

## Characteristics of Typhoid Fever in Children and Adolescents in a Major Metropolitan Area in the United States

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To examine the epidemiology of typhoid fever in children in an area that was not endemic, we analyzed 55 cases of typhoid fever in children and adolescents who were  $\leq 18$  years and whose cases were reported to the Chicago and suburban Cook County Health Departments over 7 years. Cases had positive blood and/or stool cultures for *Salmonella typhi*. The ethnic distribution of the patients was as follows: 25% Asian, 22% Hispanic, 15% African American, 9% Caucasian, 18% other, and 11% unknown. Of the 55 cases, 35% were aged 0–5 years, 25% were aged 6–10 years, 31% were aged 11–15 years, and 9% were aged 16–18 years. Twelve patients did not have a history of travel. All patients recovered; none became carriers. Symptoms in 41 patients whose charts were available for review included fever (100%), diarrhea (77%), vomiting (50%), and dehydration (30%). Bacteremia was documented in 27 (66%) of 41 cases. In 17 of 41 cases, the household contacts were food handlers or health care workers. Eight (31%) of 26 isolates were resistant to both ampicillin and trimethoprim-sulfamethoxazole. The findings in our study were as follows: typhoid fever occurred frequently in children aged 0–5 years (in contrast with reports from areas of endemicity), ~20% of patients did not have a history of travel, and multidrug-resistant strains were prevalent.

Typhoid fever is an acute systemic illness caused by *Salmonella typhi*; in children this illness is characterized by sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and nonproductive cough. Humans are the only reservoir for *S. typhi* [1]. Typhoid fever is a common infection in developing countries, where water contaminated by sewage is frequently implicated in transmission. Persons from developed countries usually acquire infection during travel to areas of endemicity and may not develop the infection until they return home.

We performed a retrospective study of typhoid fever in children in a large urban area of the United States from 1 January 1988 to 31 December 1994 to describe the epidemiology of typhoid fever in children residing in a large metropolitan area in which this illness was not endemic.

### Methods

Reported cases of typhoid fever in children and adolescents  $\leq 18$  years of age in the Chicago metropolitan area were identified through retrieval of records at the Illinois Department of Public Health. We reviewed case records from the Chicago and suburban Cook County Health Departments. The Rules

and Regulations for the Control of Communicable Diseases as stipulated by the State of Illinois require that cases of typhoid fever be reported to the local health department by telephone within 24 hours of diagnosis [2]. In addition, laboratories are required to report and submit the isolates to the Illinois Department of Public Health laboratory for confirmation of typing. All cases of typhoid fever are investigated by the Communicable Disease Division of the local health department.

A confirmed case of typhoid fever is defined as any clinically compatible illness caused by *S. typhi* that is confirmed in a laboratory by isolation of the organism. All cases in this report were confirmed cases. A chronic carrier is defined as a person who excretes *S. typhi* in feces or urine for more than 12 months after diagnosis.

Data regarding susceptibility patterns of *S. typhi* isolates from children were obtained from clinical microbiology laboratories in the Chicago metropolitan area since this information was not generally available through the health departments.

### Results

From 1 January 1988 through 31 December 1994, a total of 202 confirmed cases of typhoid fever were reported throughout the state of Illinois. Eighty-four of these cases were in children and adolescents  $\leq 18$  years of age. Within Chicago and suburban Cook County, 55 cases of typhoid fever were reported in children and adolescents  $\leq 18$  years of age, representing 65% of the cases statewide. Males accounted for 51% of cases, females for 45% (4% unknown). The ethnic distribution of these patients was as follows: 25% Asian, 22% Hispanic, 15% African American, 9% Caucasian, 18% other, and 11%

Received 16 July 1996; revised 19 November 1996.

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Clinical Infectious Diseases 1997;24:998–1000

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1058-4838/97/2405-0043\$02.00

unknown. Of the 55 cases, 35% were aged 0–5 years, 25% were aged 6–10 years, 31% were aged 11–15 years, and 9% were aged 16–18 years. All patients were hospitalized and recovered. None became carriers.

Forty-three of 55 patients had traveled outside the United States in the month preceding their illness. The destination of travel was known for 38 of the 43 patients: 61% had traveled to Asia (India and/or Pakistan), 34% to Central or South America, and 5% to Africa. Twelve patients had not traveled in the preceding month.

Of the 55 cases, 41 charts were available for further review. Symptoms in these 41 patients included fever (100%), diarrhea (77%), vomiting (50%), dehydration (30%), and abdominal pain (5%). Other less commonly reported symptoms included headache, chills, cough, and jaundice. None of the patients whose cases were reported to the Chicago Department of Health had received typhoid vaccine.

