AVIAN INFLUENZA

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Avian influenza or "bird flu" is a contagious viral disease affecting mainly chickens, turkeys, ducks and other birds, ranging from a mild to severe form of illness. Avian influenza caused by highly pathogenic virus strains have sometimes been shown to infect man also.

All avian influenza (AI) viruses belong to the genus influenza type A of the family Orthomyxoviridae that are single stranded, segmented and negative sense RNA viruses. The genus type A viruses are further divided into subtypes based on haemgglutinin (HA) and neuraminidase (NA) antigens. There are 16 antigenically distinct HA (H1-H16) and nine NA (N1-N9) antigens. All HA and NA combinations have been isolated from birds (Alexander, 2000).

Avian influenza viruses are highly species specific, but have on rare occasions, crossed the species barrier to infect others. Thus strains of avian influenza virus may infect various types of animals including birds, pigs, horses, seals, whales, minks and humans (Swayne and Halvorson, 2001)

Avian influenza viruses may be very virulent, causing highly lethal systemic disease resulting in high mortality as high as 100%, often within 48 hours (highly pathogenic avian influenza –HPAI).The World Organization for Animal Health (OIE) specifies HPAI as a list A disease (Alexander, 1996) - List A diseases are transmissible diseases that have the potential for very serious and rapid spread, irrespective of national borders, which are of serious socio-economic or public health consequences and are of major importance in the international trade of animals and animal products. These viruses have been restricted to subtypes H5 and H7. However, not all viruses of the H5 and H7 subtypes produce HPAI. Thus HPAI is an infection of poultry caused by either any influenza A virus that has an intravenous pathogenicity index in 6-week-old chicken greater than 1.2 or any influenza A virus of H5 or H7 subtypes (EUSCHAW, 2000).

All other subtypes cause much milder disease consisting primarily of mild respiratory disease, depression of egg production in layers (low pathogenicity avian influenza –LPAI) and may easily go undetected (Capua and Alexander, 2000).

The HA glycoprotein precursor HAO requires cleavage to HA1 and HA2, by host proteases to make the virus particles infectious. LPAI viruses are limited to cleavage by host proteases such as trypsin and trypsin like enzymes and thus their replication is limited to respiratory and intestinal tract. On the other hand, virulent viruses are cleavable by an ubiquitous protease (s) (Stienke-Grober et al., 1992) and this enables these viruses to replicate throughout the bird resulting in damage of vital organs and tissues, which results in disease and death (Rott, 1992).

Evidences are there to support the hypothesis that HPAI viruses are not normally present in wild birds and only arise as a result of mutation after H5 and H7 LPAI viruses have been introduced to poultry from wild birds (Capua and Alexander, 2004). When H5 and H7 viruses are introduced to poultry flocks and allowed to circulate in poultry populations, the viruses can mutate, usually within a few months, into the highly pathogenic form. Hence, the presence of H5 and H7 virus in poultry is always the cause of concern, even when the initial signs of infection are mild.

History:

Avian influenza was reported as HPAI (fowl plague) in 1878 by Perroncito in Italy (Stubbs, 1948) The filterable nature of the infectious agent was identified in 1901 by Centanni and Savonuzzi , but the virus was identified as influenza virus only in 1955 (Stubbs, 1948; Schafer, 1955). Subsequent outbreaks of HPAI were in 1894 in Northern Italy, which was disseminated through chickens to eastern Austria, Germany, Belgium and France (McFadyean, 1908; Stubbs, 1926). In many parts of Europe HPAI was endemic until mid 1930s. HPAI outbreak was reported in the United States in 1924-1925 and in 1929. Quarantine, depopulation , cleaning and disinfections were used to eradicate HPAI from the US.

The out breaks of HPAI between 1901 and the mid 1950s were identified to be caused by H7N1 and H7N7 subtypes. However, the outbreak in Scotland in 1959 and in South Africa during 1961 in common terns was identified to be H5N1 and

The reported HPAI isolates from poultry*

Sl.No.	Sub type	Countries and year
1	H5N1	Scotland (1959); England (1991); Hong-Kong (1997, 2002-2006); Japan (2005); Cambodia, China, Indonesia, Lao PDR, Korean Republic, Thailand, Taiwan, Malaysia, Viet Nam (2003-2006); Nigeria, Ethiopia, Egypt, Germany, Russia, Austria, France, Turkey, Greece, Rumania, Ukraine, Albania (2005-2006); Azerbaijan, Cameron, India, Iran, Iraq, Italy, Afghanistan , Pakistan, and Djibouti, (2006)
2	H5N3	South Africa, (1961) ;England (1963)
3	H5N9	Ontario, Canada (1966)
4	H7N7	Victoria, Australia (1976,1985); Germany (1979, 2003); England (1979)
5	H5N2	Pennsylvania, USA (1983); Mexico (1994-2003); Italy (1997-98); Texas, USA (2004)
6	H5N8	Ireland (1983)
7	H7N3	Victoria, Queens land , Australia (1992,1994); Pakistan (1994, 2001-2004); Chile (2002);
		British Columbia, Canada (2004)
8	H7N4	New South Wales, Australia (1997)
9	H7N1	Italy (1999-2001)
10	H7N2	Virginia, USA (2002)
* Swayne, D.E. and Halvorson, 2001; Capua and Alexander, 2004; OIE report, 2006		

H5N3 respectively.

