

Colon Barotrauma Caused by Compressed Air

Jin Yi Choi, Kyoung Suk Park, Tae Woon Park, Won Jun Koh, Hee Man Kim

Division of Gastroenterology, Department of Internal Medicine, Myongji Hospital, Kwandong University College of Medicine, Goyang, Korea

Colon barotrauma can be mostly caused by elevated intraluminal pressure. Air insufflation during colonoscopy procedure is the most common cause of iatrogenic colon barotrauma. Cat scratch colon can usually be seen in the mild type of colon barotrauma, and colon perforation can be seen in the severe type. We presently report a case of non-iatrogenic colon barotrauma caused by industrial compressed air. Multiple linear mucosal ulcers were noted in the recto-sigmoid colon, but the colon was not perforated. The patient was discharged without any further complications after conservative treatments. (**Intest Res 2013;11:213-216**)

Key Words: Colon; Barotrauma; Colonoscopy; Wounds and injuries; Compressed air

INTRODUCTION

Barotrauma is an injury caused by the pressure effect. Colon barotraumas are colon injuries, including colon mucosal traumas and colon perforation with elevated intraluminal pressure, mainly caused by air.^{1,2} Air insufflation during colonoscopy procedure is the most common cause of colon barotraumas. It is seen that “cat scratch” colon in a mild type of iatrogenic colon barotrauma and colon perforation is in the severe one. In some cases, it was reported that colon perforation was caused by compressed air.³ We report a case of colon barotrauma presenting colon mucosal injuries caused by compressed air.

CASE REPORT

A 46-year-old man was admitted to the emergency room for lower abdominal pain for several hours. He was a construction worker, engaged in bridge construction projects. Under the hot summer weather, his coworker turned on the industrial air compressor toward the patient to cool down his body temperature. It was blowing high pressure compressed air at the patient’s buttock area (50 cm distant from the anus, 7.0 kg/cm² pressured, less than 1 second in duration). Right

away, the patient experienced pain in the acute lower abdomen and anus, and was admitted to the emergency room. At admission, his blood pressure was 120/70 mmHg, pulse rate was 74/minute, respiratory rate was 20/minute, and body temperature was 36.6°C. On physical examination, the abdomen was slightly distended and bowel sounds were decreased. He was examined mild to moderate direct tenderness diffused from the low abdomen, but no rebound tenderness. He did not experience symptoms of nausea, vomiting or no complaining desire to defecate. On a digital rectal examination, it was seen as scanty rectal bleeding. On laboratory blood tests, white blood cell count was $13.3 \times 10^9/L$ (neutrophils 85.3%), hemoglobin 14.4 g/dL and the others were not clinically significant. Abdomen X-ray showed visible dilated colon and no free air in the peritoneal cavity (Fig. 1A, B). Immediately, computed tomography was performed to examine colon perforation. It revealed segmental wall thickening from the rectum to the sigmoid colon, without perforation (Fig. 1C, D). On an urgent sigmoidoscopy, multiple linear ulcers were noted from the area of the rectum to the sigmoid colon (20 cm from anal verge) (Fig. 2). The patient was under conservative treatments of antibiotics and hydrations intravenously, keeping the non per os status. A follow-up sigmoidoscopy after one week of the treatments showed improvement of the previous lesions presented on the distal colon (Fig. 3). The patient was discharged without any further complications.

Received January 22, 2013. Revised June 21, 2013. Accepted June 22, 2013.

Correspondence to Hee Man Kim, Division of Gastroenterology, Department of Internal Medicine, Myongji Hospital, Kwandong University College of Medicine, 55 Hwasu-ro 14beon-gil, Deogyang-gu, Goyang 412-826, Korea.

