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## Emergency laparoscopic resection of the anterior rectum due to rectal trauma secondary to compressed air, case report

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## ABSTRACT

In the XIX century, the surgeon faces surgical challenges due to the creation of new technologies. Accidental or compressed air-induced injury to the colon and rectum is rare. We present the case of a 45-year-old patient who consults the emergency department, then a high-pressure rectal pneumatic trauma, with clinical findings of peritonism, managed with a Hartmann-type colostomy, and anterior resection of the rectum using laparoscopy, with findings of rectosigmoid perforation. With this, it can be demonstrated that minimally invasive surgery is a feasible approach in hemodynamically unstable patients without contraindication for pneumoperitoneum.

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## 1. Introduction

The first report of colonic lesion secondary to high-pressure air dates back to 1904 by Dr. Stone, with the death of the patient, later Andrews in 1911 reports the second case of pneumatic rupture of the sigmoid colon after recovery of the affected intestinal loop, finally in 1912 Cotton et al., describe the pneumatic perforation of the ascending colon, with surgical management of temporary colostomy at the site of perforation [1–3].

Rectal barotrauma is a rare surgical emergency in the emergency department, with a high risk of mortality due to its complications. Reports of these events in the literature are related to the improper use and recreational use (jokes) of high-pressure airs., which are currently used in the industrial environment [4,5].

The literature accurately reports 53 cases of rectal and colonic lesions secondary to inappropriate use of industrial airs, including

inappropriate jokes, which were given open surgical management through laparotomy.

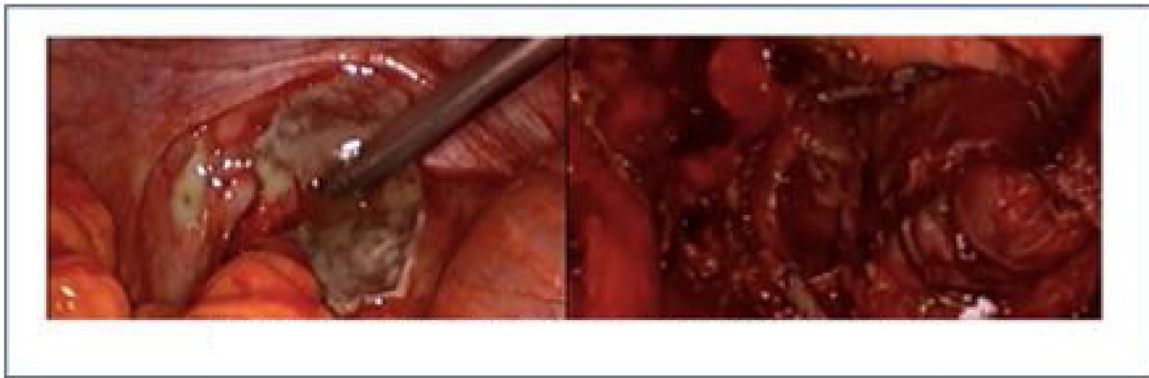
Within the different cases reported, several procedures have been evidenced that include percutaneous decompression of the pneumoperitoneum and surgical approach by laparotomy, among others, in order to control fecaloid peritonitis [6,7]. Given the low incidence of this type of lesions and the surgical challenge they represent, we allow ourselves to present the first case reported in the world of laparoscopic management of a rectal barotrauma in a hemodynamically stable patient, with adequate evolution and high postoperative on the tenth day, the patient currently continues in their postoperative controls for colostomy closure.

## 2. Clinical case

45-year-old male patient, with no previous pathological history, attended the emergency department reporting an accident at his workplace. He says that he was sitting on a compressed air machine, the machine had an accidental decompression, the air pressure directly impacted the rectal canal causing the injury and severe pain. Due to the persistence of pain, 4 h after the accident he goes to the emergency department. It is monitored with a heart rate of 130 beats per minute, temperature of 37.5 °C/99

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**Image 1.** Grade III rectum injury, more than 50% of the commitment.

