

The rare cases of pneumatic colorectal perforation: A cautionary tale of compressed air misuse

Muthu Kumar, MS, Balavignesh Durai, MS, Vijayshree Shyamsundar, MS, Manish Babu UG, MS, Sanjana Chiramel, MS

Saveetha Institute of Medical and Technical Sciences: SIMATS Deemed University, General Surgery, Saveetha Nagar ,, Thandalam, Chennai -Bengaluru Nh48, Chennai, Tamilnadu 602105, India

ABSTRACT

Barotrauma is a medical condition caused by sudden pressure changes in the body causing damage to multiple parts of the body. However, it is an infrequent occurrence when it comes to Colo-rectal perforation, wherein the trauma occurs due to the insufflation of compressed air through the anus. Several factors influence the outcome of a patient with colonic perforation due to barotrauma such as the severity of the injury, hemodynamic status of the patient, the patient's general health and well-being, the time taken for active medical/ surgical intervention since the injury, aggressive intravenous antibiotics administration to prevent sepsis, post-operative complications like surgical site infection, post-op ileus, anastomotic leak, etc. Overall, the patient's prognosis largely depends on early diagnosis, effective initial resuscitation, timely surgical intervention, and intensive post-operative care for a favorable outcome. Recently, we came across 2 cases of extensive pneumoperitoneum with Colo-rectal perforation as a result of the forceful insufflation of compressed air through the anus. Prompt medical intervention was necessary to prevent any further complications and they underwent surgical repair of the colorectal perforation.

INTRODUCTION

High-pressure air has become prevalent in industrial settings, with blowgun dust cleaners as common pneumatic tools.¹ It is crucial to be mindful of the appropriate use of cleaning agents in factories. Failure to do so can have devastating consequences, putting the lives of employees at risk due to pneumatics. These cleaners produce air pressure ten times higher than the resting anal pressure in adults (0.84 kg/cm²).² Compressed air can easily penetrate clothing and cause rapid and forceful inflation of the rectum and colon, which can lead to bursting of the bowel wall due to its high bursting pressure³. The insufflation of compressed air into the large intestine can result in a perforation of the bowel, which presents with a sudden onset of abdominal pain, distension, and respiratory distress due to tension pneumoperitoneum.⁴ Unfortunately, due to its rarity, workers may not be adequately informed about the potential dangers associated with the unintentional or intentional use of compressed air near the anal canal, leading to serious colorectal injuries^{5,6} which can be fatal. In this context, we present a case of severe colorectal laceration resulting from compressed air exposure, culminating in pneumoperitoneum, peritonitis, shock, and sepsis.

CASE REPORT

Case 1

An 18-year-old Bihari man residing in Chennai, a daily wage factory worker by occupation was brought to the ER with complaints of severe abdominal pain and abdominal distension for the last 4 hours. He gave an alleged history of trauma caused by forceful insufflation of a compressed air blower by inserting the blower nozzle into the anal canal. On examination, he was found to be tachypneic with a Glasgow coma scale of 13/15. He was hemodynamically unstable with a BP of 80/50mmhg, a pulse rate of 102 beats per minute, and a room air saturation of 88%. Systemic examination revealed a tense distended abdomen; palpable subcutaneous crepitus over the abdomen, chest, and neck; absent bowel sounds; and decreased air entry to the right side of the chest.

The patient was initially resuscitated by securing two large IV bore cannulas and administered intravenous crystalloids, intravenous broad-spectrum antibiotics, oxygen supplementation by facemask, and nasogastric decompression with continuous monitoring of vital parameters. Abdominal radiography and computed tomography confirmed the presence of gross pneumoperitoneum, which was suggestive of colonic perforation. The expected management in this case comprised emergency surgical intervention involving exploratory laparotomy and repair or resection of the bowel followed by intensive post-operative care and monitoring. In this patient, a flank drain was used to decompress the abdominal distension. Emergency laparotomy was performed, and the peritoneal cavity was filled with colonic content and blood. Large irregular perforations, serosal tears, and gangrene were found in the transverse colon, cecum, ascending colon, and proximal half of the sigmoid colon. After thorough peritoneal lavage, the large intestine was mobilized while safeguarding the bilateral ureter and gonadal vessels, subtotal colectomy was performed, and an end ileostomy was performed. The patient required intensive care support including vasopressors and mechanical ventilation. However, the patient's clinical course was complicated by shock and sepsis, culminating in cardiac arrest refractory to adequate resuscitation. Despite aggressive measures, the patient succumbed to the sequelae of a traumatic incident.

Case 2

A 22-year-old man presented to the ER with symptoms of acute onset of breathlessness and abdominal discomfort,

This article was accepted: 12 August 2024

Corresponding Author: Muthu Kumar

Email: gmkmuran99@gmail.com



Fig. 1: Chest xray showing air under diaphragm indicating and hollow viscus perforation

