Salmonella intestinal perforation: (27 perforations in one patient, 14 perforations in another) Are the goal posts changing?

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ABSTRACT

The pathology of salmonellosis after a faeco-oral transmission was first clearly described by Jenner in 1850. Over the years, the pathological manifestations in different tissues of the body have been described. The ileum is however mostly involved leading to enlarged Peyer’s patches, ulceration, and sometimes bleeding and perforation. Efforts at control have largely been improvement in public water supply, safe disposal of waste, and general public health measures. Despite these measures, intestinal perforation from salmonellosis remains the commonest cause of emergency operation in children above 3 years. The incidence continues to rise, so also the mortality, despite new antibiotics and improvement in facilities in the hospitals. Even more disturbing is that we now see more perforations per patient, and more involvement of the colon. Three recently managed patients with multiple ileal/colonic perforations were reviewed. Presenting problems, delay in referral, choice of antibiotics and postoperative complications were noted. One patient had 27 perforations and another 14 perforations. Both survived. Is salmonella changing? Are our patients changing? Is the environment changing? Are the goal posts changing? This article details our recent experience with this dreadful disease, reviews the new literature and makes suggestions for the way forwards.

KEY WORDS: Typhoid, Ileum, Perforation, Colon, Salmonella

The pathology of typhoid as a faeco-oral disease caused by salmonella has been described as far back as 1850 by William Jenner.[1] Only sporadic outbreaks occur in developed countries. However, relative lack of access to decent health care, safe water supply, good sanitation, and safe disposal of waste, have contributed to an annual rate of over 12 million in developing countries, with a case fatality rate of 18-24%.[2] Despite chlorination of public water supply, and other extensive public health measures, including education in the media, the number of patients presenting yearly in our institution continues to rise.[3,4] Despite the experience of health personnel managing these patients, improvement in anaesthesia, new antibiotics and availability of intensive therapy unit, the mortality has remained constant at 15-20% in our unit over the last 5 yrs [5] and getting worse in some units.[6] Even more clinically disturbing is that we now see more patients with multiple perforations, and more colonic perforations than before. We recently managed a patient with 27 perforations (19 ileal, 8 colonic) and another with 14 perforations (13 ileal, 1 colonic) and another with 4 perforations (2 ileal, 2 colonic). Is the pathology of typhoid changing? Are the patients getting less immune? Are there undue delays from the referring hospitals? Do we need to change the current antibiotics? Are we dealing with a different pathogen completely? Are the goal posts changing? We will use these 3 recent patients to illustrate the points and review the recent literature.

PATIENTS AND METHODS

Eighty four children less than 15 years of age with enteric perforation due to Typhoid ileitis were managed in our Paediatric Surgery Unit between January 1999 and December 2004. Majority of the patients had between one and three perforations restricted to the terminal ileum but three patients had multiple perforations, which also involve the colon. These 3 patients form the basis of this review.

RESULTS

The patients were aged 10, 5 and 12 years old respectively. There were 2 females and 1 male. The duration of fever before admission was 10-14 days and the abdominal pain varied between 4-6 days. There was associated
biliious vomiting in all 3 patients and progressive abdominal distention. Fever was high grade and the patients had diarrhea. There was classical peritonitic facies, dehydration, jaundice and anaemia in all patients. The patients were hypotensive and there was generalised peritonitis [Table 1].

They were resuscitated with intravenous fluids and blood transfused. Ceftriaxone and metronidazole were given preoperatively and gentamicin added post-operatively. Nasogastric intubation for decompression and urethral catheterization to monitor urine output was done. Laparotomy was done after the patients were stabilized. At laparotomy 1 patient had 27 perforations (19 ileal, 8 colonic). The ileal perforations were within 80cm of the ileo-cecal valve, and the colonic perforations were in the caecum and ascending colon [Figure 1]. He had right hemicolecction. He had superficial wound dehiscence postoperatively which healed with twice daily honey dressing. The 2nd patient had 14 perforations (13 ileal, 1 colonic) for which she also had right hemicolecction. She developed high-output fistula on the 4th postoperative day. She had a re-laparotomy on the 6th postoperative day when the anastomosis was found to have broken down completely. Ileostomy and mucous fistula were fashioned and the peritoneal cavity thoroughly lavaged. Her condition resolved fairly rapidly, and the ileostomy was closed 5 weeks later. The 3rd patient had 4 perforations (2 ileal, 2 colonic). She had right hemicolecction. Apart from superficial wound dehiscence, his postoperative course was uneventful [ Tables 1-3].