The reported HPAI isolates from poultry* (Table)

Countries from which isolation of H5N1 subtype has been reported in wild / migratory birds are China, Siberia, Israel, Jordan, Niger, Turkey, Tibet, Sweden, Greece, Kazakhstan, Romania, Mongolia, Myanmar, UK, Croatia, Denmark, Georgia, Poland, Slovakia, Hungary, Czech Republic, Bulgaria, Italy, Switzerland, Slovenia, Bosnia, Sudan, and Spain (OIE report, 2006).

Mammals reported to have been affected by this virus are tigers, leopards, Weston palm civet, ferrets and domestic cats .

Clinical signs

In wild birds and domestic ducks, HPAI viruses either replicate poorly or replicate to a limited degree and produce few clinical signs. The one exception was the HPAI outbreak due to H5N3 in common terns in South Africa in 1961, which produced sudden death without any other clinical signs (Becker, 1966).

In domestic chickens , turkeys and related galliformes clinical signs reflect virus replication and damage to multiple visceral organs and cardiovascular and nervous systems, but the clinical signs depends on the extent of damage and not all clinical signs are present in every bird. In per acute cases, birds die without showing any clinical signs while in acute forms the birds exhibit tremors of head and neck, inability to stand, torticollis, opisthotonus and unusual position of head and other appendages. Swelling of the head, neck, face, upper neck and feet; necrotic foci haemorrhage, and cynosis of the non-feathered skin especially combs and wattles are common.. Prominent haemorrhaes on the epicardium, pectoral muscles and mucosa of the proventriculus and the ventriculus are the visceral lesions often noticed. In the case of H5N1 infction, haemorrhages in payers' patches of small intestine, necrotic foci in pancreas, spleen and heart are often seen. Significant decline in feed and water consumption and drop in egg production, which may lead to total cessation, are the other observations (Swayne and Halvorson, 2001). The morbidity and mortality rates are very high 50-90% and can reach up to 100% depending on virus pathogenicity and the host as well as age, environment and concurrent infections (Perkins and Swayne, 2001).

The current outbreaks of highly pathogenic avian influenza, which began in South-East Asia in mid – 2003, are the largest and most severe on record with simultaneous involvement of 18 countries (Republic of Korea, Viet Nam, Japan, Thailand, Taiwan, Cambodia, Lao People's Democratic Republic, Indonesia, China, Siberia in Russia, Kazakhstan, Rumania, Turkey, Greece, UAE, Malaysia, Ukraine and Ethiopia.). Death of migratory birds due to H5N1 has been reported in China, Kazakhstan, and Mongolia in 2005 and in Italy, Germany, Bulgaria, Denmark, U.K., Poland, Slovakia, Hungary, Czech Republic, Georgia, Bulgaria, Switzerland, Slovenia, Croatia, Bosnia , Greece and Austria in 2006 (OIE report). In spite of the death or destruction of an estimated 200 million birds, the virus is now considered endemic in many parts of Indonesia and Vietnam and in some parts of Cambodia, China , Thailand and the Lao People's Democratic Republic. Japan, the Republic of Korea and Malaysia have announced control of their poultry outbreaks and are now considered free of the disease. In the

Subtypes associated with LP AI infections since 1994 (Table-2)

Sl.No.	Subtype	Country and year
1	H9N3	China (1994)
2	H9N2	Italy (1994 and 1996); Germany (1995-1998); Korea (1999); Middle East (1998); Hong Kong (1999); Pakistan (1999); and Iran (2001)
3	H7N2	Pennsylvania (1996-98); NC/VA ,USA (2002); Connecticut, USA (2003); Delaware and Maryland, USA (2004)
4	H7N7	Ireland and N. Ireland (1998); Germany (2001)
5	H5N9	Italy (1998)
6	H5N2	Belgium (1999)
7	H7N1	Italy (1999-2000) ; Ontario, Canada (2000)
8	H7N3	Pakistan (2001-04); Chile (2002); Italy (2002-03); BC, Canada (2004)
9	H5N7	Denmark (2003)

* Capua and Alexander, 2004

other countries outbreaks are continuing with varying degrees of severity.

