Mixed *Salmonella* Infection: Case Report and Review of the Literature

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DOI: 10.1111/j.1708-8305.2007.00111.x

Mixed infection with multiple *Salmonella* serotypes in the same patient is an unusual finding. We present a case of enteric fever in which both *Salmonella* Typhi and *Salmonella* Paratyphi A were isolated from the blood of a patient traveling from India.

**Case Report**

An 81-year-old woman, a resident of India traveling to the UK on holiday, presented with a history of fever, headache, and vomiting of 1-week duration. The symptoms developed 2 days after arriving in the UK, and she does not recall any of the symptoms while in India. The fever was intermittent, with no chills or rigors, and was associated with episodes of vomiting, loss of appetite, and a frontal headache. The vomitus was nondescriptive and did not resemble coffee grounds. There was no history of abdominal pain or diarrhea. On examination, she was febrile with a temperature of 40°C and a pulse rate of 66/min. Her liver and spleen were not palpable.

Her admission peripheral blood total white cell count was 4.5 × 10⁹/L with 2.9 × 10⁹/L neutrophils and 1.2 × 10⁹/L lymphocytes. *Salmonella Typhi and Salmonella Paratyphi A* with different antibiograms (Table 1) were isolated from two different sets of blood cultures that were collected a few hours apart on the first day of admission. Both isolates were sensitive to ciprofloxacin with a minimum inhibitory concentration (MIC) of 0.05 and 0.025 mg/L, respectively (reference *Salmonella* spp ciprofloxacin MIC⁹⁰ ≤ 0.06 mg/L). Concurrent stool and urine cultures did not yield *Salmonella* or other pathogens.

Both *Salmonella* isolates were sent to the reference laboratory and were confirmed as *Salmonella Typhi* (phage type E1) and *Salmonella Paratyphi A* (phage type 1).

The patient was treated with ciprofloxacin 750 mg orally twice daily for a total of 14 days. Defervescence was documented by the fourth day with complete recovery by the end of treatment.

**Discussion**

This is the first report of a mixed *Salmonella* infection in the UK. Simultaneous infection with
Mixed Salmonella Infections

Table 1  Anti-biograms of the isolates

<table>
<thead>
<tr>
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<th>Salmonella Typhi</th>
<th>Salmonella Paratyphi A</th>
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</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Ceftriaxone/cefotaxime</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Imipenem</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

S = susceptible; R = resistant.

different Salmonella serotypes in the same patient is rare. Even in developing countries where the disease is endemic, published data are sparse with there being just two case reports from India. The exact reason for this is unclear, although it is possible that mixed infections are frequently missed particularly in developing countries due to fewer blood cultures performed on those presenting with fevers, failure to isolate the organism by culture due to prior antibiotic treatment, and overreliance on an antibody test, the Widal test, which has a number of limitations including failure to diagnose Salmonella Paratyphi A infections. Thus, this phenomenon may not be as rare as is currently believed.

On the other hand, there are reports of other concurrent mixed enteric infections with enteropathogenic Escherichia coli, Campylobacter jejuni, Giardia lamblia, Schistosoma species, and enteric fever. Salmonellae resistant to ciprofloxacin are a growing concern. In 1998, 21% of Salmonella Typhi isolated in the UK were resistant to ciprofloxacin. In addition, the standard disk-based method of susceptibility testing does not detect Salmonellae with decreased sensitivity to ciprofloxacin. Therefore, treatment failures with ciprofloxacin are not uncommon. In the present case, both Salmonella isolates were sensitive to ciprofloxacin (MIC ≤ 0.06 mg/L) and the patient made a good recovery. On the contrary, such mixed infections are more likely to cause treatment failures if one of the isolates shows decreased susceptibility to ciprofloxacin. In such situations, addition of either ceftiraxone or cefotaxime is advised.

This case report adds to the existing sparse literature an apparently rare condition and raises awareness of the possibility of mixed Salmonella infections in the same patient particularly in an era where resistance to ciprofloxacin is a growing concern.

Acknowledgments

We would like to thank the Laboratory of Enteric Pathogens, Health Protection Agency, Central Public Health Laboratory, Collindale, UK, for the identification and typing of the isolates.

Declaration of Interests

The authors state that they have no conflicts of interest.

References