

Colorectal Injury by Compressed Air — A Report of 2 Cases —

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We report two colorectal trauma patients whose 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 place of work. It was difficult to diagnose in one patient due to vague symptoms and signs and due to being stunned by a stroke of the compressed air. Both patients suffered from abdominal pain and distension, tension pneumoperitoneum and mild respiratory alkalosis. One patient was treated with primary two layer closure, and the other with primary two layer closure and sigmoid loop colostomy. Anorectal manometry and transanal ultrasonography, checked 4 weeks after surgery, revealed normal anorectal function and anatomy. The postoperative courses were favorable without any wound infection or intraabdominal sepsis.

Key Words : *Colorectal Trauma, Compressed Air, Pneumoperitoneum*

INTRODUCTION

Compressed air has varied range of uses as a source of power for various tools and for cleaning machines and fabrics. Recently, many kinds of iatrogenic and accidental colon injuries were reported such as intraluminal colonoscopic pneumatic injury, barium enema perforation and foreign body perforation (Thomson et al., 1994). But colorectal injury by compressed air is not frequent in spite of the increased and widespread use of compressed air in modern life. After the first report of a pneumatic rupture of the colon (Stone, 1904), a number of cases have been described in the literature (Brown and Dwinelle, 1942; Comline, 1952). Raina and Machiedo

collected and reviewed 92 cases of colon injury from compressed air and added one case of their own (Raina and Machiedo, 1980). No additional case after that report was found in the literature and this is the first report in Korea to our knowledge. Here we report two colorectal trauma patients who had a compressed air injury to their anus while playing practical jokes with their colleagues.

CASE REPORT

Case 1

A 58-year-old female industrial worker was brought to the emergency room with an injury caused by compressed air directed to the anus. Her job was cleaning manufactured goods using compressed air. When she was leaning on the worktable for relaxation during working hours, one of her colleagues triggered the compressed air nozzle against her anus (15cm distant from the anus, 2.5 kg/cm² pressured, less than 1 second in duration) as a practical joke without

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malice. She had severe right lower abdominal pain progressing to the right flank, shoulder, chest and whole abdomen, and had abdominal distension and chest tightness. The patient visited a local emergency room in Damyang, Chollanamdo, because of the increasing severity of the abdominal pain and distension. On physical examination, the abdomen was markedly distended but abdominal tenderness or rebound tenderness was not so remarkable. She had no nausea, vomiting or desire to defecate. She was so stunned and disoriented that there was difficulty in communicating between physician and patient.

Past history showed that she had had several attacks of hysterical conversion of neurosis. The patient was treated under the impression of psychosomatic disease or gastroenteritis. As she showed no improvement with conservative treatment and the abdominal pain and distension were aggravated, the patient was transferred to the emergency room of Chonnam University Hospital for further evaluation. On arrival, her blood pressure was 140/100 mmHg, pulse 72/minute, temperature 36.2°C and respiratory rate 20/minute. Physical examination revealed

marked distension of abdomen and diffuse mild to moderate tenderness. A digital rectal examination revealed scanty rectal bleeding. Roentgenograms of the chest and abdomen showed large amounts of free air in the peritoneal cavity (Fig. 1.). Hematologic examination revealed WBC 12,000/mm³, hemoglobin 12.4 g/dL. The arterial blood gas analysis disclosed a mild respiratory alkalosis (pH 7.50, base excess 5.9 mmol/L). Upon opening the abdomen, about 8 hours after the injury, about 100mL of serosanguinous odorless peritoneal fluid and scanty blood clots were noted. There was no fecal soiling. About 1cm sized longitudinal free perforation and 5cm X 2cm sized seromuscular tearing around the free perforation was noted in the anterior surface of proximal rectum about 5cm proximal to the peritoneal reflection. There was no other injury in the rectum, colon, small intestine or other intraperitoneal organs. The wound was closed by a primary two-layer closure after debridement of devitalized tissue without leaving a drain.