Tel: +82-31-810-5412, Fax: +82-31-969-0500, E-mail: eastin@kd.ac.kr

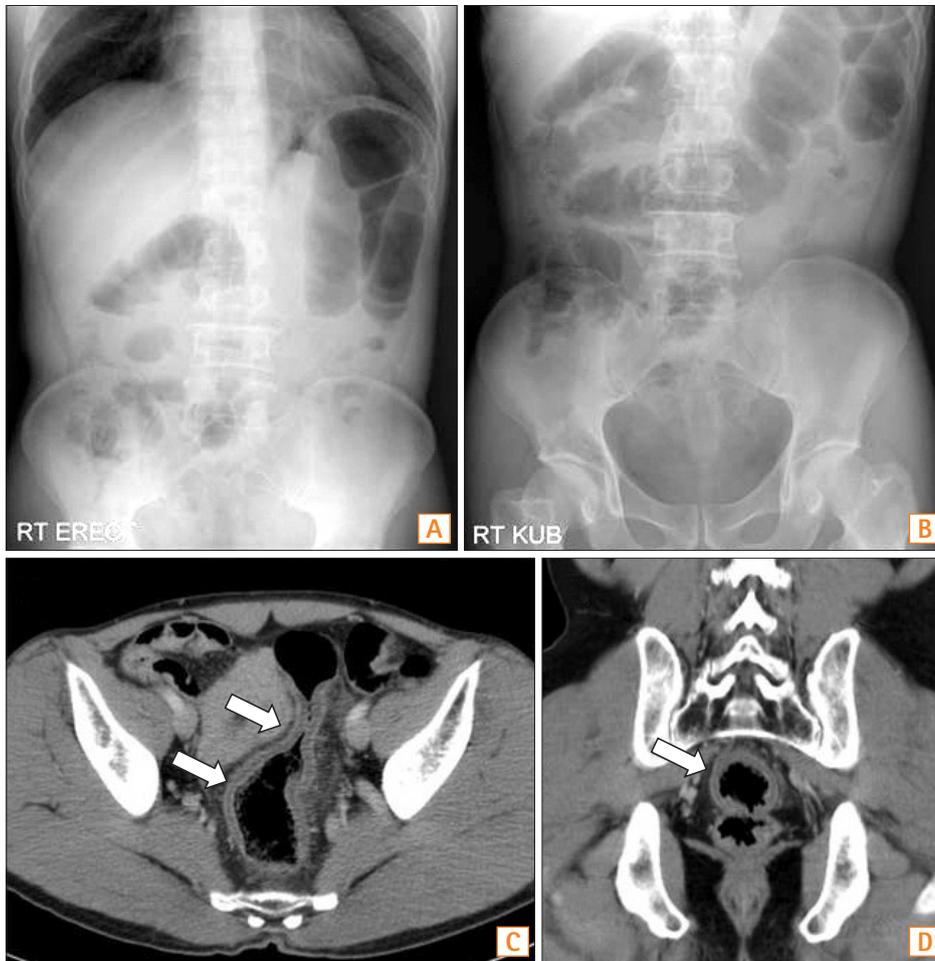


Fig. 1. Simple abdomen and abdominopelvic CT. (A, B) Simple abdomen shows gas shadow in the ascending colon and the transverse colon. (C, D) CT shows segmental wall thickening of the rectum without perforation (arrows).

DISCUSSION

Most cases of iatrogenic colonic barotrauma occurred during a colonoscopy procedure.⁴ Their incidence is reported as the 0.1 to 0.5%.⁵⁻⁸ According to the law of Laplace, the wall tension is directly proportional to the intramural pressure and the diameter of the colon.⁹ The cecum has the largest one among all the diameters of colonic segments, and is the most easily affected area to barotrauma during colonoscopy procedure.⁴⁻¹⁰ “Cat scratch” colon is usually seen in a mild type of iatrogenic colon barotrauma and colon perforation is seen in the severe one. Hemorrhagic colitis in nature normal colon tissue is one of the histologic findings in cat scratch colon.¹¹ McDonnell et al.¹ reported superficial breaks in the mucosa in the right colon during a colonoscopy procedure leading to secondarily barotraumas and termed as “cat scratch” colon in 2007. Cat scratch colon was defined as bright erythematous linear marks resembling scratches.¹ The incidence of cat scratch colon is reported as 0.25% (21 of 8,277 colonoscopy procedures).¹ The ascending colon and the cecum are mostly injured.¹ Cruz-Correa et al.¹² reported that the collagenous colitis was predisposed to cat scratch colon. Woltjen⁹ report-

ed four cecal perforations during 3,000 colonoscopy procedures.

