

CASE REPORT

A CASE OF TENSION PNEUMOPERITONEUM DUE TO COLONIC BAROTRAUMA WITH COMPRESSED AIR

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CASE REPORT: A 23 year old male working in a biscuit factory was brought to emergency department by the coworkers at 4PM with pain abdomen and distension and bleeding per rectum. On further questioning the patient confessed that his co-workers had held him firmly and directed the stream of air from a compressed-air pipeline towards his anal region in the morning.

On examination, he was alerting conscious and oriented and tachypneic. The respiratory rate was 30/min, SPO₂- 80%, Pulse was 120/min and B.P. 120/80 mm Hg. On palpation, Abdomen was grossly distended (Fig. 1), tense with generalized tenderness and rigidity of abdominal wall. The percussion note was tympanitic and liver dullness obliterated. No free fluid was detected. Bowel sounds were absent. Examination of the perineum did not show any external injury. Rectal examination showed faeces mixed with fresh blood but did not reveal any laceration or perforation in the anal canal or rectum. Straight X-ray abdomen in erect position showed extensive pneumoperitoneum (Fig. 2)

Abdominal decompression was made in view of tension pneumoperitoneum, low saturation and tachypnea. A 20G needle was inserted in the right upper quadrant just lateral to rectus abdominis muscle following which the pneumoperitoneum reduced with sudden improvement in the oxygen saturation (98%) and tachypnea got reduced. A clinical diagnosis of pneumatic rupture of hollow viscera, probably colon was made.

An emergency exploratory laparotomy under general anesthesia through a mid-midline incision was carried out. Intraoperative, a single perforation of 3x2cms in the ant mesenteric border of transverse colon 15cms away from the hepatic flexure (Fig. 3) with fecal spillage into the peritoneal cavity was noted. There was also sero muscular tear along the entire length of the transverse colon (Fig. 4) and extensive contusions around the entire colon.

Thorough visceral inspection of abdomen did not reveal any other visceral injury. The perforation was closed in two layers using 2-0 vicryl and 2-0 silk and the areas of serosal tears were sutured using 2-0 silk. After a thorough peritoneal lavage, a de functioning transverse loop colostomy was placed in the right upper quadrant and the wound was closed in layers with an abdominal drain. Postoperative recovery was quite uneventful and colostomy reversal is planned later.

DISCUSSION: Compressed air injuries should be taken seriously because the high pressure of compressed air directed to rectum can overcome barriers as clothes and anal sphincter delivering enormous amount of pressurized air into the rectum, resulting in rectal and colonic perforation and development of tension pneumoperitoneum.

Pneumatic colonic injury has been reported sporadically since the first report by Stone in 1904⁽²⁾ and reviewed in detail by Brown and Dwinelle ⁽³⁾ in 1942. An experimental study on the relationship between intestinal rupture and air pressure was performed by Burt ⁽⁴⁾ in 1931.

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According to this study of the four layers of the intestinal wall, the mucosa is the strongest layer and when pressure increases progressively the muscle and serosa tear first, then the mucosa. A pressure of 3.99 psi tears the muscle and serosal layer of intestine and 4.07psi can rupture the whole intestinal wall leading to perforation.

The usual pressure of air coming out of an air compressor is 50-150 psi which is 10-30 times greater than the pressure needed for intestinal perforation. According to Laplace's law, wall tension is directly proportional to the intramural pressure and colon diameter. Therefore colonoscopy barotrauma injuries occurring most commonly in the cecum as a result of its largest diameter.⁽⁵⁾

Kozarek and Sanowski showed that the cecum perforation occur at lower pressures (mean, 120 mm Hg) compared to the sigmoid colon (mean, 202 mm Hg) on the cadaver by colonoscopy.⁽⁶⁾ Reported colon injuries caused by the air compressor in the literature are in different regions but mostly in the recto sigmoid junction.^(7,8) This situation is contrary to the law of Laplace.

This is because the recto sigmoid junction sensitizes with the high air pressure and so perforation in this area will reduce the air passing through proximal of the colon or decrease in the pressure. The rectosigmoid junction is the first part of colon that cannot stand higher pressure while anus, distal rectum are supported with pelvic structures. Intraluminal pressure is not the only reason of intestinal injury, but a sudden and high flow velocity of air at the same time is important.^(7,8) In our case full-thickness perforation of transverse colon was found.

In the case of delay in diagnosis of a colonic perforation caused by barotrauma colostomy is recommended. However, in young patients without any signs of peritonitis, primary repair or resection anastomosis may be preferred if no delay in diagnosis.⁽⁸⁾ In our case colostomy was done proximal to perforation in the right upper quadrant in view of fecal peritonitis and delayed presentation of the patient to hospital.

Some patients may withhold information, trying to protect the guilty party or due to embarrassment. In such cases, the general symptoms are abdominal pain, abdominal distension, rectorrhagia, tachypnea, and tachycardia. Tension pneumoperitoneum is a characteristic presentation.^(1,9,10) Death can occur due to acute air embolism, acute fat embolism, acute respiratory insufficiency due to enhanced intra-abdominal pressure and chest compression, acute heart failure due to insufficient preload and peritoneal shock.⁽⁹⁾

Percutaneous decompression of the tension pneumoperitoneum can be accomplished by inserting a cannula or a Veress needle into the abdomen.⁽¹¹⁾ 16-gauge angiocath was inserted per cutaneously in the right upper quadrant of the abdomen for decompression with alleviation of respiratory and hemodynamic problems.⁽¹²⁾ The overall mortality of pneumatic rupture of the bowel was 65%. If the acute shock was not immediately fatal, the survival depends on further treatment. Surgery reduced mortality to 42%⁽¹³⁾.

CONCLUSION: Colonic injuries occur with a high pressure air compressor are reported especially in the industrial zones. If a patient who works in this segment presents with abdominal distension and pain, perforation of colon by barotrauma should be considered in the differential diagnosis of peritonitis. Though it has high morbidity and mortality rates, surgery reduces the mortality, so decision for surgery must be made as quickly as possible time is the essential factor.

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Fig. 1: showing abdominal distension of our patient at the time of admission



Fig. 2: X-ray erect abdomen picture of our patient showing extensive pneumoperitoneum

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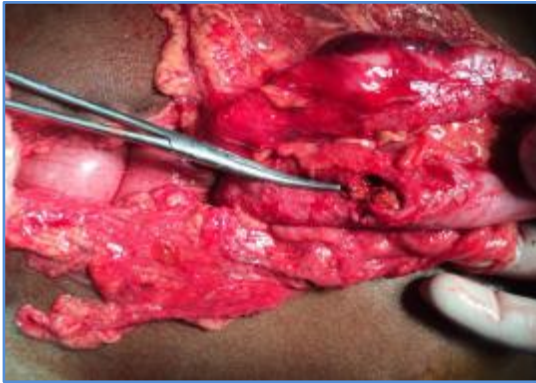


Fig. 3: intra operative picture showing perforation in the transverse colon with fecal contamination



Fig. 4: intra operative picture showing extensive splaying of the sero muscular layer and contusion in the transverse colon

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