

Analysis of Bowel Viability Alterations in Patients with Acute Small Bowel Obstruction and Comorbidities: A Case Series

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Abstract

Acute small bowel obstruction frequently necessitates emergency surgical intervention. The primary determinant of surgical extent is the condition of intestinal viability, which can be compromised by vascular compression leading to acute ischemia. Viability is also affected by various factors such as patient age, obstruction location, and existing comorbidities. Numerous scales have been developed to predict viability changes, offering only a generalized pre-surgical assessment and forecasting necrotic intestinal changes. However, no current prognostic or diagnostic method can accurately predict intraoperative changes in the intestinal walls due to various influencing factors. Notably, comorbid pathologies pose a significant risk for complications, as they can substantially alter the condition of the intestinal walls, vessels, and circulation. This review presents three cases of comorbid patients with acute small bowel obstruction and intestinal necrosis, where intraoperative viability deterioration necessitated an extension of intestinal resection.

Objective: to educate surgeons on the risks associated with the progression of ischemic intestinal viability disorders in patients experiencing acute small bowel obstruction, particularly when comorbidities are present.

Key words: Acute Small Bowel Obstruction; Incarcerated Hernia; Intestinal Volvulus; Comorbidity; Small Bowel; Viability.

INTRODUCTION

Acute small bowel obstruction frequently necessitates emergency surgical intervention [1,2]. The primary determinant of surgical extent is the state of intestinal viability, with impaired viability often necessitating resection [3,4]. However, assessing viability disorders poses significant challenges [5-8]. Viability impairment arises from vascular compression and acute ischemia, influenced by factors such as patient age, obstruction localization, and concomitant diseases [9-11]. Various scales have been developed to predict viability changes, offering only a generalized pre-surgical assessment and predicting necrotic changes [9,12-14]. Nonetheless, no

current prognostic or diagnostic method can foresee intraoperative changes in the intestinal walls due to various factors [15]. Comorbid pathology is a notable risk factor for complications, as it can significantly alter the condition of intestinal walls, vessels, and circulation [3,9,16]. Post-surgical viability impairment can lead to necrosis and complications [3,10,17]. Enhancing surgeons' awareness of these issues is crucial in mitigating such complications.

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DESCRIPTION OF CLINICAL CASES

Case 1

A 57-year-old male patient presented with an umbilical bulge, abdominal pain, gas and stool retention, persisting for three days. His medical history includes chronic hepatitis. Upon examination, vital signs were: pulse 120 bpm, blood pressure 130/80 mmHg, and body temperature 36.3°C. The patient exhibited a dry tongue, abdominal distension, and a non-reducible umbilical hernia. The anterior abdominal wall was soft with tenderness in the umbilical region, but no rebound tenderness. Bowel sounds were absent. Laboratory tests showed leukocytes at $11.2 \times 10^9/L$, neutrophils at 78%, elevated total bilirubin at 90.1 $\mu\text{mol/L}$ (indirect 83.3 $\mu\text{mol/L}$), and the urea concentration is 8.4 mmol/L. A preliminary diagnosis of incarcerated umbilical hernia was made, alongside chronic hepatitis, coronary artery disease, aortic and coronary vessel atherosclerosis, and heart failure II B, with a SAPS score of 10. An emergency surgical intervention was conducted, involving excision of the skin and umbilicus. The hernial sac was incised, releasing up to 20 ml of turbid hernia fluid. The strangulated intestinal loop was retained, and the umbilical ring was incised. The strangulated segment of the small intestine appeared necrotic, exhibiting two strangulation grooves, one with a perforation approximately 1 cm in diameter. The affected loop was located in the midsection of the small intestine. The afferent intestinal loop was edematous, distended with contents, and displayed a thickened, cyanotic wall, while the efferent loop appeared normal. Two liters of ascitic fluid were present in the abdominal cavity. Mobilization of 20 cm of the efferent segment and 40 cm of the afferent segment was executed. During this process, the afferent loop developed a diffuse dark bluish discoloration. Consequently, an 80 cm resection of the afferent loop was performed, and an ileostomy was established. The efferent loop stump was sutured. The abdominal cavity was dried and drained using two tubes. The surgical wound was temporarily closed to facilitate dynamic monitoring of the afferent loop's viability. Postoperative diagnosis: strangulated umbilical hernia with small intestine gangrene. On the following day, the surgical wound was reopened, revealing that the afferent loop had regained a normal appearance. An anastomosis was created between the afferent and efferent loops of the small intestine, and the surgical wound was sutured. The postoperative course was uneventful.

Case 2

A 41-year-old female patient was admitted with a two-day history of unexplained left abdominal pain and two episodes of vomiting. Her medical history includes Buerger's disease. Upon examination, her vital signs were stable with a pulse of 88 bpm, blood pressure of 110/80 mm Hg, and a body temperature of 37.0°C. Notable findings included a dry tongue, distension in the upper abdomen, rigidity, and tenderness on the left side, with rebound tenderness present. Laboratory tests returned normal results. An abdominal radiograph indicated moderately dilated small intestine loops, leading to a tentative diagnosis of acute intestinal obstruction. The SAPS score was 5.