Link video <https://youtu.be/oulg1Z0t9H4>

°F, blood pressure of 100/70 mmHg, physical examination shows slight respiratory distress with tachypnea, distended abdomen, tympanic percussion and signs of peritonism. The rectal examination was painful and rectal bleeding was identified. Due to the trauma mechanism, ear barotrauma was ruled out. Resuscitation was started with liquids (1000 cc) of ringing solution, analgesia, and the complementary blood test will be requested, responding to this management for what is considered volume-responsive shock shock. The initial blood count detected leukocytosis of 15,000/ml, with a shift to the left. It was not done FAST due to non-availability. Chest x-ray was performed without the presence of lung injury, an abdominal x-ray with the presence of pneumoperitoneum. With suspicion of perforation of hollow, rectal or colonic viscera, urgent surgery is indicated. A laparoscopy was performed where a systematic review of the abdominal cavity was performed. Washes were performed, grade III rectal injury with more than 50% of the involvement and fecal peritonitis was evident (Image 1), so an anterior resection was performed plus a hartman-type terminal colostomy, appendectomy and drainage. Management was performed with antibiotic treatment with ceftriaxone and metronidazole. *Escherichia coli* and *Enterobacter* sp were isolated in free peritoneal fluid cultures, sensitive to antibiotic treatment. Pathological anatomy reported the rectum with focal areas of ischemia. In the postoperative period, a wound infection appeared that evolved favorably and was discharged after 10 days. The patient follows regular check-ups through general surgery and will soon be brought to a colostomy closure and intestinal transit reconstruction.

### 3. Discussion

Colorectal lesions secondary to compressed air are not a frequent pathology. It has been reported sporadically by several authors such as Brown and Dwinelle in 1942 and later by Raina and Machideo in 1980 [8,9]. Currently in the world literature multiple cases of rectal injury due to atypical causes are reported, but few associated with rectal barotrauma by compressed air (Table 1).

In the period from 1993 to 2006, El Ashal and collaborators reported cases in 12 male patients with rectal lesions, in which secondary injuries to falling on a sharp object were reported in 5 patients, introduction of a foreign body into an anal cavity in 2 patients, sexual assault in 2 patients, secondary lesion to colon by enema in one patient and 2 rectal lesions by barotrauma. All patients were taken to open surgery with laparotomy [5,10]. However, in the world literature there are no reported patients undergoing minimally invasive management by laparoscopy, as in our case, which is completely viable in a hemodynamically unstable patient without cardiopulmonary pathologies that contraindicate pneumoperitoneum. Which makes our case the first reported in

the world, of rectal barotrauma by compressed air, managed by laparoscopy.

With the advent of new industrial technologies such as the use of compressed airs, the increase in the incidence of rectal barotrauma cases, especially with improper recreational use (jokes) [11], making this entity evident Traumatic, a great diagnostic and surgical challenge, for surgeons, since it can present complications such as sigmoid colon rupture, fecal peritonitis, traumatic pneumoperitoneum and fistulas, among others [12,13].

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Colonic lesions due to barotrauma such as Mansab et al. and Singh have reported it may be present in situations such as improper use (jokes) or in work situations with objects from the compressed air industry, additionally reporting that most injuries affect the Rectosigmoid junction and in lower prevalence ascending colon and transverse colon. No cases of small bowel involvement have been seen, this given that the anatomical shape of the rectal canal is funnel-shaped, so it allows for uniform distribution without leakage of compressed air which eventually leads to injury, additionally the rectum portions Distal are well supported by external structures, while the rectosigmoid junction only has a lateral support of the rectum [15,16].

The lesions are generated by a pressure change at 11.59 Lb/In [3,16,17], as reported by Burt et al. The pressure mentioned is the minimum with which lesions were found at the colon level. The pressure is easily exceeded since the elements of the minimum compressed air industry have a pressure of 125 Lb/In, also Andrews et al. explains that any column of air above 50 Lb/In can act as a solid element so which can enter through the anal sphincter and build up pressure in the colon causing injuries. [18,19].

