Brief Communication

Hepatitis A Virus Infection from a Contaminated Tap of Ground Water Facility in a Neighborhood Park, Republic of Korea

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Disclaimers

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ABSTRACT

A patient with Hepatitis A virus (HAV) infection was notified to the public health authority. The identical HAV was found at a water dispensing outlet at the ground water facility and the toilet close to the facility. Serosurveillance in the community was conducted. Suspicious individuals were asked to visit city public health center and had a serologic test for anti-HAV Ig M. Overall, 100 individuals were tested, and all were negative for the anti-HAV Ig M. In our study cohort, we could not identify additional case of HAV infection.

Keywords: Hepatitis A; Serosurveillance; Water wells; Korea

Hepatitis A virus (HAV), a non-enveloped RNA virus, causes hepatitis A infection, which is a vaccine-preventable infectious disease in humans [1]. HAV can be transmitted via the fecal to oral route and through direct contact with infected patients or drinking contaminated water with fecal matter [1]. HAV is stable in water with low pH level and moderate temperature; thus, it can survive in a normal environment for months [2]. Previous studies demonstrated that water contaminated by sewage was associated with hepatitis A outbreak [3, 4]. Epidemics of HAV often evolve slowly due to the long incubation period (range: 15–50 days) and the course of the unrecognized symptoms of the patient [5].

On February 2, 2017, a patient with HAV was reported to the Yeosu City Department of Public Health in Gyeonggi Province, Korea. This patient, a 29-year-old man, presented jaundice on January 31, 2017, and had not history of HAV vaccination. Because he had been studying for the exam for a few months, he rarely went outside to eat during that period. However, the only fresh food he consumed frequently was ground-well water in the neighborhood park near his house within two months. On February 3, 2017, an epidemiologic investigation was conducted to identify the source of the infection, and on February 17, 2017, the HAV genotype IA was found with identical characteristics between the specimens of the patient and the water dispensing outlet of the groundwater facility which water from the facility was recently certified as drinkable from public health authority and the tap at the washstand in the toilet

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Conflict of Interest

No conflicts of interest.

Author Contributions

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nearby the facility, according to the phylogenetic analysis conducted by Korea Centers for Disease Control and Prevention [6].

In this study, we describe the result of community-based surveillance for those who had been used the groundwater facility and/or the toilet in the neighborhood park.

On February 17, 2017, active case finding in the city was implemented to find additional cases by putting notification boards around the groundwater facility and toilet asking to visit the designated city public health center to get a laboratory test for those of suspected individual of HAV infection. As a case definition, a suspected individual or suspected patient was defined as a person with fever, fatigue, jaundice, or gastrointestinal symptoms including nausea, vomiting, abdominal discomfort, or diarrhea from 1 December 2016 (two-months prior to the symptom presentation by first patient) and had visited the groundwater facility and/or toilet in the park. A suspected individual was further classified as confirmed by identifying a positive level of anti-HAV Ig M in a serum. Communication to the public in the community was conducted through the newspapers and televisions, and official letter was sent to the medical institutions in the city where the groundwater facility located.

After providing all of the relevant information orally, written consent was obtained, and a serum specimen was collected from all the suspected individuals visited the city public health center.

The amounts of Anti-HAV Ig M and Ig G in a serum were measured by immunoassay for the in vitro qualitative detection of total antibodies (Ig M and Ig G) for hepatitis A virus using Cobas e411 analyzer (Roche Diagnostics GmbH, Penzberg, Germany) according to the manufacturer's instruction [7]. The measured values of anti-HAV Ig M below the 1.00 IU/mL and Ig G below 30 IU/mL were considered as negative for presence of Anti-HAV Ig M and Ig G.

The groundwater facility was situated at the inner edge of the neighborhood park, very close to the Namhan River (**Fig. 1**). The groundwater was drawn from the aquifer under bedrock (metamorphic rocks 200m under the surface) [8], and water dispenser was attached at the top of the groundwater pump. The groundwater facility had no restriction for accessing the water dispensing outlet directly by mouth or hand. There was toilet, located close (500 meters) to the groundwater facility, which was not equipped with soap and hand driers, and the main entrance of the toilet was opened by pulling the door.