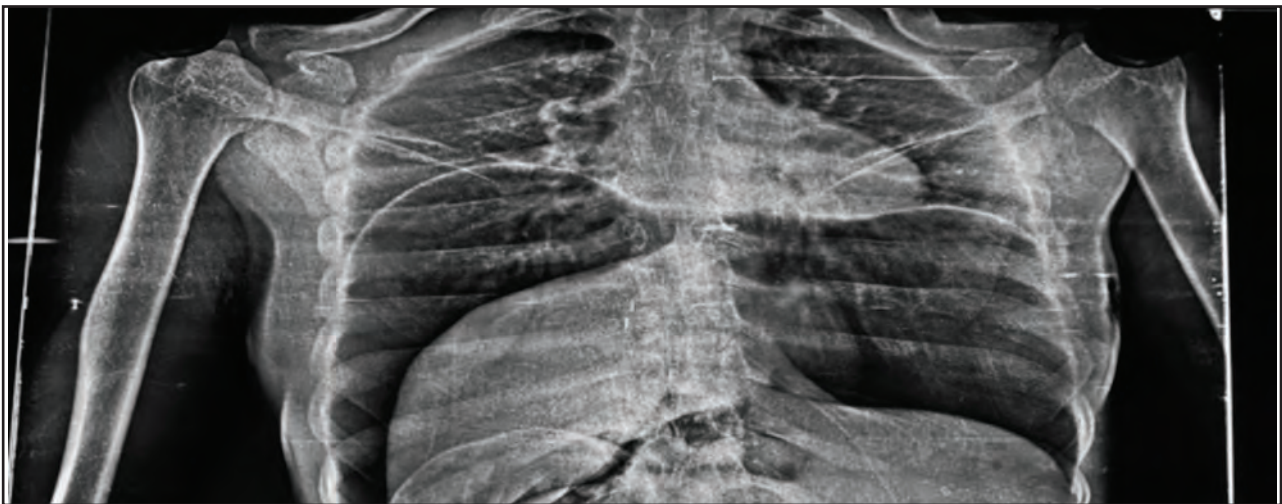


Fig. 1: Chest xray showing air under diaphragm indicating and extensive hollow viscus perforation

including pain, abdominal distension, and vomiting for 3 hours. The symptoms started after an incident at his workplace, where his colleagues allegedly insufflated compressed air forcefully into his rectum by using a blow gun. On examination, he had a Glasgow coma scale score of 13/15, bilateral reactive pupils, hemodynamic instability with vitals of 90/50 mmHg, pulse rate of 98 beats per minute, and room air saturation of 84%.

Initial resuscitative measures were performed, and relevant investigations, including abdominal radiography, were performed, which confirmed the presence of pneumoperitoneum. Based on the patient's history, clinical examination, and investigations, a diagnosis of barotrauma causing perforation of the large intestine was made and after aggressive resuscitation, and the patient was promptly taken up for an emergency laparotomy. Intraoperatively, multiple tears were identified in the sigmoid colon along the mesenteric border along with a serosal tear along the tinea coli in the transverse colon. Consequently, resection of the

sigmoid colon, closure of the rectal stump, and creation of an end-descending colostomy were performed. The remainder of the large and small bowel and other viscera were normal. The patient recovered following a challenging postoperative course in the intensive care unit. Subsequently, colostomy closure was performed after six weeks.

DISCUSSION

The most common causes of colon perforation are tumors, diverticulitis, abscess, colitis, foreign body, obstruction, volvulus, iatrogenic, blunt or penetrating abdominal trauma, and colonoscopy-induced barotrauma, with a prevalence of 0.1% to 0.5%.^{7,8,9} However, injuries caused by high-pressure air compressors are infrequent and mostly observed among industrial workers.

The cecum is more prone to distention injury due to its larger diameter, as per Laplace's law.¹⁰ While colonoscopy studies suggest that intraluminal pressures greater than 0.109

kg/cm² (1.547 psi/80 mmHg) are needed for perforation, injuries resulting from high-pressure barotrauma typically occur elsewhere in the colon, notably in the rectosigmoid junction. The anatomical structure of the buttocks and perineum creates an easy passage for compressed air to enter the anal orifice, making the rectosigmoid junction more susceptible to pressure-related barotrauma.⁹

Experimental studies have shown that the human colon can rupture at pressures as low as 120-200 mmHg, with seromuscular rupture occurring even at lower levels. The insult's suddenness causes uneven air distribution and focal perforation. Industrial air compressors, classified by pressure delivery, predominantly employ low- to medium-pressure ranges; however, their use poses significant risks. The resting pressure of the anal sphincter, estimated at 40-80 mmHg, can be easily overcome by forceful airflow from the compressors, resulting in rapid colon inflation.^{7,8}

The catastrophic consequences of this phenomenon are highlighted by the fact that a mere 1–2 seconds of pressurized air delivery can cause substantial damage, necessitating urgent management strategies. Rectal injuries beyond the rectosigmoid junction due to pelvic support are rare. The severity of high-pressure barotrauma is determined by several factors, including air pressure, flow velocity, anal resting pressure, and source-to-anal distance.³ Forceful entry of pressurized air can cause significant damage within seconds, necessitating prompt intervention to prevent serious complications. In this condition, there is a significant amount of pressure in the abdominal area, which can lead to fatal consequences if not promptly treated.

In cases of urgent management, it may be necessary to relieve tension pneumoperitoneum through percutaneous decompression, which involves converting it into open pneumoperitoneum. Depending on the severity of the clinical and radiological signs, the management of pneumatic colon The management of injury can vary from a wait-and-see approach to a formal laparotomy. Careful observation following surgery is crucial because of the potentially delayed presentation of a full-thickness colon perforation.

Management protocols range from expectant observation to surgical intervention with clinical and radiological signs guiding the approach. Prompt recognition and intervention are imperative because the development of tension pneumoperitoneum can lead to fatal hemodynamic and respiratory compromise. Timely conversion of tension

pneumoperitoneum to open pneumoperitoneum is crucial, typically achieved through urgent percutaneous decompression methods. A comprehensive understanding of the mechanisms and implications of high-pressure barotrauma is essential for effective management and prevention of potentially life-threatening complications.

CONCLUSION

In conclusion, a detailed comparison between the two cases highlights the variability in clinical outcomes observed in traumatic colorectal injuries, which is based on the severity of the injury, the time taken to seek medical advice, detailed and reliable history, aggressive resuscitation, and emergency surgical treatment, which can lead to favorable outcomes, as in case 2.

DECLARATION

No conflict of interest.

INFORMED CONSENT

Consent for publication of this case report was obtained during writing and after informing the patient.

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