The normal colon may suffer a high endoluminal pressure before the rupture of the layers occurs, the progressive increase in pressure causes the serous to rupture with subsequent rupture of the muscle and then the mucosa. As reported by Young Lee and collaborators in their recent 2019 publication by colposcopic studies, intraluminal pressure to achieve a perforation of its colonic layers achieves 0.109 KG/square cm [16,20]. It is an easily diagnosed pathology, because the symptoms occur minutes after the accidental exposure of compressed air in the rectal cavity. The therapeutic delay can lead to fatal outcomes such as acute respiratory distress syndrome, multiorgan dysfunction and death [12,20], the clinical manifestations change according to the type of injury, within them

**Table 1**  
Literature evidence of rectal baro trauma management.

Authors	Language	Numer of patients	Age	Gender		Mangment	Consultation time after the accident (Days)	Lengh of Stay	Ostomy	Associated injuries	Mortality
				Male	Female						
Gastroenterol Hepatol. 2005;28:306–7	Spanish	1	55	1	0	Laparotomy	–	10 days	Yes	Rectum	No
Intest Res 2013;11:213–216	English	1	46	1	–	Colonoscopy	1	–	No	No	No
<i>J Trauma</i> . 2002;52:793–795	English	1	29	1	0	Laparotomy	1	10 days	yes	Sigmoid	no
<i>J Korean Med Sci</i> . 1996 Apr;11(2):179–182.	English	2	56	1	1	Laparotomy	1	–	yes	Sigmoid	No
<i>J. Coloproctol. (Rio J.)</i> vol.37 no.1	English	1	27	1	0	Antibiotics	1 h	–	No	–	No
<i>J Trauma</i> . 1994;36:592–593	English	1	23	1	0	Laparotomy	–	–	No	Colonic Hepatic angle	No
AUST. N.Z. J. SURG VOL.43.No 1, July, 1973	English	2	39.5	2	0	Laparotomy	–	–	yes	Sigmoid	No
<i>Annals of Coloproctology</i> 2019;35(6):357–360.	English	10	32.5	10	0	Laparotomy	–	–	yes	Rectum	No
<i>N Engl J Med</i> 1930; 202:118–121	English	1	36	1	0	Laparotomy	20 minuts	18 days	No	Colonic Hepatic angle	No
<i>J Forensic Sci</i> . 2016 Nov;61(6):1678–1680.	English	1	17	0	1	Necropsy	–	–	No	–	Yes
<i>Egypt J Forensic Sci</i> 2016.08.002	English	1	42	1	–	Laparotomy	1	–	yes	Sigmoid	Yes
<i>J. Trauma</i> 45 (1998) 816–818.	English	1	14	0	1	Laparotomy	–	–	yes	Rectum	No
<i>Arch. Surg.</i> 105 (1972) 113–115.	English	1	–	1	0	Antibiotics	–	–	No	Anus	No
<i>Arch Surg</i> . 1980 May;115(5):660–1.	English	1	37	1	0	Laparotomy	1	17 Days	No	Rectum	No
<i>Rev Chil Cir v.62 n.3 Santiago jun. 2010</i>	Spanish	1	26	1	0	Laparotomy	–	–	–	Colon	No
<i>Int J Surg Case Rep</i> . 2015; 6: 218–221	English	1	4	1	0	Laparotomy	–	–	yes	Transverse colon	No
<i>Yonsei Med J</i> . 2000 Aug;41(4):533–5	English	1	33	1	0	Laparotomy	1	–	yes	Sigmoid	No
<i>Ann Surg</i> . 1942 Jan; 115(1): 13–20.	English	1	16	1	0	Laparotomy	–	–	yes	–	No
<i>Arch. Surg.</i> 22 (1931) 875–902.	English	18	–	11	7	Necropsy	–	–	–	–	–
<i>JAMA</i> . (1922, June 10); 78(23):1802.	English	1	35	1	–	Laparotomy	2 h	–	Apendicostomy	Sigmoid	Yes
<i>Ann Surg Treat Res</i> . 2017 Jul; 93(1):61–63	English	1	40	1	0	Laparotomy	–	–	yes	Sigmoid	No
<i>World J Gastroenterol</i> . 2016 Mar 14;22(10):3062–5.	English	1	36	1	0	Laparotomy	1	–	yes	Sigmoid	No
<i>Lancet</i> . 1904;2:216	English	1	17	1	–	Laparotomy	–	3 h	–	Sigmoid	yes
<i>Boston Med Surg J</i> 1912; 166:562–563	English	1	16	1	–	Laparotomy	–	3 Weeks	–	–	–
<i>Ann. Surg.</i> 115 (1942) 13–20	English	3	28.3	3	–	Laparotomy	–	1. 90 days,2. 30 days,3. 58 days	–	Sigmoid	No
<i>Scandinavian Journal of Gastroenterology</i> 40(3):356–9	English	1	35	1	0	Laparotomy	7 h	–	–	–	yes
<i>J Trauma</i> , 41 (1996), pp. 1073–5	English	1	23	1	0	–	–	–	–	Neumothorax	No
<i>Int J Legal Med</i> . 2011 Mar;125(2):283–7.	English	1	26	1	0	Laparotomy	–	–	Ileostomy	–	No
<i>BMJ Case Rep</i> . 2012; 2012: bcr2012006548.	English	1	30	1	0	Laparotomy	–	–	–	Sigmoid	No