By August 2006, 51 countries have reported H5N1 infection either in poultry and / wild / migratory birds (OIE Report, 2006).

For LPAI infections high morbidity and low mortality rates are typical, mortality usually less than 5%.

Subtypes associated with LP AI infections since 1994 are shown below*-

(See Table-2)

Role of migratory birds:

Avian influenza viruses have been shown to naturally infect a wide variety of wild and domestic birds, especially free living birds of aquatic habitats. Although about 90 species from 13 of the 50 orders of birds have yielded influenza viruses (Stallknecht, 1998), the number, variety and wide spread distribution of influenza viruses has been greater in waterfowls - order Anseriformes (ducks geese and swans)- than in other birds. Aquatic birds are the natural asymptomatic carriers and can spread it to more susceptible domestic stocks, but distribution varies by year, geographic location and host species. Most AI infections have not produced recognizable disease in free-living birds. (Alexander, 2000).

The role of migratory birds in the spread of highly pathogenic avian influenza is not fully understood. Wild waterfowls are considered the natural reservoir of all influenza type A viruses. They are known to carry viruses of the H5 and H7 subtypes, but usually in the low pathogenic form. Circumstantial evidence suggests that migratory birds can introduce low pathogenic H5 and H7 viruses to poultry flocks, which then mutate to the highly pathogenic form (Perdue *et al.*, 1998).

According to scientists of the FAO who studied bird flu outbreaks in Asia "Migratory birds from which viruses have been isolated were usually sick or dead; suggesting that they would have had limited potential for carrying the viruses over long distances unless sub-clinical infections were present". Although there was circumstantial evidence that the H5N1 virus could be ransmitted by wild birds "there is little reason to believe that wild birds have played a more significant role in spreading the disease than trade through live bird markets and movements of domestic water fowl ". To add, 5,000 samples collected from wild birds in 12 African countries, 1,100 samples in India and 45,000 samples in European Union were all negative for H5N1 infection .

Dr. Alexander observes that highly pathogenic H5N1 virus had only been isolated from dead wild birds and surveys had not revealed the presence of such a strain in live ones. Thus movements of birds including their annual migrations can be only one of the several possible means for disseminating the H5N1 virus. Many ornithologists had indicated that the spread of H5N1 did not fit with the known migratory behaviour of bird species in that part of the world. It was also argued that the pattern of H5N1 outbreak in South-East Asia strongly suggested that people smuggling poultry rather than migratory birds carried the virus. However, recent events make it likely that some migratory birds are now directly spreading the H5N1 virus in its highly pathogenic form. Bird flu's westward transmission and the close relationship of the virus found in Turkey (H5N1) Russia, Mongolia, China, Germany, Italy Austria, Bulgaria ,and Nigeria support this view. Moreover the countries reported bird flu outbreak during Feb-May 2006 fall in the route of migratory birds. OIE concluded, " In certain conditions migratory birds could carry the Asian H5N1 influenza virus to other parts of the world ".

Normally avian flu viruses of low virulence are found in wild waterfowl and only mutate to virulent form after they infect poultry. Similarly it is not true that H5N1 is nonpathogenic to wild fowl and they simply act as carriers as it was found that over 6000 wild birds died in Quinghai lake in Central China since April 2005 due to H5N1 infection. Some 90% of the dead birds were bar-headed geese (*Anser indicus*). The brown headed gulls (*Larus* *brunnicephalus*) and great black-headed gulls *(Larus ichthyartus)* were the other two species of migratory birds killed by H5N1. Similarly outbreaks of H5N1 among poultry and wild birds leading to heavy mortality were reported from Siberia in Russia and Kazakhstan. In August 2005, in Mongolia death of many wild ducks , geese and swans at a lake in the northern part of the country was reported . H5N1 virus was later on isolated from these dead birds. Reports of H5N1 virus infection are also there from Rumania, Turkey, Greece, UAE, Tibet, Ukraine and Ethiopia, Germany, Austria, Italy, Bulgaria and Sweden. According to Juan Lubroth, Head of Infectious disease group FAO, the virus had been documented too frequently in dead wild birds and too little in healthy bird populations. The view of David Harcharik, Deputy Director General FAO "globalization and international trade are definitely the main factors in the spread of the virus from one country or region to another and that wild birds play only a partial role in this".

Source of infection

In many areas of recent outbreaks there was a thriving trade in live birds and poultry products and some were tourist destinations. As the influenza virus can survive in poultry dropping for up to two weeks, movement of people and contaminated farm equipments could rapidly spread the virus.