Overall, 100 individuals using the groundwater facility and/or the toilet were notified to the City Department of Public Health. The mean age of study cohort was 48 years (range 16 – 92), and 52 was male. Thirty-six people were classified as suspected patients; 64 had been used well-water facility, but had not presented any symptoms. Seventy-five showed positive for the Anti-HAV IgG, and all samples were negative for the Anti-HAV Ig M (**Table 1**). The median titer of anti HAV Ig M was 0.35 IU/mL (range 0.23 – 0.99; mean 0.34). For the median titer of anti-HAV Ig G for those who showed negative for anti-HAV Ig G was 7.9 IU/mL (range 3.6 –12.0; mean 8.0) (**Supplementary Table 1**).

All suspected cases were screened by serological test; however, no HAV infection was identified. The environmental specimens including groundwater, water dispensing outlet of the groundwater pump, water at the toilet and the tap at washstand in the toilet near the groundwater facility, and patient's blood samples were tested as described elsewhere [9].

Figure 1. Location of well-water facility and the toilet in the area of hepatitis A virus identified.

HAV was identified from the water dispensing outlet at the washstand in the toilet and the ground water pump, but was not detected from the water at the facility and toilet. Therefore, because the confirmed patient had not been used the toilet in this park, the infection of this confirmed patient was likely transmitted through the water outlet of the groundwater facility.

As control measures, the groundwater facility was temporally closed, and environmental disinfection for the toilet and the groundwater facility was conducted by using alcohol and

Table 1. Demographics of study population and result of the sero-survey of hepatitis A virus infection (n = 100)

	Number (%)
Age	
<20	9 (9)
20 – <50	31 (31)
50 – <60	31 (31)
>60	29 (29)
Sex	
Male	52 (52)
Presenting symptoms ^a	
Yes	36 (36)
Seropositivity of anti HAV	
IgM	0
IgG	75 (75)

^aPresenting symptoms include systematic (fever and fatigue) and gastrointestinal symptoms (nausea, vomiting, abdominal discomfort, and diarrhea).
HAV, hepatitis A virus.

chlorine. The groundwater facility and the toilet were re-opened three month later when follow-up evaluation of the facility was reported as negative for HAV. Massive administration of hepatitis A vaccine was not considered, due to the delay ($\geq$ two weeks) of the finding of infection sources.

In our study population of sero-survey, age-group 10–20s have lower sero-positivity of anti HAV IgG (25.0%) than other age groups (94.4%). This is consistent with findings in previous Korean literature in which 20s are vulnerable to HAV infection [10, 11].

In South Korea, 6% of the population accesses groundwater or springs [12]. A previous study demonstrated that the pathogens can be transmitted by a drinking cup at the groundwater facility [13], which is similar to the transmission route of our study. Despite the Korean public health authority have examined the water dispensing outlet of the groundwater facility on a quarterly basis, the test has been conducted only to detect the presence of coliform bacteria, not including viruses such as enteroviruses, rotavirus, and HAV [14].

To keep the public drinking facility such as drinking fountain in hygienic condition, Hong Kong public health authority provides public advice not come into direct contact with the water outlet, and this advice commonly displays at the public drinking facility to improve the public awareness of hygiene and to avoid contamination of the public facility [15].

There are several limitations to this study. First, the symptoms of HAV infections are varied; thus, the number of patient with HAV might be underestimated. However, there were no additional patients notified from medical institutions in the city nor had any patient who had visited the park been recommended to have further laboratory examination for HAV. Second, follow-up serologic tests for measuring the increment of Anti-HAV Ig M among people who were negative for anti-HAV Ig G were not performed. However, all those negative for anti Ig M, had been exposed to the well-water facility from more than two months before, which was a sufficient period for anti-HAV Ig M to be detectable (5–10 days after exposure) [1]. Third, the surveillance of this study was focused on the population currently residing in the city. Thus, the person who had subsequently moved out of the city or who was temporary resident of the city may have not been noticed in this sero-survey.

This study demonstrated the serosurveillance of HAV for the individuals who had contacted a HAV contaminated water dispensing outlet of groundwater facility or toilet. Although there was no additional HAV cases identified, our findings indicate that 20s are most vulnerable adult population of HAV infection. Furthermore, continuing health advice to the public to avoid direct contact with the water outlet of groundwater facility should be considered to prevent future HAV outbreak through the public groundwater facility.

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SUPPLEMENTARY MATERIAL

Supplementary material can be found with this article on-line <https://icjournal.org/src/sm/ic-51-62-s001.xls>.

Supplementary Table 1

Seropositivity of anti HAV IgG by age group during hepatitis A virus sero-survey in Yeosu-City 2017.

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