Misuse of compressed air is reported as one of the causes occurring in a non-iatrogenic colon barotrauma.^{3,8,10-13} In various industrial fields, compressed air is broadly used for industrial machines, including cleaning or fabric machines. However, ignorant and improper use of compressed air equipment may lead to disastrous events in which colon wall rupture may occur. Fortunately, colorectal injury by compressed air is not frequent in spite of the increased and widespread use of compressed air in modern life. Colon barotrauma cases caused by compressed air were reported in the literature. Coffey et al.³ in 2007 described the case of a young man who was victim to perineal blasting by compressed air hose. In Korea, colon barotrauma caused by compressed air was first reported in 1996, where Suh et al.¹⁰ described in two colorectal trauma patients. Their rectosigmoid region was ruptured due to a jet of compressed air directed to their anus, while they were playing practical jokes with their colleagues in their work place.¹⁰ One patient was treated with primary two layer closure, and the other with primary two layer closure and sigmoid loop colostomy.¹⁰ In our case, fortunately,

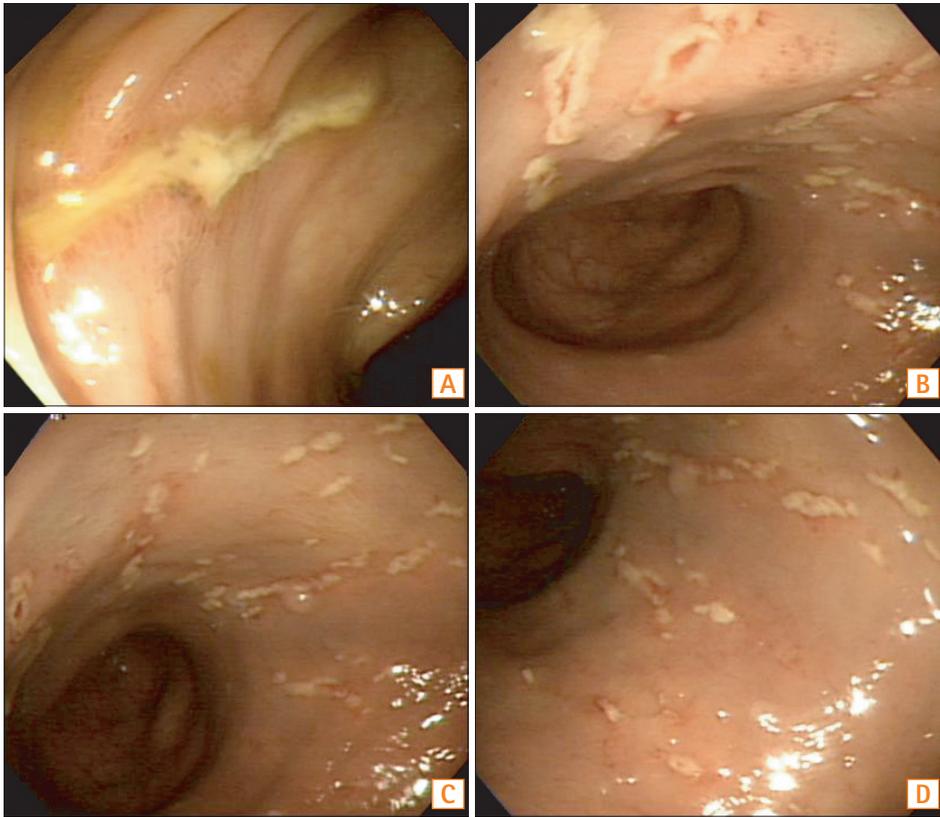


Fig. 2. Sigmoidoscopy at admission. Deep linear ulcers were shown in sigmoid colon (A), and multiple shallow linear ulcers in rectum (B-D).

