Case Report

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The role of computed tomography in acute bowel obstruction due to a supravesical hernia: a case report from Nepal

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Introduction and importance: Supravesical hernias are rare internal hernias but potential cause of small-bowel obstruction. The clinical features are often non-specific, preoperative diagnosis is very difficult and is often diagnosed intraoperatively. The exact pathogenesis is unclear with the major risk factors of prematurity, a positive family history, male sex, smoking habits leading to decreased collagen production, advancing age, and conditions characterized by defective collagen synthesis

Case presentation: The authors are reporting a case of small-bowel obstruction secondary to a supravesical hernia, in a 78-year-old male presented with central abdominal pain, vomiting and obstipation. Ultrasonography of the abdomen and pelvis identified a marked dilation of the small-bowel loop with multiple loops of dilated jejunum and ileum in contrast-enhanced computed tomography (CT) scan of the abdomen and pelvis with lead point from the terminal ileum. Exploratory laparotomy was done with the diagnosis of left posterior a left posterior superior vesical hernia with small-bowel obstruction.

Clinical discussion: The case focuses supravesical hernia as a rare yet life-threatening etiology of small-bowel obstruction, emphasizing the importance of clinical suspicion when patients present with signs and symptoms of bowel obstruction. While diagnosis often occurs intraoperatively, the utilization of CT scans in emergency settings can provide valuable insights into the location, potential causes, and condition of the herniated bowel sac. The case highlights the pivotal role of CT scans in diagnosis and emphasizes the need for multidisciplinary cooperation among clinicians, radiologists, and surgeons.

Conclusion: Early intervention ensures better outcomes and prevents irreversible bowel damage, underscoring the importance of a comprehensive approach to patient care.

Keywords: CT scan, exploratory laparotomy, multidisciplinary approach, small-bowel obstruction, supravesical hernia

Introduction

Internal hernias involve the protrusion of intra-abdominal visceral organs through a peritoneal or mesenteric opening, causing dislocation into another compartment[1,2]. They are often rare, constituting 0.2–0.9% of all intestinal obstructions and 0.6–5.8% of hernia-related obstructions, with the small intestine being the most commonly herniated organ[1–3]. These hernias, whether persistent or intermittent, pose a risk of strangulation[2], leading to mortality in more than 50% of cases if not addressed on time[3]. They can be post-traumatic, postoperative, or congenital based on etiology. Diagnosing internal hernias is often challenging, relying on clinical and radiological assessments[2]. Plain radiography can show signs of bowel obstruction or, less commonly, a mass effect from herniated bowel, but it's non-specific[4]. Abdominal computed tomography (CT) seems to be more accurate and preferred imaging over other diagnostic tools for preoperative diagnosis of Internal hernia and intestinal strangulation[4,5]. First reported in 1814, supravesical hernia is uncommon and fewer than 100 cases have been documented in the literature[6]. Diagnosing supravesical hernia, especially in

HIGHLIGHTS

- The study emphasizes the rarity of internal supravesical hernias as a potential but challenging cause of small-bowel obstruction.
- It underscores the critical contribution of computed tomography (CT) scans in diagnosing these hernias, especially in challenging cases.
- The importance of collaborative efforts among clinicians, radiologists, and surgeons is highlighted for timely intervention.
- The successful management through exploratory laparotomy emphasizes the significance of surgical expertise in addressing supravesical hernias.

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uncomplicated cases, is challenging. Complications, such as small-bowel obstruction, may serve as indicators for the presence of a supravesical hernia[7,8].

Following the SCARE criteria[9], we report a case of emergency surgery on a patient with signs of small-bowel obstruction due to supravesical hernia. This case prompts a review of surgical anatomy, emphasizes the significance of CT scan in diagnosis, and underscores the importance of timely repair for better outcomes in managing these rare hernias.

Case presentation

A 78-year-old male presented to the emergency department of a tertiary care hospital with abdominal pain for 4 days accompanied by 2 days of vomiting. The pain was acute, dull aching over the central abdomen, which was associated with progressive abdominal distension. He also reported multiple episodes of non-projectile, non-bilious, non-blood-containing vomitus for the past two days. Moreover, he was unable to pass stool and flatus for 3 days. It was not associated with yellowish discoloration of skin and sclera, fever, per rectal bleeding, or melena. Bladder habit was normal. He had undergone coronary stenting for ischemic heart disease in the past and is currently under medication (tablet amlodipine 5 mg) for hypertension. He has no history of smoking, alcohol consumption, or previous surgical interventions.