DISCUSSION

Ilorin is located in the middle belt of Nigeria. Most people obtain their water supply from the public tap (when available) and individual household shallow wells. General public sanitation is poor and there are no properly controlled waste disposal systems. These apply generally to the rest of Nigeria. But compared to other tertiary health centers in Nigeria we appear to have the highest incidence of perforations from typhoid disease[6] followed by Ibadan[6] in southwest Nigeria. This incidence continues to rise yearly despite vigorous public health measures. From our search of the english literature, 27 and 14 perforations are the highest recorded in any patient. Although typhoid ulcers could occur anywhere from the stomach to the rectum[7] the terminal ileum is usually mostly involved due to the high concentration of Payer’s patches. Boyd[8] first reported colonic perforations in 1976 on postmortem findings in 6 patients who died of salmonella poisoning. Mandal and Mani[9] also reported active procto- colitis from sigmoidoscopic biopsies of patients with salmonella diarrhoea. Chui[10] recently reported salmonella colonic ulcers diagnosed by endoscopy in an 8-yr old Chinese girl. It is postulated that colonic involvement is due to direct bacteria invasion while ileal lesions are due to enterotoxins produced from parasitizes macrophages that caused hyperplasia, necrosis and ulceration.[7,10,11] But colonic involvement in other centers is uncommon compared to ileal lesions. In a 15-yr review of 183 children by Irabor[6] in Ibadan, southwest Nigeria, the greatest no of perforations in any patient was 8, and

![](image)

**Figure 1: Multiple bowel perforation**

**Table 1: Patients and symptoms**

<table>
<thead>
<tr>
<th>Patients</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Fever [°C]</th>
<th>Duration (days)</th>
<th>Abdominal pain (days)</th>
<th>Diarrhea</th>
<th>Hematocrit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. L.</td>
<td>10</td>
<td>M</td>
<td>39.2</td>
<td>10</td>
<td>4</td>
<td>+</td>
<td>20</td>
</tr>
<tr>
<td>R. A.</td>
<td>5</td>
<td>F</td>
<td>39.8</td>
<td>14</td>
<td>3</td>
<td>+</td>
<td>24</td>
</tr>
<tr>
<td>A. M.</td>
<td>12</td>
<td>F</td>
<td>41</td>
<td>14</td>
<td>6</td>
<td>+</td>
<td>21</td>
</tr>
</tbody>
</table>

**Table 2: Patients, operative findings & procedure**

<table>
<thead>
<tr>
<th>Patients</th>
<th>No. of perforations (site)</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. L.</td>
<td>27 (19 ileal, 8 colonic)</td>
<td>Right hemicolecction</td>
</tr>
<tr>
<td>R. A.</td>
<td>14 (13 ileal, 1 colonic)</td>
<td>Right hemicolecction</td>
</tr>
<tr>
<td>A. M.</td>
<td>4 (2 ileal, 2 colonic)</td>
<td>Right hemicolecction</td>
</tr>
</tbody>
</table>

