15-19.
14. Yuen, K.Y., Chan, P.K.S., Peiris, M., Tsang, D.N.C., Que, T.L., Shortridge, K.F., Cheung, P.T., To, W.K., Ho, E.T.F., Sung, R. and Cheng, A.F.B., 1998. Clinical features and rapid viral diagnosis of human disease associated with avian influenza A H5N1 virus. *The Lancet*, *351*(9101), pp.467-471.