

Avian Influenza & Human Health

*P Roy¹, SMR Islam², F Rahman³, MMR Siddiqui⁴

¹Dr. Prosun Roy, National Influenza Surveillance, Bangladesh, IEDCR. plini303@yahoo.com

²Dr. S M Rashed-ul Islam, Department of Virology, BSMMU, Bangladesh.

³Dr. Farhana Rahman, Department of Physiology, Universal medical college, Dhaka.

⁴Dr. Md. Mahmudur Rahman Siddiqui, Department of Medicine, AKMMC

*Corresponding author

ABSTRACT

The world is now under human pandemic threat by avian influenza viruses. As the human, animal and the environment interact closely from the dawn of the civilization, human health is tremendously influenced by animal health and their health issues. In last few centuries the world has suffered a number of influenza pandemics killing millions of people such as Spanish Flu (1918), Asiatic or Russian Flu (1889-1890), Asian Flu (1957-1958) etc. The exceptional capability of genetic mutation of the influenza viruses offered threats to the whole world time to time. Like all other countries Bangladesh also not away from the heat of the situation. Human cases of avian influenza subtype H1N1, H3, H5N1, and H9N2 have already been reported from Bangladesh. This article reviews the information available on pandemic potential of avian influenza viruses. The article also sheds light on different avian influenza viruses along with some emphasis on clinical and preventive aspects of the avian influenza viral infections, and on avian influenza pandemic preparedness of Bangladesh.

Key words: Avian Influenza A Virus, Influenza A (H1N1) 2009, Influenza A (H5N1), Influenza A (H7N9), Pandemic, Bangladesh

Introduction

In last few centuries the world has suffered a number of influenza pandemics killing millions of people such as Spanish Flu (1918), Asiatic or Russian Flu (1889-1890), Asian Flu (1957-1958) etc¹. Recently, in early 2013, China faced a catastrophic outbreak by a novel influenza virus H7N9. Fortunately, the infection did not transform to a pandemic. Constant genetic mutation of the influenza viruses made it the most unpredictable infection around the globe.

Human cases of avian influenza subtype H1N1, H3, H5N1, and H9N2 have already been reported from Bangladesh. In March 2007, the H5N1 virus was first identified in a poultry farm near capital Dhaka. Since then the virus continues to spread in many poultry farms and backyard poultries in different districts. Till date 49 out of Bangladesh's 64 districts have reported outbreaks of H5N1 in poultry and authorities has so far culled more than 1.8 million chickens². In

2009, the world faced pandemic caused by another novel strain of Influenza A subtype (H1N1 Pdm09). A recent study lead by CDC (Centers for Disease Control & Prevention) suggested that the estimated number of total deaths from 2009 H1N1 pandemic is more than 284,000, about 15 times the number of laboratory confirmed cases³.

Though Bangladesh stands relatively unaffected by global pandemics till date, loosely controlled poultry markets, vast population and low rate of hygienic practices (frequent hand wash, protective masks) increased the chances of avian influenza outbreaks in epidemic and pandemic forms as well.

Avian Influenza A (H7N9) Virus

In March 2013, China first reported human infections with a novel avian influenza A (H7N9). It is a serotype of 'Influenza A' virus

(RNA virus from 'Orthomyxoviridae' family). H7N9 infection is hosted by birds, pigs, dogs and human as well. Though some mild illnesses in human H7N9 cases have been seen, most patients had exhibited severe respiratory illness, with about one-third resulting in death. Close contacts with infected poultry or contaminated environment considered to be the mode of transmission of the virus. However, recent study shows the evidence of airborne exposure too. No evidence of sustained person-to-person spread of H7N9 has been found, though in rare circumstances some evidence indicates to limited person-to-person spread⁴. No cases of H7N9 outside of China have been reported yet. A case has been detected in Taiwan; however, the patient has a recent travel history to affected area of China.

China has acted very efficiently to control the recent H7N9 outbreak. Though the last outbreak of H7N9 did not cause a pandemic, a case has crossed international borders. The most concerning in this situation is that if there is another H7N9 outbreak, the infection might end up as a pandemic the result of which can be catastrophic.

Influenza viruses constantly change their genetic properties. It is possible that during this process a virus could gain the ability to spread easily and sustainably among people, triggering a global outbreak of disease (pandemic). International health agencies like WHO, CDC are following this situation closely and coordinating with domestic and international partners.

Influenza A (H1N1) 2009 Virus (Swine Flu):

In April 2009, Influenza A (H1N1) 2009 virus was first detected in Mexico. This is a novel subtype of Influenza A virus, also known as 'Swine Flu'. This virus spreads from person-to-person, probably in much the same way that regular seasonal influenza viruses spread. It is more common in pigs in the Midwestern United States (and occasionally in other states), Mexico, Canada, South America, Europe (including the United Kingdom, Sweden, and Italy), Kenya, Mainland China, Taiwan, Japan and other parts of eastern Asia⁵ and initial testing showed many of the genes in the virus

were similar to influenza viruses normally occurring in North American swine⁶.

