Nonfatal Barium Intravasation into the Portal Venous System during Barium Enema Examination

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Abstract

We report a case of barium intravasation in a 66-year-old patient. Unenhanced computed tomography (CT) scan revealed barium and air emboli in portal veins and liver. We believe he survived because his liver prevented inflow of barium into the systemic circulation. To the best of our knowledge, this is the 23rd reported case of venous barium intravasation in the last 50 years. Because all 23 patients had bowel disease or diverticulitis, we conclude barium enema should be used cautiously in such patients.

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Key words: barium enema, barium intravasation, septic shock, embolization

Case Report

A 66-year-old man was admitted to Matsudo City Hospital on March 4, 2002, with shock after several days of diarrhea, malaise, chills and fever. Physical examination revealed blood pressure of 63/29 mmHg, pulse of 68 beats/min and temperature of 31.8°C. Bloody stool appeared intermittently. Laboratory evaluation revealed a white blood cell count of 16,800/ μ l, metabolic acidosis (pH 6.85), blood urea nitrogen concentration of 102.2 mg/dl, creatinine concentration of 13.9 mg/dl and C-reactive protein (CRP) concentration of 24.0 mg/dl. After 7 days of antibiotic treatment with imipenem and continuous hemodiafiltration, the patient recovered from shock. The shock was likely caused by enterogenous sepsis because of chronic diarrhea and intermittent bloody stool, but some blood and stool cultures were negative for pathogens. No X-ray and CT scan examinations revealed an infectious focus (Fig. 1). When he was discharged from the hospital on April 13, he was scheduled for barium

enema and colon fiber examinations to investigate the cause of the diarrhea and intermittent bloody stool. Barium enema was performed on April 24. During the examination, venous barium intravasation from sigmoid colon into the portal venous system via the inferior mesenteric vein was recognized on the image intensifier (Figs. 2 and 3). A 2.5-cm mass was also recognized at the sigmoid colon (Fig. 4). The patient lost consciousness temporarily. The examination was immediately discontinued, and he was moved to the emergency room.

In the emergency room, the patient's condition improved. He was nearly fully alert (Glasgow Coma Scale E4V5M6), with a blood pressure of 180/106 mmHg, pulse of 84 beats/min and temperature of 37.8°C. His white blood cell count was 9,700/ μ l. Fibrin degradation product was elevated to 41.7 μ g/ml. Urea, electrolytes and liver function parameters were within normal limits. Unenhanced abdominal CT scan revealed barium and air emboli in portal veins and liver tissue (Fig. 5). Abdominal ultrasonography also revealed multiple high echoic lesions caused by air emboli, but abdominal doppler ultrasonography showed no hemodynamic change in the main portal vein. Portal venography via the supra mesenteric artery was performed 3 hours after the barium enema. The portal vein was patent, and no embolus was recognized. No anomalous vessels were found, and the intravasation point was not revealed.

Blood culture specimen were obtained and treatment with antibiotics (imipenem 1 g/day intravenous drip, kanamycin and polymyxin B per os) was started. Growth of *Escherichia coli* was verified later. Although the air embolus in portal veins disappeared the next day, the barium deposit in the liver did not change (Fig. 6). Liver function parameters remained within normal limits. There was no clear sign of infection, although CRP had increased slightly. Peritoneotomy was performed 6 days after the barium enema to determine the cause of intravasation such as deformity, to resect the point of intravasation, and to perform liver biopsy. He was found to have an inflamed swollen sigmoid colon, but the

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Figure 1. Unenhanced abdominal CT performed at the first time admission did not reveal an infectious focus.

Figure 2. Contrast material is seen filling a tubular structure to the oral side (arrows).

vessels, mesentrium and liver showed nothing abnormal. Sigmoidectomy with end-to-end anastomosis was performed. A 25-mm sigmoid polyp and multiple ulcers 1 to 5 cm in size were found (Fig. 7A). A small fragment of liver tissue

Figure 3. Barium is seen in the inferior mesenteric vein (arrows).

was removed from lateral segment for biopsy.

Pathologic examination showed the sigmoid polyp with carcinoma in situ (Fig. 7C), and the ulcers reached the submucosa and partially reached the muscular layer. Though the cause of appearance of the ulcers were not diagnosed, it was only supposed that they had likely existed for 1 to 2 months from their fibrous change (Fig. 7B). The barium inflow could not be pointed out. Liver biopsy microscopic examination showed enlargement of Glisson's sheath, inflammatory cell invasion and barium sulfate particles (30 μ m) in many portal veins (Fig. 8).

The patient improved after the last operation and was discharged 27 days later, free from symptoms and with the normal liver function. After 3 months, colon fiber examination was performed and showed nothing abnormal in the rest of his colon. After 18 months, CT scan examination showed almost no change in the liver barium deposit (Fig. 9).

Discussion

Although barium enema is a relatively safe examination, barium intravasation is a serious complication for some patients. During the last 50 years, 22 cases of venous barium intravasation have been reported; the present case is the 23rd

Figure 4. A 2.5-cm mass lesion was recognized at the sigmoid colon (arrowhead).

case (Table 1). The reported causes of venous barium intravasation are diverticulum (9 cases), inflammatory colitis (5 cases: 3 of ulcerative colitis and 2 of Crohn's disease), and intestinal obstruction (5 cases). Wheatley and Eckhauser (19) reported that in almost every case out of 12 cases they reviewed, barium intravasation occurred because of mucosal defect. In the present case, multiple sigmoid ulcers were formed and made a colovenous fistula. Therefore the colonic contents leaked into vessels causing sepsis at the first time admission, and venous barium intravasation occurred during barium enema.

