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CASE REPORT

A curious cause of appendicitis

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SUMMARY

A previously healthy 10-year-old boy presented to the emergency department with central abdominal pain, loose stool and vomiting. He was diagnosed with gastroenteritis, but was well enough to be discharged. The next day he reattended with ongoing diarrhoea and vomiting, with the pain now localised to the right iliac fossa (RIF). Acute appendicitis was suspected, and he was taken for laparoscopic appendectomy. At surgery, a gangrenous appendix was found, with pus extending from the pelvis up to the liver. The appendix was excised and thorough peritoneal washout performed. Postoperatively, he received 48 hours of intravenous antibiotics and was discharged home. Unfortunately the boy presented again 11 days later with right lower quadrant pain and fever. Ultrasound revealed a collection in the RIF, and he returned to theatre for washout. His recovery was slow until the peritoneal pus sent for bacterial culture grew *Salmonella enteritidis*, identification of which facilitated appropriate antibiotic treatment.

BACKGROUND

Non-typhoidal *Salmonellae* are important food-borne pathogens that cause gastroenteritis and may cause infection mimicking appendicitis through mesenteric lymphadenopathy or rarely from bacteraemia and focal infection in immunocompromised individuals. Non-typhoidal *Salmonella* appendicitis may indeed be under-reported as peritoneal fluid is not universally sent for examination at the time of surgery, and laboratories often do not fully identify coliforms isolated from peritoneal fluids, assuming that these are gut flora. This is an important case as it not only highlights a rare cause for the most common surgical intra-abdominal emergency, appendicitis, but emphasises the vital role of simple investigations, including stool cultures and bacterial analysis of peritoneal fluid in order to identify infective agents and facilitate prompt, appropriate management.

CASE PRESENTATION

A previously fit and well 10-year-old boy presented to the emergency department (ED) with a 48-hour history of colicky, central abdominal pain, one episode of loose stool, five episodes of vomiting and anorexia. He had not eaten out, travelled abroad or been around anyone else unwell over the preceding days, and there was no history of upper respiratory tract symptoms, rashes or fever. The boy had no significant medical or surgical history, and he did not take any regular medications. All vaccinations were up-to-date. He had no family history of note and was an only child. As he had a soft, non-tender abdomen, his symptoms were

attributed to gastroenteritis. Inpatient treatment was not required as the boy appeared adequately hydrated with normal observations and was tolerating oral fluids. He was, therefore, discharged with the advice to stay well hydrated and to return if symptoms worsened. A stool sample had been requested, but the boy was unable to provide this in the ED. He reattended the following day with constant, right-sided, abdominal pain, and ongoing diarrhoea and vomiting. Examination revealed tenderness which had now localised to the right iliac fossa (RIF) and a temperature of 37.8°C.

INVESTIGATIONS

While blood tests had not been performed the previous day, on this second presentation they revealed a white cell count (WCC) of 14⁹/L and C reactive protein (CRP) of 25 mg/L. Urinalysis showed 1+ketones only.

As acute appendicitis was suspected, the boy was started on intravenous (IV) antibiotics as per Trust guidelines for appendicitis (amoxicillin, metronidazole and gentamycin) and booked for a laparoscopic appendectomy. At surgery, an acute, gangrenous appendicitis of the body and tip of the appendix was found, with pus in the RIF, right paracolic gutter, pelvis and around the liver. Vicryl endoloops were applied to the base of the appendix and the appendix was excised, placed in an Endocatch bag and removed through the umbilical port. A thorough washout with 2.5 L of saline followed until the fluid was clear. Postoperatively, the patient received 48 hours of IV antibiotics, was well and was discharged home. No oral antibiotics were given on discharge as the boy had clinically appeared to be very well, with observations within the normal range and no concerning features on abdominal examination.

OUTCOME AND FOLLOW-UP

Unfortunately, 11 days after discharge, the boy presented again with right lower quadrant pain, nausea and fever. His bowels had been opening normally. His mother explained that he had seemed much better 3 days previously, and had been planning to go back to school. Apart from eating poached eggs, he had not eaten anything different from the usual in the preceding days.

On examination, he had a soft abdomen with mild tenderness in the RIF, but his blood revealed significantly raised inflammatory markers, with WCC of 16.7⁹/L, normal lymphocyte count (2.6⁹/L), neutrophilia of 13.6⁹/L and raised CRP (173 mg/L). Despite IV antibiotics as per Trust guidelines for intra-abdominal sepsis—amoxicillin, metronidazole and gentamycin—he spiked temperatures up to



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Unusual association of diseases/symptoms

38.5°C. An ultrasound showed a fluid collection in the RIF and he was, therefore, booked on the emergency list for theatre.