we find sudden abdominal pain with abdominal distension, tension pneumoperitoneum and fecal peritonitis secondary to colon perforation, which can occur singularly or multiply at any other site of the colon [5,21].

Several articles that recommend primary repair and derivative colostomy have been published, Jacobson et al. They performed primary anastomosis in 58 patients with penetrating colon lesions without evidence of apparent leaks or anastomosis, concluding that the complications depend on the severity of the injury and most likely the contamination that occurs at the time of the injury, due to which, as in our case, the derivative colostomy was performed due to the findings found [18,22].

Within the review carried out as indicated in the table, the ratio of cases between men and women is 4.5 to 1, with an average age of 44.5 years. The most frequent surgical procedure was laparotomy with broad-spectrum antibiotic administration, the most prevalent lesion was in the anterior rectum, the hospital stay after the procedure, averaged 14.5 days, finally the mortality rate is proportionally associated with number of injuries and secondary complications.

#### 4. Conclusion

All patients with compressed air lesions at the rectal level should be immediately started on clinical surveillance and imaging, in severe cases that present with pain followed by abdominal distension, colonic injury should be suspected. In case of a timely diagnosis, hemodynamic stability and absence of contraindications, minimally invasive surgery such as diagnostic laparoscopy should be considered as a therapeutic method for these patients.

#### Declaration of Competing Interest

The authors report no declarations of interest.

#### Funding

Nothing to declare.

#### Ethical approval

The study is exempt from ethical approval in our institution.

#### Consent

Written informed consent was obtained from the patient for publication of this case report.

#### Author contribution

1. Daniel Gomez MD FACS, Luis Felipe Cabrera MD FACS, Mauricio Pedraza MD, Hector Wadi Cure: Surgical procedure.
2. Nicolas Sanchez MD, Jean A Pulido, Hector Wadi Cure: Pre operative assessment.
3. Andrez Mendoza MD, Héctor O Cure Bulicie, Hector Wadi Cure: Pos operative follow up.
4. Nicolas Sanchez, Mauricio Pedraza, Héctor O Cure Bulicie: Information recruitment.

#### Registration of research studies

N/A.

#### Guarantor

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#### Ethical responsibilities

**Protection of people and animals.** The authors declare that no experiments have been performed on humans or animals for this research.

**Confidentiality of the data.** The authors stated that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informative consent.** The authors have obtained the informed consent of the patient and/or referred subject. This document is held by the correspondence author.

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#### Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at <https://doi.org/10.1016/j.ijscr.2020.09.133>.

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