Physical examination revealed a blood pressure of 130/90 mmHg, temperature of 98.0°F, pulse rate of 88 beats per min, respiratory rate of 16 breaths per min, and oxygen saturation of 96% in ambient air. No signs of pallor, icterus, or edema were observed. Despite the absence of these signs, the patient appeared unwell and dehydrated, with an NG tube and Foley catheter in place. On abdominal examination, the abdomen was soft, tender, and distended with a tympanic note upon percussion with the presence of bowel sounds on auscultation. On digital rectal examination, the rectum was empty and anal tone was normal. Following presenting symptoms and clinical findings, a provisional diagnosis of complete bowel obstruction was considered.

Laboratory analysis revealed neutrophilia (77%), lymphocytopenia (19%) along with a reduced red blood cell count (4.29 million/cu). Other blood tests including liver and renal function tests were within the normal range as shown in Table 1. The serological test for HIV, HBsAg and HCV were non-reactive. Arterial blood gas analysis indicated hypercapnia in the patient (Pco_2 – 57.5 mmHg) (Table 1).

The echocardiography (ECHO) screening was done which showed normal cardiac chambers and valves, a left ventricular ejection fraction of 50–55%, and no regional wall motion abnormality. Ultrasonography of the abdomen and pelvis identified a marked dilation of the small-bowel loop. Multiple loops of dilated jejunum and ileum measuring up to 3.7 cm in diameter was noted in contrast-enhanced CT scan (CECT) of abdomen and pelvis as shown in (Fig. 1A-C). The lead point was arising from the terminal ileum along with its abrupt narrowing, extending to the midpoint of ileal loop. The bowel wall was normal with symmetric homogenous enhancement and the large bowel appears non-distended. These findings in CECT were suggestive of small-bowel obstruction. There was no evidence of ascites and pneumatosis in the abdomen. However, simple renal cortical cysts were noted in the left kidney in a CT scan of the patient.

Table 1

Laboratory findings of the patient at the time of presentation.

Laboratory parameters	Results	Units	Reference range
Complete blood cell count			
Hemoglobin	13.5	g/dl	12–18
RBC count	4.29	million/cu	4.5–5.5
WBC count	9300	/mm^3	4000–11 000
Platelet count	219 000	/mm^3	150 000–450 000
Differential count			
Neutrophils	77	%	45–75
Lymphocytes	19	%	25–45
Eosinophils	1	%	1–6
Monocytes	3	%	2–10
Packed cell volume	38.7	%	36–54
Mean cell volume	90.21	fl	82–92
Mean cell hemoglobin	31.47	pg	27–32
Mean cell hemoglobin concentration	34.88	%	32–36
Red cell distribution width – coefficient of variation (RDW-CV)	13.5	%	11–15
Renal function tests			
Serum Na^+	135	mmol/l	135–146
Serum K^+	3.8	mmol/l	3.5–5.2
Serum calcium (ionized)	1.11	mmol/l	1.1–1.3
Serum creatinine	60	μmol/l	72–127 (Male > 50 years)
Serum urea	6.2	mmol/l	2.8–7.2
Liver function tests			
Alkaline phosphatase (ALP)	51	U/l	< 306
Aspartate transaminase (AST)	24	U/l	5–40
Alanine transaminase (ALT)	19	U/l	5–45
Total bilirubin	18	gm/l	3–21
Direct bilirubin	3	gm/l	0–5
Serum albumin	35	U/l	38–49
Arterial blood gas (ABG) Analysis			
Blood pH	7.398	—	7.35–7.45
PCO_2	57.5	mmHg	35–45
HCO_3^-	22.9	mEq/l	22–26

RBC, red blood cell; WBC, white blood cell.

