International travel of Korean children and Dengue fever: A single institutional analysis

Soo-Han Choi, M.D., Yae-Jean Kim, M.D., Ji Hun Shin, M.D., Keon Hee Yoo, M.D., Ki Woong Sung, M.D. and Hong Hoe Koo, M.D.

Department of Pediatrics, Sungkyunkwan University School of Medicine, Samsung Medical Center, Seoul, Korea

Purpose: Dengue fever occurs in many popular tourist destinations and is increasingly imported by returning travelers in Korea. Since Korea is not an endemic country for dengue fever, pediatricians do not usually suspect dengue fever in febrile children even with typical presentation and exposure history. This study was performed to describe the international travel experiences and dengue fever in Korean children.

Methods: Travel histories were collected based on questionnaires completed by all patients’ guardians who visited the pediatric infectious diseases clinic at Samsung Medical Center from January 2008 to December 2008. For patients who were suspected of dengue fever, a serological test was performed.

Results: Five hundred and seventeen children visited the pediatric infectious diseases clinic for the first time during this period. About 30% of patients who responded to the questionnaire (101/339) had experienced international travel within the last 2 years. Four patients were diagnosed with dengue fever by serological test.

Conclusion: Increasing numbers of Korean children visit dengue endemic areas and they may return home with dengue fever. Dengue fever should be suspected in patients who have a travel history to endemic areas.

Key Words: Dengue, Travel, Child, Korea

Introduction

Dengue is an acute influenza-like disease caused by mosquito-borne arboviruses of the family Flaviviridae, with four different serotypes: DEN-1, DEN-2, DEN-3 and DEN-4.1, 2 Dengue viruses are maintained in cycles of human-mosquito-human transmission, the major vector is Aedes aegypti, and recently Aedes albopictus is found as a less-efficient but more adaptable vector3. Dengue is found in tropical and sub-tropical regions around the world, predominantly in urban and semi-urban areas. The incidence of dengue has grown dramatically around the world in recent decades. About 2.5 billion people - 40% of the world's population - are now at risk for dengue. The World Health Organization (WHO) currently estimates that there may be 50 million to 100 million dengue infections worldwide every year, with 500,000 hospitalizations and 22,000 deaths, mostly in children3. Dengue is now endemic in more than 100 countries in Africa, the Americas, the Eastern Mediterranean, South-east...
Asia and the Western Pacific region. The South-east Asia and Western Pacific regions are the most seriously affected with lethal complications such as dengue hemorrhagic fever. In Korea, 22 cases of pediatric dengue fever from 2001 to 2008 were reported according to the data collected by the Korea Centers for Disease Control and Prevention (KCDC). All cases were imported dengue fever.

Many countries where dengue is endemic are popular tourist destinations and the disease is an increasingly important problem encountered by international travelers. The importance of dengue to pediatric infectious diseases practice has been increasing. This study was performed to estimate international travel experiences of Korean children and to report clinical features of dengue fever.

**Methods**

Data was collected from all patients who visited the pediatric infectious diseases clinic at Samsung Medical Center from January 2008 to December 2008. All new patients were asked through a questionnaire about their illness and history which included travel and environmental exposure history. Four patients who returned from international travel were suspected of dengue fever. Enzyme-linked immunosorbent assay detecting serum IgM and IgG (Dengue Duo IgM and IgG capture ELISA) was performed according to the manufacturer's protocol (Inverness Medical Innovations Australia Pty Ltd, Sinnamon Park, Queensland, Australia) at the Korea Centers for Disease Control and Prevention (KCDC). Medical records and questionnaires were reviewed.

**Results**

Five hundred and seventeen patients visited the pediatric infectious diseases clinic at Samsung Medical Center from January 2008 to December 2008. Three hundred and thirty nine patients (65.6%, 339/517) responded to the questionnaire. One hundred and one patients (29.8%, 101/339) had experiences of international travel within 2 years and 26 patients (25.7%, 26/101) had visited more than two countries. The popular destinations were the USA (n=32, 31.7%), China (n=23, 22.8%), Japan (n=21, 20.8%), Singapore (n=10, 9.9%), Thailand (n=8, 7.9%), the Philippines (n=7, 6.9%), and Indonesia (n=7, 6.9%) in order (Fig. 1).

