Case Report

DOI: 10.7860/JCDR/2024/70506.19498

Surgery Section

Large Bowel Perforation Resulting from Barotrauma via Transanal Route by Compressed Air Jet: A Case Report

KEVAL R DHONE[1], PRAVIN W NIKHADE[2], AVINASH T RINAIT[3]

ABSTRACT

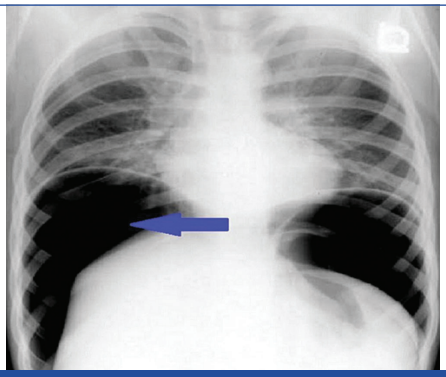
Barotrauma-induced bowel perforation due to high-pressure air jets represents an exceptionally rare clinical entity. The authors present a case involving a 22-year-old male patient, who suffered multiple perforations of the large bowel following accidental exposure to a compressed air gun in an industrial environment. This occurrence, provoked by a co-worker's irresponsible use of the device, emphasises the need for heightened awareness and stricter safety protocols in similar settings. Upon experiencing severe abdominal pain, the patient was promptly admitted to the hospital where an abdominal x-ray demonstrated significant pneumoperitoneum. Emergency exploratory laparotomy confirmed extensive damage, including multiple perforations and serosal tears along the descending and sigmoid colon. Surgical management included primary repair of the perforations and the formation of a temporary ileostomy. The successful closure of the ileostomy three months later marks a crucial phase in the patient's recovery. This case highlights the critical clinical implications of barotrauma in non-traditional settings and underscores the necessity of prompt surgical intervention, which may significantly influence patient outcomes. The novelty of this case lies in the uncommon mechanism and setting of injury, coupled with the extensive nature of the bowel damage, illustrating a rare but serious workplace hazard that necessitates greater preventive measures and awareness.

Keywords: Abdomen, Colon, Industrial, Injury, Laparotomy, Pneumoperitoneum

CASE REPORT

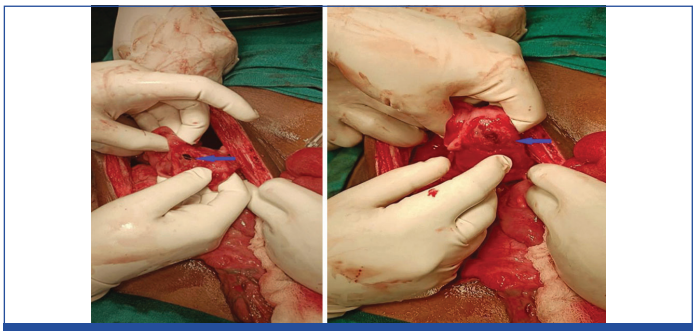
A 22 years old male patient, who developed severe abdominal pain and a sensation of fullness due to accidental exposure to a compressed air gun in an industrial setting immediately following the incident. The incident occurred as the patient was changing clothes, and a co-worker mischievously directed the high-pressure air jet towards the patient's perianal region. The patient resisted, but exposure lasted several minutes before the air gun was dropped. Upon arrival at the hospital, the clinical examination revealed tachycardia with a pulse rate of 110/min, hypotension with a blood pressure of 90/60 mmHg, a respiratory rate of 20/min, and oxygen saturation at 95% on room air.

Abdominal examination was notable for distension and generalised tenderness, indicating acute intra-abdominal pathology. An upright abdominal x-ray was urgently performed, showing gross pneumoperitoneum and free gas, a critical finding suggestive of bowel perforation [Table/Fig-1].



[Table/Fig-1]: X-ray of abdomen standing position. (Blue arrow indicating free gas under diaphragm.)