Relook laparoscopy found inflammatory adhesions around an abscess in the RIF, which was drained and washed out with 5.5 L of saline. A drain was left in situ, and the pus was sent for bacterial culture.

The patient, who was continued on the same triple IV antibiotic therapy as per hospital guidelines for appendicitis (amoxicillin, metronidazole and gentamycin), continued to feel unwell over the following days, with vomiting, loose stool and colicky abdominal pain. Recovery was slow as he declined food and was hesitant to move.

Fortunately, bacterial culture on the pus taken during the second laparoscopy shed some light on the boy's failure to progress postoperatively. The fluid cultured a pure growth of one type of coliform, identified by Vitek 2 and Api20E as *Salmonella enteritidis*. It was then found to be of subspecies I, Multilocus Sequence Typing (MLST) type 11, as derived by a whole genome sequencing method.

Identifying *Salmonella* as the cause explained why the boy's symptoms persisted despite laparoscopic washout and treatment with IV amoxicillin, metronidazole and gentamycin as these antibiotics did not give adequate *Salmonella* coverage. Consequently, the Trust microbiologist advised a course of ceftriaxone to target the *Salmonella*, which was given as IV for 7 days. His symptoms resolved and abdominal ultrasound revealed no further collection. He has since been well.

DISCUSSION

S. typhi and *S. paratyphi* infections are known to present as acute abdomen due to intestinal perforations,¹ salpingitis, gall-bladder involvement and indeed, rarely, appendicitis.²⁻⁴ Non-typhoidal *Salmonella* species are also rarely associated with appendicitis. On literature review, around half of these relate to *Salmonella* infection mimicking appendicitis through mesenteric lymphadenopathy rather than via a direct invasion of the appendix, resulting in acute inflammation.⁴⁻⁷ The former, 'pseudoappendicitis', presents a diagnostic challenge and has led to the finding of a normal appendix at the time of surgery. There are, however, a few reported cases of acutely inflamed or perforated appendicitis as a result of *Salmonella* infection, including that of an immunocompromised patient with renal transplant and a pregnant woman.⁸⁻¹⁰ Other enteric bacterial infections have also been identified in the aetiology of appendicitis, particularly *Shigella*.⁸⁻¹¹ In a case series of seven patients who had preoperative positive stool cultures for *Shigella* or *Salmonella*, and who were found to have acutely inflamed or perforated appendicitis at the time of surgery, five were infected with *Shigella sonnei* and two with *S. typhimurium* and *S. enteritis*.⁸

The protracted course of our patient's recovery mirrors that of other *Salmonella* appendicitis cases where patients are often readmitted with ongoing symptoms or sepsis before the diagnosis is made.³⁻⁸ These cases have also necessitated return trips to the operating theatre for drainage of intra-abdominal collections.³⁻⁸

Our case emphasises the importance of collecting timely stool and pus samples to send for microbiology. Unfortunately, there was no preoperative stool sample or peritoneal fluid sent for culture during the first laparoscopy, and thus it is feasible that the boy may have been very unlucky and developed *Salmonella* infection after his appendectomy. However, given his initial presentation with loose stool and vomiting and later collection, it appears likely that *Salmonella* infection resulted in acute appendicitis.

Some clinicians believe intraoperative bacteriology in appendicitis is of little benefit, but our case stresses that it is vital.¹⁻¹⁰

Indeed, as fluid is not routinely sent for bacterial culture, it is thought that *Salmonella* appendicitis is under-reported.⁸ Identifying *Salmonella* allowed for the most appropriate antibiotic to be selected; although our case had already received broad spectrum IV antibiotics, it was only when he was put on ceftriaxone that his infection was effectively treated.

Learning points

- *Salmonella* infection is a rare cause of appendicitis; it can mimic appendicitis or progress to it. Observe patients with atypical histories or advise them to seek medical attention if symptoms progress.
- Send stool samples of all patients with suspected appendicitis and loose stool; a positive culture for *Salmonella* should not contraindicate appendectomy.
- Send peritoneal fluid at time of laparoscopy in acute appendicitis for bacterial culture, and pair these with stool samples.
- Laboratories should fully identify coliforms isolated from appendectomy cases as the incidence of *Salmonella* appendicitis may be under-reported.
- *Salmonella* appendicitis may require different antibiotic treatment to that used in appendicitis; therefore, prompt diagnosis facilitating appropriate antibiotic selection is the key to recovery.

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