The possible sources of infection are

1. mixing of poultry with wild birds- chances are very high where in backyard poultry keeping is a practice as seen in Kerala
2. Contamination of fields by droppings of wild birds while flying
3. Contamination of water for poultry by the same means as in (2)
4. Contamination of poultry feed with droppings of infected wild birds
5. Humans, vehicles and objects such as farm implements can become contaminated through contact with droppings from infected wild birds and carry the virus to poultry.

The other possible means of spread are

a). illegal bird trade – wild and caged birds. For example the two mountain hawk eagles smuggled into Belgium from Thailand were found to be infected with H5N1 virus.

b). Trade of bird meat, meat product, egg and egg products and feathers and the religious practice in parts of South and South-East Asia of releasing captive birds to gain spiritual merit could also spread bird flu.

Control:

Some of the factors that contribute to the current spread of avian influenza and the risk of other animal diseases infecting humans are the rapid transportation of goods and people, increasing population density and a growing dependence on intensive livestock production for food. The risk is further increased by human encroachment into formerly isolated areas and a massive trade in wildlife around the world and animal and human populations that were previously separated are now in much closer contact.

The measures available to prevent, control and eradicate HPAI are :

i) . Keeping birds in good condition so that they are able to resist disease better

ii). By providing good access to clean water , adequate food and adequate housing for the birds and proper de-worming and vaccination

iii). Keeping poultry in closed building to avoid contact with free flying birds

iv). Control entry to the farm- both people , vehicles, implements, animals brought from elsewhere and even dogs and cats carrying dead animals can bring the virus to the farm

v). Visitors should be kept away from the farm.

vi). Provide disinfection facility particularly at the entry point.

The following aspects should also be taken care off:-

i). Increase knowledge of wildlife biology, in particular, migration patterns of wild birds and trade routes of wild life.

ii). Effective disease surveillance of domestic poultry and wild birds for early detection and reporting of outbreaks.

iii). Enhanced bio-security of poultry farms and associated premises.

iv). Swift and complete culling of infected poultry flocks in the event of an outbreak

v) Control movement of birds and products that may contain virus, including strict controls and / or closure of wild birds for the pet trade market.

vi). Rapid humane destruction of infected poultry and poultry at high risk of infection.

vii). Disposal of carcasses and potentially infective material in a bio-secure manner.

viii). The proper use of poultry vaccination.

The best strategy is to control the virus at its source – at the animal level itself . Such a strategy has to be based on preparedness to handle an outbreak, an early warning available trough active and intensive surveillance quick testing, immediate notification and rapid containment. Common standards for hygienic poultry rearing, processing practices and testing labs will help to tackle bird flu outbreaks.

WHO, FAO and OIE are of opinion that control of avian influenza infection in wild bird population is not feasible and should not be attempted. They do not advise against killing wild birds to contain an outbreak. Apart from ethical reasons, mass killing leads to dispersion of birds to new areas leading to dispersion of the virus to much larger areas. These organizations recommended surveillance and preventive efforts to be focused on vaccination of poultry in areas at risk and keeping domestic animals separate from wild birds.

Since 1997 there appears a significant increase of H5 and

H7 outbreaks in domestic poultry over the previous years . Climate changes and consequent variation in the wild bird migratory pattern or populations have some impact on the incidence of AI introductions to domestic poultry. Increase in densely populated poultry areas (DPPAs) coupled with a move towards rearing an open range have worsen the situation. Hence to reduce the risk of future introduction and spread , to facilitate rapid and effective control once diseases has occurred and to minimize the economic and sociological impact there is a need to control the concentrations of pouitry farms and poultry in specified geographical areas.

The fact that the control measures for LPAI viruses especially those of H5 and H7 subtypes which do not currently fall within virus definitions for statutory control cause dilemma for both farmers and national authorities which was highlighted by the problems in Italy during 1999 and 2000.There, the HPAI outbreaks occurred killing 130 million birds following a LAPI infection and had to implement depopulation of intensive and semi intensive chicken and turkey farms along with vaccination of meat type birds and table egg layers to control/ eradicate LAPI H7N1 infection. Hence despite falling outside the current agreed definitions , trading partners are most reluctant to receive poultry and poultry products from countries or areas where LPAI H5 or H7 viruses are known to be present. Equally , the consequences of the LPAI mutating to HPAI after circulating for some time , as occurred in Pennsylvania in 1983, Mexico in 1994 and Italy in 1999 are recognized extremely serious. As a result most countries faced with outbreaks of H5 or H7- LPAI in recent years have implemented either stamping –out policy or one of early depopulation and marketing.

In the past 10 years, severity of clinical signs and the massive and uncontrolled spread of both HPAI and LPAI strains have resulted in the adoption of vaccination policies in countries like Mexico against H5N2, H7N3 virus in Pakistan and against H5N1 virus in China, Viet Nam and Indonesia.. However, the usefulness of conventional vaccination for eradication purpose is questioned, as this will result in a decline in bio-security measures requiring constant monitoring of the epidemiological situation.

