

Unusual pressure-induced rupture of colonic volvulus in a patient with long-term corticosteroid therapy

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Abstract

Perforation due to colonic volvulus is typically considered to occur following ischemic necrosis of the intestinal wall. In this report, we report a rare case of sigmoid colon volvulus rupture caused by increasing intraluminal pressure without any sign of ischemia. The patient was an 88-year old Japanese male, who had been treated with 5 mg of oral prednisolone daily for 8 years. He consulted for severe abdominal pain that had lasted for three days. X-ray and computed tomography showed free peritoneal air, suggesting peritonitis. He was diagnosed with sigmoid colon volvulus perforation and underwent emergency surgery. Pathological examination showed no ischemic necrosis around the perforations in the resected intestine. As a result, we came to believe that the fragility of the colonic wall, caused by the patient's long-term use of corticosteroid, had lowered the threshold for pressure-induced colonic rupture. (*Acta gastroenterol. belg.*, 2008, 71, 339-341).

Key words : volvulus, steroid, pneumatic rupture, sigmoid colon.

Introduction

Perforation of the colon caused by increasing intraluminal pressure has been reported as an injury during diagnostic colonoscopy or blunt trauma. We searched thoroughly for original literature in PubMed, but we could not find any study reporting air-pressure-induced rupture of colonic volvulus. Colonic volvulus is typically followed by obstruction of the blood supply and necrotic perforation of the intestinal wall. However, it has been reported that steroid therapy itself may affect the structure of the intestinal wall, sometimes resulting in bowel perforation (1-6). Here we report a rare case of pressure-induced rupture of colonic volvulus that may implicate a possible side-effect of chronic corticosteroid therapy.

Case report

An 88-year old male had been followed for microscopic polyangiitis in the department of internal medicine at our hospital and had been treated with 5 mg of oral prednisolone daily for a period of 8 years. On one of his regular visits to our hospital, he presented with severe and deteriorating abdominal pain that had lasted for the previous three days. Physical examination showed severe abdominal distention and moderate muscular guard. Plain abdominal x-ray radiograph revealed a large dilated loop of the sigmoid colon, and additional

emergency computed tomography showed free peritoneal air, suggesting free peritonitis (Figs. 1A and 1B). He was diagnosed with sigmoid colon volvulus perforation and underwent emergency surgery. Following laparotomy, we found a moderate amount of turbid ascites and a dilated loop in the sigmoid colon. The colonic wall on the anti-mesenteric side was split in the sero-muscular layer, though the mucosal layer remained intact, except for several pinholes. We found no signs of ischemic changes in the mucosal and muscular color during the operation (Fig. 2). We performed partial colectomy to remove the damaged intestine and carried out sigmoid colostomy. The patient left the intensive care unit on the second postoperative day, and was discharged from our hospital on the 30th postoperative day without any major morbidity.

Macroscopic pathological study revealed a large longitudinal split on the anti-mesenteric side. There were no signs of ischemic necrosis or diverticulae around the affected mesentery and the colonic wall. The split reached the outer two layers ; serosa and muscularis, but the mucosal layer remained intact except for a few pinholes that had also been seen during surgery (Fig. 3). These pathological findings suggest that the rupture was induced not by ischemia, but by increased intraluminal pressure.

Discussion

Air-pressure-induced colonic rupture was first described by G.W. Stone in 1904 (7). Following his report, several cases were recorded as pneumatic rupture of the intestines caused by compressed air directed to the anus or as an iatrogenic trauma during diagnostic colonoscopy (8-10). In addition to these clinical reports, Burt *et al.* were the first to record the mechanism of how pressure-induced colonic rupture occurs in experimental

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Fig. 1A. — Plain abdominal x-ray radiograph shows a large loop in the dilated colon.