**Table 3: Patients complications and outcome**

<table>
<thead>
<tr>
<th>Patients</th>
<th>Complications</th>
<th>Treatment of complications</th>
<th>Duration of admission (days)</th>
<th>outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>J.L.</td>
<td>Wound dehiscence</td>
<td>Honey dressing</td>
<td>37</td>
<td>Alive</td>
</tr>
<tr>
<td>R.A.</td>
<td>High output fistula</td>
<td>Ileostomy + mucous fistula</td>
<td>54</td>
<td>Alive</td>
</tr>
<tr>
<td>A.M.</td>
<td>Wound dehiscence</td>
<td>Honey dressing</td>
<td>22</td>
<td>Alive</td>
</tr>
</tbody>
</table>
no colonic perforations. In another review of cases in North Western Nigeria by Edino et al.,[12] the greatest no is 3 with a caecal perforation in 1 of them. No colonic perforation was recorded. So typhymurium colonic ulcers in children are truly rare.[10] But we are seeing more of colonic perforations in our unit than other units in Nigeria. Is the strain of salmonella in our centre more virulent? Is our center dealing with more paratyphi than typhoid organisms because in general, paratyphi B infection involves more of other parts of the gut than selectively the ileum.[7] Unfortunately we cannot phage-type these organisms in our center. Are our children more susceptible from worse malnutrition than other centers in Nigeria? This is very unlikely. Are we dealing with a yet unidentified set of pathogens- other viruses, fungi, etc? Because of the septicemia, complications could affect any organ in the body resulting in pneumonia, meningitis, intestinal hemorrhage and perforation. The clinical picture may be complex when typhoid fever occurs with HIV infected patients.[14] After the 1st 2 cases we were worried about HIV and therefore tested the 3rd patient but she was HIV negative.

The use of antibiotics has been extensively discussed in the past. Chloramphenicol with metronidazole used to be the antibiotic of choice[6,13] and is still used in some centers.[12] With possible side effect of aplastic anaemia from chloramphenicol, ampicillin, ofloxacins and metronidazole have been recently used in different combinations.[9,13,14] With increasing resistance of the organisms, cephalosporins came into being with metronidazole added for the anaerobes and gentamicin for the gram-negative pathogens. This is the regimen used in our unit. But resistance can develop to this combination.[15] Imipenem and meropenem are then the drugs of choice.[10] These may not be readily available in many 3rd world countries. Short-term corticosteroids is said to improve the prognosis in severely ill patients.[10] We have not tried this in our unit.

Trimming the edges of the perforation and double-layer transverse closure is satisfactory for single ileal perforations.[5,6] When there are multiple perforations close together, ileal resection and primary anastomosis should be done. In multiple ileal and right colonic perforations right hemicolectomy is done in our unit as elsewhere.[6,10] If the perforation is on the descending colon, primary colonic closure in the presence of intra-peritoneal sepsis is dangerous. A leak with a fistula will almost certainly result. A stoma is best done at the site of the perforation. If there is a major anastomotic leak or a reperforation, it is dangerous, in our experience, to perform another anastomosis in the face of generalized septicemia and grossly contaminated peritoneum. Fifty percent of patients who had enterocutaneous fistula in Ibadan[5] died, no doubt of continuing sepsis and inadequate nutrition and immunity to fight the sepsis where facilities for parenteral nutrition are non-existent. Five patients (out of 106) who had enterocutaneous fistula in Rahman’s[5] series had mean hospital stay of 89 days instead of 24 days for the rest.

Chui[10] also did a re-anastomosis when there was a fistula. From our experience in this unit we advise that in such situations, defunctioning of the bowel be done. The intra-abdominal and general sepsis can then be controlled, early oral nutrition will improve the patient’s immunity, and the stoma could be closed later as we did in our second patient.

Managing an ileostomy is not as dreadful as we once thought! Late referral from peripheral hospitals continues to be a problem. Most patients present with fever, abdominal pain and mild diarrhea. Some clinicians treat these as malaria first. Moreover, Plasmodium falciparum malaria may predispose to non-typhoidal salmonella septicemia in children less than 5yrs.[16] It is when peritonitis and septicemia set in that these patients are eventually referred. This delay definitely worsens the prognosis as suggested in a study from South Africa.[17]

In conclusion operation for typhoid perforation remains the commonest emergency operation for children over 3yrs with the yearly incidence rising, the complications remaining the same and the mortality rising. Involvement of the colon is getting commoner than previously reported. Is salmonella getting resistant to new antibiotics or is it the inappropriate use of antibiotics and delay in referral from peripheral hospitals that continue to worsen the prognosis? Is malnutrition or HIV complicating the problems? Are there some yet unidentified organisms causing the colonic perforations? Is it man or the organisms or the environment changing the goal posts?

If any is, the answer to controlling typhoid may not be solely provision of safe water and environmental hygiene. Typhoid immunization to cover most (if not all) of the known strains may be the long term answer, and more research is urgently needed for this dreadful disease.

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