The contemporary outbreak of Pandemic (H1N1) 2009 Influenza is a unique form of the old Influenza A virus that is a combination of the genetic material of classical Swine H1N1, Human H3N2 and Avian influenza viruses (known as the North American Swine H3N2 and H1N2) that eventually converted into the Human (H1N1) virus 2009⁷. Already it has affected a large number of countries globally, indicating that it is capable of causing large-scale pandemic destruction⁸.

Highly Pathogenic Avian Influenza A (H5N1) Virus (Bird Flu):

Highly pathogenic avian influenza (HPAI) A (H5N1) virus, also known as 'Bird Flu', is responsible for sporadic cases of human infection. This virus was first detected in 2003. Since 2003, more than 600 human cases have been reported by WHO from 15 countries in Asia, Europe, the Pacific and the Near East. Case fatality rate of the infection is approximately 60%. Indonesia, Vietnam and Egypt have reported the highest number of human cases to date⁹.

HPAI H5N1 virus can infect the respiratory tract of humans. When people develop illness from HPAI H5N1 virus infection, severe respiratory illness (e.g. pneumonia and respiratory failure) and death may occur. The majority of HPAI H5N1 cases have occurred among children and adults younger than 40 years old. Mortality has been highest in people aged 10-19 years old and young adults. In the majority of cases, the person got HPAI H5N1 virus infection after direct or close contact with sick or dead infected poultry. Currently, there is limited evidence of human to human transmission of H5N1 infection. Some cases of limited, non-sustained human-to-human transmission have likely occurred.

Seasonality of human cases of HPAI H5N1 has been observed with increases during months at the end and beginning of the year. This seasonality corresponds to the seasonality of HPAI H5N1 virus outbreaks among poultry, which increase during the relatively cooler periods. However, human cases can occur at

any time, especially in countries where HPAI H5N1 is endemic in poultry. Currently, HPAI H5N1 virus is considered endemic in poultry in six countries (Bangladesh, China, Egypt, India, Indonesia, and Vietnam). However, many other countries have experienced poultry outbreaks⁹.

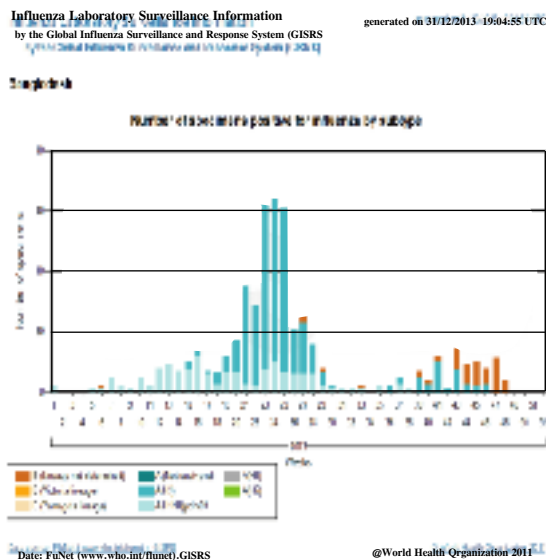


Figure 1: Number of samples positive for influenza by subtype 10

Signs and Symptoms of Avian Influenza A Virus Infections in Humans

Signs and symptoms may depend on which avian influenza A virus caused the infection. Low pathogenic avian influenza (LPAI) A virus infections of humans have been associated with generally mild, non-fatal illness. The reported signs and symptoms of LPAI A virus infections in humans have ranged from conjunctivitis to influenza-like illness (e.g., fever, cough, sore throat, muscle aches) to lower respiratory disease (pneumonia) requiring hospitalization.

On the other hand, highly pathogenic avian influenza (HPAI) A virus infections of humans have been associated with a wide range of illness. Illness has ranged from conjunctivitis only, to influenza-like illness, to severe respiratory illness (e.g. shortness of breath, difficulty breathing, pneumonia, acute respiratory distress, viral pneumonia, respiratory failure) with multi-organ disease, sometimes accompanied by nausea, abdominal

pain, diarrhea, vomiting and sometimes neurologic changes (altered mental status, seizures). Sometimes infection with highly pathogenic avian influenza A virus infection leads to death, especially with HPAI H5N1 virus¹¹.

The precision of clinical diagnosis of human infection with avian influenza A viruses on the basis of signs and symptoms alone is limited because symptoms from illness can be caused by other pathogens, such as Respiratory syncytial virus, Pneumococcus including seasonal influenza A or B viruses, can overlap considerably.

Detecting Avian Influenza A Virus Infection in Humans

Avian influenza A virus infection in humans cannot be diagnosed by clinical signs and symptoms alone; laboratory testing is required. Avian influenza A virus infection is usually diagnosed by collecting a swab from the nose or throat of the sick person during the first few days of illness. In some cases, specimen from lower respiratory tract is also done. This specimen is sent to a lab; the laboratory looks for avian influenza A virus either by using a molecular test, by trying to grow the virus, or both⁽¹¹⁾. In Bangladesh, usually rRT-PCR method is used to diagnose the infections. Viral isolation facility is also available.

