

THE MYTH-BUSTER: APPROACH TO SMALL BOWEL OBSTRUCTION IN THE EMERGENCY DEPARTMENT – CASE REPORT AND UPDATED LITERATURE REVIEW

RAZBIJANJE MITOVA: PRISTUP OPSTRUKCIJI TANKOG CRIJEVA U HITNOM BOLNIČKOM PRIJAMU – PRIKAZ SLUČAJA I PREGLED LITERATURE

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Abstract

Small bowel obstruction (SBO) is a common disease that accounts for up to 4 % of emergency department (ED) visits. It occurs due to an interruption in the normal flow of intraluminal contents, either by intrinsic luminal obstruction or extrinsic compression. A characteristic clinical image consists of abrupt abdominal pain and distention, accompanied by nausea and vomiting. However, patients can present with symptoms which are far from typical. As obstruction progresses into ischaemia and bowel necrosis, delayed diagnosis and treatment can significantly increase patients' morbidity and mortality.

Through a case of a 59-year-old man presenting to our ED with atypical symptoms, as well as the review of current literature on the topic, we aim to present novel options and dispel old myths regarding the diagnosis and management of SBO in the ED. Atypical symptoms and findings? Efficacy of point-of-care ultrasound? Conservative vs operative treatment? Early markers for treatment prognosis? Usefulness of nasogastric probe and water-soluble contrast? We offer the reader an overview of which of these might and which might not have a place in the treatment of a patient with SBO in the ED.

Key words: acute abdomen; ileus; procalcitonin; small bowel obstruction; ultrasound

Sažetak

Opstrukcija tankog crijeva učestalo je hitno stanje te je ujedno i razlog i do 4 % posjeta hitnoj službi. Nastupa kada opstrukcija unutar lumena crijeva ili vanjska kompresija onemogućuje odgovarajuće pražnjenje crijevnog sadržaja. Karakterističan bolesnik predstavlja se s naglo nastalom boli u abdomenu praćenom distenzijom, mučninom i povraćanjem, no bolesnici s opstrukcijom tankog crijeva često se prezentiraju na sasvim neuobičajen način. Dugotrajna opstrukcija progredira u ishemiju i nekrozu crijeva, stoga svako zakašnjenje u postavljanju dijagnoze ili liječenju značajno povećava rizik od razvoja komplikacija i smrtnog ishoda.

Kroz slučaj 59-godišnjeg muškarca s opstrukcijom tankog crijeva te obradu trenutne literature na ovu temu, cilj nam je predstaviti novitete i suzbiti mitove u obradi i liječenju. Koji su atipični simptomi i nalazi na koje možemo naići? Koja je korist ultrazvuka u postavljanju dijagnoze? Kada se odlučiti za konzervativno, a kada operativno liječenje? Postoje li rani biljezi za prognozu liječenja? Koja je uloga nazogastrične sonde i vodotopljivog kontrasta u dijagnozi i liječenju? Istražite s nama što od navedenog ima, a što nema, svoje mjesto u pristupu pacijentu s opstrukcijom tankog crijeva u hitnoj službi.

Ključne riječi: akutni abdomen; ileus; opstrukcija tankog crijeva; procalcitonin; ultrazvuk

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Introduction

Small bowel obstruction (SBO) is a common disease that warrants surgical evaluation (1-3). It accounts for up to 4 % of emergency department (ED) visits, approximately 15 % of hospital admissions, and 20 % of emergency surgeries for abdominal pain (4-5). Between 20 and 30 % of patients with SBO undergo surgery (6). Bowel obstruction occurs when the normal flow of intraluminal contents is interrupted, either by intrinsic luminal obstruction or extrinsic compression (7). The small bowel is involved in approximately 80 % of mechanical intestinal obstructions. Obstruction leads to progressive dilation of the bowel oral to the blockage, while the bowel located aborally to the blockage decompresses as luminal contents pass. As the process continues, bowel wall becomes oedematous, normal absorptive function is disturbed, and fluid is sequestered intraluminally (8). If left untreated, complete obstruction can progress to bowel ischaemia, significantly increasing morbidity and mortality rate.