Cases were confirmed by positive blood cultures (66% of patients) and by positive stool cultures (54% of patients): 20% of the patients had positive blood and stool cultures. There was a mean interval of 10 days from the onset of symptoms to the time that samples were obtained for blood or stool cultures.

There were an average of five household contacts per case. Seventeen household contacts were either food handlers or medical personnel. One case was a food handler. Of the 12 patients who had not traveled to an area of endemicity, five were found to have a household contact who was a typhoid carrier. Three had had a contact who had recently traveled to the United States from an area of endemicity, and in four cases no apparent source for the infection was discernable by interview or on the basis of the results of cultures of samples from household contacts.

Six clinical microbiology laboratories provided susceptibility data for a total of 26 cases. Eighteen (69%) of 26 isolates were not resistant to any antibiotics. The remaining eight isolates (31%) were resistant to both ampicillin and trimethoprim-sulfamethoxazole. None of the isolates were resistant to third-generation cephalosporins.

## Discussion

Although typhoid fever is generally considered a rare illness in the United States, this disease is more commonly reported to the Chicago Department of Health than several well-publicized endemic diseases such as Lyme disease or Legionnaire's disease. Malaria has a worldwide geographic distribution somewhat similar to typhoid fever but is more strictly associated with travel than is typhoid fever because of the vector mode of transmission, the lack of person-to-person spread, and the lack of transmission by contaminated food or water. From January 1989 to December 1994, 50% more cases of typhoid than malaria were reported to the Chicago Department of

Health in children and adolescents who were <18 years of age.

Typhoid fever should be considered in the differential diagnosis of fever in a child or adolescent who has traveled to an area of endemicity. However, the disease may occur in patients who do not have such a travel history; ~20% of our patients did not have a history of travel. The diagnosis of typhoid fever was delayed in our cases, with a mean interval of 10 days between the onset of symptoms and the time that a sample for a blood or stool culture was obtained.

The failure of physicians to consider the diagnosis of typhoid fever in the absence of a history of travel may have accounted for the delay in diagnosis in some of our cases. A thorough history for a child with suspected typhoid fever should include not only the travel history of the child but also the travel history of family members and close contacts, the presence of nannies or housekeepers in the home who are from areas of endemicity, and a record of visits from individuals who reside in areas of endemicity.

One-third of the cases in our series occurred in children aged 0–5 years. Although some investigators have found typhoid fever to be uncommon in this age group [3], others have reported that 18%–32% of patients with typhoid fever are <5 years of age [4, 5]. Clinical features in our patients were similar to those reported from areas of endemicity. We have summarized symptoms that were reported to the health department; not every symptom manifested by each case may have been reported. It has been previously recognized that the carrier rate of *S. typhi* is lower for children than for adults [1], and no child in our series became a chronic carrier.

In the 41 cases for which charts were available, 17 household contacts were food handlers or medical personnel and one case was a food handler. The large number of contacts in these professions indicates the potential for local outbreaks of typhoid fever if cases and contacts are not investigated and if possible continued sources of transmission are not interrupted.

The most effective measures to prevent the spread of typhoid fever include sanitary disposal of human feces and scrupulous cleanliness in food preparation and handling. Travelers should drink only pasteurized or boiled milk, eat only pasteurized dairy products, and drink only purified bottled water or boiled water. Foods should be cooked and served hot, fruits should be peeled by the consumer, and shellfish should be boiled or steamed before eating. Other means to reduce infection include administration of typhoid vaccine to travelers at particularly high risk, i.e., those who have prolonged exposure to potentially contaminated food and drink [6]. However, typhoid vaccines are not always effective, and large inocula of *S. typhi* can overwhelm vaccine efficacy [6]. Twenty percent of our cases were acquired in the United States and thus could not have been prevented directly by vaccination.

Susceptibility data suggest that *S. typhi* resistance to ampicillin and trimethoprim-sulfamethoxazole is common and reflects

the resistance patterns reported from areas of endemicity such as India and South America [7]. When typhoid fever is suspected, current resistance patterns in the country to which the patient has traveled should be considered in decisions regarding therapy.

In summary, it is important to consider the diagnosis of typhoid fever in children with prolonged fever. The ill child may not have traveled recently, and therefore a high index of suspicion is needed to avoid a delay in diagnosis. Antibiotic resistance patterns of *S. typhi* isolates from children who live in areas that are not endemic parallel those seen in areas of endemicity. Cases of typhoid fever should be promptly reported to the local health department so that contacts and sources of infection can be investigated, thus further reducing transmission of this illness within the United States.

#### Acknowledgments

The authors thank Margaret Swartz, Dr. Stephanie Smith, John Hunter, Frank Cocka, Daisy Ross, Tommy Williams, the Cook

County Department of Public Health, and the Illinois Department of Public Health for their assistance with this study.

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