

Outbreak of human adenovirus type 7 infection in a hospital in Beijing

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Abstract

Rationale, aims and objectives: An outbreak of HAdV-7 infection in a tertiary hospital that led to a death case and nosocomial infection is described in the report. 14 confirmed cases (8 laboratory-confirmed cases and 6 silent-infection cases) were identified. **Methods:** The epidemiology investigation was carried out and 75 nasopharyngeal swab specimens were collected. Extraction and detection of viral nucleic acids and virus isolation were done to confirm the pathogenic factor. **Results:** The overall attack rate of this outbreak was 18.7%. 14 samples of 75 specimens were positive for HAdV-DNA, the virus strains belonged to HAdV7 and had high homology with the predominant HAdV7 strain (HAdV7 0901HZ/ShX/CHN/2009 GU230898), which was isolated in 2009 from Hanzhong, Shaanxi. **Conclusion:** There were no a standard fever clinic in the hospital and no strict infection control procedures when caring for the patients, which were the main causes of the outbreak. Setting up a standard fever clinic, improving diagnostic capabilities for rapid detection of HAdV infection, isolating the infection sources as soon as possible and adopting infection control precautions strictly were necessary to prevent nosocomial infections.

Keywords

HAdV-7; Outbreak ; Nosocomial infections

1 INTRODUCTION

Human adenovirus (HAdV) is a common pathogen among children and adults and HAdV infections can range in severity from unapparent clinical illness to severe, life-threatening disease, which vary depending on the cell tropism of the viruses. Pneumonia caused by HAdV7 infection commonly associated with lower respiratory tract disease is usually severe. According to the last global survey, approximately one-fifth of all HAdV infections reported to the WHO was attributed to HAdV7, and in a few cases can lead to death.¹⁻³

HAdV7 outbreaks typically occur and the virus can spread rapidly in closed environments, such as hospital wards, military barracks, and chronic care facilities.⁴⁻⁷ In the study, a HAdV7 outbreak in a tertiary hospital that led to a death case and nosocomial infection was reported.

2 METHODS

2.1 Outbreak description

The index case had a fever with 39 on Jan 18th, 2014, took some medicine at home. On Jan 26th, he was admitted to the emergency department of a tertiary hospital. Cefoxitin sodium was used but the situation was not improved. He was diagnosed with pneumonia and transferred to the respiratory department on Jan 28th, transferred to ICU because of lung consolidation on Feb 3rd, and died on Feb 5th. During his hospitalization, 7 of 75 close contacts had a fever higher than 38.0°C, including 1 bedside clinician, 1 family member, 2 patients in the same ward, and 3 nurses in the respiratory department.

2.2 Case definition and specimen collection

A confirmed case of HAdV infection was defined as laboratory confirmation, by virus culture or PCR assay. The individual was considered a silent infection case if the nasopharyngeal swabs were positive for HAdV but without overt symptoms. 75 nasopharyngeal swab specimens were collected from the 8 patients and 67 close contacts and delivered to laboratory.

2.3 Amplification of virus DNA, virus isolates and molecular analysis

Extraction of nucleic acid, primers design, PCR, cell culture, virus isolation and Nucleotide and deduced amino acid identities analysis were carried out as described as references.⁸⁻¹⁰

3 RESULTS

3.1 Outbreak description

The first case was a 23-years-old male with final death. 14 confirmed cases, including 8 laboratory-confirmed cases and 6 silent-infection cases were identified in the investigation. The overall attack rate of this outbreak was 18.7%, with the highest attack rate of 25% in home, followed by 19.1% in respiration apartment and 16% in emergency apartment.

Among the 8 patients with clinic symptoms, the admitting diagnosis was 4 with upper respiratory infection, 3 with HAdV pneumonia and 1 with severe pneumonia (the first/index case, death). Clinical manifestations included fever (100%) with the highest at 40 and most cases presented with sore throat (75%), cough (62.5%), headache (37.5%), and fatigue (12.5%).

3.2 Outbreak investigation and infection control measures

There was no a standard fever clinic in the hospital and the patients with fever were treated in the emergency apartment, which may be an important reason of the outbreak of the adenovirus infection. Not basically following the standard infection control procedures (especially no surgical mask wearing) when the staff cared for the patients contributed to the virus transmission.

Control measures were implemented to prevent transmission from Feb 3rd. Environmental disinfection and self-protections (including glove and surgical mask wearing, hand hygiene) were both reinforced. All the close contacts of the cases were either given medical leave or treated in isolation and followed up. Visitors to the hospital were required to wear surgical masks. In addition, monitoring for similar symptoms (fever, cough and headache) was performed in the entire hospital. Swab specimens from symptomatic contact were collected and sent to the laboratory for pathogen detection.

3.3 Laboratory results

From 75 nasopharyngeal swab specimens collected in the outbreak, 14 samples were positive for HAdV-DNA. Nucleotide analysis of the sequences revealed that they were all HAdV7. Comparison of the nucleic acid sequences of all the 14 samples indicated that the isolates were 100% identical, which suggested that all isolates were derived from a common ancestor (HAdV7309-1B). Phylogenetic analysis of partial sequences was performed (Fig.1) and the results suggested that the strains belonged to HAdV7 and had high homology with the predominant HAdV7 strain (HAdV7 0901HZ/ShX/CHN/2009 GU230898), which was isolated in 2009 from Hanzhong, Shaanxi.¹¹

4 DISCUSSION

The break of HAdV7 infection in a tertiary hospital that led to a death case and nosocomial infection was describes. There were no a standard fever clinic in the hospital and no strict infection control procedures when caring for the patients, which were the main causes of the outbreak. Some doctors and nurses have not adopted these infection control precautions properly (even badly no wearing surgical masks) due to weak control awareness, which contributed to the virus transmission.

