
An Influenza B Outbreak at a Juvenile Detention Center in Puli Township, Nantou County

Abstract

From July 1 to 5, 2000, an influenza B outbreak occurred at a juvenile detention center in Puli township of Nantou County. 21 of the 29 inmates of 12 to 17 years of age developed typical flu symptoms of cough (19, 90%), headache (17, 81%), sore throat (16, 76%), fever (15, 71%), vomiting and diarrhea (6 each, 29%). Of the 15 throat swabs, influenza B virus was isolated in 10; and nine of them were assessed to be B/Beijing/184/93-like virus strain. The incident was considered a collective influenza B infection. The incident was special in that it occurred in a season of normally low rate of flu, that 90% of cases became sick in three days, that cases were young, and that the attack rate was as high as 72%.

Introduction

Influenza is an acute viral disease of the respiratory tract caused by

influenza virus. Major symptoms are fever, headache, sore throat, cough, myalgia and prostration, frequently accompanied with some G-I tract symptoms such as nausea, vomiting and diarrhea[1-2]. Some will develop pneumonia. Fever lasts for 3-4 days, and weakness and cough may continue for one week. Influenza virus has three types, A, B and C. Influenza A virus, by the antigenic properties of its surface glycoproteins, hemagglutinin (H) and neuraminidase (N), can be divided into several subtypes. Of them, H1N1, H2N2 and H3N3 have caused widespread epidemics and pandemics worldwide. Symptoms induced by influenza B virus are milder, its frequency and areas of infection are smaller. Influenza C virus causes sporadic and localized outbreaks. Influenza virus can persist for hours in the air and in nasal secretions. Infection is transmitted via air by droplets, and also through nasal secretions by personal contact. Incubation period is 1-3 days[1].

On July 5, 2000, the Third Branch Bureau of the Center for Disease Control, DOH, was informed by the Nosocomial Infection Control Office of the Puli Christian Hospital of infections at a juvenile detention center. From July 4, 19 of the 29 inmates of the center had been treated at the Hospital for fever, dizziness, sore throat, cough and diarrhea; some had to be given intravenous drip for high fever. Of the ten not treated, two had similar symptoms. On July 6, the Third Branch Bureau, together with the Nantou County Health Bureau and the Puli Health Station, visited the center to conduct an epidemiological investigation. Specimens were collected for laboratory testing. Symptoms of the cases and laboratory findings all indicated that the incident was a collective influenza B infection. This report presents the process that the incident was dealt with and the likely causes of infection.

Epidemiological Investigation and Microbiological Testing

Epidemiological Investigation: On July 6, staff members of the Third Branch Bureau, the Nantou County Health Bureau and the Puli Health Station visited the center for survey of environmental sanitation and the living conditions of the inmates. The inmates and the voluntary workers of the center were each given a questionnaire containing questions on age, sex, date of onset of symptoms, and medical care. They were interviewed in particular of symptoms such as fever, headache, cough, sore throat, vomiting and diarrhea.

Definition of Case: A case was defined as one who had two or more symptoms of cough, headache, sore throat and fever on June 29 through July 5.

Collection of Specimens: As most cases had symptoms of the respiratory tract such as sore throat and cough, and some had diarrhea, throat swabs and rectal swabs were collected for viral and bacteriological testing. In total, throat swabs and rectal swabs were collected from 29 inmates, and throat swabs from three volunteers. They were kept at 4 °C in Cary-Blair transport agar (Eiken Chemical Co., Tokyo, Japan) for transport to the laboratory of the Third Branch Bureau for bacteriological testing. Some additional throat swabs were collected from 15 inmates with respiratory tract symptoms, and kept at 4 °C in New Virus Transport Swab (Brescia, Italy) for transport to the laboratory of the Taichung Veterans' General Hospital for the isolation of virus.

Bacteriological Testing: Throat swabs were kept in blood agar plates (Chihsin, Taipei) for the isolation of group A streptococci. Rectal swabs were kept in Baird-Parker agar (Taiwan Merck, Taipei), salmonella-shigella

agar (Difco Laboratories, Detroit, MI, USA), and trisulfate citrate bile salt sucrose agar (Eiken) for the isolation of *Staphylococcus aureus*, *Salmonella* spp., *Shigella* spp., and *Vibrio* spp. The *emm*-specific PCR products of group A streptococci were decided by the method developed by Beall *et al.*[3]

Virological Testing: The throat swabs were centrifuged. Four drops of the supernatant fluid were collected and inoculated on MDCK cell strains. The cell strains were placed in DMEM culture agar (Life Technologies Co., Taipei) for 3-4 days for observation of the pathological changes of cells. Pathologically changed cells were kept in culture agar to preserve virus strains. Pathologically changed cells were assessed by immuno-fluorescence method to decide the types of the viruses. Observation continued for ten days. Isolated virus strains were sent to the Division of Viral Diseases of the Center for Disease Control for serotyping.

Result

The juvenile detention center, located in the outskirts of Puli township, is in a beautiful surrounding of green rice fields. The center, a two-story white building, started its operation only in the year 2000. At the time of the incident, the center had 29 inmates of 12 to 17 years of age (two of 12 years, two of 13 years, nine of 14 years, five of 15 years, six of 16 years and five of 17 years), all males. They live and eat together. One 17-year old inmate surnamed Lin (suspected index case) worked as a clerk during daytime at the Puli court and returned to the center to sleep at night. During daytime, the inmates either stayed in the center or went out in a group. Volunteers helped with cooking and management of the center. The kitchen was well kept. The inmates slept upstairs in two rooms of about

20 m² each. The rooms, with windows around, were well ventilated, though not air-conditioned. Chests were on one side of the rooms for storage. Bathrooms were located on both floors and well kept. A water fountain was located on each floor. The place was, generally speaking, well kept.