Vaccination was recommended for the Southeast Asian countries by the FAO in 2004, as there is a risk of removal of For both LPble to replicate in clinically healthy vaccinated birds and this probably is the reason for not achieving eradication by vaccination alone. This situation, without the application of of the virus in a ine during the outbreak showed a significant protection to the disease and virus excretion by birds stopped in 2-3 weeks following vaccination. It was reported that when these vaccinated birds were deliberately exposed to H5N1, all were protected from the disease and 80% of them did not excrete the virus. In the remaining 20% virus excretion was over 1000 fold less than unvaccinated chicken. Thus in Hong Kong vaccination with killed H5N2 used in conjunction with enhanced bio-security measures on chicken farms and in poultry markets reduced the risk of H5N1 outbreak and consequently the spread in humans (Trevor Ellis *et al*. 2005). Vaccination policy in China includes not only chicken but also ducks and geese. China used vaccines developed from H5N1 itself and reported to give better protection to the birds for a longer period compared to heterologous vaccine.

India developed a prototype vaccine with indigenous virus strain. It had tested successfully in the laboratory and now needs extensive field trials. It is a killed adjuvanted vaccine to be given intramuscularly. It is recommended immediately after an outbreak to control spread of the virus as well as for vaccination in anticipation of an outbreak. However, vaccination before an outbreak is not advisable as the vaccine has its own limitations.

Economic impact

Economic losses from avian influenza vary depending on the strain of virus, species of bird affected , number of farms involved, control methods used and the speed of implementation of control or eradication methods.

Great losses have occurred during epizootics of HPAI in domestic poultry raised on commercial farms of intensive production areas or in large Live Poultry Market systems. According to FAO, since 2003, in South East Asia alone 200 million poultry had been culled and the disease had resulted in a cumulative loss of $200 billion. In addition due to the report of bird flu in Western Europe a loss of about 550 million Euro is also reported in 2006. "The prospect of a human pandemic aside, the damage the disease will cause to bird populations and domestic poultry in particular is likely to be tremendous. The knock on effect on the poultry sector is enormous and it could deal a significant blow to local, national and regional economies. Small holder families dependent on chicken and other poultry for sustenance or livelihood face the prospect of losing their animals by disease or culling to prevent the disease spreading. In many countries fear of infection is leading consumers to shy away from poultry, throwing the multimillion dollar industry into crises" adds Dr Joseph Domenech, the Chief Veterinary Officer FAO.

The Indian poultry industry worth 22,000 crores is hit by bird flu. In India the bird flu scare resulted in 30-50% sales drop. But it has started improving now. The egg and chicken export to Sri Lanka and West Asia practically came to a halt. The estimated loss to poultry industry in India is around 7000 crores for 35 days since the bird flu outbreak

Avian (Bird) flu in humans:

It has been known for some time that the human pandemic viruses of 1957 and 1968 (H2N2 and H3N2) originated by re-assortment between viruses present in the human population and AI viruses. However, direct infection of humans with AI viruses appeared only recently. Up to 1996 there were only three instances on record of an isolation of AI viruses from humans.

The reported incidence of AI during the recent years show that the virus is able to infect humans fairly regularly, especially through conjunctiva and respiratory tract, and cause disease signs.

Avian influenza virus isolations from humans (Table-4)

Sl. No	Subtype	Origin	year	reference
1	H7N7 (HPAI)	Patient with hepatitis	1959	Campbell, 1970
2	H7N7 (HPAI)	Eye of an Australian laboratory worker	1977	Taylor and Turner, 1977
3	H7N7 (LPAI)	Eye of an animal handler (infected from a seal)	1981	Webster et al., 1981
4	H7N7 (LPAI)	Eye of a woman with conjunctivitis	1996	Kurtz et al., 1996
5	H5N1(HPAI)	Infected 18 people 6 of them died (Hong Kong)	1997	Shortridge et al., 1998
6	H9N2 (LPAI)	Mainland china – resulted in respiratory problems.	1998	Capua and Alexander, 2004)
7	H9N2 (LPAI)	Influenza like illness in two girls – Hong Kong	1999	Peiris et al., 1999
8	H7N2 (HPAI)	Virginia, USA, only serological evidence	2002	
9	H7N2	New York- respiratory problems	2003	
10	H7N7 (HPAI)	Conjunctivitis and influenza like illness, one person died (Netherlands)	2003	Koopmans et al., 2003
11	H3N2	Influenza	2003	Koopmans et al., 2003
12	H7N3 (HPAI)	British Columbia- mild illness with eye infections	2004	WHO report – as on 17th August, 2006
13	H5N1	Infuenza – 239 infected , 140 died in Azerbaijan. Cambodia, China, Djibouti Egypt, Indonesia, Iraq, Thailand, Turkey and Viet Nam.	2003-2006	

