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A REVIEW ARTICLE ON SWINE ORIGIN INFLUENZA VIRUS A (S-OIV) INFECTION

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ABSTRACT

H1N1 influenza (Swine influenza or Swine flu) is a respiratory disease of pigs caused by type A influenza virus that regularly causes outbreaks of influenza in pigs. The 2009 flu outbreak in humans, known as "swine influenza" or H1N1 influenza A, refers to influenza A due to a new H1N1 strain called swine-origin influenza virus A (S-OIV). The new swine flu virus is actually a genetic mixture of two strains, both found in swine, of unknown origin. S-OIV can be transmitted from human to human and causes the normal symptoms of influenza. Prevention of swine influenza spread among humans includes use of standard infection control measures against influenza and constitutes the main scope of World Health Organization. For the treatment of S-OIV influenza oseltamivir and zanamivir are effective in most cases. Prophylaxis against this new flu strain is expected through a new vaccine, which is not available yet. The 2009 flu pandemic is a global outbreak of a new strain of influenza A virus subtype H1N1 and was first identified April 2009 in Mexico. Worldwide, as of April 11, 2010, more than 214 countries and overseas territories or communities have reported laboratory confirmed cases of pandemic influenza H1N1 2009, including over 17798 deaths. This review article focuses on Introduction ; structure of the virus ; classification ; symptoms of the disease ; diagnosis ; treatment ; vaccination .

Keywords: - "swine influenza" Or H1N1 influenza A; pandemic ; oseltamivir ; zanamivir ; Prophylaxis.

INTRODUCTION

➢ What is Swine Influenza ?

H1N1 influenza is an infectious disease caused by a Type A strain of influenza virus (WHO, 2008).

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There are three types of influenza viruses: A, B and C depending upon the virus structure. These viruses are negative-sense single-stranded RNA viruses that belong to the family of Orthomyxoviridae [31]. Among these, Type A can cause H1N1 influenza where as types A, B and C can cause seasonal influenza in humans [32]. The classical swine flu virus (influenza type A H1N1 virus) was first isolated from a pig in

1930 [31]. Enveloped virions of H1N1 virus are 80 to 120 nm in diameter, are 200 to 300 nm long, and may be filamentous [30].They consist of spike-shaped surface proteins, a partially host-derived lipid-rich envelope, and matrix (M) proteins surrounding a helical segmented nucleocapsid (six to eight segments). Like all influenza viruses, H1N1 viruses change constantly[30].

- **The structure of Swine Influenza :-**

The influenza virion (as the infectious particle is called) is roughly spherical. It is an enveloped virus – that is, the outer layer is a lipid membrane which is taken from the host cell in which the virus multiplies. Inserted into the lipid membrane are 'spikes', which are proteins – actually glycoproteins, because they consist of protein linked to sugars – known as HA (hemagglutinin) and NA (neuraminidase). These are the proteins that determine the subtype of influenza virus (A/H1N1, for example). The HA and NA are important in the immune response against the virus; antibodies (proteins made by us to combat infection) against these spikes may protect against infection. The NA protein is the target of the antiviral drugs Relenza and Tamiflu. Also embedded in the lipid membrane is the M2 protein, which is the target of the antiviral adamantanes – amantadine and rimantadine. Beneath the lipid membrane is a viral protein called M1, or matrix protein. This protein, which forms a shell, gives strength and rigidity to the lipid envelope. Within the interior of the virion are the viral RNAs – 8 of them for influenza A viruses. These are the genetic material of the virus; they code for one or two proteins. Each RNA segment, as they are called, consists of RNA joined with several proteins shown in the diagram: B1, PB2, PA, NP. These RNA segments are the genes of influenza virus. The interior of the virion also contains another protein called NEP (Nuclear Export Protein).

- **Classification:-** Out Of the three genera of influenza viruses that cause human flu, two also cause influenza in pigs, with influenza A being common in pigs and influenza C being rare[1]. Influenza B has not been reported in pigs. Within influenza A and influenza C, the strains found in pigs and humans are largely distinct, although because of reassortment there have been transfers of genes among strains crossing swine, avian, and human species boundaries.
- **Influenza C-** Influenza viruses infect both humans and pigs, but do not infect birds[2]. Transmission between pigs and humans have occurred in the past[3]. For example, influenza C caused small outbreaks of a mild form of influenza amongst children in Japan[4] and California[4]. Because of its limited host range and the lack of genetic diversity in influenza C, this form of

influenza does not cause pandemics in humans[5].

