Sexual Transmission of Typhoid Fever: A Multistate Outbreak among Men Who Have Sex with Men

Megan E. Reller,1,2 Sonja J. Olsen,1 Amy B. Kressel,1 Troy D. Moon,1 Kristy A. Kubota,1 Malcolm P. Adcock,4 Scott F. Nowicki,9 and Eric D. Mintz2

1Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, and 2Epidemic Intelligence Service, Epidemiology Program Office, Centers for Disease Control and Prevention, Atlanta, Georgia; and 3Department of Medicine, University of Cincinnati Hospital, and 4Cincinnati Health Department, Cincinnati, and 5Ohio Department of Health, Columbus, Ohio

In August 2000, the Ohio Department of Health reported a cluster of men with typhoid fever who denied having traveled abroad. To determine the cause and the extent of the outbreak, an epidemiological investigation was initiated in which 7 persons in Ohio, Kentucky, and Indiana with culture-confirmed Salmonella enterica serotype Typhi infection and 2 persons with probable typhoid fever were evaluated; all were men, and all but one reported having had sex with 1 asymptomatic male S. Typhi carrier. We document sexual transmission of typhoid fever, which may be acquired by means of oral and anal sex, as well as via food and drink.

Typhoid fever is endemic in the developing world but uncommon in the United States. Since 1960, the incidence of typhoid fever has remained stable, with a rate of ~0.2 cases per 100,000 population, or ~400 cases annually [1]. Most cases occur among persons who have traveled to or among visitors from areas where disease is endemic [2]. Food or waterborne outbreaks occur as a result of fecal contamination with Salmonella enterica serotype Typhi by ill or asymptptomatically infected persons [3].

On 1 August 2000, the Ohio Department of Health (Cincinnati, OH) notified the Centers for Disease Control and Prevention (CDC; Atlanta, GA) of a cluster of 4 persons with typhoid fever in Cincinnati and neighboring Boone County, Kentucky. All were men who had had sex with men, who were known to be at increased risk for enteric infection [4], and who denied recent foreign travel. We conducted an investigation to characterize the clinical cases, determine the extent of the outbreak, identify the mode of transmission, and implement prevention and control measures.

**Methods.** In early August 2000, the Cincinnati Health Department initiated active hospital and laboratory surveillance for cases of typhoid fever. We defined a culture-confirmed case as isolation of S. Typhi from stool specimens or blood samples obtained from a resident of Cincinnati or traveler thereto during the period of 2 July through 10 September 2000, and a probable case was defined as acute illness with ≥3 days of documented fever (temperature, ≥38.5°C) and ≥3 other symptoms (headache, malaise, anorexia, nausea, abdominal discomfort, dry cough, or myalgia) without isolation of S. Typhi [5]. All 50 state health departments and laboratories were alerted to the cluster. S. Typhi isolates submitted to the National Antimicrobial Resistance Monitoring System for Enteric Bacteria (CDC; Atlanta, GA) from May through July 2000 were subtyped by PFGE, and results were compared with the outbreak pattern.

We reviewed emergency department records for the interval of 23 June through 31 July 2000 at the University of Cincinnati Hospital for patients with typhoid-like illness. Patients were asked to report food and beverages consumed during the month before onset of illness and to report attendance at those commercial establishments and events where food and/or drinks were served. Because an earlier outbreak of Salmonella infection was caused by contaminated marijuana [6], we inquired about recreational drug use. We asked patients whether they had engaged in ≥1 of a wide array of sexual practices, including those involving fecal-oral exposure. For each patient, we attempted to construct social and sexual networks to identify common friends and sex partners. In addition, we visited Bar A, the only eating or drinking establishment named by ≥2 patients. We inspected the premises, interviewed all employees, and collected stool and serum samples from all food handlers.

Stool specimens or rectal swab samples were obtained from suspected patients and were transported in Cary-Blair medium to the Cincinnati Health Department for culture on differential media and for enrichment in selenite broth. S. Typhi isolates were sent to the Ohio Department of Health for confirmation and for performance of PFGE subtyping and to the CDC for susceptibility testing by disk diffusion to ampicillin, ceftriaxone, chloramphenicol, ciprofloxacin, and trimethoprim-sulfameth-

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Reprints or correspondence: Dr. Megan E. Reller, Brigham and Women’s Hospital, 75 Francis St., Boston, MA 02115 (meller@partners.org).

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Results. We identified 6 symptomatic cases and 1 asymptomatic case (patient A) of culture-confirmed S. Typhi infection and 2 probable cases of typhoid fever (figure 1); all cases occurred in men. Date of onset of illness for the 6 symptomatic culture-confirmed cases ranged from 2 July to 12 August 2000. The median age of the patients was 34 years, the median temperature at presentation was 39.5°C, the median WBC count was 5650 cells/µL, and the median duration of fever was 11 days. Those with probable typhoid fever—patients F and I—had nearly identical illnesses, as did those with known HIV infection. The median CD4 cell count of the HIV-positive patients was 530 cells/µL, with a median virus load of 57,000 copies/µL; no patient was receiving antiretroviral therapy.