Widespread persistence of H5N1 in poultry population poses two main risks for human health. The risk of direct infection from poultry to humans resulting in very severe disease. Unlike normal seasonal influenza where infection causes only respiratory symptoms, in most people, the disease caused by H5N1 follows an unusually aggressive clinical course with rapid deterioration and high fatality. Primary viral pneumonia and multi-organ failure are common. In the present outbreak more than half (58.5%) of those infected with the virus have died. Most cases have occurred in previously healthy children and young adults. In 1997, first recorded outbreak of human infection with H5N1 was reported from Hong Kong. The virus infected 18 people and killed 6 of them (Mounts *et al.,* 1999). There was some evidence of very limited human-to-human spread but the efficiency of transmission was extremely low. In early 2003, the virus caused two infections, with one death . As on 17th August, 2006, about 239 people have become infected with the strain and 140 died. Thus the H5N1 HPAI infections of humans have been of particular concern because of apparent high mortality rates. Although H5N1 has not displayed the ability to transmit easily from person to person, WHO is "alarmed" as there are ample evidences to show that avian flu can spread from one human to another from the cluster of bird flu cases in Indonesia.

Confirmed human cases since 2003 as on 17th August, 2006*

Country	Cases	Deaths
Azerbaijan	8	5
Cambodia	6	6
China	21	14
Djibouti	1	0
Egypt	14	6
Indonesia	58	45
Iraq	2	2
Thailand	24	16
Turkey	12	4
Viet Nam	93	42
Total	239	140

* Report of WHO – only laboratory confirmed cases. Total number of cases includes number of deaths

In 2003 another bird flu virus H7N7 that hit poultry farms in the Netherlands also slipped into people. In the week following the outbreak 86 people who had been exposed to the chickens and three of their family members fell sick, most had severe conjunctivitis while some had flu like symptoms. The virus claimed the life of a 57-year old veterinarian who had visited a poultry farm with sick birds.

Though the infections to date have been extremely limited in their human-to-human spread it is quite possible that AI and human influenza viruses could infect the same individual. This could result in re-assortment between the two viruses with the consequence that a virus emerged with the internal genes from human virus allowing easy transmission but with the HA from the AI virus, which inevitably, would lead to a new pandemic. Thus the public health implications of the co-circulation of human and avian viruses are severe. Hence it is important that AI should be eradicated from poultry rather than controlled by vaccination and that vaccination should be used only as a tool in delivering eradication.

Direct contact with infected poultry or surface and objects contaminated by their droppings is considered the main mode of human infection. Most human cases have occurred in rural or peri urban areas where many house holds keep small poultry flocks, which often roam freely, sometimes entering home or sharing outdoor areas where children play. As infected birds shed large quantities of virus in their droppings, opportunities for exposure to such droppings or the infected environments contaminated by the virus are abundant. Many households in Asia depend on poultry for income and food. They sell or slaughter and consume birds when signs of illness appear in a flock. It is very difficult to change this practice.

According to Viet Nams' Hochi Minh City Pasteur Institute the bird flu virus strain H5N1 in the country has mutated to make it more dangerous. The changes are reported in gene segments of surface antigens HA and NA and some other gene segments of bird flu virus H5N1 in Viet Nam in early 2005. This mutation is reported to increase its capability to reproduce in mammalian cells compared to 2003 isolates. However, there is no evidence so far that the virus had mutated into a form that passes easily between people.

For successful penetration into human cells H5N1 must mutate while the victim must have defective immune system, otherwise the virus in poultry must combine with flu viruses in mammals such as pigs to form new strain.

How safe is poultry meat and other poultry products:

In areas free of the disease, poultry and poultry products can be prepared and consumed as usually following a good hygienic practice and proper cooking with no fear of acquiring infection. In areas where outbreaks have been reported, poultry and poultry products can also be safely consumed provided these items are properly handled during preparation and properly cooked (above 70 C). The virus H5N1 is highly sensitive to cooking temperature , but the consumers should make sure that all parts of the poultry are fully cooked. Consumers should also be aware of the risk of cross contamination and juices from raw poultry and poultry products should be avoided. Similarly raw eggs should not be used in foods that will not be further heat treated as for example by cooking or baking. When handling raw poultry or raw poultry products persons involved in food preparation should wash their hands thoroughly and clean and disinfect surfaces in contact with poultry products with soap and hot water.

Till date there is no evidence for any one contracting avian influenza following the consumption of properly cooked poultry or poultry products even when these foods were contaminated with H5N1 virus.

