**In vitro** activity of cefpodoxime, a third generation cephalosporin against *Salmonella enterica* serotype Typhi

Antimicrobial therapy is the mainstay for treatment of typhoid fever. In 1948 Woodward et al. successfully used chloramphenicol to treat patients of typhoid fever (8). After this accomplishment, the first choice for the therapy of typhoid fever was chloramphenicol until the 1970s, when the first outbreaks of infection by antibiotic-resistant bacteria appeared (5). There has been an increase in the resistance of strains of *Salmonella enterica* serotype Typhi to chloramphenicol as well as other drugs like ampicillin and trimethoprim-sulphamethoxazole and this emerging multiple drug resistance (MDR) is a major problem in control of typhoid fever (6,7). Fluoroquinolones have been proven to be effective for treatment of typhoid fever caused by MDR strains (1). Recently, reports of clinical failure on fluoroquinolone treatment have become a subject of worldwide attention. Due to the emergence of MDR *S*. *Typhi* in endemic countries, search for alternative antibiotics for treatment of typhoid fever are required.

The third generation cephalosporins such as cefpodoxime proxetil, ceftriaxone and cefixime have shown promising therapies in pediatric typhoid (2,3). However, only cefixime and cefpodoxime proxetil allow oral administration while ceftriaxone is parenteral, for use in ambulatory patients. Also, cefpodoxime proxetil has favourable pharmacokinetic profile, which allows twice-daily administration.

A representative of 90 *S*. *Typhi* strains were analyzed in this study. These strains were isolated during the period 2003-2005 from a prospective surveillance for typhoid fever in
two urban slums in eastern Kolkata, India. Identification and characterization of organisms was carried out according to conventional procedure (9).

The antimicrobial susceptibility testing was determined following Kirby and Bauer disk diffusion method in accord with the Clinical and Laboratory Standards Institute (formerly National Committee for Clinical Laboratory Standards) using commercially available antimicrobial discs (Difco, Detroit, USA) (4).

All the S.Typhi strains were uniformly susceptible to cefpodoxime, ceftriaxone and cefixime according to the zone size criterion of the manufacturer. For comparison with ceftriaxone and cefixime, data on zone size geometric mean and range is provided in the Table. It appears that ceftriaxone is the best for treatment of typhoid fever but as it is a parenteral drug, the choice of cefpodoxime and cefixime, as oral agents is preferred in paediatric population. To date, the fluoroquinolone are the agents of choice for the treatment of MDR typhoid fever. However, the role of this agent in children is controversial because of concerns about quinolone-induced arthropathy and cartilage damage. In this setting cefpodoxime accomplishes the desired characteristics of antibiotic and may be the treatment of choice of MDR typhoid fever, particularly in children from areas with high prevalence of MDR typhoid fever. A study from Pakistan reported about 86% efficacy of cefpodoxime in treatment of typhoid fever. In Bangladesh, where typhoid fever is also endemic, a clinical trial showed high efficacy of cefpodoxime in the treatment of typhoid fever and it was reported that cost of cefpodoxime is less than cefixime. Our in-vitro study shows that oral cefpodoxime provides an effective alternative for the treatment of typhoid fever particularly in children even in cases of multidrug-resistant S.Typhi because of its excellent activity.
REFERENCES


4. **National Committee for Clinical Laboratory Standards.** 2006. Performance standard for antimicrobial susceptibility testing; approved standard, 16th edn, Document M100-S16, Villanova PA.


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Table: Comparative data on zone sizes geometric means and ranges of three antimicrobial agents against 90 isolates of *Salmonella enterica* serotype Typhi.

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Mean (mm)</th>
<th>Range (mm)</th>
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<tbody>
<tr>
<td>Cefpodoxime</td>
<td>24.04</td>
<td>8</td>
</tr>
<tr>
<td>Cefixime</td>
<td>23.67</td>
<td>9</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>26.22</td>
<td>10</td>
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