- **Influenza A-** In pigs, four influenza A virus subtypes (H1N1, H1N2,H3N2 and H7N9) are the most common strains worldwide[6]. In the United States, the H1N1 subtype was exclusively prevalent among swine populations before 1998; however, since late August 1998, H3N2 subtypes have been isolated from pigs. As of 2004, H3N2 virus isolates in US swine and turkey stocks were triple reassortants, containing genes from human (HA, NA, and PB1), swine (NS, NP, and M), and avian (PB2 and PA) lineages[7]. In August 2012, the Center for Disease Control and Prevention confirmed 145 human cases (113 in Indiana, 30 in Ohio, one in Hawaii and one in Illinois) of H3N2v since July 2012[8]. The death of a 61-year-old Madison County, Ohio woman is the first in the nation associated with a new swine flu strain. She contracted the illness after having contact with hogs at the Ross County Fair[9].

SIGNS AND SYMPTOMS

Swine: In Swine, an influenza infection produces fever, lethargy, sneezing, coughing, difficulty breathing and decreased appetite[6]. In some cases the infection can cause abortion. Although mortality is usually low (around 1–4%)[10], the virus can produce weight loss and poor growth, causing economic loss to farmers[6]. Infected pigs can lose up to 12 pounds of body weight over a three- to four-week period[6]. Swine have receptors to which both avian and mammalian influenza viruses are able to bind to, which leads to the virus being able to evolve and mutate into different forms[11]. Influenza A is responsible for infecting swine, and was first identified in the summer of 1918[11].

Humans

Direct transmission of a swine flu virus from pigs to humans is occasionally possible (zoonotic swine flu). In all, 50 cases are known to have occurred since the first report in medical literature in 1958, which have resulted in a total of six deaths [12].

According to the Centers for Disease Control and Prevention (CDC), in humans the symptoms of the 2009 "swine flu" H1N1 virus are similar to those of influenza and of influenza-like illness in general. Symptoms include fever; cough, sore throat, watery eyes, body aches, shortness of breath, headache, weight loss, chills, sneezing, runny nose, coughing, dizziness, abdominal pain, lack of appetite and fatigue. The 2009 outbreak has shown an increased percentage of patients reporting diarrhea and vomiting as well. The 2009 H1N1 virus is not zoonotic swine flu, as it is not transmitted from pigs to humans, but from person to person through airborne droplets. Because these symptoms are not specific to swine

flu, a differential diagnosis of *probable* swine flu requires not only symptoms, but also a high likelihood of swine flu due to the person's recent and past medical history. For example, during the 2009 swine flu outbreak in the United States, the CDC advised physicians to "consider swine influenza infection in the differential diagnosis of patients with acute febrile respiratory illness who have either been in contact with persons with confirmed swine flu, or who were in one of the five U.S. states that have reported swine flu cases or in Mexico during the seven days preceding their illness onset." A diagnosis of *confirmed* swine flu requires laboratory testing of a respiratory sample (a simple nose and throat swab)[13]. The most common cause of death is respiratory failure. Other causes of death are pneumonia (leading to sepsis)[14], high fever (leading to neurological problems), dehydration (from excessive vomiting and diarrhea), electrolyte imbalance and kidney failure[15]. Fatalities are more likely in young children and the elderly.

DIAGNOSIS:

The CDC recommends real-time PCR as the method of choice for diagnosing H1N1[16]. The oral or nasal fluid collection and RNA virus preserving filter paper card is commercially available[17]. This method allows a specific diagnosis of novel influenza (H1N1) as opposed to seasonal influenza. Near-patient point-of-care tests are in development[18].

TREATMENT

Swines

As swine influenza is rarely fatal to pigs, little treatment beyond rest and supportive care is required[19]. Instead, veterinary efforts are focused on preventing the spread of the virus throughout the farm, or to other farms [6]. Vaccination and animal management techniques are most important in these efforts. Antibiotics are also used to treat this disease, which although they have no effect against the influenza virus, do help prevent bacterial pneumonia and other secondary infections in influenza-weakened herds [19].

Humans

If a person becomes sick with swine flu, antiviral drugs can make the illness milder and make the patient feel better faster. They may also prevent serious flu complications. For treatment, antiviral drugs work best if started soon after getting sick (within two days of symptoms). Beside antivirals, supportive care at home or in a hospital focuses on controlling fevers, relieving pain and maintaining fluid balance, as well as identifying and treating any secondary infections or other medical problems. The U.S. Centers for Disease Control and Prevention recommends the use of oseltamivir (Tamiflu) or zanamivir (Relenza) 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[20]. The viruses isolated in the 2009 outbreak have been found resistant to amantadine and rimantadine [21].

In the U.S., on April 27, 2009, the FDA issued Emergency Use Authorizations to make available Relenza and Tamiflu antiviral drugs to treat the swine influenza virus in cases for which they are currently unapproved. The agency issued these EUAs to allow treatment of patients younger than the current approval allows and to allow the widespread distribution of the drugs, including by volunteers[22].

