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Swine Flu - A Pandemic Outbreak

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Abstract

Hippocrates, who is considered to be the father of modern medicine, has described the symptoms of the flu in 412 B.C at Perinthus in North Greece and since then repeated influenza like epidemics and pandemics have been recorded in recent times. One of the greatest killers of all time was the swine flu pandemic of 1918-1919, when 230 million people died. Annual influenza epidemics are estimated to affect 5–15% of the global population, resulting in severe illness in 3–5 million patients causing 2,50,000–5,00,000 deaths worldwide. Severe illness and deaths occur mainly in the high-risk populations of infants, the elderly and chronically ill patients. The 2009 outbreak of swine flu is thought to be a mutation more specifically a reassortment of four known strains of influenza A virus subtype H1N1; one endemic in humans, one endemic in birds, and two endemic in pigs. WHO (World Health Organization) officially declared the outbreak to be a pandemic on June 11, 2009, but stressed that the new designation was a result of the global “spread of the virus,” not its severity.

Keywords: Swine Flu, Pandemic, Outbreak, Occupational Health, Influenza, Zoonoses.

Introduction

Swine flu, also called Hog or Pig flu, is a respiratory infection caused by any one of the several types of Swine Influenza Virus (SIV) which is common throughout pig population worldwide. The term “influenza” derived from Italian word “influence” was coined in 1357 AD as the disease was thought to be caused by influence of stars. Influenza pandemics are believed to have occurred at unpredictable intervals for many centuries. Outbreaks of swine flu are common and cause significant economical losses. Influenza, the flu, is believed to have been around for a few thousand years. Hippocrates has described the symptoms of the flu in 412 B.C at Perinthus in North Greece.

Swine flu is a respiratory disease caused by a strain of the influenza virus type A. These are RNA viruses have an envelope surface antigen hemagglutinin that is responsible for the infectivity. It attaches specifically to a receptor on the

erythrocytes and other host cells. Some influenza viruses have an enzyme called neuraminidase which helps the virus penetrate the mucus layer protecting the respiratory epithelium. The neuraminidase enzyme plays a role in the budding of the new virus particles from the infected cells. Swine influenza viruses may circulate among swine throughout the year, but most outbreaks occur during the late fall and winter months similar to outbreaks in humans. The classical swine flu virus (an influenza type A H1N1 virus) was first isolated from a pig in 1930. Influenza A virus strains caused three major global epidemics during the 20th century: the Spanish flu in 1918, Asian flu in 1957 and Hong Kong flu in 1968–69. These pandemics were caused by strains of Influenza A virus that had undergone major genetic changes and for which the population did not possess significant immunity. Influenza B virus also undergoes antigenic changes but less extremely and at a slower rate than influenza A virus. Influenza C virus is rarely recognised.

The 2009 flu pandemic is a global outbreak of a new strain of influenza A virus subtype H1N1, referred to as the "*novel H1N1*", first identified in April 2009, and commonly called "swine flu". It is thought to be a reassortment of four known strains of influenza A virus: one endemic in (normally infecting) humans, one endemic in birds, and two endemic in pigs. Transmission of the new strain is human-to-human. The U.S. Center for Disease Control and Prevention (CDC) notes that although this is a very serious virus, cases worldwide are usually mild, and most hospitalizations and deaths have been of persons that also had underlying conditions such as asthma, diabetes, obesity, heart disease, or a weakened immune system. Beginning in March 2009, an outbreak of influenza in North America was found to be caused by a new strain of influenza virus, designated "Influenza H1N1 2009". On April 9, 2009 it became apparent to public health officials in Mexico City that an outbreak of influenza was in progress late in the influenza season. On April 17, two cases in children were also reported in California near the Mexican border. The current outbreak of swine influenza A (H1N1) evolved so rapidly that as on 29 April 2009, nine countries officially reported with confirmed cases of swine influenza A/H1N1 infection. Of these, Mexico, United State, Austria, Canada, Germany, Israel, New Zealand, Spain and the United Kingdom have reported laboratory confirmed human cases and deaths due to rapidly progressive pneumonia, respiratory failure and acute respiratory distress syndrome (ARDS). World Health Organization (WHO) declared ever high stages on its "pandemic" scale-alert 6, designating the Influenza H1N1 2009 a potential threat to worldwide health and declared the outbreak as Public Health Emergency of International Concern (PHEIC). Then in India total confirmed cases and total deaths crossed to a level were the threat of a full blown epidemic is very real.

