Short Communication

Emergence of Tetracycline-Resistant *Vibrio cholerae* O1 Serotype Inaba, in Kolkata, India

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(Received March 16, 2007. Accepted December 3, 2007)

**SUMMARY**: Out of 2,235 diarrheal stool samples collected from patients admitted to the Infectious Diseases Hospital, Kolkata, 343 cases were positive for *Vibrio cholerae* (341, *V. cholerae* O1 and 2, O139). During the year 2004, infections caused by *V. cholerae* serotype Ogawa and Inaba were 93 and 7%, respectively, while in 2005, the Inaba isolation rate rose to 88% as compared to 12% for Ogawa. Susceptibility to antimicrobial agents revealed that the O1 strains were resistant to multiple antibiotics (ampicillin, co-trimoxazole, furazolidone, nalidixic acid and streptomycin) with reduced susceptibility to ciprofloxacin. Increased isolation of tetracycline-resistant strains (27.3% for Ogawa and 15% for Inaba) was noted in 2005. It appears that the population might be at risk of infection by the Inaba serotype and that tetracycline may not be useful for the treatment.

The disease known as ‘cholera’ is characterized by the passage of voluminous watery stools, which rapidly leads to dehydration and if left untreated, may cause death. The toxigenic *Vibrio cholerae* strains belonging to O1 and O139 serogroups are the causative agents of cholera. *V. cholerae* strains belonging to the O1 serogroup are further classified into two biotypes, Classical and El Tor, and into two major serogroups belonging to O1 and O139. *V. cholerae* O1 strains can undergo serotype shifting extending between 2 and 8 years have been reported. We have witnessed the reemergence of *V. cholerae* O1 strains of El Tor biotype, serotype Inaba, among the cholera patients admitted to the Infectious Diseases Hospital (IDH), Kolkata since August 2004 (2). *V. cholerae* O1 strains can undergo shifting between the Ogawa and Inaba serotypes during epidemics or in areas where cholera is endemic (3). Cycles of serotype shifting extending between 2 and 8 years have already been reported (4). The detection in clinical cases of *V. cholerae* that shows resistance to multiple drugs including co-trimoxazole, nalidixic acid, furazolidone and fluoroquinolones, has complicated the situation (5,6). The present study was conducted to track and portray the nature of the newly emerged *V. cholerae* O1 Inaba strains, in Kolkata, India.

Stool samples or rectal swabs collected from patients enrolled in the surveillance system established at IDH, Kolkata, were processed for the isolation and identification of *Vibrio* spp. through initial plating on thiosulfate citrate bile salt (TCBS) agar followed by biochemical analysis of the sucrose-fermenting yellow-colored colonies. The *V. cholerae* strains were serotyped based on their agglutinability with monospecific antisera to O1 and O139. The O1 strains were further classified into Ogawa or Inaba serotypes. Susceptibility to different antimicrobial agents was carried out by the disc diffusion technique (7), and commercially available discs (HiMedia, Mumbai, India) were used. The ATCC strains *Escherichia coli* 25922 were used as a standard control strain.

Screening of 2,235 specimens collected from hospitalized diarrheal patients resulted in detection of a total of 343 cholera cases during 2004-2005. Out of 343 cases, 341 cases were caused by *V. cholerae* O1 and 2 by the O139 serogroup. Serotyping analysis showed that 104 cases (30.5%) belonged to Inaba and 237 cases (69.5%) to Ogawa serotypes. Cholera due to O1 infection was found among 241 and 100 cases during 2004 and 2005, respectively. Among the 241 cases during 2004, 224 (93%) were by Ogawa and 17 (7%) by Inaba. While 93% (*n* = 241) cases were by Ogawa in 2004, a dramatic drop to 12% (*n* = 100) Ogawa cases was observed in 2005. Conversely, infections due to Inaba strains increased sharply in 2005 and reached 88% (*n* = 100) as compared to 7% (*n* = 241) in 2004. After almost 16 years of quiescence since 1989, a preponderance of the Inaba serotype among cholera cases was observed in 2005. Detection of *V. cholerae* O139 from cholera cases was less significant. This trend started in 2003 and has continued up to the writing of this report. A declining trend in the isolation of *V. cholerae* O139 cases from 2003 possibly created a consonance for the Inaba serotype to reemerge. Incidence of *V. cholerae* O1 Inaba in different parts of India have been reported recently (2,8).

Both the Inaba and Ogawa strains displayed similar resistance profiles when tested for their susceptibility to different antimicrobial agents including quinolones and fluoroquinolones. As shown in Table 1, most of the strains were resistant to ampicillin, co-trimoxazole, furazolidone, nalidixic acid and streptomycin and exhibited reduced susceptibility to ciprofloxacin (reduced susceptibility of 90.7 and 0.0% for Ogawa and 90.0 and 20.0% for Inaba strains isolated during 2004 and 2005, respectively). Importantly, isolation of tetracycline-resistant strains, 27.3 and 15% for Ogawa and Inaba, respectively, were noted in 2005. The *V. cholerae* O1 strains interconvert between the Ogawa and Inaba serotypes, and the mechanism for multidrug resistance appears to be same for both serotypes.

The switching over of Ogawa to serotype Inaba as well as its acquisition of resistance to tetracycline should serve as a warning of possible future cholera outbreaks by multidrug...
resistant Inaba strains. A routine monitoring system will allow detection of outbreaks for early control and changing drug resistance patterns.

ACKNOWLEDGMENTS

This work was supported in part by the Grant-in-Aid from the Ministry of Health, Labor and Welfare of Japan (Project H17-Shinkou-3), and was also supported in part by the Japan International Cooperation Agency (JICA/Niced Project 054-1061-E-O).

REFERENCES


