INTRODUCTION

Barium peritonitis is a rare but life-threatening complication associated with gastrointestinal (GI) contrast investigation. After the first report of barium peritonitis by Himmelmann (1) in 1932, the incidence of peritonitis following barium examination has been reported to be 0.2–0.8% (2, 3). To date, there are about 30 reported cases of barium peritonitis following an upper GI series in the literature, which focused on clinical findings and management (3). However, to the best of our knowledge, there has been no report of barium peritonitis following an upper GI series that deals with radiologic findings. In this report, we described a rare case of barium peritonitis following an upper GI series with its imaging findings and facilitated a discussion on the prevention and management of this disease entity.

CASE REPORT

A 74-year-old female presented to the emergency department with a history of sudden abdominal pain immediately after swallowing half a cup of barium for an upper GI series at an outside hospital about three hours ago. During the examination, intraperitoneal barium leakage was identified, representing intestinal perforation. An upper GI series was planned for her general health check-up and she had no clinical symptom prior to the examination. The patient's past medical history was unremarkable. Unenhanced abdominopelvic computed tomography (CT) was performed at an outside hospital and she was diagnosed as having barium peritonitis. Physical examination, which was performed in our hospital, showed diffuse abdominal tenderness and involuntary abdominal guarding. Plain abdominal radiograph and imported outside unenhanced abdominopelvic CT images (Sensation 64 multi-detector scanner; Siemens Medical...
barium contamination in the peritoneal cavity causes marked chemical peritonitis, which leads to exudation of extracellular fluid with albumin, resulting in hypovolemia and shock (4). Therefore, prompt fluid replacement is important. Moreover, spilled barium quickly agglomerates together and the clumps adhere to the parietal and visceral surfaces of the peritoneal cavity because of its mucosal coating properties, which cannot be easily removed (3, 4). If consequent spillage of bowel contents occurs, it has known to be associated with poor outcome (8). Therefore, early laparotomy with thorough irrigation is considered as the first-line management and such management has been shown to diminish the severity of peritonitis and reduce morbidity and mortality (3). Also, consecutive surgical resection or repair of the perforated bowel should be performed (3). Postoperatively, critical care support, such as fluid balance and administration of broad-spectrum antibiotics, and nutritional support are required.

In our case, the above mentioned surgical and medical management options were performed in a sequence and we assume that such type of management contributed to diminution of the intensity of peritonitis and led to a relatively better prognosis.
Fig. 1. Pre- and post-operative images of barium peritonitis following an upper gastrointestinal series in a 74-year-old female.

A. Pre-operative plain abdominal radiography shows extensive barium spillage in the peritoneal cavity with pneumoperitoneum. Especially, larger amounts of agglomerated barium clumps are seen in bilateral subdiaphragmatic areas (arrows).

B. Pre-operative unenhanced axial CT image reveals agglomerated barium clumps adhering to the parietal and visceral surfaces of the peritoneal cavity with a large volume of pneumoperitoneum. Assessment of bowel perforation on current CT images is limited due to unenhanced scan protocol, insufficient bowel distension and beam hardening artifacts.

C. Post-operative plain abdominal radiography on the 3rd post-operative day shows residual barium, which outlines the abdominopelvic cavity and probably adheres along the peritoneum.

D. Contrast-enhanced axial CT image on the 19th post-operative day shows residual barium and mesenteric fat haziness with ascites. Generalized soft tissue edema is also seen.
However, complete removal of barium is clinically impractical. The remaining barium clumps undergo stages of chemical inflammatory reaction including phagocytosis, fibrosis and subsequent adhesion causing small bowel obstruction (3, 4). Postoperative small bowel obstruction has been reported in up to 30% of patients who survive barium peritonitis (9). Fortunately, our patient did not suffer from bowel obstruction during the recovery period, even though a significant quantity of barium was left behind after the operation. The prognosis of barium peritonitis has been regarded as poor and the mortality rate has been reported to be as high as 35–50% (4, 7). Minimal barium spillage is associated with better prognosis.

In conclusion, we have presented a case of barium peritonitis following an upper GI series with its imaging findings. Because of its rarity and high mortality rate, we suggest that there is a need for clinical awareness about barium peritonitis following intestinal perforation as a possible complication of an upper GI series. Careful review of clinical history, previous endoscopic procedure, and preliminary radiographs could prevent this fatal complication. Once perforation occurs, prompt recognition and management should be performed to decrease the morbidity and mortality.

REFERENCES

1. Himmelmann W. Ueber die perforation im bereich des magen-darmtraktus bei und nach der rontgenbreipassage. *Munch Med Wochenschr* 1932;79:1567-1571
2. Ott DJ, Gelfand DW. Gastrointestinal contrast agents. Indications, uses, and risks. *JAMA* 1983;249:2380-2384
3. Karanikas ID, Kakoulidis DD, Gouvas ZT, Hartley JE, Koundourakis SS. Barium peritonitis: a rare complication of upper gastrointestinal contrast investigation. *Postgrad Med J* 1997;73:297-298
4. Williams SM, Harned RK. Recognition and prevention of barium enema complications. *Curr Probl Diagn Radiol* 1991;20:123-151
5. Noveroske RJ. Intracolonic pressures during barium enema examination. *Am J Roentgenol Radium Ther Nucl Med* 1964;91:852-863
6. Thoeni RF, Margulis AR. Intracolonic pressures during barium–enema studies using the single- and double- contrast techniques. *Invest Radiol* 1979;14:162-165
7. de Feiter PW, Soeters PB, Dejong CH. Rectal perforations after barium enema: a review. *Dis Colon Rectum* 2006;49:261-271
8. Terranova O, Meneghello A, Battocchio F, Martella B, Celi D, Nistri R. Perforations of the extraperitoneal rectum during barium enema. *Int Surg* 1989;74:13-16
9. Zheutlin N, Lasser EC, Rigler LG. Clinical studies on effect of barium in the peritoneal cavity following rupture of the colon. *Surgery* 1952;32:967-979