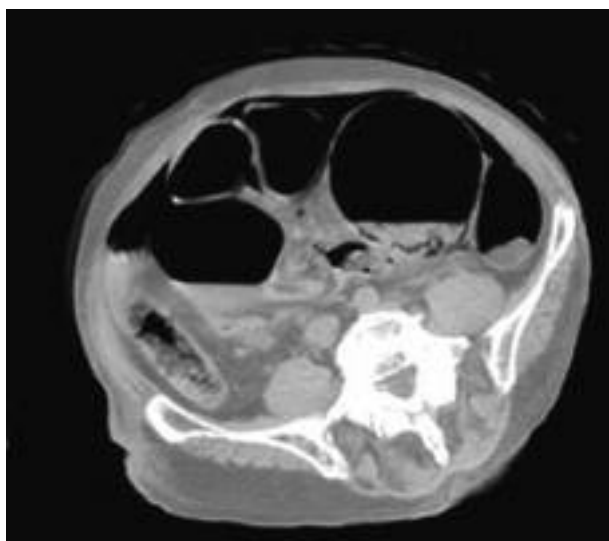


Fig. 1B. — Computed tomography shows the dilated colon and free peritoneal air, suggesting perforation and free peritonitis.

design (11). They employed human intestine obtained at an autopsy and recorded the maximum pressure that the colonic wall could bear. They also recorded anatomical changes during pressure-induced rupture and described how colonic rupture generally occurred first in a longitudinal direction on the anti-mesenteric surface, tearing the serosal and muscular layer. They demonstrated that the mucous layer herniated through the opening of the outer two layers and ruptured with increasing pressure, leaving a small, ragged mucosal perforation. The ruptured intestine in our case showed exactly the same anatomical changes as reported in this previous experiment, imply-



Fig. 2. — The ruptured colonic wall shows lacerations of serosa and muscularis, with the mucosal layer remaining intact, except for several pinholes.

ing that our case was presumably induced by increasing intraluminal pressure.

Colonic perforation is also reported to occur as a complication following vasculitis. Geboes *et al.* has reported that severe, occlusive damage to vessels often leads to ischemia that may result in ulceration or perforation in the gastrointestinal tract (12). Here we should consider microscopic polyangiitis as a possible risk that may induce bowel perforation (13). We examined the resected specimen microscopically if it showed necrotizing vasculitis, typically observed in microscopic polyangiitis. Necrotizing vasculitis is characterized as extravasation of erythrocytes, neutrophilic infiltration with its nucleus destroyed, vascular fibrinoid necrosis and intimal thickening of arterioles. We examined the vessels around the perforation in the resected specimen to see if it shared such findings; however, we did not detect any changes that would mark vasculitis. Rather, the vascular wall remained intact. In addition, although a perforation associated with microscopic polyangiitis should present ischemia induced by occlusive damages, a mucosal layer, which is subjected to blood perfusion, remained intact even after muscular and serosal layers were spoiled. From these pathological findings and also from the fact that the activity of microscopic polyangiitis would be suppressed by corticosteroid therapy, we doubt that microscopic polyangiitis itself would cause damage on the colonic wall. There must be some other factors, such as steroids, that would cause perforation.

It has been reported that patients on steroid therapy are at increased risk of bowel perforation. This complication has been reported commonly in patients treated with steroids for neurological disease or in homograft recipients (1,2). The risk of bowel perforation has been reported to increase as the amount of steroid increases (4). Mechanisms by which steroids affect the intestinal wall include thinning of the intestinal wall due to atrophy of the lymphoid aggregates, a decrease in the turnover of

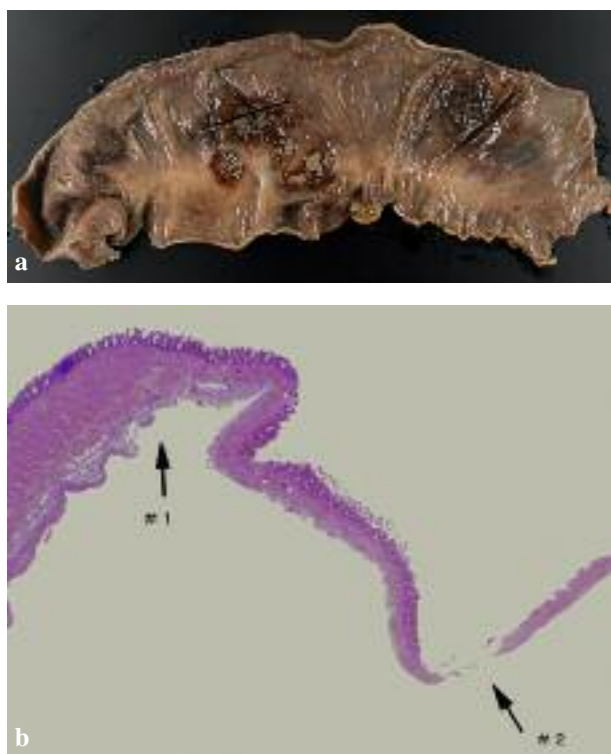


Fig. 3. — Photomicrograph of the partial wall of the sigmoid colon (shown in Figure 3a with a bold line). Figure 3b shows the absence of serosa, and an incomplete laceration of the inner circular muscularis ; however the mucosal layer is normal (right of arrow #1). The mucosal layer around the rupture shows no ischemic change (arrow #2).