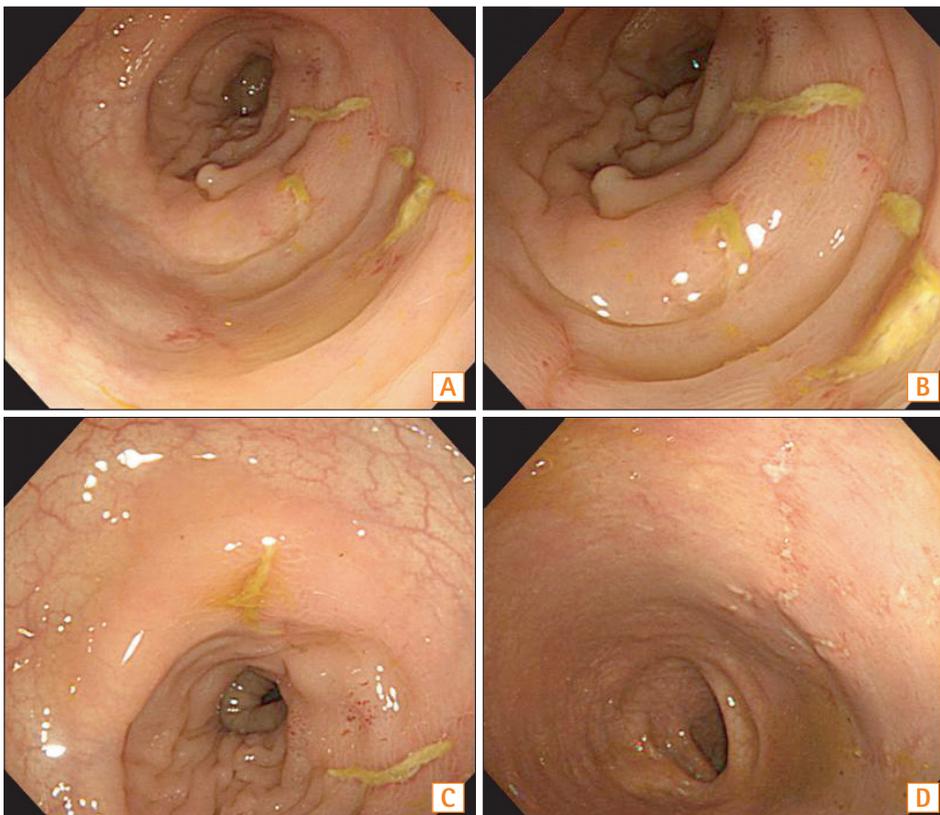


Fig. 3. Follow-up sigmoidoscopy showed improved healing deep ulcers in sigmoid colon (A-C), and rectum (D).

compressed air only caused linear ulcers at the recto-sigmoid colon without perforation. Unlike air insufflations during colonoscopy procedure, misuse of compressed air may lead mainly to recto-sigmoid colon perforation.^{3,10,11} The most affected site of perforation by compressed air does not follow the law of Laplace. In case of non-iatrogenic colon barotrauma, the recto-sigmoid junction in the colon is the vulnerable site due to easily increasing of the intramural pressure. Burt¹⁴ showed that the average pressure necessary to rupture the full thickness of bowel considering different layers of human gastrointestinal tract was 0.29 kg/cm². The order of resistant strength to intraluminal pressure were rectum, sigmoid colon, ileum, esophagus, jejunum, transverse colon, cecum and stomach in order.¹⁴ Not only actual intraluminal pressure, but the velocity of airflow is also important in the occurrence of bowel injury.¹⁰ The sudden high velocity insufflation of air induces extreme shear force at the point of maximal fixation. The recto-sigmoid junction has bilateral fixation, which limits its mobility; thus, compressed air insufflation with high velocity can cause recto-sigmoid colon barotrauma.³ The diagnosis is not difficult if the patient has a history of abdominal pain and distension after exposure to the compressed air. However, patients with acute abdominal pain of unknown origin should be checked for trauma history and occupational history, such as construction, industrial worker and cleaner's staff, using compressed air. Intraperitoneal free air on a simple abdomen or abdominopelvic computed tomography confirms the colon perforation. In our case, no free air on simple x-ray and mucosal injury on sigmoidoscopy confirmed the colonic barotrauma without perforation. However, possibility of delayed colon perforation should be considered. Necessary management depends on the severity of barotraumata. In case of colon perforation, surgical procedure should be considered and conservative treatment can be given in colonic mucosal ulcers. The prognosis has generally been favorable in recent years.¹⁰ Our patient was managed with conservative treatments and recovered without any further complications.