Anorectal manometry and transanal ultrasonography, checked 4 weeks after surgery, revealed normal anorectal function and anatomy. The patient was

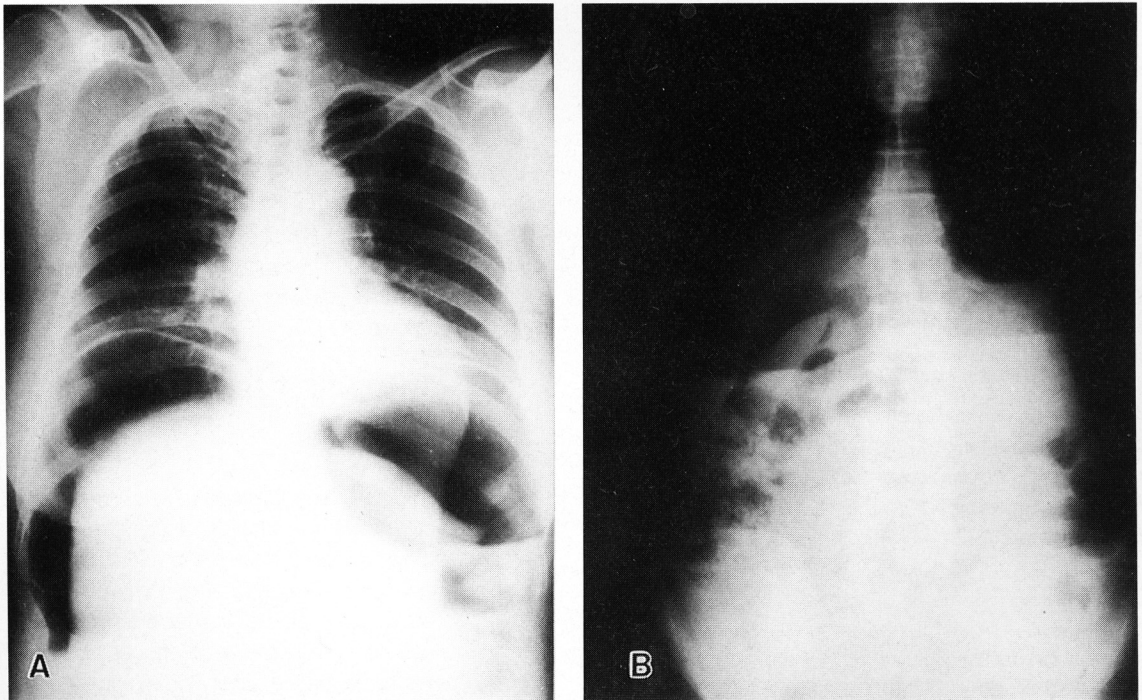


Fig. 1. Simple roentgenograms of the chest (A) and abdomen (B), showing extremely large amounts of intraperitoneal free air.

discharged on the eighth postoperative day without any sign of wound infection or intraabdominal sepsis.

Case 2

A 55-year-old ashman was brought to the emergency room with compressed air injury directed to the anus. When the patient was cleaning his clothes using compressed air before lunch, one of his colleagues turned on the compressed air against his anus while he was fully dressed (50cm distant from anus, 3.0 kg/cm² pressured, less than 1 second in duration). Just at that time, he felt a thundering abdominal pain and severe abdominal distension. He had the desire to defecate, and he found fresh red blood in the stool during defecation. The patient visited a local emergency room in Yeosu, Chollanam-do, due to increasing severity of his abdominal pain and abdominal distension. He had no nausea or vomiting. On examination, the abdomen revealed marked distension, tympanic sound and diffuse tenderness. The rectal examination revealed no abnormal finding except fresh-red colored blood. Roentgenograms of the chest and abdomen showed large amounts of free air in the peritoneal cavity. The patient was diagnosed as having peritonitis due to visceral perforation and was transferred to the Department of Surgery, Chonnam University Hospital for emergency surgery. His blood pressure was 150/90 mmHg, pulse 86/minute, temperature 36.3°C, and respiratory rate 26/minute. Hematologic examination revealed WBC 13600/mm³, hemoglobin 14.7 g/dL. The arterial blood gas analysis was mild respiratory alkalosis (pH 7.498, base excess 5.8 mmol/L). On laparotomy, about 9 hours after the injury, about 100 mL of cloudy stool odoured fluid was found. There were small amount of fecal materials and blood clots in the pelvic peritoneal cavity. A 4cm sized longitudinal all-layered tearing was noted on the antimesenteric border of distal sigmoid colon extending to the rectosigmoid junction. There was no other injury in the rectum, colon, small intestine and other intraperitoneal organs. The wound was managed by a primary two layer closure and proximal sigmoid loop colostomy.

Anorectal manometry and transanal ultrasonography, checked 4 weeks after surgery, revealed normal anorectal sphincter function and anatomy. The patient's postoperative course was favorable without any wound infection or intraabdominal sepsis. He underwent closure of colostomy a month after laparotomy.

DISCUSSION

Compressed air has been used in industry and daily living for variety of purposes. As industry and civilization develop, the uses of compressed air are increasing too. But ignorant and improper use of compressed air equipment may lead to disastrous events. Colorectal injury due to compressed air is generally an industrial injury and mostly occurs as a result of a prank or as one is dusting off a person (Waugh and Leonard, 1951; Weckesser and Putman, 1962; Zechel, 1967).