Patient A experienced a typhoid-like illness in May 2000, 2 weeks after returning from Puerto Rico. On 15 May, he presented to a hospital emergency department with a 3-day history of chills, fever, malaise, myalgias, and arthralgias. His temperature was 38.6°C, and his WBC count was 6500 cells/µL. No specimens were obtained for culture, and he made a full recovery within days. However, after case-finding efforts led to his identification as a sex partner of a symptomatic patient with culture-confirmed S. Typhi infection, stool specimens obtained on 4, 15, and 23 August yielded S. Typhi on culture. Presence of gallstones was documented by ultrasonography on 11 September. Beginning on 23 August, patient A received trimethoprim-sulfamethoxazole for 2 weeks followed by ciprofloxacin for 3 weeks for treatment of his carrier state [5]. The results of 4 follow-up cultures of fecal specimens, which were obtained on 15, 18, and 19 September and 4 October 2000, were negative. We identified no additional cases after 9 September 2000.

Seven of the 8 symptomatic patients reported having had sex with patient A ≤1 month before they became ill (figure 1). Three reported a history of both oral-anal and oral-genital sex; 1 reported oral-anal, oral-genital, and receptive anal sex; 1 reported oral-anal and receptive and insertive anal sex; 1 reported receptive anal sex only; and 1 reported having licked the hand he used to stimulate his partner. The eighth symptomatic patient denied having had sex with men but reported that the onset of illness began 2 weeks after he spent a weekend as the sole houseguest of patient A. No common source of food, drink, or marijuana was identified.

Four patients had S. Typhi isolated only from blood cultures, 2 only from cultures of stool specimens, and 1 from both blood and stool cultures. All isolates were susceptible to all antimicrobial agents tested and had indistinguishable PFGE patterns; their PFGE pattern differed from all 160 other S. Typhi patterns in the CDC database. None of the 8 patients, including patient A, had elevated Vi antibody titers. None of the Bar A employees had elevated Vi antibody titers or had S. Typhi isolated from stool samples.

Discussion. We conclude that this outbreak of infection resulted from sexual transmission of S. Typhi among men. The patients were linked by a history of sexual exposure to the same asymptomatic carrier, compatible disease incubation periods, and S. Typhi isolates with the same unique PFGE pattern. Moreover, the outbreak ceased after therapy to eradicate S. Typhi from the feces of the putative source was initiated. The potential for transmission by traditional foodborne and waterborne

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**Figure 1.** Cases of typhoid fever, by date of onset and contact with patient A, reported in Ohio, Kentucky, and Indiana from July 2000 through September 2000 (n = 9).
routes was limited to consumption of drinks at a bar frequented by gay men, yet no carrier was identified among employees nor did other patrons become ill. Although 1 patient denied having engaged in male-male sex, he was a lone houseguest of the carrier and did not eat food prepared by him.

Oral-anal and oral-penile contact can result in ingestion of enteric pathogens and have been associated with outbreaks of shigellosis [9, 10], giardiasis [11, 12], and hepatitis A infection [13], as well as with infection with Campylobacter species [14], Cryptosporidium species [15], Entamoeba histolytica [16], and Strongyloides species [17]. Paradoxically, non-Typhi Salmonella serotypes have not been recognized as being sexually transmitted enteric pathogens, despite their importance as a cause of bloodstream infection in HIV-positive patients [18]. Although a letter published in 1977 reported likely sexual transmission of S. Typhi between partners in 2 male couples [19], specific sexual practices were not described nor was PFGE typing available. In this outbreak, onset of typhoid fever after oral-anal or oral-penile sex documents ingestion as a recognized mode of sexual transmission of enteric pathogens. That illness also occurred after receptive anal sex only suggests that another mode of sexual transmission—direct intestinal inoculation—can also occur. The plausibility of anal intercourse as a risk factor for typhoid fever is corroborated by reports of transmission of S. Typhi infection via an unsterilized fiber-optic endoscope [20], polyvinyl duodenal tube [21], or rectal tube [22]. In this outbreak, the absence of shared food and drink and the collection of detailed sexual histories made the determination that transmission during sex was possible. Because the implicated sexual practices are not unique to men who have sex with men, cases of enteric infection without a recognized common source of food or drink may actually be transmitted by sex.

Traditional “safer sex” messages did not prevent this outbreak. Five of the 8 men reported using condoms during sex with patient A. Oral-anal sex or oral-penile contact after anal insertive intercourse can allow ingestion of enteric pathogens, whether or not condoms are used. Whereas the risk of infection with both enteric pathogens and with pathogens traditionally transmitted during sex increases as the number of sex partners increases, transmission of enteric pathogens is distinct, because a person may acquire infection sexually from someone who was infected by consumption of contaminated food or drink. Thus, commitment by HIV-seroconcordant partners to monogamy and successive HIV testing [23, 24], like commitment to condom use, may be inadequate to prevent enteric infections.

Counseling should focus on reducing the risk of specific practices rather than on eliminating them altogether [25], especially because oral-genital and oral-anal contact may be practiced instead of anal sex to minimize the risk of HIV infection [26, 27]. Dental dams and other barrier methods may lessen risk during oral-anal contact. Changing condoms after anal insertive sex, frequent hand washing, and washing genitals, especially before engaging in oral sex, may also limit transmission of S. Typhi and other enteric pathogens. Health care professionals should perform follow-up cultures of stool specimens obtained from persons with sexually-acquired S. Typhi, just as they would for food handlers, and should instruct patients to refrain from oral and anal sex while cultures of stool specimens remain positive.

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