



SWINE FLU: SYMPTOMS, SEVERITY, PRECLUSION AND THERAPY

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ABSTRACT

Swine flu also known as H1N1 is a new influenza virus which is a respiratory disease of pig has become the world's fastest moving influenza pandemic, sweeping across many countries in a short span of time. It transmitted to humans via contact with infected pigs or environments contaminated with swine influenza viruses. The scientists call this a 'quadruple reassortant' virus. This is a dangerous scenario in 21st century. So, there is a need to prevent and to treat the swine flu all over the world. Here we reveal that complete drug therapy for this disease for swine flu in several medicinal systems and prevention techniques like vaccine therapy. According to the World Health Organization (WHO) worldwide more than 209 countries and overseas territories or communities have reported laboratory confirmed cases of pandemic influenza H1N1. Respiratory failure resulting from severe pneumonia and acute respiratory distress syndrome is main reason for most of the death. Clinical trials are going on for treating this swine flu but still there is no proper drug therapy for this disease. Alternate system of medicine such as ayurveda, homeopathy and siddha could provide very effective medicines for the prevention and treatment of swine flu without any side effects. One of the powerful health tools for control of influenza is vaccination.

Keywords: Swine flu, Pandemic influenza, Quadruple Reassortant, Respiratory disease.

INTRODUCTION

Infectious diseases, also known as communicable, contagious or transmissible diseases comprise clinically evident illness resulting from the infection, presence and growth of pathogenic biological agents in an individual host organism. The various causes of common infectious diseases are bacteria, fungus, parasites, prions and viruses. Respiratory tract infections are the most common infectious diseases. Upper Respiratory tract infections (URIs) includes rhinitis (common cold), sinusitis, ear infections, acute pharyngitis, tonsillopharyngitis, epiglottitis, and laryngitis of which ear infections and pharyngitis cause the more severe complications. The vast majority of URIs has a viral etiology. Rhinoviruses, parainfluenza and influenza viruses, human metapneumovirus, adenoviruses, and corona viruses are the main causes of URIs. The common lower respiratory tract infections (LRIs) in children are pneumonia and bronchiolitis. The major threats related to infectious diseases (IDs) have not changed substantially over the years. These include antimicrobial resistance, health care-associated infections, vaccine-preventable diseases, respiratory tract infections and HIV infection.^{1,2}

In last decade new viral respiratory infections have emerged and these new infections have the potential to affect millions of people world-wide. Severe acute respiratory syndrome (SARS) originated from southern China and rapidly transmitted to more than thirty countries in early 2003.³

SWINE INFLUENZA (H1N1)

Swine flu, also known as Influenza A (H1N1), pig influenza, swine flu, hog flu and pig flu is a new influenza

virus which is a respiratory disease of pig. The H number in the name refers to the viral hemagglutinin protein, while the N refers to the type of neuraminidase enzyme on the surface of the virus. Both the hemagglutinin and the neuraminidase are involved in the infection process.

It is the H1N1 type that generally causes seasonal influenza worldwide each year and kills tens of thousands of people. Influenza A (H1N1) virus is a subtype of influenza A virus and the most common cause of influenza (flu) in humans. Other strains of H1N1 are endemic in pigs (swine flu) and in birds (avian influenza). Swine influenza A viruses are RNA viruses with a segmented genome that is comprised of eight negative-sense, single-stranded RNA segments, belong to the viral family of *Orthomyxoviridae*. These eight segments encode eleven proteins. The polymerase complex includes the PB2, PB1 and PA proteins as well as the nucleoprotein (NP). There are two surface glycoproteins, hemagglutinin (HA) and neuraminidase (NA).⁴

In April 2009, in California (USA), the first novel Swine-Origin Influenza A (H1N1) virus was detected, it quickly spread to other parts of the Americas, Europe, Australia, and Asia within a short span of time.⁵ This pandemic flu is different from ordinary flu because it's a new flu virus that appears in humans and spreads very quickly from person to person worldwide.

On June 11, 2009, the World Health Organization (WHO) raised the alert level to the highest⁶ indicating the ongoing pandemic of this viral infection⁷, within two months of the discovery of this new virus. Most infected children or adults recover uneventfully with supportive treatment. However, continuing monitoring across the world is



important to reveal the true impact of this infection globally.