Reported regions of barium intravasation are the ileum (1 case), transverse colon (2 cases), sigmoid colon (11 cases including ours), rectosigmoid colon (2 cases), and rectum (7 cases). Barium almost always leaked into the portal circulation in patients with a mucosal defect of the ileum, transverse colon or sigmoid colon because colonic veins flow into the portal vein (Fig. 10). Barium almost always leaked into the systemic circulation in patients with a mucosal defect of the rectum because rectal veins flow mainly into the systemic circulation via the inferior and middle hemorrhoidal veins. Of the 9 patients with systemic circulation embolus, 7 died

Figure 5. Unenhanced abdominal CT scan shows diffuse hyper density area, a few discrete barium emboli in the left lobe and anterior segment of the right lobe of the liver (black arrows) and air emboli in portal veins (white arrows).

Figure 6. Unenhanced abdominal CT scan 24 hours after the enema; the air emboli in portal veins disappeared, but the diffuse hyper density area and barium emboli (arrows) did not change.

immediately with a massive embolus in the right side of the heart and/or pulmonary circulation (mortality 77.8%). The other 2 patients survived because only a small amount of barium had become intravasated (18). Of the 14 patients with portal circulation embolus, 12 survived (mortality 14.3%). One died from sepsis, and the other died from cancer (10, 22). When barium drains into the portal system, the liver seems to act as a filter, protecting against pulmonary embolism which may explain the increased survival of patients with portal circulation embolus.

We conclude that death in barium intravasation can result from massive systemic embolism and/or sepsis. If venous

a

b

c

Figure 7. a) Resected sigmoid colon. Multiple ulcers (circles) and a polyp (arrows) are recognized. b) Microscopic section of the sigmoid colon ulcer (HE stain, $\times 10$). c) Microscopic section of the sigmoid colon polyp. The polyp has carcinoma in situ (arrows) (Masson trichrome stain, $\times 40$).

intravasation is observed, the flow of barium should be stopped and the barium should be drained from the rectum by gravity (18). Intravenous antibiotics should be given early to combat endotoxic shock (15). Surgery should then be undertaken to resect the site of intravasation. More importantly, barium enema examination should be used cautiously in patients with inflammatory bowel disease or diverticulitis. When a rectal mucosal defect is suspected, we suggest that water-soluble contrast medium be used to avoid emboliza-

tion and sudden death.

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Figure 8. Intravascular barium (arrows) in lateral segment of the liver (Masson trichrome stain, $\times 120$).

Figure 9. 18 months later, follow-up CT scan reveals parenchymal infiltration of barium remaining in both the right and left hepatic lobes.

Table 1. Reported Cases of Barium Intravasation during Barium Enema

Authors	Patient Age (y)	Sex	Embolus Origin	Site	Colonic disease	Outcome
Issacs (1)	25	F	Transverse	Portal	Ulcerative Colitis	Survived
Roman (2)	78	F	Rectum	Systemic	Obstruction	Died
Rosenberg (3)	73	F	Rectum	Systemic	(Evaluation of mass)	Died
Truemner (4)	76	F	Sigmoid	Systemic	Diverticulitis	Died
Frecker (5)	81	F	Rectum	Systemic	Constipation	Died
Noveroske (6)	72	F	Rectum	Systemic	Rectal bleeding	Died
Nordahl (7)	39	M	Sigmoid	Portal	Diverticulitis	Survived
Cove (8)	64	F	Rectosigmoid	Systemic	Obstruction	Died
Juler (9)	35	M	Sigmoid	Portal	Diverticulitis	Survived
Salvo (10)	36	F	Sigmoid	Portal	Diverticulitis	Died
Schumacher (11)	50	M	Rectum	Portal	Obstruction	Survived
Archer (12)	86	M	Stoma (sigmoid)	Portal	Obstruction	Survived
Rothman (13)	37	M	Sigmoid	Portal	Diverticulitis	Survived
Tsoutsanis (14)	67	M	Rectum	Systemic	Ulcerative Colitis	Died
Blom (15)	73	F	Rectum	Systemic	Diverticulitis	Survived
Fowlie (16)	38	F	Transverse	Portal	Crohn's Disease	Survived
Kanehann (17)	58	M	Sigmoid	Portal	Diverticulitis	Survived
Taylor (18)	79	F	Sigmoid	Systemic	Obstruction	Survived
Wheatley (19)	27	M	Rectosigmoid	Portal	Diverticulitis	Survived
Payen (20)	22	M	Ileum	Portal	Crohn's Disease	Survived
Zalev (21)	29	M	Sigmoid	Portal	Ulcerative Colitis	Survived
Rossmann (22)	32	M	Sigmoid	Portal	Diverticulitis	Died
Present case	66	M	Sigmoid	Portal	Colitis	Survived

F: Female, M: Male.

Figure 10. Anatomy of colonic and hemorrhoidal veins.

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