Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Medicine

journal homepage:www.elsevier.com/locate/apjtm

Document heading doi:

Outbreak of *Salmonella* Typhi enteric fever in sub-urban area of North India: A public health perspective

Nidhi Singla, Neha Bansal*, Varsha Gupta, Jagdish Chander

Department of Microbiology, Government Medical College Hospital, Chandigarh, 160030, India

ARTICLE INFO

Article history:
Received 15 August 2012
Received in revised form 27 October 2012
Accepted 28 December 2012
Available online 28 February 2013

Keywords:
Enteric fever
Fluoroquinolones
Outbreak
Salmonella

ABSTRACT

Outbreaks of enteric fever are a major health concern not only due to significant human morbidity and mortality but also fear of spread of multidrug resistant strains. We report an outbreak of enteric fever caused by *Salmonella enterica* serotype Typhi in a suburban area, in city Chandigarh of North India. Twenty-seven strains of *S. typhi* were isolated from blood cultures over a period of two weeks with 18 of these 27 patients residing in the same area. Maximum cases were in the age group 5-14 years (10 patients, 55.5%) while 4 (22.2%) cases were children under 5 years. All the strains showed similar resistogram being resistant to ampicillin and nalidixic acid, intermediate to ciprofloxacin and sensitive to chloramphenicol, ceftriaxone, cefotaxime, cotrimoxazole and azithromycin on disc diffusion testing. Minimum inhibitory concentration of ciprofloxacin was determined by agar dilution method and was found to be raised ($\geqslant$ 2 μg/mL). This nalidixic acid resistant *S. typhi* outbreak report warrants the necessity of implementing stringent sanitation practices in public health interest.

1. Introduction

Enteric fever is an important cause of human morbidity and mortality in developing nations like India. This acute systemic infection is caused mainly by *Salmonella enterica* serotype Typhi and Paratyphi A, rarely by *S. paratyphi* B and C. The World Health Organization in 2006 reported an incidence of up to 33 million cases of enteric fever occurring globally per year, with 500 000 to 600 000 deaths and 1.5%-3.8% case fatality rate[1].

Though sporadic cases occur throughout the year, small outbreaks are common whenever there is lapse in sanitary practices. These outbreaks are seen more often in suburban and slum areas where low socioeconomic conditions, overcrowding and poor sanitary practices best conspire to foster the emergence and transmission of the bacterium. Humans are the only natural reservoir and the main source of infection is water and food contaminated with feces or urine of cases and carriers[2]. Typhoid fever outbreaks continue to be reported in the country. Recently, in 2009 an epidemic in a slum of South Dumdum municipality, West Bengal, India, was investigated by Bhunia *et al* with an evidence for food borne and waterborne transmission[3]. In addition to high frequency and easy transmission; these outbreaks also accompany the threat of multidrug resistance. There are many reports of multidrug resistant *S. typhi* enteric fever epidemics from Indian subcontinent as has been previously notified in Mumbai Garrison, in Nagpur, in a rural area of North-east Karnataka and many other areas[2,4,5].

2. Epidemiological data

We reported an outbreak of enteric fever caused by *Salmonella enterica* serotype Typhi in a suburban area, Ram Darbar located in city Chandigarh of North India. The present outbreak attracted our attention due to increased isolation of *Salmonella typhi (S. styphi)* (27 strains) from blood cultures over a period of two weeks (28.12.2009 to 10.01.2010) in comparison to usual $\leqslant$ 3 isolates in the same duration. A retrospective analysis was done to evaluate the epidemiology of these patients. As expected, it was found that 18 of these 27 patients were residents of the same area, Ram Darbar. Most of the patients had continuous fever, abdominal pain with or without diarrhea, hepatosplenomegaly and some had signs and symptoms of bradycardia and neutropenia. The laboratory investigations

*Corresponding author: Dr. Neha Bansal, Demonstrator, Department of Microbiology Government Medical College Hospital, Chandigarh, 160030, India.
E-mail: drneha_bansal@yahoo.com

including hematological parameters, blood culture and Widal test were carried out. The Widal tests were carried out in most of the cases on admission and 7-10 days thereafter. A single significant titre of $T_O \geqslant 160$ and $T_H \geqslant 200$ was positive in >50% of cases. The age of these 18 patients varied from 1 year to 32 years with no sex preponderance. Maximum cases were in the age group of 5-14 years (10 patients, 55.5%) while 4 (22.2%) cases were children under 5 years. A prospective community based study in slum areas of Kolkata, India reported an incidence as high as 2 per 1 000 population per year for children under the age of 5 years and 5.1 per 1 000 population per year under 10 years. In another study from Northern India, maximum cases were in the age group of 5-12 years with 24.8% cases affecting children under 5 years. The children and young adults were amongst the most affected group, most probably because adults develop immunity from sub-clinical and recurrent infections.