In summary, occurrence of colon barotrauma can be caused by industrial compressed air and the recto-sigmoid colon is most likely injured. Patients with acute abdominal pain of unknown origin should be checked for trauma history and occupational history using compressed air. Most cases of colon barotrauma in compressed air reported rectosigmoid colon perforation, but our case reported multiple linear mucosal ulcers at the site of rectosigmoid colon.

REFERENCES

1. McDonnell WM, Loura F, Pointon MJ, Greenson JK. Cat scratch colon. *Endoscopy* 2007;39:459-461.
2. Baudet JS, Diaz-Bethencourt D, Arguiñarena X, Soler M, Morales S, Avilés J. Cat scratch colon is caused by barotrauma secondary to insufflation during colonoscopy. *Endoscopy* 2008;40:878; author reply 878-879.
3. Coffey JC, Winter DC, Sookhai S, Cusack SP, Kirwan WO. Non-iatrogenic perforation of the colon due to acute barotrauma. *Int J Colorectal Dis* 2007;22:561-562.
4. Anderson ML, Pasha TM, Leighton JA. Endoscopic perforation of the colon: lessons from a 10-year study. *Am J Gastroenterol* 2000;95:3418-3422.
5. Orsoni P, Berdah S, Verrier C, et al. Colonic perforation due to colonoscopy: a retrospective study of 48 cases. *Endoscopy* 1997; 29:160-164.
6. Jentschura D, Raute M, Winter J, Henkel T, Kraus M, Manegold BC. Complications in endoscopy of the lower gastrointestinal tract. Therapy and prognosis. *Surg Endosc* 1994;8:672-676.
7. Lippert H, Falkenberg B. Treatment strategy in iatrogenic perforation of the large intestine. *Kongressbd Dtsch Ges Chir Kongr* 2001;118:301-306.
8. Marwah S, Gupta R, Singh I, Marwah N. Compressed air injury of the colon--delayed presentation. *Indian J Gastroenterol* 2002;21:206-207.
9. Woltjen JA. A retrospective analysis of cecal barotrauma caused by colonoscope air flow and pressure. *Gastrointest Endosc* 2005; 61:37-45.
10. Suh HH, Kim YJ, Kim SK. Colorectal injury by compressed air--a report of 2 cases. *J Korean Med Sci* 1996;11:179-182.
11. Ikapischke M, Tepel J, Pai M, Schulz T. Sigmoid perforation by compressed carbon dioxide. *Scand J Gastroenterol* 2005;40:356-359.
12. Cruz-Correa M, Milligan F, Giardiello FM, et al. Collagenous colitis with mucosal tears on endoscopic insufflation: a unique presentation. *Gut* 2002;51:600.
13. Zunzunegui RG, Werner AM, Gamblin TC, Stephens JL, Ashley DW. Colorectal blowout from compressed air: case report. *J Trauma* 2002;52:793-795.
14. Burt AV. Pneumatic rupture of the intestinal canal with experimental data showing the mechanism of perforation and the pressure required. *Arch Surg* 1931;22:875-902.