![Fig. 1. Popular international destinations of Korean children. The popular destinations were the USA (n=32, 31.7%), China (n=23, 22.8%), Japan (n=21, 20.8%), Singapore (n=10, 9.9%), Thailand (n=8, 7.9%), the Philippines (n=7, 6.9%), and Indonesia (n=7, 6.9%).](image-url)
Discussion

For the present, there is no report of dengue occurring in Korea. Six cases of imported dengue were first reported in 2001. As increasing numbers of international travelers visit dengue endemic areas, the incidence of imported dengue has increased. Choi et al reported the characteristics of 17 adult cases with dengue fever by collecting domestic literature from Korean bibliographic databases. Park et al reported the characteristics of 17 adult cases with dengue fever complicated by rhabdomyolysis. This is the first report that prospectively estimated international travel experiences and dengue fever in Korean children who visited a pediatric infectious diseases clinic at a university hospital.

Dengue fever is a reportable infectious disease (group 4) in Korea. The KCDC reported 169 cases of dengue from 2003 to 2007. The destinations of imported dengue patients were mostly Asian countries except in one case where the patient was infected in Brazil. The most common destination where Korean travelers were infected with dengue was the Philippines (36.7%, 62/169). Among 169 cases, 13 cases (7.7%, 13/169) occurred under 20 years of age. Of note, we diagnosed 4 pediatric dengue cases in 2008 in our clinic.

The data from the Korea national statistical office showed that 13.33 million people accounting for 22.3 percent of the total population traveled abroad in 2007. The spread of dengue is attributed to expanding geographic distribution of the four dengue viruses and their mosquito vectors, A. aegypti and A. albopictus. Of note, although Korea is not a dengue endemic country, the A. albopictus ("Asian tiger mosquito") mosquitoes have been discovered throughout Korea. These mosquitoes are well adapted to life in urban settings. Global air travel has allowed introduction and cocirculation of different serotypes of the virus in new regions. Consequently, dengue has developed into a disease of pandemic proportions.

Dengue may present symptoms 3-14 days (usually 4-7 days) after exposure to the virus and the infection may range from subclinical to fever, retro-orbital headache, arthralgia and sometimes a quite florid maculo-papular rash usually within 3-5 days following the onset of the fever. Patients with dengue fever sometimes may have hemorrhagic manifestations. Laboratory findings commonly include thrombocytopenia, leukopenia with lymphopenia, mild to moderate elevations of hepatic aminotransferases and lactate dehydrogenase, and hyponatremia. The capillary leak results in dengue hemorrhagic fever and in its severe or fatal form dengue shock syndrome, which are complications defined by the WHO.

Table 1. Characteristics of Patients with Dengue Fever

| Patient 1 | Patient 2 | Patient 3 | Patient 4 |
|-----------|-----------|-----------|-----------|
| Gender    | Female    | Male      | Male      | Male      |
| Age (yrs) | 19        | 14        | 11        | 8         |
| Destination | Philippines | Philippines | Philippines | Philippines |
| Season    | Feb. 2008 | Jul-Aug. 2008 | Jun-Aug. 2008 | Jun-Aug. 2008 |
| Purpose   | Volunteer work | Study overseas | Study overseas | Study overseas |
| Travel duration | 6 days | 2 months | 3 months | 3 months |
| Clinical presentation | F, R | F, R | F, R, V | F, R, V |
| Sign of capillary leak | None | None | None | None |
| Lowest WBC (/mm³) | 1,420 | 1,210 | 1,300 | 2,560 |
| Lowest PLT (/mm³) | 103,000 | 120,000 | 44,000 | 98,000 |
| Highest ALT/AST (UL) | 47/70 | 27/22 | 302/179 | 70/52 |
| Dengue Antibody (IgM) | Positive | Positive | Positive | Positive |
| From initial sx to positive antibody (days) | 5 | 14 | 11 | 11 |

Abbreviations: F, fever; R, rash; V, vomiting; Sx, symptom
albopictus is native to tropical and subtropical regions, they are successfully adapting to cooler regions and have been expanding globally at an alarming rate. Having vectors capable of transmitting dengue in Korea has a very important implication on the nation’s dengue surveillance since there is the possibility for a domestic dengue case by the Aedes albopictus mosquito in the future.

Many countries where dengue is endemic are popular tourist destinations and the disease is an increasingly serious problem encountered by international travelers. Many Korean children visit dengue endemic areas, may return home with dengue fever and there are no vaccines or drugs against dengue yet.

Dengue fever is not a familiar disease to Korean pediatricians which makes its diagnosis harder. Fever in the returned traveler can be a manifestation of a minor, self-limited process or can develop into a progressive and life-threatening illness. The clinician’s lack of familiarity with the types of infections that the patient may have encountered while traveling is often an obstacle for the assessment of these patients. A systematic approach to the evaluation of febrile patients should include basic information about the geographic distribution of infectious diseases in the locations where the person has lived and traveled.

In conclusion, dengue fever should be suspected in Korean children who have a travel history to endemic areas and febrile illness.

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