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Correspondence

Pitfalls of interpreting ciprofloxacin minimum inhibitory concentrations in *Salmonella enterica* serovar Typhi

Sir,

We read with interest the article on emergence of fluoroquinolone resistance in *Salmonella enterica* serovar Typhi in Andaman and Nicobar Islands[1]. As fluoroquinolones are widely used in the empirical therapy of enteric fever, it is important to determine the minimum inhibitory concentrations (MIC) of this group of antimicrobials in an endemic area. However, there were certain points in the article that needed clarification, which we would like to highlight:

(i) CLSI 2007 guidelines have been used though the study was conducted in 2009-2010.

(ii) The Table showed that five out of six isolates had an MIC of 0.25 µg/ml. Based on CLSI guidelines till 2011[2], MICs of <1 µg/ml have indicated that the organism is susceptible to ciprofloxacin. The 2012 CLSI guidelines have reduced the MIC indicating ciprofloxacin susceptibility to <0.06 µg/ml, probably making most of our strains resistant to ciprofloxacin[3].

(iii) The authors have interpreted that five isolates of *S*. Typhi with MICs of 0.25 and 1 µg/ml showed intermediate level resistance to ciprofloxacin and norfloxacin, respectively. As per CLSI guidelines (2011) MICs of 2 and 8 µg/ml for ciprofloxacin and norfloxacin, respectively, indicate intermediate resistance. The authors probably implied "reduced susceptibility" to ciprofloxacin based on their molecular data. Nalidixic acid resistance in salmonellae indicates reduced susceptibility to fluoroquinolones (MICs 0.125-1 µg/ml) and may be associated with clinical failure or delayed response in fluoroquinolone treated patients[4]. It should not be confused with intermediate level resistance to fluoroquinolones.

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Authors' response

Sir,

We appreciate the authors[1] for their keen interest in our work. We used CLSI Guidelines 2007 for interpreting the results of antibacterial drug sensitivity testing[2].

The Table in the article[2] shows the results of disk diffusion test as well as estimation of MIC using E-test. The categorization of the isolates as 'Sensitive', 'Resistant' and 'Intermediate resistant' was based purely on the results of disk diffusion test. We had estimated the MICs of only the fluoroquinolones and this had been mentioned in the article. Therefore, it was obvious that the categorization of the isolates' drug sensitivity status was based on the results of disk diffusion test.

Khan and Anil Kumar[1] point out that as per CLSI 2012, strains with MIC < 0.06 µg/ml are considered susceptible to ciprofloxacin. We thank them for adding this information. This change in the cut-off, obviously, would result in all our five isolates of *S. enterica* serovar Typhi being categorized as not susceptible to

ciprofloxacin. Further, nowhere in the article did we mention that we used MICs to categorize the isolates' drug sensitivity status. However, we agree that the use of the term 'intermediate level resistance ' in the statement in the article (page 100, paragraph 3, lines 9-11) '…the remaining above the level (0.125 µg/ml) that is considered to confer intermediate level resistance…' could be misleading and it should have been mentioned as 'reduced susceptibility'.

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