VACCINATION

Swine

Methods of preventing the spread of influenza among swine include facility management, herd management, and vaccination (ATCvet code: QI09AA03 (WHO)). 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[23][24]. Present vaccination strategies for SIV control and prevention in swine farms typically include the use of one of several bivalent SIV vaccines commercially available in the United States. Of the 97 recent H3N2 isolates examined, only 41 isolates had strong serologic cross-reactions with antiserum to three commercial SIV vaccines. Since the protective ability of influenza vaccines depends primarily on the closeness of the match between the vaccine virus and the epidemic virus, the presence of nonreactive H3N2 SIV variants suggests current commercial vaccines might not effectively protect pigs from infection with a majority of H3N2 viruses[12][25]. The United States Department of Agriculture researchers say while pig vaccination keeps pigs from getting sick, it does not block infection or shedding of the virus[26].

Humans

Vaccines are available for different kinds of swine flu. The U.S. Food and Drug Administration (FDA) approved the new swine flu vaccine for use in the United States on September 15, 2009[27]. Studies by the National Institutes of Health show a single dose creates enough antibodies to protect against the virus within about 10 days[28].

In the aftermath of the 2009 pandemic, several studies were conducted to see who received influenza vaccines. These studies show that whites are much more likely to be vaccinated for seasonal influenza and for the H1N1 strain than African Americans[29] . This could be due to several factors. Historically, there has been mistrust of vaccines and of the medical community from African Americans. Additionally, vaccines are typically administered in clinics, hospitals, or doctor's offices. Many people of lower socioeconomic status are less likely to receive vaccinations because they do not have health insurance.

CONCLUSION

Response actions against S-OIV must be aggressive, although may vary across countries and communities depending on local circumstances. Communities, businesses, places of worship, schools and individuals can all take action to slow the spread of this outbreak. Information is insufficient to make recommendations on the use of the antivirals in prevention and treatment of S-OIV infection. In addition, until a new vaccine against S-OIV becomes available, avoidance of viral spreading is the most appropriate way to prevent a new pandemic.

REFERENCES

1. *Heinen PP (15 September 2003).* "Swine influenza: a zoonosis". *Veterinary Sciences Tomorrow.* ISSN 1569-0830.
2. *Bouvier NM, Palese P (September 2008).* "THE BIOLOGY OF INFLUENZA VIRUSES". *Vaccine. 26 Suppl 4 (Suppl 4): D49–53.*
3. *Kimura H, Abiko C, Peng G, et al. (April 1997). "Interspecies transmission of influenza C virus between humans and pigs". Virus Research. **48** (1): 71–9.*
4. *Matsuzaki Y, Sugawara K, Mizuta K, et al. (February 2002).* "Antigenic and Genetic Characterization of Influenza C Viruses Which Caused Two Outbreaks in Yamagata City, Japan, in 1996 and 1998". *Journal of Clinical Microbiology. **40** (2): 422–9.*
5. *Lynch JP, Walsh EE (April 2007). "Influenza: evolving strategies in treatment and prevention". Semin Respir Crit Care Med. **28** (2): 144–58.*
6. *Kothalawala H, Toussaint MJ, Gruys E (June 2006). "An overview of swine influenza". Vet Q. **28** (2): 46–53*
7. *Yassine HM, Al-Natour MQ, Lee CW, Saif YM (2007).* "Interspecies and intraspecies transmission of triple reassortant H3N2 influenza A viruses". *Virology Journal. **4**: 129.*
8. "CDC confirms 145 cases of swine flu". *FoxNews.com. 9 August 2012.*

9. *MYERS, AMANDA LEE.* "1ST DEATH LINKED TO NEW SWINE FLU IS OHIOAN, 61". *AP*.
10. "Swine influenza". *The Merck Veterinary Manual. 2008.* ISBN 1-4421-6742-4.
11. *Thacker, Eileen; Janke, Bruce (2008-02-15).* "Swine Influenza Virus: Zoonotic Potential and Vaccination Strategies for the Control of Avian and Swine Influenzas". *Journal of Infectious Diseases.* ***197*** *(Supplement 1): S19–S24.*
12. *Myers KP, Olsen CW, Gray GC (April 2007).* "Cases of Swine Influenza in Humans: A Review of the Literature". *Clinical Infectious Diseases.* ***44*** *(8): 1084–8.*
13. *Centers for Disease Control and Prevention (April 27, 2009).* "CDC Health Update: Swine Influenza A (H1N1) Update: New Interim Recommendations and Guidance for Health Directors about Strategic National Stockpile Materiel". *Health Alert Network.*
14. "Study: Swine flu resembles feared 1918 flu". *MSNBC. 2009-07-13*.
15. "Swine flu can damage kidneys, doctors find". *Reuters. April 14, 2010.*
16. "CDC H1N1 Flu | Interim Guidance on Specimen Collection, Processing, and Testing for Patients with Suspected Novel Influenza A (H1N1) (Swine Flu) Virus Infection". *Cdc.gov. 2009-05-13*.
17. "RNASound(TM) RNA Sampling Cards (25)". *fortiusbio.com.*
18. "Micronics Acquires License to Biosearch Technologies' Nucleic Acid Assay Chemistries". *Biosearchtech.com. 2009-10-28*.
19. "Influenza Factsheet" *(PDF). Center for Food Security and Public Health, Iowa State University.*
20. http://www.who.int/csr/disease/swineflu/faq/en/index.html
21. "Antiviral Drugs and Swine Influenza". *Centers for Disease Control*.
22. "FDA Authorizes Emergency Use of Influenza Medicines, Diagnostic Test in Response to Swine Flu Outbreak in Humans. FDA News, April 27, 2009". *Fda.gov. 2009-04-27*.
23. "Swine flu virus turns endemic". *National Hog Farmer. 15 September 2007*
24. "Swine". *Custom Vaccines. Novartis. Archived from* the original *on April 30, 2009.*
25. *Gramer MR, Lee JH, Choi YK, Goyal SM, Joo HS (July 2007).* "Serologic and genetic characterization of North American H3N2 swine influenza A viruses". *Canadian Journal of Veterinary Research.* ***71*** *(3): 201–6.*
26. "Swine flu: The predictable pandemic?". *2009-04-29.*
27. "FDA Approves Vaccines for 2009 H1N1 Influenza Virus". *FDA.*