SBO can be classified as acute or chronic, based on symptom recurrence and duration, and as partial or complete, depending on the severity of bowel obstruction (9-10). A distinctive form of complete SBO is a closed-loop obstruction, in which a bowel segment is obstructed at two locations, with no proximal or distal outlet. Such obstructions can rapidly lead to ischaemia and necrosis.

Patients classically present with an abrupt onset of colicky abdominal pain, nausea, vomiting, and abdominal distention. Pain is most often described as periumbilical and cramping with paroxysms occurring every few minutes (11). Complete obstruction leads to cessation of passage of stool or flatus. However, passage may continue for an additional 12 or even 24 hours following the onset of other symptoms due to the evacuation of contents from the distal bowel. Patients with chronic obstruction will have intermittent, often self-resolving symptoms by the time they reach the ED.

Small bowel obstruction is a common and potentially serious emergency, often difficult to diagnose and manage in the ED, requiring careful evaluation and up-to-date clinical strategies..

Approach to a patient with SBO in the ED can be far from simple, and recent studies have begun to question some of the previously established “rules” in its management, as well as explore new “tools” that could both simplify and improve treatment and the patient’s prognosis. Through a case presentation of one such patient in our ED and a review of the current literature, we offer the reader a few tips & tricks when dealing with SBO.

Case presentation

A 59-year-old man was brought to the ED by ambulance due to suspected STEMI – ST elevations in leads I and aVL were initially described. Patient had no previous illnesses to report. He arrived from Switzerland on a plane earlier that day. He complained of a piercing pain that started in his epigastrium several hours earlier and spread to his left hemithorax and neck area. He also experienced severe nausea, without emesis, accompanied by episodes of profuse sweating. Pain was constant at first. By the time of his arrival at the ED, it became intermittent, occurring every 5 to 10 minutes. He had taken no analgesics to relieve the pain. Ambulance was called by his family members when he felt lightheaded and fell in the bathroom while trying to relieve himself. He didn’t hit his head, but lost consciousness for a few seconds.

During transport, he was stable and had received 300 mg of aspirin. Upon arrival at the ED, his vital signs were taken: RR 140/90 mmHg, heart rate 90/min, SpO₂ 96 %, respiratory rate 16/min, body temperature 36.6°C. ECG upon arrival showed no pathologic findings; ST elevations in leads I and aVL were insignificant. He was placed on a heart monitor, and symptomatic treatment was initiated: Nitroglycerin spray, Pantoprazole, Metoclopramide and Metamizole. Initial clinical exam revealed moist, pale skin, normal heart and lung auscultation, and a soft, non-tender abdomen with audible bowel sounds. Symptoms persisted despite administered symptomatic treatment, every few minutes, patient would start shivering and sweating profusely and would complain of an increase in nausea and pain in his chest and upper stomach.

Initial laboratory results came back unremarkable – an increase in total leucocyte count (13.6) on account of increase in neutrophils, CRP of 1.4 mmol/L, lactates of 1.2 mmol/L, with electrolytes (sodium (Na), potassium (K), and chloride (Cl)), liver enzymes (aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma-glutamyl transferase (GGT), and alkaline phosphatase (ALP), lipase, urea, creatinine and high sensitivity troponin I within appropriate reference ranges. As the patient’s symptoms persisted, acute aortic syndrome was taken into consideration as a potential differential diagnosis. The d-dimer level was obtained and came back positive, 1.92 mg/L. CT aortography revealed no signs of acute aortic syndrome, but instead signs of strangulated ileus of small bowel – a distended small bowel wall 2,8 cm in width with the visible inflammation of surrounding fatty tissue. A nasogastric tube (NGT) was immediately placed, and an abdominal surgeon was consulted, who indicated emergency surgery.

The procedure was initially attempted via a laparoscopic approach; however, due to inability to identify transition points, conversion to a midline laparotomy was required. Two transition points were identified intraoperatively: a proximal one located approximately 40 cm aboral to the ligament of Treitz and a distal one approximately 50 cm oral to the ileocecal valve. A clockwise rotation of the mesentery consistent with small bowel volvulus was visualised. Following detorsion, the affected bowel appeared viable, demonstrating normal

colouration, preserved peristalsis, and intact mesenteric arterial pulsations. There was no evidence of ischaemia or necrosis; therefore, resection was not indicated. Postoperative course was uneventful, and the patient was discharged on postoperative day five.