Treatment of Avian Influenza A Virus Infections in Humans

CDC and WHO currently recommend Neuraminidase inhibitors such as Oseltamivir or Zanamivir, for treatment and prevention of human infection with avian influenza A viruses. However, some evidence of resistance to Oseltamivir that developed has been reported in HPAI H5N1 viruses isolated from some human cases¹¹.

Prevention of Human Infection with Avian Influenza A Viruses

The best way to prevent infection with avian influenza A viruses is to avoid sources of exposure i.e. direct or close contact with infected poultry. As there are evidence of rare episodes of limited, non-sustained human-to-human transmission of HPAI H5N1 virus, persons should avoid sick patients who have

suspected or confirmed HPAI H5N1 virus infection. Frequent hand wash with soap water and maintenance of hygiene practices can prevent influenza virus infection.

Seasonal influenza vaccination will not prevent infection with avian influenza A viruses, but can reduce the risk of co-infection with human and avian influenza A viruses¹¹.

Health care personnel caring for patients with suspected or confirmed HPAI H5N1 virus infection should wear recommended personal protective equipment and follow recommended infection control measures (standard, droplet, contact, and airborne precautions).

Avian and pandemic preparedness plan of Bangladesh:

There is a "National Avian Influenza and Human Pandemic Influenza Preparedness and Response Plan" in Bangladesh to prevent and control avian and human pandemic influenza. The preparedness plan developed and adopted first on 2006; and then amended on 2009¹². The preparedness plan encompasses strategy development including planning & coordination, surveillance, prevention & control, risk communication, and operational research. Different committees and teams were placed at different levels of government to ensure timely intervention. The plan offers different strategies for different scenarios (whether Bangladesh is affected or not) involving both human and avian health.

Though Bangladesh is a resource poor country, the role of Bangladesh in controlling the "Swine Flu Pandemic" in 2009 is praiseworthy. Millions of poultry were culled to prevent the infection. Prompt medical care of the suspected patients with proper precautions were provided to control the infection. However, we need a collaborative approach harnessing multiple sectors which include not only human health but also animal health, border control authority, customs etc. to strengthen Bangladesh's capacity to control and prevent such pandemics if there is any. Moreover, the popular concept of "One Health" also recommends the collaborative approach to control and prevent avian and human pandemic influenza to reduce mortality & morbidity in both poultry & human.

References

1. DHHS. Pandemic Flu History Washington DC: Department of Health & Human Services, US; 2013 [cited 2013 16th December]. Available from: <http://www.flu.gov/pandemic/history/>.
2. Zaman RU, Alamgir ASM, Rahman R, et al. Influenza in Outpatient ILI Case-Patients in National Hospital-Based Surveillance, Bangladesh, 2007-2008 2009 December 16, 2013. Available from: <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0008452;jsessionid=800865B82CA9D8FD54D01443667D62EB>.
3. Robert R. CDC estimate of global H1N1 pandemic deaths: 284,000 Minnesota, USA: CIRDP; 2012 [cited 2013 12 August]. Available from: <http://www.cidrap.umn.edu/news-perspective/2012/06/cdc-estimate-global-h1n1-pandemic-deaths-284000>.
4. WHO. Avian Influenza A (H7N9) Virus Atlanta, USA: WHO; 2013 [updated 20 December; cited 2013 20 December]. Available from: <http://www.cdc.gov/flu/avianflu/h7n9-virus.htm>.
5. CDC. Key Facts about Swine Influenza (Swine Flu) in Pigs: Centers for Disease Control; 2012 [cited 2013 12 November]. Available from: http://www.cdc.gov/flu/swineflu/keyfacts_pigs.htm.
6. CDC. 2009 H1N1 Flu ("Swine Flu") and You Atlanta, USA: Centers for Disease Control; 2010 [cited 2013 12 August]. Available from: <http://www.cdc.gov/h1n1flu/qa.htm>.
7. WHO. Pandemic (H1N1) 2009 - update 67: WHO; 2009 [cited 2013 20 December]. Available from: http://www.who.int/csr/don/2009_09_25/en/.
8. Khanna M, Gupta N, Gupta A, et al. Influenza A (H1N1) 2009: A pandemic alarm. *J Biosci*. 2009;34:481-9.
9. CDC. Highly Pathogenic Avian Influenza A (H5N1) in People Atlanta, USA: Centers for Disease Control; 2013 [updated June 21, 2012; cited 2013 20 December]. Available from: <http://www.cdc.gov/flu/avianflu/h5n1-people.htm>.
10. WHO 2013. Influenza Laboratory Surveillance Information . Data source: FluNet (www.who.int/flunet), GISRS
11. CDC. Avian Influenza A Virus Infections in Humans 2012 [cited 2013 20 December]. Available from: <http://www.cdc.gov/flu/avianflu/avian-in-humans.htm>.
12. DGHS. 2nd National Avian and Pandemic Influenza Preparedness and Response Plan, Bangladesh. In: DGHS, editor. 2nd ed. Dhaka: DGHS; 2009. p. 1-128.