

Pneumatic Colon Injury: A Case Study

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Abstract

Introduction: Pneumatic colon injury is a severe condition rarely seen at general surgery departments that can pose some diagnostic and therapeutic uncertainty.

Patients and methods: A case study and review of the literature.

Results: A young male was admitted to our intensive care department after being attacked by his co-workers and inflated with a construction compressor. The damage to the colon revealed during the surgery was unexpectedly massive and exceeded the pre-operative CT scans. Our patient had to undergo a subtotal colectomy and recovered well after the surgery.

Conclusion: In pneumatic colon injury and emergency surgery should be the method of choice, as the damage to the large colon is often devastating. A prompt CT scan can offer more accurate information on its extent. However, it should only be done if readily available and not delaying the operation procedure.

Keywords: Colon injury; Compressed air injury

Introduction

Foreign body induced injuries of the anus and rectum are not uncommon in patients presenting at emergency general surgery departments. These include iatrogenic trauma caused during endoscopic procedures, outcome of various sexual activities, victims of violence and less common accidents [1]. Early and aggressive therapy is usually their only chance of successful healing. However, many of these patients are silent about the circumstances of their condition and seek help after a significant delay [2].

Compressed gas injuries are rare and just like any other colonic injury, can have potentially life-threatening consequences [3]. This case study describes a rare pneumatic colon injury caused by compressed air insufflation per rectum (Figure 1).

Case Study

A 44-year-old man of Roma ethnicity who was a victim of a violent act at a construction site, was admitted to our department.

The patient reported that a group of construction workers forcibly inserted the exhaust of a construction compressor into his anus and switched the machine on. After which, the offenders loaded him into a private car and transported him to a hospital 100 km away.



Figure 1: A rare pneumatic colon injury caused by compressed air insufflation per rectum.

Upon admission and despite a generous analgesic therapy the patient was showing obvious signs of distress and pain (Figure 2). His abdomen was visibly distended and tender on palpation. Clinical signs of peritoneal irritation were minimal, but no bowel sounds were audible on auscultation. However, a combination of central type obesity and personality features triggered by the traumatic experience made clinical examination difficult. Furthermore, the patient did not manifest a tachycardia, hypotension or increased body temperature.

After learning part of what had happened to him, deflation of his bowel *via* a rectal tube was attempted. He reported some relief, but only temporarily, and the abdominal distention and signs of peritoneal irritation remained (Figure 3).



Figure 2: A generous analgesic therapy the patient was showing obvious signs of distress and pain.

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Investigations

A plain X-ray showed a distended colon over the entire length with a diameter up to 8 cm. The only laboratory abnormality was a high white blood count (26.000 leu/mm³). Due to the somewhat vague history and the difficult clinical examination, a CT scan of the abdomen was performed (Figure 4). It demonstrated colonic distension as noted already but also revealed a small pneumoperitoneum along the transverse colon and a trace of fluid around the liver and spleen, although the colonic wall appeared to be intact. With these findings, the patient proceeded to an urgent laparotomy.

Surgery

There was no pneumoperitoneum apparent at the start of the laparotomy, but a very distended colon was obvious immediately and spilled out of the wound. A teniae coli was split the whole length of the colon directly above the peritoneal line to the caecum and the colonic wall consisted of a bruised and distended mucosa. The cecum also had a number of serosal tears. There were no further injuries apparent in the abdominal cavity. A small collection of blood around the spleen was initially considered a sign of laceration of its lower pole but this proved to be a transudate from the extensive bowel injury. A subtotal colectomy was performed with a single layer, hand sewn, end to end ileo-recto anastomosis undertaken. Post operatively, a slow decrease in the blood hemoglobin level led to another CT scan. A large retroperitoneal hematoma in the pelvis was evident. A further laparotomy was undertaken to evacuate this. The source of the bleeding in the pelvis

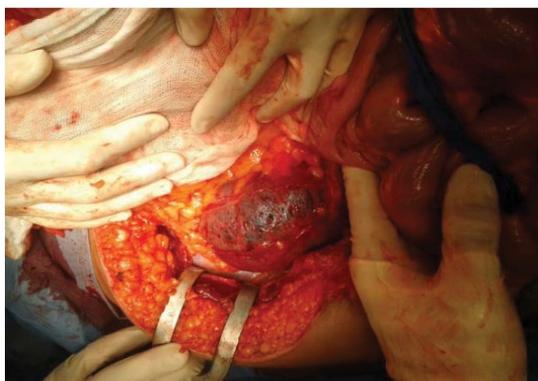


Figure 3: Abdominal distention and signs of peritoneal irritation.

