Brief introduction of emerging avian influenza a virus

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INTRODUCTION

In recent decades, some fatal or neglected viral infectious diseases have been disseminated to many countries or caused several re-emerging outbreaks. Accordingly, the dissection of pathogenic mechanisms of these diseases, high sensitive novel diagnostic assay reaction and improvement, vaccine development and new drug discovery of these disease are essential actions to control and prevent these disease outbreak or re-occurrence. In recent years, Asia and Southeast Asian countries face the problem of recurrent attacks by emerging or re-emerging viral diseases, which include avain influenza A virus, enterovirus, dengue virus and zika virus. Here, we briefly introduce the updated information on avian influenza A virus status and its current diagnostic assays.

AVIAN INFLUENZA A VIRUS

Highly pathogenic H5N1 avian influenza virus (AIV) ability to transmit to humans was firstly reported in Hong-Kong in 1997. After that, outbreaks of H5N1 AIVs have occurred in many countries including China, Canada, Vietnam, Thailand, Indonesia and Egypt. Until September, 2017 there were a total of 864 human infected cases, among them 454 died. It is known that the virulence and high pathogenesis is due to multiple basic amino acid occurrence in the cleavage region of hemagglutinin precursor envelope (HA0). The regions of H5N1 outbreaks have been shown to be correlated with bird migration routes based on whole-genome sequences and satellite tracking data. It is suggested that H5N1 AIVs may replicate and be carried by migrating birds. In more recent years, avian influenza virus H7N9 and H9N2 as well as swine influenza virus subtypes H1N1 and H3N2 have caused human infections. The detail mechanism is still unclear. Regarding the treatment of influenza virus, two major antiviral drugs-M2 ion channel inhibitors (amantadine and rimantadine) and neuraminidase (NA) inhibitors (oseltamivir, zanamivir, peramivir and laninamivir), have been approved for clinical treatment of influenza virus infections. Although currently influenza A virus has these therapeutic anti-viral drugs, many studies have reported occurrence of drug resistance phenomenon, in virus serotypes such as H7N9, H5N1, H1N1 and H3N2 viruses. This raises an important concern regarding new anti-viral drug discovery, continuous monitoring, control and prevention as well as timely and highly accurate clinical diagnosis of influenza A viruses. In addition, these avian influenza viruses with cross-species infection capabilities and virus-host interaction and the cellular and immunological responses are still worthy of being addressed. Reassortment of influenza A eight RNA genomic fragments is a major issue which is beneficial in the generation of new serotypes. Avian influenza with great antigenic changes also contributes to high virulence and severe pathogenesis to humans.

DIAGNOSIS OF AVIAN INFLUENZA A VIRUS

Avian influenza A virus (AIVs) infection is usually diagnosed by collecting a swab from the upper respiratory tract of the illness person. More accurate result is shown when the swab is collected during the first few days of illness. For severe ill patients, it is suggested to collect the specimens from lower respiratory tract. However for some patients who do not display significant symptoms or who have fully recovered, it may be difficult to detect the AIVs in the specimen. Regarding the diagnosis of AIVs infection, conventional laboratory techniques include virus isolation, virus identification and characterization in vitro. While it has showed successful in the past and remains the practicable method of choice, the delays associated with conventional diagnosis are often considered unacceptable for the application of control measures. According to WHO guideline, the molecular biological techniques are more suggested to be used. Reverse transcriptase-polymerase chain reaction (RT-PCR) and real-time RT-PCR technologies are suggested to be employed for rapid diagnosis of avian influenza infection. Sometimes it may still be possible to diagnose AIVs infection by testing the antibodies against AIVs. Several rapid and high accurate diagnostic assays are still developing using serological methods such as glycan-based impedimetric biosensor, sandwich-based aptamer assay, quantum dot-based immunoassay and surface plasmon resonance-based fiber optic sensors . These detection assays displaying high sensitivity and specificity and have potential to be used for clinical AIVs infection diagnosis in humans.

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