S. typhi strains isolated from the blood specimens were identified by conventional microbiological procedures[6]. Antimicrobial susceptibility testing of these 18 strains was performed using Kirby-Bauer disc diffusion method according to Clinical Laboratory Standards Institute (CLSI) criteria[7]. All the strains showed similar antibiogram being resistant to ampicillin and nalidixic acid, intermediate to ciprofloxacin and sensitive to chloramphenicol, ceftriaxone, cefotaxime, cotrimoxazole and azithromycin. Minimum inhibitory concentration (MIC) of ciprofloxacin was determined against these strains by agar dilution method and was found to be raised ($\geqslant 2$ μg/mL).

The water samples from the suspected contaminated common source sent to our laboratory, to trace the source of outbreak, were processed as per standard methods but did not yield *S. typhi*. The possible reasons of the failure to isolate the bacteria from water samples could be chlorination of water, which might have made the bacteria non-viable. Also, the dilution of bacteria in the water might have precluded their isolation. Nevertheless, epidemiological investigators consider that lapse in the piped water supply is the most probable source of an outbreak.

3. Discussion

Outbreaks of *S. typhi* are a major health concern due to significant human morbidity and mortality and fear of spread of multidrug resistance (MDR) strains. This outbreak is further notable in public health interest as it draws attention to the increasing antimicrobial resistance in *Salmonellae*. In the present report also, the isolates are resistant to ampicillin and nalidixic acid. Despite the emergence of nalidixic acid resistance worldwide, fluoroquinolones remain an important therapeutic option for enteric fever[8]. However, over the past decade there has been a dramatic increase in the reports of nalidixic acid resistant isolates with reduced susceptibility to fluoroquinolones as observed in this report also. Potential treatment failures with ciprofloxacin have been observed in patients infected with such strains. There are many studies reporting high level ciprofloxacin resistance in *S. typhi* (MIC $\geqslant 32$ μg/mL) from various parts of India including Kolkata, Pondicherry, and Delhi[8-10].

To conclude, this nalidixic acid resistant *S. typhi* outbreak report emphasizes the necessity of implementation of stringent sanitation practices with prevention of all possible lapses in the water supply systems. The doubtful clinical effectiveness of fluoroquinolones in such nalidixic acid resistant fluoroquinolone susceptible *S. typhi* strains has prompted debate over changing the established CLSI breakpoints for this group of drugs. It is regrettable that resistance to ciprofloxacin has now emerged in MDR *S. typhi* and it is of paramount importance to limit the unnecessary use of this vital drug so that its efficacy should not be further jeopardized.

Conflict of interest statement

We declare that we have no conflict of interest.

References

[1] Farooqui A, Khan A, Kazmi SU. Investigation of a community outbreak of typhoid fever associated with drinking water. *BMC Public Health* 2009; **9**: 476.

[2] Misra RN, Bawa KS, Magu SK, Bhandari S, Nagendra A, Menon PK. Outbreak of multidrug resistant *Salmonella typhi* enteric fever in Mumbai Garrison. *MJAFI* 2005; **61**: 148-150.

[3] Bhunia R, Hutin Y, Ramakrishnan R, Pal N, Sen T, Murhekar M. A typhoid fever outbreak in a slum of South Dumdum municipality, West Bengal, India, 2007: Evidence for foodborne and waterborne transmission. *BMC Public Health* 2009; **9**: 115.

[4] Agarwal V, Jalgaonkar PD, Pathak AA, Saoji AM. An outbreak of multidrug resistant typhoid fever in Nagpur. *J Assoc Physicians India* 1992; **40**: 416.

[5] Kulkarni R, Bhandar M, Srinivasa S. Chloramphenicol resistant *Salmonella typhi* outbreak in a rural part of north-east Karnataka. *J Commun Dis* 1994; **26**: 235-236.

[6] Old DC. Salmonella. In: Collee JG, Fraser AG, Marmion BP, Simmon A. (eds.) *Mackie and McCartney practical medical microbiology*. 14th ed. Edinburgh: Churchill Livingstone; 2006, p. 385-404.

[7] Clinical and Laboratory Standards Institute. *Performance standards for antimicrobial susceptibility testing. Nineteenth informational supplement. Document M100-S19*. Wayne, PA: CLSI; 2009.

[8] Rao RS, Amarnath SK, Sujatha S. An outbreak of typhoid due to multidrug resistant *Salmonella typhi* in Pondicherry. *Trans R Soc Trop Med Hyg* 1992; **86**: 204-205.

[9] Renuka K, Sood S, Das BK, Kapil A. High-level ciprofloxacin resistance in *Salmonella enterica* serotype Typhi in India. *J Med Microbiol* 2005; **54**: 999-1000.

[10] Arora RK, Gupta A, Joshi NM, Kataria VK, Lall P, Anand AC. Multidrug resistant typhoid fever: study of an outbreak in Calcutta. *Indian Pediatr* 1992; **29**: 61-66.