The questionnaire survey showed that 21 of the 29 inmates had two or more symptoms of fever, headache, cough and sore throat, giving an attack rate of 72%. Of the major symptoms, 19 had cough (90%), 17 had headache (81%), 16 had sore throat (76%), 15 had fever (71%), and six each had vomiting and diarrhea (29%). One each became sick on 1st and 2nd July, six on 3rd, 10 on 4th, and three on 5th. Eight of them had been to the emergency department, and 11 to the outpatient department (three had been to both the emergency and the outpatient departments, six had been given intravenous drip) of the Puli Christian Hospital for care. Two had not been medically cared. One each of them visited the clinic on 1st and 2nd July, three on 3rd, and seven each on 4th and 5th. Of the three volunteers, one had cough and diarrhea. He did not meet the definition of a case.

Of the 15 throat swabs collected from inmates, influenza B virus had been isolated in 10. Of specimens collected on different days, their virus isolation rates were: 0% (0/1) for the specimen collected on 1st July, 0% (0/1) for the specimen collected on 2nd, 50% (2/4) for the specimens collected on 3rd, 86% (6/7) for the specimens collected on 4th, and 100% (2/2) for the specimens collected on 5th. Nine of the virus strains serotyped by the Center for Disease Control were assessed to be B/Beijing/184/93-like strain. Group A streptococci had been isolated in three of the 32 throat swabs for bacteriological testing. Their M gene types were *emm* 12, *emm* 89 and *st* 2034. The *emm* 12 strain was isolated from one who had headache and

sore throat. The *emm* 89 and *st* 2034 were isolated from inmates of no symptoms. No enteropathogens were isolated from the 29 rectal swabs.

Discussion

Many of the cases in this incident had developed symptoms of influenza such as fever, cough, sore throat and headache. In 15 throat swabs, influenza B virus had been isolated in 10; and nine were decided to be B/Beijing/184/93-like strain. The outbreak at the detention center was considered to be a collective influenza infection caused by influenza B virus.

The index case of the outbreak could be one 17-year old inmate surnamed Lin. He worked as a clerk at the Puli court during daytime, and returned to the center to sleep at night. He had fever, sore throat, and tonsillitis on July 1st. On July 2nd, one more case appeared; more cases appeared on July 3rd; and 10 cases appeared on July 4th. The epidemiological curve showed that cases concentrated on 3rd and 4th July. The index case could have been the source of infection. The infection was then transmitted by droplets or through close personal contacts among inmates to result in an outbreak.

Influenza B more often attacks schoolchildren[2]. More outbreaks occur in closed environment such as schools[4], nursing homes for the elderly[5-7], work sites[8] or military camps[9]. In general, widespread epidemics in temperate areas occur more often in cold winter; whereas in tropical areas, they are more likely to occur in rainy seasons. Sporadic outbreaks can occur in any month[1]. By the surveillance of the Division of Viral Disease of the Center for Disease Control in collaboration with laboratories of several hospitals, in the last two years in tropical Taiwan,

epidemics caused by influenza A virus have been more frequent than those by influenza B virus. They occur primarily under cold weather between December and February, though in smaller scale in other seasons as well[10]. Some specific features about the present incident of influenza B infection were that it occurred in July at a time of normally low infection rate; cases were children of 12 to 17 years; 21 children were infected in five days (in three days, 90% of them had developed symptoms); and the attack rate was as high as 72%. The patients had recovered in a few days without any complications.

Most cases were treated at the Puli Christian Hospital. They had symptoms of respiratory tract infection such as fever, cough and sore throat; they were initially diagnosed as influenza. However, since the cases concentrated on two days (3-4 July), the incident was first suspected to be food poisoning by a common source of infection, group A streptococcus for instance. Food poisonings by group A streptococci also show influenza-like symptoms such as fever, sore throat and headache[11-12]. It was decided to collect throat swabs for bacteriological and virological testing and isolation. At the time of the investigation, some cases were noticed to have diarrhea. Rectal swabs were also collected for the testing of enteropathogens. In the 15 throat swabs, influenza B virus was isolated in 10, giving an isolation rate of 67%. Of the specimens collected on 1st through 5th July, their virus isolation rates were, respectively: 0, 0, 50, 86 and 100%, indicating that early-infected patients had lower virus isolation rate. This finding suggested the association of influenza B virus with the present outbreak. Of the 32 throat swabs, group A streptococcus was isolated in three; two of them were from persons of without symptoms. About 10% of the general population carry group A streptococci in their throats, and group A streptococci can be isolated from 40% of patients with

sore throat[13-14]. In the present incident, group A streptococci were isolated in only 9% of the specimens collected, and the three strains, by serotyping assessment, were found to be of different M gene types, group A streptococci were not considered to be the cause of the present incident.

The collective way of living of the inmates of the detention center was the environmental factor of the influenza B outbreak. The specific features of the incident were that it occurred in a normally low infection rate of July, and that children of 12 to 17 years of age were infected in a short period of time at a high attack rate of 72%. The close collaboration of the Center for Disease Control, the Nantou Health Bureau and the Puli Health Station in dealing with the present incident made it possible to complete epidemiological investigation and specimen collection in one day. This mode of collaboration can be applied in future investigations.

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