Illness with influenza in pigs was first recognized during the influenza pandemic of 1918 to 1919, and a swine influenza virus was first isolated from a human in 1974.⁸⁻¹⁰ In 1976, swine influenza virus caused a respiratory illness with one fatality among 13 soldiers in Fort Dix, New Jersey¹¹. No exposure to pigs was found. A subsequent epidemiologic study showed that up to 230 soldiers had been infected with the virus.¹² Between 1958 and 2005, 37 cases of swine influenza among civilians were reported. Six cases (17%) resulted in death. Forty-four percent of infected individuals had known exposure to pigs.

QUADRUPLE REASSORTANT

The genes of a flu virus are packaged in eight discrete segments. When two flu viruses infect the same host cell, the segments of each are copied and repackaged, 8 at a time, in new viral particles which then bud off from the infected cell. They then may infect a new host cell. In this repackaging process the segments of the two different viruses may mix and match, so that new virus particle will have segments from two different viruses. The new virus is, in a sense, not just a swine flu virus. It does have viral segments characteristic of two different families of swine flu, one typical of North America, where swine flu is endemic, and one typical of pig flu viruses from Europe and Asia. The scientists call this a 'quadruple reassortant' virus and hence this new virus is christened "influenza-A (H1N1) virus." It turns out this virus is highly unusual, a quadruple reassortant.^{13, 14}

1x US-pig

1x Asian pig

1x Bird

1x Human

= 4 viruses recombined = 4 sources = Quadruple source combined to obtain 1 virus.

PANDEMIC VS EPIDEMIC

Endemic is refers to the disease found only among a particular group of people or in a local region of the world. Epidemic is refers to a disease which occur in many individuals in a community at the same time. The term pandemic is used to describe a disease that is epidemic throughout the world at approximately the same time and a pandemic occurs when a completely new virus emerges, one that has demonstrated a dramatic change.¹⁵

INFLUENZA VIRUS- TYPES

There are 3 types of influenza virus, designated A, B, and C. Influenza A and B cause seasonal respiratory epidemics, whereas influenza C infection results in mild or no clinical manifestations and does not appear to provoke epidemics.¹⁶ There are four main influenza types A virus subtypes that have been isolated in pigs: H1N1, H1N2, H3N2, and H3N1. Influenza viruses contain the surface

glycoproteins hemagglutinin and neuraminidase, which are integral to viral replication and proliferation.¹⁷ Hemagglutinin mediates viral attachment to a host cell and penetration into its cytoplasm and neuraminidase mediates the release of viruses from infected host cells. The influenza A virus has 9 known subtypes, which are distinguished by structural variations in hemagglutinin and neuraminidase; the influenza B virus has no known subtypes.

H1N1 INFLUENZA OUTBREAK

Human cases of influenza A (H1N1) have been reported worldwide. In 2009, cases of influenza like illness were first reported in Mexico on March 18; the outbreak was subsequently confirmed as H1N1 influenza A.¹⁸ Investigation is continuing to clarify the spread and severity of H1N1 influenza (swine flu) in Mexico. Suspected clinical cases had been reported in 19 of the country's 32 states. As of May 5th, 2009, nearly 600 H1N1 influenza cases had been confirmed in Mexico, including 25 deaths.¹⁹

On April 17, 2009, the CDC determined that two cases of febrile respiratory illness in children who resided in adjacent counties in southern California were caused by infection with a swine influenza A (H1N1) virus.²⁰ By April 26, 2009, the US Department of Health and Human Services declared a national public health emergency involving H1N1 influenza A, citing its significant potential to affect national security.²¹ By June 25, 2009, 27,717 lab-defined cases of H1N1 influenza had been confirmed in the United States.^{22, 23}

Estimates in the United States for the first 6 months of the pandemic report approximately 22 million people in the United States became ill from the H1N1 influenza, nearly 100,000 were hospitalized, and about 3900 have died. Deaths include an estimated 540 children younger than 18 years, 2900 adults aged 18-64 years, and about 440 elderly individuals. These estimates are from the CDC's Emerging Infection Program, rather than using only laboratory-confirmed cases.