Based on these findings of ultrasonography and CT, a diagnosis of small-bowel obstruction was established prompting the patient to undergo surgical intervention under general anesthesia through exploratory laparotomy. The patient received intravenous ceftriaxone 45 min prior to surgical incision as prophylactic antibiotics. The patient was placed in supine position under general anesthesia. Then, midline incision was given, and the abdomen was opened in layers. During the surgery, a 2 cm defect was noted in the peritoneum of the anterior abdominal wall in the hypogastric region through which a circumferential bowel wall was herniating (Fig. 2A). This internal hernia was a left posterior superior vesical hernia, responsible for intestinal obstruction and clinical manifestation of pain, vomiting, and constipation in the patient. The hernia was confirmed during the surgical procedure. The affected bowel segment was located 220 cm distal to the duodeno-jejunal junction and 60 cm proximal to the ileocecal junction. Although the proximal bowel loop exhibited dilation, the entire bowel loop was found to be viable as shown in (Fig. 2B).

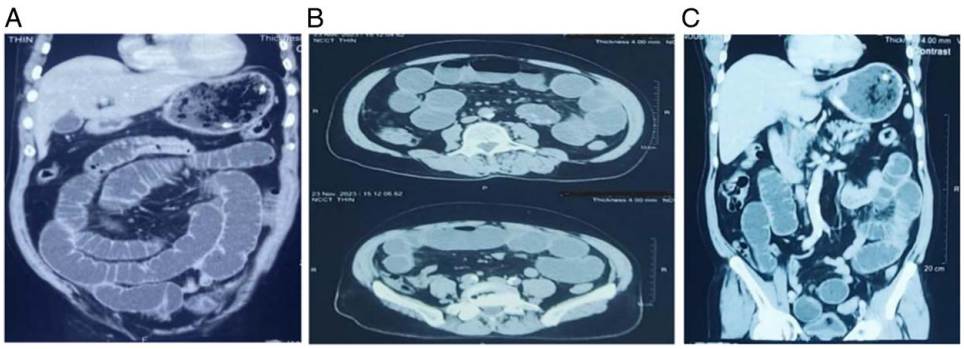

Figure 1. Contrast-enhanced CT scan (CECT) of abdomen and pelvis suggestive of small bowel obstruction.

The hernial content was then gradually reduced, ensuring the secure handling of the bowel contents as shown in (Fig. 2C). Initially, the reduced portion of the bowel was inspected to check its viability. A comprehensive examination of the bowel, extending from the duodeno-jejunal junction to the rectosigmoid colon, was carried out to identify any additional pathologies.