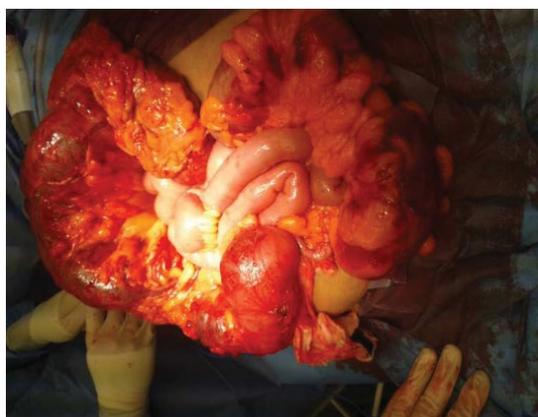


Figure 4: CT scan of the abdomen.



Figure 5: Barotrauma causes typical tears in the serous membrane, also known as a "cat scratch injury" and sometimes bowel perforation.

was considered to be more likely from the original trauma and not as a consequence of the first laparotomy. In total, he spent 12 days in the ICU and a further 9 days at the ward. His laparotomy wound healed with no signs of infection. Currently he remains well, his abdominal wall is intact and has 2 to 3 stools a day.

Discussion

Barotrauma is defined as physical damage to body tissues caused by a difference in pressure between a gas space inside, or in contact with the body, and the surrounding tissues. Common examples include an injury of the middle and inner ear (eardrum perforation, hemotympanum), pneumothorax, bowel perforation, and decompression sickness. Barotrauma can be caused during diving, flying, airbag rupture or a blast, a so-called blast injury [4]. An iatrogenic injury during artificial pulmonary ventilation should also not be ignored. A reasonable amount of data is available on the barotrauma during endoscopic examination of the colon. Although colon perforations are rare (0.03-0.3% incidence) and mainly caused by a direct damage to the bowel wall during polypectomy or by thermal injury, 35% of these perforations are estimated to be due to barotrauma [5].

During colonoscopy the colon is insufflated with air under a pressure of 50 kPa at a flow rate of 2.7 l/min. resulting in an intraluminal pressure of around 29 kPa. Bowel perforation is thought to occur at an intraluminal pressure of around 28-48 kPa [6,7]. Building compressors are able to exert pressure of up to 1000 kPa at a flow rate of 13000 l/min. It is evident that under such great pressure the extent of the injury may be considerable. Barotrauma causes typical tears in the serous membrane, also known as a "cat scratch injury" and sometimes bowel perforation (Figure 5). Such changes are found most commonly in the cecum. The clinical picture varies and is influenced mainly by the presence or absence of peritonitis. A diverse range of findings can be observed on a plain X-ray- pneumoperitoneum, pneumoretroperitoneum, pneumothorax, pneumomediastinum or even emphysema.

Barotrauma caused by insufflation of compressed air into the anus is very infrequent and is described in the scientific literature rarely. Stone published the first reported case in the Lancet in 1904 [8]. Ali et al. published in 2010, the largest ever cohort of 10 construction workers with an isolated perforation particularly in the left half of the colon [9]. Kampmann highlighted in 1983, a case of a labourer who died after devastating barotrauma to the colon. Several similar case reports have been published [10-15]. Barotrauma can be also caused by a pneumatic

pressure cleaner [16] or during water sports when a crash on the water surface can lead to bowel perforation or rectal injury as a result of the water enema [17].

Our experience is in accordance with the literature, that only the colon above the pelvic floor was affected with both anus and distal rectum spared from injury. However, all the previously described cases had a single colonic perforation, usually at the transition of the sigmoid and descending colon where a relatively loose segment becomes fixed and hence more easily succumbs to injury. The surgical findings in our case varies. His entire colon was affected both by a fissure in the teniae and a cat scratch injury of the cecum.

The current trend in bowel trauma surgery is resection with a primary anastomosis. However, exceptions to this may occur if the patient has suffered simultaneous organ injury, the whole affected segment cannot be resected, the patient is in hemorrhagic shock or presents late with gross faecal contamination, in which case damage limitation surgery with or without the creation of a proximal stoma [18]. Where there is doubt as to the mechanism of injury, the history is poor, and/or the clinical signs not clear cut, a CT scan can give useful diagnostic information to guide the need for a laparotomy. However, in this case, we observed a marked discrepancy in the CT scan appearances and the operative findings. While the CT had really only shown only a small pneumoperitoneum, a devastating injury of the whole colon was found intra-operatively. When there is any doubt about the extent of the injury, surgical intervention is advised. While signs of peritonitis make this decision more obvious, delaying surgery in such cases with more equivocal signs, risks the development of faecal peritonitis with potentially fatal consequences for the patient.

Conclusion

Trans-anal insufflation of compressed air often results in serious colonic injury. Mere decompression of the colon per rectum is rarely sufficient in itself, and a laparotomy is usually indicated. The history, supported by clinical examination is very important in the decision making around surgical intervention. A CT examination may be helpful, but it is important to remember that despite negative clinical findings on admission and modest findings on CT scanning, the bowel injury can be devastating, as demonstrated in this case study. Therefore, a laparotomy is advised in such cases.

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