

Emergence of Nalidixic Acid-Resistant *Shigella sonnei* in Acute-Diarrhea Patients on Andaman and Nicobar Islands, India

Shigella infection has been occurring in both epidemic and sporadic forms on Andaman and Nicobar Islands in India (92 to 94°E longitude, 6 to 14°N latitude; Bay of Bengal). Although acute gastrointestinal infection clinically resembling shigellosis has been reported on the islands frequently, bacteriological surveillance was only started in 1994. The surveillance data showed that shigellosis is a common cause of bacterial diarrhea (1). Endemic infection is mainly due to *Shigella flexneri* 2a, whereas *S. dysenteriae* type 1 was responsible for the outbreaks that occurred among the general population and among the Andamanese tribe. The ampicillin- and co-trimoxazole-resistant pandemic strain of *S. dysenteriae* type 1 was first observed during an epidemic that occurred in 1986 (4). By 1994, 100% of the *Shigella* isolates had become ampicillin resistant and 80.6% had become co-trimoxazole resistant. All co-trimoxazole-resistant strains were also resistant to ampicillin. Nalidixic acid resistance was first observed among *S. dysenteriae* type 1 strains in 1995 (15.1%), and gentamicin resistance was first observed in 1996 (37%) (2).

The proportions of different strains among the isolates have been showing considerable variability from year to year. During 1994 and 1995 to 1999 and 2000, a total of 15 *S. sonnei* strains were isolated from acute-diarrhea patients. All of the isolates were sensitive to nalidixic acid (Table 1). Since September 1999 to August 2000, a rural-community-based study was conducted to estimate the disease burden due to shigellosis. Three *S. sonnei* (phase I) isolates were recovered from patients who were identified in a follow-up study. The first isolate was sensitive to nalidixic acid, but two subsequent isolates were resistant. During 2001 and 2002, 106 samples from acute-diarrhea cases were processed. This yielded nine isolates (isolation rate, 8.49%). Seven were *S. sonnei* (phase I), one was *S. flexneri* 3a, and one was *S. flexneri* 4b. All seven of the *S. sonnei* isolates were resistant to nalidixic acid (30 µg/disk; HiMedia), ampicillin, and co-trimoxazole (the dates of isolation of the first and last reported isolates were 27.06.01 and 15.03.02, respectively), whereas the *S. flexneri* isolates were sensitive to nalidixic acid. The emergence of nalidixic acid-resistant *S. sonnei* has been observed since the last week of September 1999 (29.09.99) and has continued during the reported study period. The MIC of nalidixic acid was estimated by using both the E-test (AB Biodisk) and agar dilution (3) methods. It ranged from 24 to more than 96 µg/ml (mean, 40.88 ± 26.06 µg/ml) among the resistant strains. *S. sonnei* was also iso-

lated in previous years (1, 2); however, those strains were sensitive to nalidixic acid. Besides nalidixic acid, ciprofloxacin and furazolidone are used in the treatment of bacillary dysentery in the hospital. Most of the *S. sonnei* isolates were isolated from children <5 years old admitted to G. B. Pant Hospital, the only referral hospital in Port Blair. The youngest child was 4 months old. They had fever, abdominal pain, and watery stools with mucus.

During 2000 to 2001 and 2001 to 2002, *S. flexneri* 2a and *S. dysenteriae* type 1 were not isolated either from the community or from hospitalized patients. It appears that the multidrug-resistant *S. sonnei* strain is replacing the endemic *S. flexneri* 2a and epidemic *S. dysenteriae* type 1 strains as the predominant strain of *Shigella* in Port Blair. The patients who were infected with this strain of *S. sonnei* were from different parts of South Andaman, indicating a wide distribution of the strain in Andamans. A shift in the predominant *Shigella* strain, usually from *S. flexneri* 2a to *S. dysenteriae* type 1, precedes shigellosis epidemics. The present shift from *S. flexneri* 2a to *S. sonnei* may also be an early signal of an emerging important problem.

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TABLE 1. Nalidixic acid-resistant *Shigella* strains isolated from 1994 to 2002^a

Bacterium	No. of <i>Shigella</i> strains isolated (no. of nalidixic acid-resistant strains)								Total (n = 2,295)
	1994–1995 (n = 691)	1995–1996 (n = 190)	1996–1997 (n = 198)	1997–1998 (n = 208)	1998–1999 (n = 164)	1999–2000 (n = 188)	2000–2001 (n = 550)	2001–2002 (n = 106)	
<i>S. flexneri</i>	35 (0)	18 (0)	17 (1)	9 (1)	5 (0)	5 (0)	8 (0)	2 (0)	91 (2)
<i>S. dysenteriae</i>	24 (0)	29 (8)	6 (4)	4 (4)	2 (2)	1 (1)	4 (0)	0 (0)	70 (19)
<i>S. sonnei</i>	6 (0)	4 (0)	2 (0)	1 (0)	1 (0)	1 (0)	3 (2)	7 (7)	25 (9)
<i>S. boydii</i>	7 (0)	2 (0)	2 (0)	0 (0)	2 (0)	1 (0)	9 (0)	0 (0)	23 (0)
Total	72 (0)	53 (8)	27 (5)	14 (5)	10 (2)	8 (1)	24 (2)	9 (7)	209 (30)

^a Years were counted from March through March. n, number of fecal samples examined. Resistant strains of *S. flexneri* and *S. dysenteriae* belong to types 2a and 1, respectively.