CASE REPORT

The use of an ex vivo contrast study at the time of surgery to confirm the site of a perforated jejunal diverticulum

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SUMMARY

A 63-year-old patient was diagnosed with acute jejunal diverticulitis and possible perforation. The patient was taken to the operating room for an exploratory laparotomy where a suspected segment of small bowel was resected. However, the surgical team was unsure whether the resected segment was the definite location of the perforation. A novel technique; using intraoperative contrast enhanced ex vivo x-ray photographs aided the surgical team in finding the exact location of the perforation and thus allowing the operating team to confidently and safely proceed with closure of the abdomen.

BACKGROUND

Diverticulosis is more common in the large bowel than in the small bowel. Small bowel diverticuli occur most frequently in the duodenum;^{1 2} however, there are also published cases of jejunal diverticulosis with often more complicated symptoms.^{2 3} Small bowel diverticuli are thin-walled mucosal herniations through the gaps in the muscular layers and are therefore considered 'pseudo diverticula' because the walls are composed of only mucosa and submucosa and thus exclude the muscularis layer. Although enteroclysis, barium studies or capsule endoscopy are optimal diagnostic tools for small bowel diverticulosis, CT scan is easily available and thus more helpful in identifying any complications of this disease such as diverticulitis with or without abscess formation or perforation.⁴ This case report shows that using an ex vivo barium study can be a useful tool to reach a precise diagnosis in cases of suspected perforation or abscess formation resulting from jejunal diverticulitis.

CASE PRESENTATION

A 63-year-old woman was admitted with acute onset of epigastric pain in the background of a 4-month history of intermittent more diffuse abdominal pain. The pulse rate at presentation was 54 (though the patient was on a β -blocker), blood pressure 138/103 and temperature 37.5°C. The white cell count was $11.1 \times 10^3/\mu\text{l}$ and C reactive protein level 139 mg/l. During this first admission a CT scan demonstrated an area of mesenteric fat stranding on the left side of the abdomen with slight thickening of adjacent small bowel wall (figure 1A). The most likely explanation for the changes on the CT was thought to be acute jejunal diverticulitis. During this first admission the patient

was treated with intravenous antibiotics and fluids and discharged after the symptoms and inflammatory markers improved.

She re-presented to accident and emergency 3 weeks after her discharge with signs of peritonism. At this point her pulse rate was again normal on β -blockers (69) but she was hypotensive, 93/51, though afebrile at 36.2°C. At this early stage of the illness her white blood cell count was $9.6 \times 10^3/\mu\text{l}$ and her C reactive protein level was 6 mg/l. Abdominal x-ray showed normal bowel gas pattern and a chest x-ray did not reveal any free air under the diaphragm. She underwent a repeat CT scan that demonstrated a pocket of gas lying outside the bowel lumen along the anterior border of an inflamed jejunal loop, suggesting localised perforation (figure 1B). The CT also showed free fluid in the right paracolic gutter extending into the pelvis.

She was diagnosed with jejunal diverticulitis which was possibly complicated by perforation and abscess formation. She was resuscitated, started on intravenous antibiotics and this time was taken to the operating theatre for a laparotomy. At laparotomy there was free air in the peritoneal cavity and fluid in both paracolic gutters. A 30 cm segment of proximal small bowel containing diverticuli with surrounding inflammatory changes was easily identified (figure 2). The remaining abdominal viscera were normal. Gross examination of the inflamed segment showed diverticulosis in the jejunum. Attempts to demonstrate the area of perforation with bowel leak tests were unsuccessful.

An 80 cm segment of jejunum was resected starting 12 cm from the duodenojejunal flexure. The surgical team, however, was uncertain as to whether this segment of jejunum was responsible for the perforation. On careful examination there was no clear site of perforation and or abscess formation though in a number of locations small bowel mesentery was possibly compromised by the inflammatory process. The resected part of the jejunum was transferred to the radiology department where ex vivo barium-enhanced x-rays confirmed a perforated jejunal diverticulum (figure 3).