MODES OF TRANSMISSION

Transmission of swine influenza viruses to humans is uncommon. However, the swine influenza virus can be transmitted to humans via contact with infected pigs or environments contaminated with swine influenza viruses. Once a human becomes infected, he or she can then spread the virus to other humans, presumably in the same way as seasonal influenza is spread (i.e., via coughing or sneezing).

Person-to-person transmission — Influenza virus is present in respiratory secretions of infected persons. As a result, influenza virus can be transmitted through sneezing and coughing via large-particle droplets.

Transmission via contact with surfaces that have been contaminated with respiratory droplets or by aerosolized



small-particle droplets may also occur, although these modes of transmission have not been proven.

In addition to respiratory secretions, certain other bodily fluid should also be considered potentially infectious. The incubation period for A (H1N1) 2009 infection appears to range from 2 to 7 days, but most patients probably shed virus from day 1 before the onset of symptoms through 5–7 days after.²⁴ The median period during which the virus could be detected with the use of real-time PCR in quarantined patients was 6 days (range 1–17), whether or not fever was present.²⁵ Studies of transmission in animal models show that the pandemic H1N1 virus transmits just as efficiently as seasonal flu²⁶, contrary to earlier findings at the start of the pandemic.²⁷

IDENTIFICATION OF CASE

The case definition will vary between countries such as Mexico, the USA and Canada. A suspected case of H1N1 influenza 09 virus infections can be defined as²⁸:

An acute febrile respiratory illness (temperature of $\geq 38^{\circ}\text{C}$ or history of fever, and recent onset of at least one of the following symptoms: rhinorrhoea, nasal congestion, sore throat or cough), with onset within 7 days of close contact with a person who is a confirmed case of H1N1 Influenza 09 (human swine influenza) virus infections or a suspected case with influenza a positive test result. It uses the definition of influenza like illness as used for seasonal influenza purposes by public health investigators. Consequently, cases of swine flu are divided into confirmed, probable or suspected cases. Influenza-like-illness (ILI) is defined as fever and a cough and/or a sore throat in the absence of a known cause other than influenza. A confirmed case is defined as a person with an influenza-like illness with laboratory confirmed novel influenza A (H1N1) virus infection by one or more of the following tests:

1. real-time, reverse transcriptase polymerase chain reaction [RT-PCR] on the viral throat or nasal swab
2. viral culture on the same sample which is slower, and therefore not the preferred test

A probable case is defined as a person with an influenza-like illness who is positive for influenza A, but negative for human H1 and H3 by influenza RT-PCR.

SYMPTOMS OF SWINE FLU

The symptoms of pandemic H1N1 influenza of 2009^{29, 30} are essentially the same as the seasonal flu, although some have noted an increased frequency of gastrointestinal symptoms, including vomiting and diarrhea, and others have noted the absence of fever in a significant number with virologically proven cases.

The CDC defines cases as *influenza-like illness* (ILI) if there is fever of $\geq 100^{\circ}\text{F}$ (37.8°C) plus cough and/or sore throat in the absence of a known cause other than influenza. Another category is *acute respiratory illness* (ARI), defined by the presence of 2 of the following symptoms: fever,

cough, sore throat, or rhinorrhea. In the outbreak of pandemic influenza in New York City, 95% of virologically proven cases satisfied the ILI definition.³¹ Patients with 2009 influenza A H1N1 infections have higher rates of gastrointestinal symptoms and lack of fever compared with those who have seasonal flu. Most patients have mild symptoms, but a small subset of previously healthy young adults have severe pulmonary disease that progresses to acute respiratory distress syndrome (ARDS); this may occur with or without underlying conditions.

H1N1 COMPLICATIONS

There are many serious complications that may result with this particular virus. Naturally, those that suffer from medical conditions that are considered to be chronic may experience more symptoms and complications than those that do not suffer from these types of medical problems. In addition to this, the following types of situations may be experienced by those suffering from H1N1 swine flu³²⁻³⁵:

- Many individuals will suffer from respiratory complications. This may include the onset of pneumonia or even respiratory failure as a whole. Many patients have experienced moderate to severe medical complications associated with breathing.
- Dehydration and malnutrition are common issues associated with this condition due to the fact that many individuals do not get enough to drink and they may not have much of an appetite as a whole. Many also experience complications such as vomiting and diarrhoea. This results in a natural loss of fluids.
- For many individuals, mental complications may be experienced. These complications may include, but are not limited to, confusion and changes in the mood and/or behaviour.