Large community outbreaks of acute respiratory disease caused by HAdV7 with severe outcomes have been reported. Thus, control of HAdV7 spread is crucial. However, difficulties of differentiating pneumonia caused by HAdVs from other types of pneumonia and recognition of HAdV7 infections promoted the transmission to a large extend.

In the investigation, it was concluded that 13 patients were infected by the index case after first contact with him. A strict infection control procedure with the use of disposable protection suit and gloves, strict hand hygiene, and disinfection of public place (such as floors and toilets), was initiated immediately when the pathogen was identified. The 13 confirmed cases were medical treatment in single rooms and the 7 symptomatic patients had recovered well after 5 to 8 days of hospitalization. The 6 silent-infection cases and other close contacts were treated with temperature and symptom monitoring for 8 days, which were all asymptomatic and removed from medical observation.

In summary, hospital infections are transmitted when the officials become self-content and personnel do not abide by correct hygiene rules. We suggest that more importance should be given to the early diagnosis of HAdV7. Hospitals should set up a standard fever clinic (especially in regular influ season), improve their diagnostic capabilities for rapid detection of HAdV and reinforce the management of nosocomial infections.

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Figure Legend

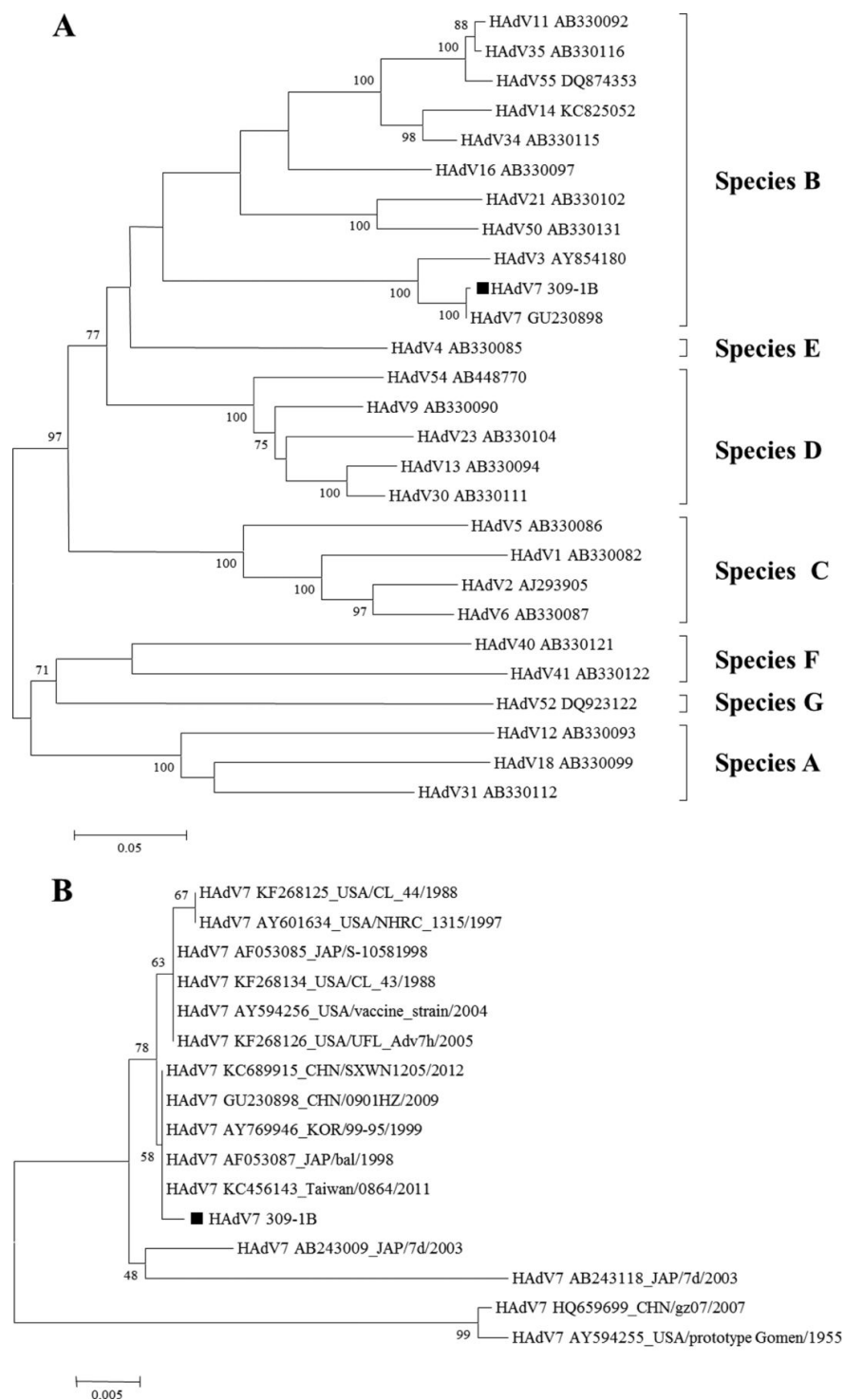


Fig.1 Phylogenetic analysis of a portion of the hexon gene for strain HAdV7 309-1B. (A) Strains HAdV7 309-1B compared to other subgenotype E HAdV; (B) HAdV7 309-1B compared to other HAdV7 reference strains.