Management of small bowel obstruction – myths & novelties

1) Elevated troponin and ECG changes outside myocardial infarction

There are several reported cases in the literature of SBO presenting with symptoms mimicking myocardial infarction with or without findings of ischaemic ECG changes and troponin elevation (14-17). Most recognised STEMI patterns involve the inferior leads (II, III, and aVF). While the mechanism of ST-segment elevation in such cases is not yet fully understood, it is speculated to be related to the increased intra-abdominal pressure, which compresses the diaphragmatic surface of the heart, particularly the inferior wall (18-19). Suggested explanations also include elevated vagal tone due to pain causing coronary artery spasms, stress-related catecholamine-associated cardiomyopathy, and variant angina. Other rarely described ECG findings in SBO patients included unspecified tachyarrhythmias, T-wave inversions in the inferolateral and anterior leads, signs of right heart strain, and left bundle branch block (LBBB).

Small bowel obstruction can rarely present with symptoms and ECG changes mimicking acute myocardial infarction, including ST-segment elevation and tachyarrhythmias.

Elevated troponin levels in SBO patients are most likely the result of a physiologically stressful state leading to demand-supply mismatch of oxygen in the heart – the so-called “type 2” myocardial infarction (20). A few cases of stress-related cardiomyopathy, such as Takotsubo syndrome, have been reported in patients with SBO (21-22). A retrospective study by Kumar et al. described a significant increase in mortality of SBO patients with elevated troponin levels (67%) compared to the overall patient group (32%), most likely due to delayed diagnosis and treatment (12).

2) Overlooked risk factors

The most common cause of mechanical SBO are intraperitoneal adhesions, accounting for approximately 55-80 % of all cases (23). Up to 80 % of these cases have a history of prior intraabdominal surgery; the rest had prior peritonitis or no discernible cause for adhesions (24). If a patient has never undergone intra-abdominal surgery, a hernia with small bowel incarceration is the most likely cause (25-29). Older patients with suspected SBO with no prior abdominal surgery and

absence of a hernia on examination should be evaluated for malignancy (30).

Intraperitoneal adhesions are the most common cause of mechanical SBO, particularly in patients with prior abdominal surgery.

An often-overlooked risk factor for SBO in previously healthy patients is congenital bowel anomalies, particularly intestinal malrotation (31). Its incidence is 1 in 200-500 newborns (32). The prevalence of malrotation in adults is unknown. Most cases present during the first year of life; however, they can also remain undiagnosed until later age – cases have been reported even in octogenarians (33-34). Malrotation in adults can present with obscured clinical symptoms, such as recurrent abdominal pain and vomiting, often resulting in multiple hospital visits. It may also present acutely, due to midgut volvulus, and may result in bowel ischaemia and gangrene. A characteristic CT finding is a reversed relationship between the superior mesenteric artery and the superior mesenteric vein, which can also be visualised by ultrasound (US). All patients, regardless of age, should undergo surgery, as it is impossible to predict the development of complications (35).

Congenital bowel anomalies, such as intestinal malrotation, represent an often, overlooked risk factor in previously healthy adults and may lead to acute complications requiring surgery.

3) Role of Point-of-Care ultrasound in diagnosis and management

Following physical exam and laboratory evaluation, imaging of the abdomen should be obtained. Supine and upright plain radiographs are often the initial imaging tests due to their widespread availability, low cost, and ability to follow disease progression serially (36-37). The standard of care is Computed tomography (CT) of the abdomen with intravenous contrast, if not contraindicated (38). CT without contrast enhancement can be used instead if necessary (39).