Antigenic Variation

Antigenic variation occurs by two processes, antigenic drift and antigenic shift. The antigenic drift results from mutations in genes that code for haemagglutinin and neuraminidase. Such mutations change the configuration of the part of antigenic molecule that stimulates the production of and combines with specific antibodies. Antigenic shift results from gene assortment possibly after two different viruses infect the same cells. Antigenic shift generally precedes a major pandemic.

Epidemiology

The 1957 outbreak of the so called Asian flu provided an opportunity to study the development of a pandemic. The pandemic probably arose when a virulent mutant strain, differing antigenically from all previous strains appeared in the population. Evidence links the pandemics of 1918 and 1957 to the reassortment of the avian influenza viruses and human viruses in swine. Swine cells have receptors for both avian and human influenza orthomyxo viruses and can bind and propagate these strains.

Transmission

Transmission between pigs

The main route of transmission is through direct contact between infected and uninfected animals. These close contacts are particularly common during animal transport. Intensive farming may also increase the risk of transmission, as the pigs are raised in very close proximity to each other. The direct transfer of the virus probably occurs either by pigs touching noses, or through dried mucus. Airborne transmission through the aerosols produced by pigs coughing or sneezing is also an important means of infection. The virus usually spreads quickly through a herd, infecting all the pigs within a few days. Transmission may also occur through wild animals, such as wild boar, which can spread the disease between farms.

Transmission to humans

People who work with poultry and swine, especially people with intense exposures, are at increased risk of zoonotic infection with influenza virus. Vaccination of these workers against influenza and surveillance for new influenza strains among this population may therefore be an important public health measure. Transmission of influenza from swine to humans who work with swine was documented in a small surveillance study performed in 2004 at the University of Iowa. This study among others, form the basis of a recommendation that people whose jobs involve handling poultry and swine be the focus of increased public health surveillance. Other professions at particular risk of infection are veterinarians and meat processing workers, although the risk of infection for both of these groups is lower than that of farm workers.

Signs and Symptoms

In swine

In pigs influenza infection produces fever, lethargy, sneezing, coughing, difficult breathing and decreased appetite. In some cases the infection can cause abortion. Although mortality is usually low (around 1-4%), the virus can produce weight loss and poor growth, causing economic loss to farmer.

In Human beings

The signs of infection with Swine flu are similar to other forms of influenza, and include fever, coughing, headaches, pain in the muscles or joints, sore throat, chills, fatigue and running nose. Diarrhoea and vomiting have also been reported in some case. People at higher risk of serious complications included people aged 65 years and older, children younger than 5 years old, pregnant women and people of any age with underlying medical conditions such as asthma, diabetes, obesity, heart disease or a weakened immune system (e.g., taking immunosuppressive medications or infected with HIV). In children, clinical signs include blue lips and skin, dehydration, rapid breathing, excessive sleeping and significant irritability that lead to critical condition. In adults, shortness of breath, pain in the chest or abdomen, sudden dizziness may be seen following an infection with swine flu. In both children and adults, persistent vomiting or the return of flu-like symptoms that include a fever and cough may require medical attention. In certain cases of pregnancy, spontaneous abortion and premature rupture of membranes were also reported.

Diagnosis

The best specimens for the isolation of virus are throat swabs as early in the illness as possible. The virus can be cultured in embryonated chick eggs and various cell lines and identified by hemagglutination inhibition and immune-fluorescent antibody tests.

Treatment

In swine

As swine influenza is rarely fatal to pigs, little treatment beyond rest and supportive care is required. Instead veterinary efforts are focused on preventing the spread of the virus throughout the farm, or to other farms. Vaccination and animal

management techniques are most important in these efforts. Antibiotics are also used to treat this disease, which do help prevent bacterial pneumonia and other secondary infections in influenza-weakened herds, although they have no effect against the influenza virus.