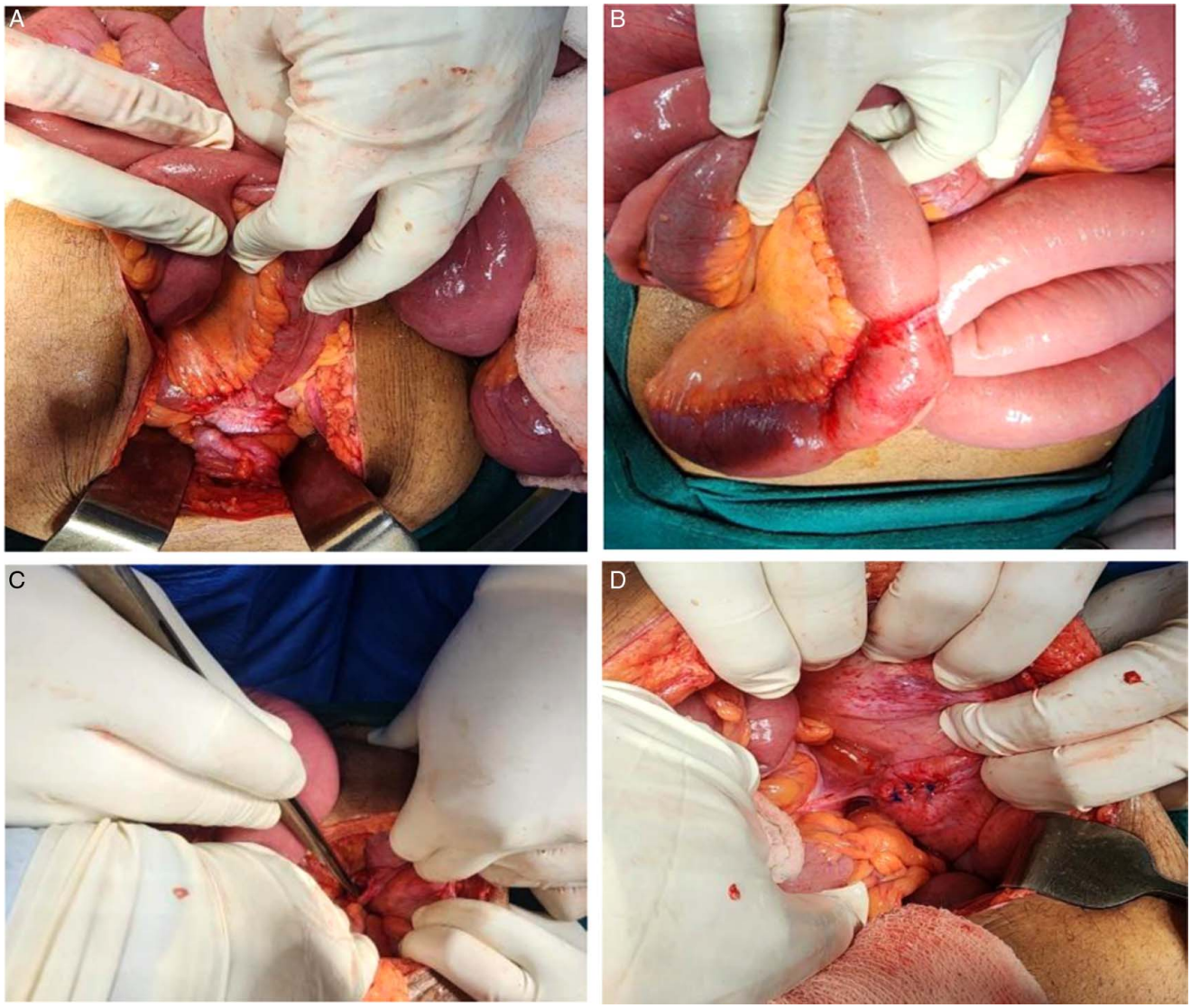

Figure 2. Intra-operative findings suggestive of internal supravesical hernia.

Following this, the defect in the anterior abdominal wall was primarily repaired using Prolene 2-0 interrupted suture, and the abdomen was closed in layers with loop suture as shown in (Fig. 2D).

Postoperatively, the patient received intravenous paracetamol (500 mg twice daily), intravenous ondansetron (4 mg three times daily), and intravenous pantoprazole (40 mg once daily). Regular monitoring of the abdominal girth was maintained to know the status of abdominal distension. The patient responded well to the treatment, exhibiting stable vital signs, and showed improvement during follow-up. No postoperative complications, signs and symptoms of blood loss noted in the patient during routine follow-up of the patient.

Discussion

Internal hernias can occur in various locations, including natural orifices like the foramen of Winslow, as well as abnormal sites such as paraduodenal, transmesenteric, transomental, pericecal, or supravesical regions[2,10]. Supravesical hernia is classified as internal and external forms based on direction of extension of the hernial sac[11]. Internal supravesical hernia is a rare abdominal hernia that develops at the supravesical fossa between remnants of urachus and the left or right umbilical artery[12–14], protruding the bowel contents either into the prevesical space of Retzius or the paravesical space[7,15]. The external supravesical hernia on the other hand, are acquired, and results from laxity of preperitoneal tissue[13]. It often mimics a direct inguinal hernia by protruding through the anterior abdominal wall, extending into the inguinal canal[16].