This study was carried out by injecting contrast into the resected part of the jejunum and then obtaining serial x-rays. For these kinds of case studies it is the novel technique which is of interest. An end to end primary anastomosis of the small bowel was performed after the diagnosis was made certain. Histological examination of the specimen confirmed jejunal diverticulitis with signs of a

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Figure 1 (A) An axial contrast-enhanced CT image initially demonstrated multiple jejunal diverticulae along the mesenteric border with surrounding fat stranding (arrow). No extraluminal gas was identified. (B) Axial contrast-enhanced CT images through abdomen at second presentation. Thickened jejunal loops are again visualised with surrounding fat stranding. On this selected view, a pocket of gas lying outside the bowel lumen is noted along the anterior border of the inflamed jejunal loop (arrow).

perforation having occurred (figure 4). The patient had an uneventful recovery and was discharged home in good condition on the seventh postoperative day. She has since been reviewed in the clinic and is eating and drinking normally with a complete resolution of her recurrent abdominal pains.

DISCUSSION

Jejunal diverticulosis is an uncommon entity with an incidence range of 0.02% and 7.1%.⁵ About 80% of patients with jejunal diverticulosis remain asymptomatic, hence low incidence in the general population. The mean age of symptomatic patients is 60 years and less than 10% of the affected individuals develop acute complications.³ These potential complications include perforation, intestinal haemorrhage and rupture of the diverticulum or bowel obstruction.⁶ The associated symptoms caused by

Figure 2 Ex vivo photograph of the resected segment of bowel containing diverticuli (an example highlighted with white arrow) with surrounding inflammatory changes (yellow arrow).

Figure 3 Ex vivo barium-enhanced x-rays of the resected segment of bowel showing contrast extravasation (arrow) suggesting an intramesenteric abscess due to a perforated jejunal diverticulum.

these complications, such as acute upper and central abdominal pain, fever and elevated white cell count may mimic many other abdominal diseases. Hence, it is usually necessary to acquire additional imaging for a more accurate diagnosis.

Diagnosis of jejunal diverticulosis can be made by either barium study, which can show an air-filled or contrast-filled diverticular sac, or CT scan which can show focal area of out-pouching of the mesenteric side of the bowel filled, sometimes filled with faeces-like material. In cases of suspected jejunal diverticulitis a CT scan is deemed superior as it can show asymmetric wall thickening, evidence of inflammation and or perforation.^{5, 7}

Jejunal diverticulitis is a rare diagnosis, however its presence and its associated complications should be suspected in cases of unexplained peritonitis. Operative management is the treatment of choice, either via laparotomy or laparoscopy.⁸

Intraoperatively, in this patient, mesentery of the small bowel adjacent to jejunal diverticulitis was found to be acutely inflamed but there was no obvious leakage of small bowel contents or a visible site of perforation. The concern was that resection of this segment would leave behind another pathology responsible for free intraperitoneal air and fluid. Although the CT scan was suggestive of acute jejunal diverticulitis, a definite diagnosis was established at the time of surgery by performing ex vivo barium enhanced x-ray study on the suspicious small bowel segment. This illustrates that in case of intraoperative uncertainty ex vivo barium x-ray studies could be utilised to obtain a definite and precise diagnosis prior to closing the abdomen. Although the use of air leak or bowel leak tests is

Figure 4 Representative H&E sections at x40 magnification sections from the longitudinal resection margins show congested and oedematous small bowel wall with evidence of a fibrinopurulent serosal exudate, in keeping with the clinical history of perforation.

simpler and quicker, the ex vivo radiological method described in this case is a useful second line procedure if there is uncertainty about the location of the perforation and or if the surgeons require absolute confirmation that the perforation has been resected prior to closure.

Learning points

- ▶ Perforation can be a complication of jejunal diverticulitis.
- ▶ Intraoperatively the location of perforation may be determined by air leak or bowel leak tests.
- ▶ In case of intraoperative uncertainty ex vivo barium x-ray studies could be utilised to establish a definite area of perforation due to jejunal diverticulitis

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