In humans

If a person becomes sick with swine flu, antiviral drugs can make the illness milder and make the patient feel better faster and they may also prevent serious flu complications. For treatment, antiviral drugs work best if started soon after getting sick (within 2 days of symptoms). Beside antivirals, palliative care, at home or in hospital, focuses on controlling fevers and maintaining fluid balance. The U.S. Centres for Disease Control and Prevention recommends the use of Tamiflu (oseltamivir) or Relenza (zanamivir) for the treatment and or prevention of infection with swine influenza viruses; however, the majority of people infected with the virus make a full recovery without requiring medical attention or antiviral drugs.

Prevention

Prevention of swine influenza has three components: prevention in swine, prevention of transmission to humans, and prevention of its spread among humans.

Prevention in swine

Methods of preventing the spread of influenza among swine include facility management, herd management, and vaccination. Because much of the illness and death associated with swine flu involves secondary infection by other pathogens, control strategies that rely on vaccination may be insufficient. Control of swine influenza by vaccination has become more difficult in recent decades, as the evolution of the virus has resulted in inconsistent responses to traditional vaccines. Standard commercial swine flu vaccines are effective in controlling the infection when the virus strains match enough to have significant cross-protection and custom (autogenous) vaccines made from the specific viruses isolated are created and used in the more difficult cases. The United States Department of Agriculture researchers say that while pig vaccination keeps pigs from getting sick, it does not block infection or shedding of the virus.

Facility management includes disinfectants and ambient temperature to control virus in the environment. The virus is unlikely to survive outside living cells for more than two weeks, except in cold (but above freezing) conditions and it is readily inactivated by disinfectants. Herd management includes not adding pigs carrying influenza to herds that have not been exposed to the virus. The virus survives in healthy carrier pigs for up to 3 months. Carrier pigs are usually responsible for the introduction of SIV into previously uninfected herds and countries, so new animals should be quarantined. After an outbreak, as immunity in exposed pigs wanes, new outbreaks of the same strain can occur.

Prevention in humans

Prevention of pig to human transmission

Swine can be infected by both avian and human influenza strains of influenza. The transmission from swine to human is believed to occur mainly in swine farms where farmers are in close contact with live pigs. Although strains of swine influenza are usually not able to infect humans this may occasionally happen, so farmers and veterinarians are encouraged to use a face mask when dealing with infected animals. The use of vaccines on swine to prevent their infection is a major method of limiting swine to human transmission. Risk factors that may contribute to swine-to-human transmission include smoking and not wearing gloves when working with sick animals.

Prevention of human to human transmission

Influenza spreads between humans through coughing or sneezing and people touching something with the virus on it and then touching their own nose or mouth. Swine flu cannot be spread by pork products, since the virus is not transmitted through food. The swine flu in humans is most contagious during the first five days of the illness although some people, most commonly children, can remain contagious for up to ten days. Diagnosis can be made by sending a specimen, collected during the first five days for analysis. Recommendations to prevent spread of the virus among humans include using standard infection control against influenza. This includes frequent washing of hands with soap and water or with alcohol-based hand sanitizers, especially after being out in public. Chance of transmission is also reduced by

disinfecting household surfaces, which can be done effectively with a diluted chlorine bleach solution. The current trivalent influenza vaccine is unlikely to provide protection against the new 2009 H1N1 strain. Influenza can spread in coughs or sneezes, but an increasing body of evidence shows small droplets containing the virus can linger on tabletops, telephones and other surfaces and be transferred via the fingers to the mouth, nose or eyes. Social distancing is another tactic. It means staying away from other people who might be infected and can include avoiding large gatherings, spreading out a little at work, or perhaps staying home and lying low if an infection is spreading in a community. Anyone with flu-like symptoms such as a sudden fever, cough or muscle aches should stay away from work or public transportation and should contact a doctor for advice. World Organisation for Animal Health (OIE) and U.N.'s Food and Agriculture Organisation reiterated that pork is not a source of infection and is safe to eat provided it is prepared properly. Existing vaccines against seasonal flu provide no protection, and there is no vaccine for this strain. Because of influenza virus ability to mutate, annual immunization is recommended especially for high risk persons. A human gene that confers resistance to influenza was identified at the University of California in Santa Barbara. This gene is turned on by interferon. It produces a specific Mx protein which prevents the virus from making viral RNA and protein.

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