the mucosal cells, inhibition of the reparative capacity of fibroblasts, and alternation in the microcirculation of the colon (3,5). We believe that the fragility of the intestinal wall caused by chronic steroid therapy might have been a contributing factor in this rare case of sigmoid colon rupture which showed no ischemic changes.

Another serious problem in steroid therapy is masking of the severe clinical manifestations that typically follow bowel perforation. Steroid use in a septic patient can pre-

dictably decrease the leukocyte count and cause hypothermia, shutting off the inflammatory process that is responsible for the clinical expression of peritonitis (4). This masking effect of steroid therapy may delay in recognizing bowel perforation, which affects morbidity and mortality (6).

In conclusion, we experienced a rare case of pressure-induced rupture of sigmoid colonic volvulus in the patient who had been treated with chronic corticosteroid therapy. We should bear in mind that patients treated with long-term steroids are at a high risk for developing acute rupture of colonic volvulus even without any ischemia.

References

1. CHURCH J.M., FAZIO V.W., BRAUN W.E., NOVICK A.C., STEINMULLER D.R. Perforation of the colon in renal homograft recipients. A report of 11 cases and a review of the literature. *Ann. Surg.*, 1986, **203** : 69-76.
2. FADUL C.E., LEMANN W., THALER H.T., POSNER J.B. Perforation of the gastrointestinal tract in patients receiving steroids for neurologic disease. *Neurology*, 1988, **38** : 348-52.
3. KONISHI T., WATANABE T., KITAYAMA J., SHIBAHARA J., HIRAMATSU T., HARA K., KURIKI K., NAGAWA H. Successfully treated idiopathic rectosigmoid perforation 7 years after renal transplantation. *J. Gastroenterol.*, 2004, **39** : 484-9.
4. RE MINE S.G., MC ILRATH D.C. Bowel perforation in steroid-treated patients. *Ann. Surg.*, 1980, **192** : 581-6.
5. STELZNER M., VLAHAKOS D.V., MILFORD E.L., TILNEY N.L. Colonic perforations after renal transplantation. *J. Am. Coll. Surg.*, 1997, **184** : 63-9.
6. STERIOFF S., ORRINGER M.B., CAMERON J.L. Colon perforations associated with steroid therapy. *Surgery*, 1974, **75** : 56-8.
7. GERALD W.S. A case of rupture of the bowel caused by compressed air. *The Lancet*, 1904, **164** : 213.
8. ANDREWS E.W. Pneumatic rupture of the intestine, a new type of industrial accident. *Surgery, Gynecology and Obstetrics*, 1911, **12** : 63-64.
9. KOZAREK R.A., EARNEST D.L., SILVERSTEIN M.E., SMITH R.G. Air-pressure-induced colon injury during diagnostic colonoscopy. *Gastroenterology*, 1980, **78** : 7-14.
10. SUH H.H., KIM Y.J., KIM S.K. Colorectal injury by compressed air – a report of 2 cases. *J. Korean Med. Sci.*, 1996, **11** : 179-82.
11. BURT C.A.V. Pneumatic rupture of the intestinal canal. *Archives of Surgery*, 1931, **22** : 875-902.
12. GEBOES K., DALLE I. Vasculitis and the gastrointestinal tract. *Acta Gastroenterol. Belg.*, 2002, **65** : 204-12.
13. LAZARIS A.CH., PAPANIKOLAOU I.S., THEODOROPoulos G.E., PETRAKI K., DAVARIS P.S. Ischaemic necrosis of the rectum and sigmoid colon complicating systemic lupus erythematosus. *Acta Gastroenterol. Belg.*, 2003, **66** : 191-4.