Laparoscopy revealed a blackened loop of the small intestine and serous-hemorrhagic fluid in the pelvic cavity. Subsequent laparotomy identified a small intestine volvulus 40 cm from the Treitz ligament, with a 60 cm blackened torsion loop. The efferent loop appeared normal, while the afferent loop was cyanotic and swollen. Approximately 1 liter of serous-hemorrhagic exudate was present. The non-viable intestinal segment was resected, and due to concerns about the afferent loop's viability, an anastomosis was not performed. A jejunostomy was created, and the efferent loop stump was sutured. The abdominal cavity was lavaged and drained, and the surgical wound was temporarily closed. Postoperative diagnosis included small intestine volvulus, gangrene, and diffuse peritonitis.

A planned reoperation the following day revealed 500 ml of serous-hemorrhagic exudate. The initial small intestine segment, starting 10 cm from the Treitz ligament, was necrotic. The non-viable section was resected, and a jejunostomy was re-established. The abdominal cavity was lavaged, and the wound was temporarily closed.

Two days later, another planned reoperation found 200 ml of serous exudate. The initial small intestine segment appeared normal, with slight wall swelling and pulsating mesenteric vessels. An anastomosis was successfully formed between the intestinal loops, and the surgical wound was closed. The postoperative course was uneventful.

Case 3

A 40-year-old male patient presented with acute symptoms including right inguinal hernia pain, frequent vomiting, and bowel obstruction persisting for one day. His medical

history is notable for polyallergy. Upon examination, vital signs were stable with a pulse of 88 bpm, blood pressure of 130/80 mm Hg, and a body temperature of 37.0°C. Dermatological assessment revealed extensive polymorphic rashes. The oral cavity was adequately hydrated. A 6 cm painful, irreducible hernia was identified in the right inguinal region. The abdomen was distended, yet the anterior abdominal wall remained soft upon palpation, accompanied by hyperactive bowel sounds. Laboratory tests indicated leukocytosis with leukocytes at $13.2 \times 10^9/L$ and neutrophils at 79%, while other parameters were within normal limits. Radiographic imaging of the abdomen revealed Kloiber's small intestinal cups. A preliminary diagnosis of right-sided incarcerated inguinal hernia with polyallergy and allergic dermatitis was established, with a SAPS score of 6.

An emergency surgical intervention was conducted. The procedure involved incision of the skin and subcutaneous tissue over the hernia, isolation and incision of the hernial sac, releasing 50 ml of hemorrhagic fluid. The sac contained a loop of the small intestine, which was fixed, and the superficial inguinal ring was incised. The strangulated intestinal segment, measuring up to 10 cm, was located 30 cm from the ileocecal junction, exhibiting necrosis with a black, swollen wall and mesenteric hematoma. Resection was performed, removing 40 cm proximally and 20 cm distally from the necrotic margins. Post-resection, the subsequent development involved the afferent loop of the intestine becoming cyanotic, prompting a lower median laparotomy. Further examination revealed moderate swelling and cyanosis of the afferent loop stump, with absent mesenteric vessel pulsation over 10 cm. An additional 20 cm of intestine was resected, followed by the formation of an anastomosis between the afferent and efferent loops. The laparotomy wound was closed, and Shouldice's hernioplasty was executed. The postoperative course was uneventful.

DISCUSSION

The clinical cases presented share common characteristics, including the patients' average age, lack of significant hemodynamic disturbances, stable laboratory parameters, low SAPS scale scores, and the presence of comorbid conditions. Notably, the Charlson Comorbidity Index scores were minimal, with one patient scoring 2 and two patients scoring 0, indicating no major health issues. Furthermore, two patients were free from any concomitant diseases typically included in prognostic scales like the Charlson Comorbidity Index.

Intraoperative procedures, however, led to the progression of intestinal viability disorders, potentially triggered by vascular changes or alterations in blood properties. These viability issues necessitated extending the standard limits of intestinal resection. In one instance, this approach sufficed, while in two cases, the "damage control" strategy was employed, successfully preventing postoperative complications.

While imaging techniques can identify intestinal necrosis pre- or intra-operatively, they fall short in predicting viability changes during surgery. Additionally, the recommended practice of injecting dye into vessels may exacerbate viability disorders [18-20].

Thus, it is imperative to tailor the surgical intervention volume for acute small intestinal obstruction and comorbidity, considering the heightened risk of intestinal viability disorder progression. Developing a specialized prognostic scale is advisable. Prior to intestinal suturing and anastomosis formation, employing methods for an objective local assessment of intestinal section viability is recommended to ensure the absence of disorders [5,7,8]. Intestinal viability issues can occur following the suturing of a laparotomy wound and may persist undetected during surgery. These issues could potentially lead to the complications commonly observed in patients [3,8-10]. To mitigate this risk, implementing a prophylactic "damage control" procedure is recommended for high-risk patients [21], the need for which is identifiable through an appropriate specialized prognostic scale.

CONCLUSIONS

In patients experiencing acute small intestinal obstruction with comorbid conditions, there is a potential for the progression of intestinal viability disorders during surgical procedures. Current predictive scales lack the precision needed to foresee these complications accurately. This limitation must be considered during surgical interventions. There is a pressing need to enhance prognostic scales and devise methods for an objective, local, non-invasive evaluation of the viability of intestinal segments intended for suturing.

Additional Information

Disclosures

Human subjects

Consent was obtained or waived by all participants in this study.

Conflicts of interest

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Payment/services info

All authors have declared that no financial support was received from any organization for the submitted work.

Financial relationships

All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other relationships

All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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Analysis of Bowel Viability Alterations in Patients with Acute Small Bowel Obstruction and Comorbidities: A Case Series

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