Reason for Mortality

Respiratory failure resulting from severe pneumonia and acute respiratory distress syndrome is main reason for most of the death.³⁶

TREATMENT OF H1N1

Antiviral agents

In the early phase of the infection, oseltamivir and zanamivir, neuraminidase inhibitor antiviral medications, is used. However, this strain is resistant to adamantanes, such as amantadine and rimantadine.³⁷

Oseltamivir

It is a prodrug with an elimination half life of about 6-10 h, hydrolyzed by liver to its active metabolite oseltamivir carboxylate. Oseltamivir is a neuraminidase inhibitor, serving as a competitive inhibitor of sialic acid, found on the surface proteins of normal host cells. By blocking the



activity of the neuraminidase, oseltamivir prevents new viral particles from being released by infected cells.³⁸

Zanamivir

Zanamivir³⁹ is administered by inhalation with a dry powder inhaler. It shows 10-20% bioavailability of the drug by inhalation as that of 2% by oral administration. About 90% of the absorbed dose is excreted unchanged in the urine. The elimination half-life in serum of zanamivir is about 2–5 h.⁴⁰

Zanamivir is a selective inhibitor of neuraminidase, an enzyme that cleaves sialic acid from host and viral cell surfaces and thereby facilitates the release of progeny virus from infected host cells. Zanamivir is thought to prevent neuraminidase from cleaving sialic acid from host cells by blocking the active site of neuraminidase. The resultant binding of viral hemagglutinin to the uncleaved sialic acid hinders release of nascent viruses from the host cell and causes them to clump at the host cell surface, with a net reduction in the amount of active virus.⁴¹ The therapeutic dose is 10 mg inhaled twice daily for 5 days starting within 48 h of the initial symptoms. The recommended doses for children are the same. Because zanamivir therapy requires the patient to voluntarily inhale through the device, oseltamivir may be preferred over zanamivir for young children.

ALTERNATIVE TREATMENTS

Medicine in Ayurveda⁴²

Ayurveda promotes the concept that if one's immune system is strong, then even if the body is exposed to viruses, one will not be affected. During a pandemic or an epidemic, Ayurveda emphasizes on the immunity of people living in regions affected by viruses. This branch of medicine promotes the intake of special herbs or decoctions to increase the immunity level of the people. Ayurvedic remedies comprise pure natural herbs which are effective in preventing swine flu. Moreover, the herbs are used to relieve swine flu symptoms, and boost the immune system against the H1N1 virus. Ayurvedic treatment for swine flu involves

This is done by prescribing various digestive fire strengthening herbs such as Guduchi (licorice), Tulasi (Holy Basil), Sahadevi, Neem (Indian Margosa Tree), Shunthi (ginger), Pippali (pepper) etc. Once the digestive fire is corrected, medicines such as Triphala, Rasna, Eranda, Guggulu can be prescribed to relieve the symptoms. Ayurvedic treatment for swine flu involves: Basil, Ginger and Garlic, Gooseberry and AloeVera, Camphor and Eucalyptus Oil.

Homeopathy Medicine^{43,44}

Considering that the Swine Flu virus produces symptoms similar to the human influenza virus, the following homeopathy medicines may prove useful in cases of swine influenza: Gelsemium, Baptisia, Eupatorium perfoliatum, Sabadilla, Arsenicum, Arsenicum iodide, Dulcamara, Bryonia Phosphorus, Rhus toxicodendron.