US has been investigated as a diagnostic option for SBO. Its benefits include rapid diagnosis and serial assessments without radiation exposure; however, its efficiency is highly operator-dependent (40-44). Published studies, such as the 2018 meta-analysis by Gottlieb et al. and the 2021 meta-analysis by Lin et al., demonstrate US's high sensitivity (up to 92 %) and specificity (up to 96 %) in diagnosing SBO (45). However, this finding is limited by the fact that most studies were conducted in non-ED settings. In fact, Lin et al.

demonstrated significantly lower specificity when considering only US performed in the ED.

Ultrasound offers a rapid, radiation-free option for initial diagnosis and serial monitoring of SBO, but CT remains the gold standard for definitive evaluation.

Another downside to US is that the criteria for diagnosing SBO haven't been clearly defined. SBO is typically diagnosed when the lumen of fluid-filled small bowel loops is dilated, although the definition of dilation varies across studies. It is most often defined as bowel diameter ≥ 2.5 cm measured from outer wall to outer wall; however, some physicians consider a diameter ≥ 1.5 cm a positive sign of SBO (46). At an early stage of the disease, the bowel loop diameter might yet be within the normal range. Still, bowel loops are fluid-filled and hyperkinetic, with hyper-representation of Kerckring folds (47). Another finding to observe by US is a change in peristalsis. Peristalsis is demonstrated by whirling movements of the bowel contents (48). It can be reduced, ineffective, with a back-and-forth motion, or completely absent – while its alteration is an excellent criterion for diagnosis of SBO, its evaluation is completely subjective (49). Finally, visualisation of free fluid, alongside previous findings, suggests the development of bowel infarction/ischaemia. Initially, free fluid is located only between the recesses of the mesenteric fan, giving rise to the characteristic 'sign of the thong' (50). As obstruction progresses, the amount of free fluid increases, and it can be found in the abdominal cavity.

At this point, US cannot be considered a substitute for imaging such as CT; however, it may have a role in the management of SBO as an initial screening tool and for serial monitoring of disease progression.

4) Timing of operative vs conservative management

Not every SBO requires surgical treatment – in fact, current guidelines, such as the Bologna guidelines for diagnosis and management of adhesive small bowel obstruction and the Eastern Association for the Surgery of Trauma practice management guideline, favour non-operative management in all patients with adhesive small bowel obstruction, unless there are signs of peritonitis, strangulation, and/or bowel ischaemia. Simply put, the main goal is to avoid surgery when unnecessary and to avoid delaying it when it is necessary (13).

Non-operative management is safe and effective for most adhesive SBO cases, with surgery reserved for signs of peritonitis, strangulation, or bowel ischaemia.

Unequivocal duration of non-operative management remains undefined – most recommend a 48-h to 72 h period as safe and appropriate (51-54). Patients typically display improvement within 48 h. However, some studies associate conservative therapy with increased risk of recurrent obstruction, and the risk of recurrence also worsens with each episode of SBO, with SBO related to adhesive disease recurring in up to 50 % of cases (55-56). Early results from an ongoing randomised controlled trial on the topic have demonstrated that non-operative management within 48 hours prevented surgery in 80 % of patients with SBO, with an interim analysis finding no significant between-group differences in mortality, complication rates, or bowel resection rates (57).

5) Potential markers for treatment prognosis

Most SBOs can be treated conservatively, but there are no objective criteria for when treatment fails or surgery is needed. Recently, procalcitonin (PCT) has been suggested as a marker for bowel strangulation and a predictor of operative treatment (58-59). Several previous studies indicated a correlation between PCT and bowel ischaemia and necrosis (60-62). In a retrospective study by Cosse et al., a PCT-based algorithm was compared to the previously suggested Gastrografin test (which used a water-soluble contrast to assess restoration of bowel peristalsis). While the need for operative treatment was similar between both groups, the time to surgery and length of hospital stay were significantly lower in the PCT group (48 h vs 72 h, and 4 vs 6 days, respectively). A clinical trial investigating the use of a PCT-based algorithm is currently in development by the same team - cutoffs of 0.2 $\mu\text{g/L}$ (failure of conservative management) and 0.6 $\mu\text{g/L}$ (need for surgery) have been set based on their previous results on the subject (which accurately identified more than 80% of patients) (63). If the initial PCT is between 0.2 and 0.6 $\mu\text{g/L}$, a second assay will be performed after 24 h. If conservative management is initiated 48 h after symptom onset or bowel function is absent, operative management will be performed. Based on the findings so far, the introduction of the PCT-based algorithm might improve the quality of SBO management.