Andrews, using compressed air to distend the intestine of oxen and dogs, has shown that the normal intestine will be ruptured by a pressure of 0.49 to 0.88 kg/cm² (Andrews, 1911). Burt showed that the average pressure necessary to rupture the full thickness of bowel from different level of human gastrointestinal tract was 0.29 kg/cm² (Burt, 1931). In the order of the greatest resistance to intraluminal pressure were the rectum, sigmoid colon, ileum, esophagus, jejunum, transverse colon, cecum and stomach. When compressed air is introduced into the gastrointestinal tract, the bowel will tear primarily the two outer layers, serosa and muscularis, and when the pressure is sufficient, mucosa will also tear resulting in full thickness perforation. The reported sites of perforation with compressed air are varied. The vast majority are in the rectosigmoid region. The minor is the ascending colon, hepatic flexure, splenic flexure and transverse colon. Injury to the small intestine by compressed air has not been reported. There are two reports of delayed full thickness perforation of the colon (Germer and Feuchtwagner, 1975; Raina and Machiedo, 1980). Between the two delayed perforations of the colon, one had no distinct point of perforation (Germer and Feuchtwagner, 1975). Our two patients had the typical site of perforation, rectosigmoid. Not only actual intraluminal pressure but the rapidity of air is important to the occurrence of the bowel injury. According to the explanation by Andrews, air at 3.5 to 8.8 kg/cm² forms a column which acts as a solid body forcing open the anal sphincter. The anatomical configuration of the buttock and perineum, like a funnel, do facilitate the concentration of air on the anal orifice. Clothes did not alter the effect of compressed air. As the anal canal and distal rectum are well supported by outside structure, the anterior wall of the rectosigmoid region is the first part of the colon struck by a column of air. This may

be an explanation for the most common site of colon rupture by compressed air in spite of the rectosigmoid region is the most resistant site of gastrointestinal tract. The diagnosis is not difficult if the patient has a history of abdominal pain and distension after exposure to compressed air. A tense, distended tympanic abdomen and respiratory distress are characteristics. In doubtful cases, intraperitoneal free air on a simple roentgenogram will confirm the diagnosis without difficulty.

When a large amount of gas is introduced into the peritoneal cavity, respiratory distress occurs due to increased intraabdominal pressure. In order to overcome the increased intraabdominal pressure, hyperventilation developed resulting in mild to moderate respiratory alkalosis. In order to eliminate intraperitoneal free air, a Veress needle or a simple large bore needle can be used. This seems to be a simple, economic, convenient, time saving, and useful method for relieving the tension pneumoperitoneum and respiratory alkalosis if the procedure is carried out carefully in order not to injure the intraperitoneal organ. The management principles of patients with acute colon injury apply to those patients with colorectal injuries by compressed air. The prognosis has generally been favorable in recent years, although early collective reviews before 1950 reported grave con-

sequences. As a conclusion, earliest possible exploration is mandatory.

REFERENCES

- Andrews EW. *Pneumatic rupture of the intestine, or new type of industrial accident.* *Surg Gynecol Obstet* 1911; 12: 63-4.
- Brown RK, Dwinelle JH. *Rupture of the colon by compressed air.* *Ann Surg* 1942; 115: 13-20.
- Burt CAV. *Pneumatic rupture of the intestinal canal.* *Arch Surg* 1931; 22: 875-902.
- Comline JC. *Pneumatic rupture of the colon.* *Br Med J* 1952; 1: 745-6.
- Gemer M, Feuchtwagner MM. *Pneumatic rupture of the colon.* *JAMA* 1975; 233: 355.
- Raina S, Machiedo GW. *Multiple perforations of colon after compressed air injury.* *Arch Surg* 1980; 115: 660-1.
- Stone GW. *Rupture of the bowel caused by compressed air.* *Lancet* 1904; 2: 216.
- Thomson SR, Fraser M, Stupp C, Baker LW. *Iatrogenic and accidental colon injuries-what to do?* *Dis Colon Rectum* 1994; 37: 496-502.
- Waugh RL, Leonard FC. *Rupture of the colon due to compressed air with particular reference to the character of the lesion.* *Mil Surg* 1951; 108: 294-301.
- Weckesser EC, Putnam TC. *Perforating injuries of the rectum and sigmoid colon.* *J Trauma* 1962; 2: 474-8.
- Zechel GI. *Pneumatic rupture of the colon as an industrial injury.* *Ind Med Surg* 1967; 36: 663-7.