Given the clinical signs of shock (tachycardia and hypotension) coupled with the X-ray findings there was a compelling indication for emergency surgical intervention. The decision for an emergency laparotomy was primarily driven by the need to explore and manage potential bowel perforations and prevent severe complications such as peritonitis or systemic infection. During the laparotomy, multiple small perforations were identified in the descending and sigmoid colon, each approximately 0.5 cm in diameter, along with extensive serosal tears [Table/Fig-2,3].



[Table/Fig-2]: Intraoperative image, blue arrow showing descending colon perforation.
[Table/Fig-3]: Intraoperative image, blue arrow showing sigmoid perforation. (Images from left to right)

The bowel was minimally contaminated with a mild presence of intraperitoneal fluid, likely due to the early hospital presentation. A thorough washout was performed with copious amounts of saline, followed by suturing of all perforations with Polyglactin (Vicryl) 3-0. A diversion ileostomy was created in the right iliac region to mitigate fecal contamination and promote healing. The patient's post-operative recovery was uneventful, and he was discharged on the seventh day on a full diet. Sutures were removed on day 12 [Table/Fig-4].

Follow-up after one month showed a fully functioning stoma, with the patient asymptomatic and nutritionally improving. Three months postoperatively, a stoma reversal was successfully performed. Subsequent regular follow-ups confirmed that the patient had fully recovered and was living a normal, healthy life. This case highlights the necessity of rapid clinical assessment and intervention in traumatic bowel injuries, demonstrating that timely and appropriate surgical management can lead to successful outcomes even in complex cases of bowel perforation.

[Table/Fig-4]: Image showing post-ileostomy reversal scar, blue arrow showing healed scar.

DISCUSSION

Barotrauma-induced bowel perforation is a rare but severe clinical entity predominantly reported in the context of high-pressure air exposure, notably from industrial accidents or misuse of equipment such as compressed air guns [1,2]. While iatrogenic bowel injuries during procedures like colonoscopies are well-documented with a known incidence rate, injuries from air compressors are less frequent and often catastrophic [3]. Research, including experimental studies on animal models, has demonstrated that the intestine can perforate at pressures as low as 0.29 kg/cm^2, indicating the high vulnerability of the bowel to compressed air [4]. Sy ED et al., in their review, described air insufflation leading to a step-ladder pattern obstruction, suggesting that sudden and high-velocity air flows can create significant pressure differentials within the bowel, predisposing it to rupture, especially at the rectosigmoid junction [4]. This area is anatomically predisposed to injury due to its fixed position and lesser ability to disperse the sudden increase in intraluminal pressure [5]. Comparatively, the case presented herein involved multiple perforations in both the descending and sigmoid colon, accompanied by extensive serosal tears, which is a rare and severe manifestation of barotrauma.

The literature reports cases where sigmoid colon perforations are most common; however, instances like the current case with multiple perforations indicate a higher severity and an unusually traumatic exposure. For example, a case reported by the American Journal of Forensic Medicine and Pathology detailed a single perforation resulting from direct compressed air injection, which contrasts with the presently discussed case's multiple perforations that indicate a longer or more intense exposure [6,7]. This case highlights the efficacy of using radiological imaging, such as x-rays showing pneumo-peritoneum, to quickly suspect and confirm the diagnosis, aligning with findings in the literature that emphasise imaging's role in identifying bowel dilation and air patterns indicative of perforation. Immediate surgical intervention remains the cornerstone of treatment for such injuries to prevent complications like fecal peritonitis or septic shock. This case supports existing literature advocating for emergent exploratory laparotomy, where the injury's extent can be assessed and managed promptly to optimise outcomes [8].