6) Efficacy of nasogastric tube in conservative treatment

NGTs have been considered the backbone for management of non-operative SBO, dating back to the early 20th century (64). Their use is universally accepted, and decompression via NGT is included in the Bologna guidelines for the management of SBO. Use of NGT can assist with symptom management by relieving abdominal distention, pain, nausea, and vomiting by decompressing contents proximal to the obstruction. However, they are also associated with substantial discomfort and pain, which is why some physicians tend to avoid them. Additionally, to function properly, NGTs require management – if they become occluded, clamped, or are assembled improperly, they can stent open the oesophagus and increase the risk of aspiration.

Literature evaluating NGT use in SBO patients is scarce; only a few retrospective studies are available (65-67). They showed no differences in risk of bowel ischaemia, need for surgery or mortality rates between the two groups, but almost all of them noted prolonged hospital stay (up to 2-3 days, depending on the study) in the NGT group, as well as higher rates of complications such as pneumonia and respiratory failure. No major complications were observed during treatment of SBO without an NGT. One five-year retrospective study showed a significantly higher surgery rate in the NGT group (8 % vs 2 %) and a far longer time to surgery (58.8 h vs 19.4 h); however, these results may reflect a selection bias toward patients with greater disease severity.

Further research is needed to determine which patients would benefit from NGT decompression and in which patients it can be avoided, a prospective controlled trial currently in development will yield some answers (68).

7) Use of water-soluble contrast as a diagnostic and therapeutic tool

Water-soluble contrast (WSC), such as *Gastrografin*, was evaluated at the end of the 20th century to predict the need for surgical treatment. The rationale for this idea was that WSC transit would help differentiate complete from partial SBO and predict whether partial SBO might resolve without operative treatment. Some authors have reported that detection of *Gastrografin* in the right colon 4-6 h post-ingestion was a reliable indicator of the success of conservative treatment (69-71). The Bologna guidelines still recommend WSC as the sole imaging study for patients with a clear SBO diagnosis and no signs of immediate surgery. It is now considered that WSC appearing in the colon on X-ray within 24 h of administration predicts resolution without the need for operative intervention.

The role of nasogastric tubes and water-soluble contrast in SBO management is increasingly questioned, with ongoing trials expected to clarify their efficacy.

Aside from its diagnostic use, the potential therapeutic role of WSC was also investigated. It has been theorised that the hyperosmolar property of the WSC could reduce bowel wall oedema by drawing fluid into the lumen. *Gastrografin* has also been reported to enhance smooth muscle contractility, but supporting literature is currently lacking (72). A randomised controlled study by Assalia et al. in 1994 was among the first to demonstrate a correlation between WSC use and improved resolution of obstruction and a shorter hospital stay. There is currently no consensus in the available literature, as subsequent studies have yielded conflicting results (73-77). The latest meta-analysis found no significant reduction in the need for operative management, or in mortality rates (78). The only positive result was a 0.15 day (3.6 h) reduction in hospital stay, which is not clinically significant.

The benefit of WSC appears to be more pronounced in cases of partial rather than complete obstruction. The latest guidelines of Eastern Association for the Surgery of Trauma (EAST) for SBO treatment recommend considering it in the setting of partial SBO that has not resolved within 48 hours, as it is believed to improve bowel function (time to bowel movement) and decrease the length of stay (Level 2 recommendation).

Conclusion

Our review offers a brief overview of some of the contested and controversial topics in the management of SBO in the ED. Some of these principles, such as NGS and WSC, have been utilised and recommended for decades based on anecdotal experiences and are only now starting to be questioned. In contrast, others that are only now in development, such as PCT and point-of-care US, will, over time, show whether they deserve their place in the sun. It is important to keep in mind, however, that no medical condition can be completely reduced to a perfect, solve-it-all algorithm, and that, alongside knowledge, creativity and willingness to challenge old beliefs and test new approaches, are qualities that every physician should strive for.

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