Less commonly, the sac surrounds the area adjacent to the bladder[17]. Based on relation to the bladder, internal supravesical hernia can be of various types, including prevesical, paravesical, lateral, or intravesical[15]. The intravesical type of internal supravesical hernia occurs due to a weakened bladder apex resulting from a defective closure of the urachus, leading to herniation of the diverticulum directly into the bladder[18]. Supravesical hernia predominantly affects men over 50 years of age[7,17]. It is mainly due to antero-superior enlargement of the bladder during its filling entraping the intestine in the supravesicular diverticulum whenever present. In females, there is lateral enlargement of the bladder during filling, which forces supravesical diverticular contents upward and outward, thus making the hernia relatively uncommon[6,19]. The overall incidence of supravesical hernia is less than 4% among all internal abdominal hernias[14,19]. Around 60 cases of supravesical hernias have been reported till date in the literature worldwide[20,21]. The defect mostly lies in area around the bladder[22], however, may involve broad ligament in elderly patients with the ileal segment being most commonly involved. Bowel loops may stay within or extend above the pelvis[21].

The exact pathogenesis of the disease remains unclear. The major risk factors associated with abdominal wall hernias encompass prematurity, a positive family history marked by congenital weakness in the transversus abdominis muscle, male gender, smoking habits leading to decreased collagen production, advanced age, and conditions characterized by defective collagen synthesis, such as Ehlers-Danlos Syndrome or Marfan's Syndrome[23]. It is likely an acquired condition, influenced by the concave peritoneal depression of the paravesical space, primarily due to atrophy of peritoneal fat resulting from factors like aging, malnutrition, and disease[18,19]. These factors predispose to the development of inflammatory areas and subsequent scarring, creating conditions conducive to hernia formation[19]. Furthermore, a potential cause is suggested to be dysraphism between Cooper's ligament and the transversalis fascia, arising from sub-peritoneal tissue-fibrillary contraction following inflammation[18,19]. Increased intra-abdominal pressure can also lead to this type of hernia[19]. In predisposed individuals, difficulties in urination and urinary retention during bladder filling can weaken the integrity of the transverse abdominal aponeurosis and transversalis fascia, leading to the formation of a supravesical peritoneal diverticulum[19]. Increased expression of umbilical folds may lead to a deeper peritoneal depression in the paravesical space into which surrounding abdominal structures can protrude[11,18]. Inadequate collagen synthesis, whether congenital or acquired, contributes to the weakness of fascial and aponeurotic structures in the anterior abdominal wall leading to internal hernia[19].

Clinically, the disease presents with vague abdominal symptoms, such as recurrent abdominal pain, nausea, and vomiting, indicative of recurrent intestinal obstruction[11,14,24]. It often mimics with other primary causes of small-bowel obstruction, such as adhesion bands due to previous abdominal surgery, malignancy, invagination, inflammatory bowel diseases, trauma, congenital atresia, cholelithiasis, or Meckel's diverticulum creating challenges in clinical diagnosis of disease[24]. Symptom intensity varies based on hernia reducibility and the presence of incarceration or strangulation[19]. Strangulation if occur, often leads to ischemic necrosis or gangrene of the intestine requiring bowel resection of varying extent, contributing to a heightened mortality risk among the patients[11,24]. Thus, clinicians must consider supravesical hernia as one of the differentials, when the patient present with signs and symptoms of acute abdominal obstruction. Pain in the hypogastric region and vomiting were associated with acute intestinal obstruction in the patient. In some cases of intravesical supravesical hernia, clinical signs may include increased urination frequency, bladder irritation, and dysuria due to compression of the bladder by dilated small-bowel convolutions[11,15,19,22]; however, anatomy or function of the bladder doesn't seem to be affected in our case.

Diagnosing this condition before surgery is challenging, as illustrated in our case where the confirmatory diagnosis was established only during laparotomy. For patients with small-bowel obstruction, lacking a history of prior abdominal surgeries, and without evident external hernias, preoperative investigations, such as CT or MRI scans, can be valuable for diagnosis[20,21,25,26]. However, most of the time, the disease is correctly diagnosed only after a surgical procedure. Some authors suggest that CT findings can enhance preoperative suspicion of internal supravesical hernias, potentially revealing the transition point of the incarcerated bowel near a compressed bladder[27]. CT surpasses conventional imaging in pinpointing the site, level, cause, and ischemic changes of small-bowel obstruction. Internal hernia-related obstructions typically involve closed-loop blockages, with bowel segments occluded at adjacent points[28]. Sasaya *et al.*[20] had reported the possibility for preoperative diagnosis of supravesical hernias using abdominal CT, highlighting cases where dilated small intestine loops were observed compressing the bladder[6].