Treatment:

Two drugs (neuraminidase inhibitors) oseltamivir (Tamiflu) and zanamivir (Relenza) can reduce the severity and duration of illness and may improve the prospects of survival. However, the efficacy depends on their administration within 48 hrs after the onset of symptoms. H5N1 strains are fully resistant to M2 inhibitors – amantadine and rimantadine. Of late Tamiflu resistant H5N1 strain has been reported from Viet Nam, necessitating the need of other antiviral drugs along with Tamiflu. Tamiflu resistance might have developed due to the use of low dose of the drug.

To prevent the misuse of the drug Tamiflu, India had banned its retail sale and it is now available only through the government health system under medical supervision.

Vaccination:

In any case, existing flu vaccines will not work against the current strain of the H5N1 virus. Studies by influenza laboratories investigating the current outbreak show that the virus has genetically changed and significantly enough to render existing vaccines ineffective.

Currently no commercial vaccine is available to protect humans against H5N1 virus. However vaccine development efforts are taking place. China's State Food and Drug Administration (SFDA) approved its first home made human bird flu vaccine for clinical trials. The vaccine was developed from NIBRG-14 virus strain recommended and provided by WHO. Preclinical trials of this vaccine were satisfactory being fairly safe and effective.

The WHO says mass slaughter of infected birds is the major line of defense to prevent further cases of human infection and to avert the emergence of a new virus. Infectious disease specialists believe that no country in the world is prepared for a new influenza pandemic.

Situation in India:

Reports of isolation of AI viruses in India have been rare. Though Manjunath and Mallick (1977) report isolation of AI virus from birds there is no mention about the subtype they have isolated. Rao et al (1979) isolated H4N2 subtype from a flock which showed sudden mortality. Influenza A virus was isolated from 2-6 week old ducklings during an outbreak of respiratory disease in Government duck farm Niranam, Kerala, during 1985 and again in 1987. The mortality rate ranged between 15-20%. The subtypes isolated were H9N2, H9N3, H3N2 , H3N?, and H9N?. Experimental infection studies on ducklings have shown that H9N2 was more pathogenic compared to others (Mini, 1988).

Isolation of AI subtypes in India

There is a report that three years ago, a traveler from Saudi Arabia flew into Chennai airport with 80 pigeons to sell them as pets. The laboratory (?), which has the mandate to screen all imported birds and animals, discovered that some of the birds were infected with a virulent bird flu virus – not H5N1 (no information about the virus subtype) . All 80 pigeons were killed and incinerated.

Outbreak involving H5N1 has been reported in the tribal

Nandurbar District of Maharashtra , Uchhal Taluka of Surat district in Gujarat and Ichchapur in Burhanpur district of Madhya Pradesh. Following the report, the Central Govt. and Govts. of Maharashtra ,Gujarat and Madhya Pradesh have taken immediate steps to contain the disease. About 10 lakhs of poultry including backyard poultry and more than 20 lakhs of eggs have been destroyed and properly disposed off. Poultry farmers were given compensation on 50:50 basis from both the State and Central Govts.

Since the initial outbreak in Feb. 2006, only 50 samples out of 20,000 had tested positive. The HA gene of the viruses from Nandurbar and Jalgaon outbreaks were not identical suggesting two independent introduction of the virus possibly by wild birds. The two Indian H5N1 viruses were genetically closest to the viruses isolated from Italy and Iran. This suggests the spread of the virus to distant places through wild aquatic bird migrations. India receives up to 20 million migratory birds between Nov-July. The role of migratory birds in the introduction of this virus is being investigated. In the mean time we have to be cautious with the next migratory season.

The risk of infected birds arriving in India will depend on what proportions of birds have come into contact with the infection, the transmission rate of the virus and the likelihood that an infected individual could undertake a long – distance migration. Currently these factors are difficult to quantify. What is clearly established is the role of infected poultry in the transmission of the disease and consequently, our steps should focus in the prevention and spread of the virus in the poultry sector through improved surveillance and bio-security of farming enterprises. Under bio-security measures steps are being taken to break the link system through "netting" – separating migratory birds, their feed and implements from domestic water fowl.

The State departments are asked to educate poultry farmers on the threat as well as to take bio-safety measures. Unusual mortality or disease in poultry / wild / migratory birds is to be treated as "suspect" and serum samples sent for testing. In cases of eventuality, the farmers will be compensated, as all infected birds have to be "stamped out".

In Kerala, adequate arrangements have made in various districts to collect the blood samples and droppings of migratory birds. Migratory birds arrive the State during Nov-Feb from their summer breeding sites. It is stated that about 35 migratory species reach the State annually, mostly from areas reported to have bird flu. Consequent to the report of H5N1 infection in Maharashtra Gujarat and Madhya Pradesh the State Government has already strengthened the precautionary measures and we have to keep our eyes open during the coming season.