Siddha Medicine⁴⁵

The traditional Siddha system has very effective medicines for the prevention and treatment of swine flu without any side effects on the users a decoction made of Tulsi (*Ocimum tenuiflorum*), Karpooravalli (*Plectranthus amboinicus*), Black Pepper (*Piper nigrum*), Cloves (*Eugenia aromaticum*), Cardamom (*Elettaria cardamomum*) and Honey (*Apis mellifera*) would be effective for preventing the swine flu. The ingredients should be boiled in one litre of water and then filtered. An adult should take 150 ml of the filtered potion once in a day while a child could be given 75 ml. It could be taken for about seven to 10 days. Other Siddha preparation for treating an infected person includes crushing hundred grams each of Nilavembu, Seenthil, Adathoda, Vishnu Karanthai, Parpadagam to make into a powder. Take 50 grams of the powder and heat it adding one litre of water. The infected adult should take 150 ml while a child could be given 75 ml for seven to ten days.

PREVENTION IS BETTER THAN CURE

The following are the WHO safety precautions to be taken against swine flu⁴⁶:

- The nose and mouth must be covered with disposable tissues while coughing or sneezing.
- The used tissues must be disposed off immediately after using them.
- Hygiene and cleanliness must be maintained by washing hands frequently with soap and water.
- Touching the eyes, nose or mouth without washing hands must be totally avoided.
- A doctor must be consulted immediately, in case flu-like symptoms are observed.
- In case of flu-like symptoms, the patient must be quarantined.
- One should stay at home from work, school and crowded places in case flu-like symptoms are observed.

GUIDELINES FOR EDUCATIONAL INSTITUTIONS

- Schools are advised to avoid any large gathering of students during the course of the day in the school.
- Students, teachers and other employees working in schools/educational institutions are advised to stay at home if they develop flu like symptoms.
- All the schools should display "DO'S AND DON'TS" for H1N1 infection at all important places.

GUIDELINES FOR PATIENT

- Be informed about the illness during screening.
- Stay home for seven days, preferably isolate himself / herself in a well ventilated room.



- Wear mask all the time. Three layered surgical mask should be provided by the hospital /community health worker. If mask is not readily available, mouth and nose should be covered with a piece of cloth/handkerchief.
- Avoid smoking.
- Avoid going into the community, school, office, markets.
- Wash hands frequently.
- Self monitor health and report to identified health facility in case of worsening of symptoms

Vaccination

The World Health Organization (WHO) figures show that worldwide more than 209 countries and overseas territories or communities have reported laboratory confirmed cases of pandemic influenza H1N1 2009. Protection against influenza infection is conferred by neutralizing antibody for the two surface proteins, namely the hemagglutinin (HA) and the neuraminidase (NA). It has been difficult to develop a vaccine for H1N1 influenza A virus that provides long lasting immunity. This is due to the antigenic drift of the virus where the circulating strain in an infectious cycle is different from the previously circulating strain. Current inactivated vaccines provide essential protection when the vaccine antigen and the circulating viruses share high degree of similarity in the structural protein. Since new influenza virus antigenic variants emerge frequently from accumulation of point mutations in the structural protein, influenza vaccine antigens end to be updated frequently.

One of the powerful health tools for control of influenza is vaccine. As novel strain hemagglutinin is different from seasonal influenza A, these seasonal influenza vaccines are not expected to provide protection against Swine Origin Influenza Virus (S-OIV) infection.⁴⁷

A step-wise approach to vaccinate particular groups may be considered by the Strategic Advisory Group of Experts of the WHO noting that countries need to determine their order of priority based on country-specific conditions: healthcare providers; pregnant women; those aged above 6 months with one of several chronic medical conditions; healthy young adults of 15–49 years of age; healthy children; healthy adults of 50–64 years of age; and healthy adults of 65 years of age and above. Since the S-OIV vaccine is not intended to replace the seasonal flu vaccine, individuals should be encouraged to get their seasonal flu vaccine along with it.⁴⁸

CONCLUSION

Swine flu, also known as H1N1 is a new influenza virus which is transmitted to humans via contact with infected pigs or environments contaminated with swine influenza viruses. The virus itself mutated so that it transmits from human to human. In the early phase of the infection, oseltamivir and zanamivir, neuraminidase inhibitor

antiviral medications, could be used. As the golden adage says, Prevention is better than cure, hand washing, wearing face masks and avoiding touching surfaces that someone else who may have been exposed to swine flu has touched will, in combination, provide you with the best defenses.

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