28. "NIH studies on Swine flu vaccine". *NIH. Archived from* the original *on October 13, 2009*.
29. Uscher-Pines, Lori, Jurgen Maurer, and Katherine M. Harris. "Racial And Ethnic Disparities In Uptake And Location Of Vaccination For 2009-H1N1 And Seasonal Influenza." American Journal Of Public Health 101.7 (2011) 1252–1255. SocINDEX with Full Text. Web. 6 Dec. 2011.
30. Centers for Disease Control and Prevention. (2009a). Questions and answers about 2009 H1N1 Flu (H1N1 influenza).Retrieved from http:// www.cdc.gov/h1n1flu/qa.htm
31. Centers for Disease Control and Prevention. (2009b). Key facts about Swine Influenza (H1N1 influenza).Retrieved from http:// www.cdc.gov/flu/swineflu/key_facts.htm
32. Centers for Disease Control and Prevention. (2009c). Retrieved from http:// www.cdc.gov/h1n1flu/.

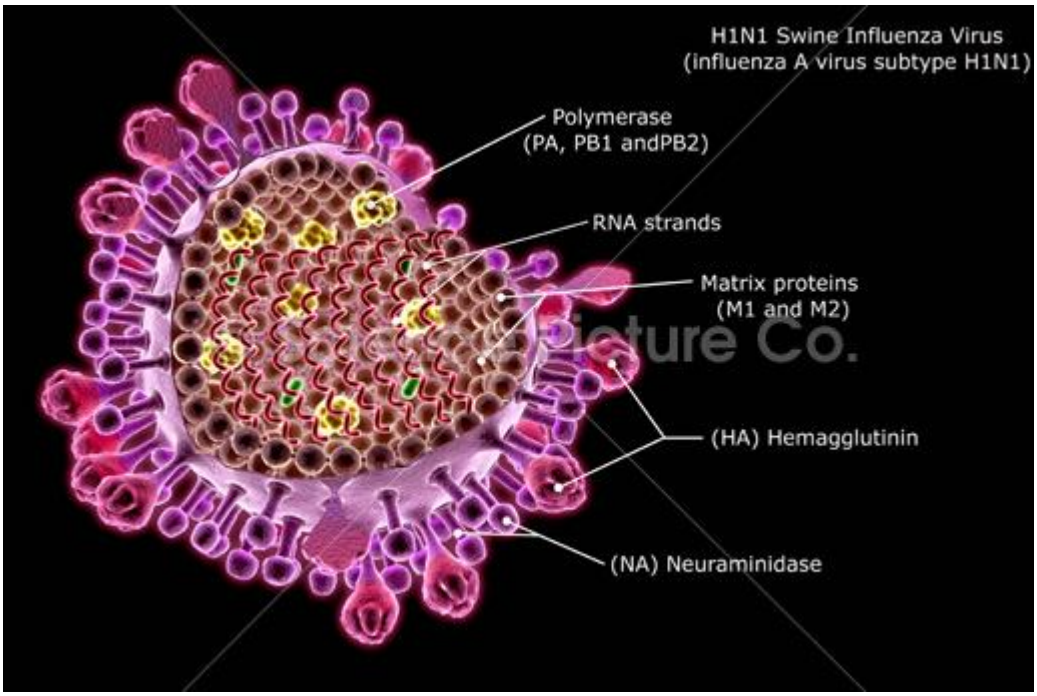

Figure 1: The structure of Swine Influenza