According to the Union Minister of Agriculture " there has been no outbreak of avian influenza or bird flu in the country for more than three months. On August 10, India will seek a certification from the International Animal Disease agency (OIE) to declare the country free from bird flu". This will help India to regain its export market in eggs and chicken and to revive the domestic market.

Global approach

In Geneva a global three day meeting of delegates from over 100 countries organized by WHO,FAO , OIE and World Bank identified key components of an action plan to control bird flu and simultaneously limit the threat of a human influenza pandemic. The World Bank is planning to spend $ one billion to tackle avian flu, after it was revealed that an influenza pandemic could cost the world up to 800 billion – 2% of the global economy.

The $ one billion Global programme is aimed at

1. Improved Veterinary system

Isolation of AI subtypes in India

Location	year	Subtype	Reference
?	1977	?	Manjunatha and Mallick, 1977
TamilNadu, Tirunelveli	1978	Hav4 N2 (H4N2)	Rao *et al.*, 1979
Kerala, Niranam	1985	H9N2, H9N3	
he subtype they h	ave i	solated. Rao et a	
79) isol	ated	H4N2 subtype from a flock which sh owed sudden m ortality. Inf	luenza A virus was isol
fro	m 2-6	week	old ducklings dur ing a
tbreak of respiratory	disea	se i	n Government duck
m Niranam, Kerala, dur ing 1985 and again	in 19	87.	The mortality rate ra nged between 15-20%.

2. Better access to veterinary system
3. Establish animal vaccination programmes
4. Compensation for culling and
5. Improve human health services for surveillance and treatment

According to Lee Jong-Wook, Director General of the WHO **"The world recognizes that this is a major public health challenge".**

The U. N. health agency plans to conduct training exercises across the world over in next few months to help experts to put in place measures to check the spread of bird flu, should it take the form of epidemic among humans. These experts consist of epidemiologists, laboratory specialists plus experts in logistics, ethics and communications.

Why there is a panic:

If the bird flu virus H5N1 transforms into a human pathogen either by mutation or by recombination and get easily transmitted between humans there is a chance of a pandemic. If it occurs it could be the worst of its kind the world has ever experienced. The reasons are:-

1. he increased world population and the population density
2. The increased travel facilities across national borders .
3. Humans have no immunity to H5 antigen
4. The mortality rate in affected cases is above 55%.

The recent findings of the genetic reconstruction studies of the 1918-19 pandemic flu virus (H1N1) which caused about 40 million deaths across the world, was an avian virus with some similarities to H5N1 point to the possibility of an impeding pandemic. Hence the Influenza experts are urging governments to prepare for the next pandemic.

Acknowledgement

In addition to the references cited in the text, information from European Union, WHO, OIE , FAO and other web sites were collected for the preparation of this paper.

❑

INFOMANIA

1. What do we call a squirrels nest?
2. Lilac Angora, Usual Abyssinian, Blue Long hair are three breeds of an animal. Which animal?
3. Fairway,tee, green,bunker,water hazard... .To which game these terms relates to?
4. What is the study of friction ejected when two different surfaces come into contact?
5. How do we name people, who in addition to being vegetarians, do not use other animal products and by-products such as eggs, dairy products, honey, leather, fur, silk, horn etc.
6. What is the science of growing grapes.
7. In which George Orwell novel, do barn dwellers insist "four legs good, two legs bad".
8. In 1912, the crew of The Carpathia helped assist the survivors of which nautical disaster.
9. Name the disease of calves in which the chondrodystrophic lesions of long bones result in marked dissimilarity between fore and hindquarters with a crest of thick bristles on dorsal midline and an aggressive attitude.
10. Downward arching of the back with treading of the hind feet and lying down are the manifestations of which disease in cattle.
11. What is the common clinical name for allotriophagia .
12. Increment, fastigium and decrement are three stages of a very common clinical condition. Name?
13. The deficiency of two nutritional factors can cause an anaphylaxis like reaction after iron injection in piglets. Identify the factors.
14 How do we name the favored food of a region?
15. Name the caecal worm species of poultry that acts as intermediate host in blackhead disease.
16. The intermediate stage of which tapeworm causes beef measles.
17. If you are served Mountain Oysters in a restaurant,what are you actually eating ?
18. Name the process of application of a chain to the hind leg in preparation for hoisting a carcass to an overhead rail.

(Answers on page-45)

VETERINARY PRACTICE TOMORROW

The Editorial board proposes a **special column** on your dream about tomorrow's veterinary practice as well as the goals that the profession should achieve and your suggestion to improve professional standards. Fellow veterinarians are requested to freely send in their ideas to ***editorjiva@gmail.com***