The decision to perform primary repair versus creating a diversion (e.g., ileostomy) depends on the contamination level, the perforation's location, and the patient's overall condition [8]. In this case, the choice of diversion ileostomy following primary repair of perforations reflects prudent surgical judgment to minimise the risk of infection and facilitate bowel recovery, aligning with recommended practices in cases of severe contamination or extensive injury. Regular follow-up and careful monitoring are crucial, as evidenced by the successful stoma reversal and the patient's recovery in the current case. This aligns with literature emphasising the need for ongoing care to ensure nutritional support and monitor for potential complications post-recovery [9]. This case underscores the need for enhanced safety protocols and educational programs in industrial settings to prevent such injuries. Further research could also explore more about the specific conditions under which barotrauma to the bowel is most likely to occur and investigate the long-term outcomes of different management strategies to refine treatment protocols further.

CONCLUSION(S)

Barotrauma-induced bowel perforation by high-pressure air jets represents a rare yet potentially life-threatening phenomenon. Prompt recognition, coupled with decisive surgical intervention, is imperative to optimise patient outcomes and mitigate associated morbidity. Heightened awareness and adherence to stringent safety measures are essential in preventing such occupational mishaps.

REFERENCES

[1] Yin WB, Hu JL, Gao Y, Zhang XX, Zhang MS, Liu GW, et al. Rupture of sigmoid colon caused by compressed air. World J Gastroenterol. 2016;22(10):3062-65. Doi: 10.3748/wjg.v22.i10.3062.

[2] 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;22:561-62. Doi: 10.1007/s00384-005-0752-3.

[3] Park YJ. Rectal perforation by compressed air. Ann Surg Treat Res. 2017;93(1):61-63. Doi: 10.4174/astr.2017.93.1.61.

[4] Sy ED, Chiu YI, Shan YS, Ong RL. Pneumatic colon injury following high pressure blow gun dust cleaner spray to the perineum. Int J Surg Case Rep. 2015;6:218-21. Doi:10.1016/j.ijscr.2014.12.022.

[5] Choi JY, Park SK, Park TW, Koh WJ, Kim HM. Colon barotrauma caused by compressed air. Intest Res. 2013;11(3):213-16.

[6] Kim SY, Kim HS, Park HJ. Adverse events related to colonoscopy: Global trends and future challenges. World J Gastroenterol. 2019;25(2):190-204. Doi: 10.3748/wjg.v25.i2.190.

[7] Bains L, Gupta A, Kori R, Kumar V, Kaur D. Transanal high-pressure barotrauma causing colorectal injuries: A case series. J Med Case Rep. 2019;13:133. Doi: 10.1186/s13256-019-2067-y.

[8] Thatte M, Taralekar SV, Raghuvanshi K. Colonic barotrauma with tension pneumoperitoneum- review of literature and report of a successfully treated case. Int J Sci Res. 2014;3:339-41.

[9] Weber M, Kolbus F, Dressler J, Lessig R. Survived ileocaecal blowout from compressed air. Int J Legal Med. 2011;125(2):283-87. Doi: 10.1007/s00414-010-0445-5.

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of General Surgery, Datta Meghe Medical College, Nagpur, Datta Meghe Institute of Higher Education and Research (DU), Wardha, Maharashtra, India.
2. Associate Professor, Department of General Surgery, Datta Meghe Medical College, Nagpur, Datta Meghe Institute of Higher Education and Research (DU), Wardha, Maharashtra, India.
3. Associate Professor, Department of General Surgery, Datta Meghe Medical College, Nagpur, Datta Meghe Institute of Higher Education and Research (DU), Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Keval R Dhone,
Phase II, Pioneer Woods, Wanadongri, Hingna, Nagpur-441110, Maharashtra, India.
E-mail: kewaldhone@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Mar 05, 2024
- Manual Googling: Apr 19, 2024
- iThenticate Software: May 03, 2024 (3%)

ETYMOLOGY: Author Origin

EMENDATIONS: 5

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Mar 05, 2024**
Date of Peer Review: **Apr 16, 2024**
Date of Acceptance: **May 06, 2024**
Date of Publishing: **Jun 01, 2024**