Numerous studies have illustrated CT scan's precision in identifying small-bowel obstruction, boasting a sensitivity and specificity ranging from 94 to 100% and 90 to 95%, respectively[28]. CT findings of closed-loop small-bowel obstruction (SBO) depend on the length of the bowel segment involved and its orientation relative to the imaging plane. A short, closed loop, aligned within the plane of imaging, presents as a U- or C-shaped bowel loop. Alternatively, a radial array of distended small-bowel loops with converging mesenteric vessels indicates torsion. A longer closed loop, perpendicular to the imaging plane, appears as a clump of bowel loops. The "beak sign," characterized by fusiform tapering, and the "whirl sign," resulting from tightly twisted mesentery, signify the site of torsion[29]. CT with contrast shows decreased bowel wall enhancement as the most specific sign of ischemic bowel. The "small bowel feces sign" indicates obstruction's transition zone. Other ischemia signs include bowel wall thickening, mesenteric edema, and ascites[29,30]. In the absence of small-bowel dilation, mesenteric-vessel abnormalities and anomalous clustering of small-bowel segments become crucial diagnostic clues[4].

In the emergency department, CT scan offers a comprehensive assessment of the abdomen, crucial for evaluating acute abdomen cases with various potential causes in consideration[31]. CT scan's advantage in the emergency department for small-bowel obstruction (SBO) lies in its rapidity, enabling multiple acquisitions during a single contrast injection. Although imaging protocols vary based on potential diagnoses, clinical considerations, and radiographers' experiences, an abdominal CT scan has emerged as the definitive method for diagnosing urgent conditions in patients experiencing acute abdominal pain[32]. CT should be preferred when clinical or plain radiographic findings are inconclusive[31]. However, its low sensitivity for partial SBO is a limitation. Proper technique and protocol are crucial for enhancing CT examination and ensuring maximum diagnostic accuracy[32]. On the other hand, MRI matches CT's sensitivity for locating and assessing SBO causes. However, it lacks bowel viability assessment, clear mass lesion definition, and universal availability in emergency departments, restricting its use in emergency department[29]. USG can provide valuable information in emergency settings, particularly when immediate imaging is needed, and CT availability is limited. A small-bowel diameter exceeding 3 cm, along with a bowel wall thickness exceeding 3 mm, indicates potential obstruction or inflammation. Non-compressibility of the bowel and the presence of free fluid further support the diagnosis of obstruction. However, Ultrasound is not a substitute for CT scan and should not postpone surgical consultation[33]. Thus, clinicians need to be familiar with the anatomy of the supravesical fossa and should consider abdominal CT, a mandatory imaging method when patients present with non-specific clinical symptoms suggestive of intestinal obstruction, considering the conditions as a medical emergency. In our case, CECT of the abdomen and pelvis provided physicians with a clear indication of the level of obstruction rather than specific details about the hernia, enabling the timely intervention in the patient. This case report underscores the significance of utilizing CT in cases of bowel obstruction for prompt action and emphasizes the need for caution to prevent complications associated with late presentation or delayed diagnosis.

The disease requires an emergency surgical repair of hernia. Surgical management, whether through laparoscopy or laparotomy, typically involves reducing the hernia, eversion of the hernial sac, ligating, and excising the sac[6,23]. In most cases, exploratory laparotomy is performed, involving the release of intestinal obstruction and closure of the hernial defect[25]. Suture repair is commonly employed for ventral hernia defects smaller than 2 cm. However, for defects larger than 4 cm, this technique has been linked to recurrence rates of up to 54% and thus mesh repair is more preferred[34]. Surgery within 24–36 h lowers mortality rates, while delayed surgery increases them beyond 10%. Discharged patients should be educated on recognizing recurrent obstruction symptoms and seeking immediate medical attention[33]. Many authors discourage hernial sac excision, suggesting that freshening the ring edges and closing the defect with continuous or interrupted non-absorbable sutures is usually adequate[25,35]. The prognosis of the disease is favorable and rely primarily on early diagnosis and the prompt management of bowel obstruction[17]. However, this requires a good understanding of pelvic anatomical structures and the expertise of an experienced endoscopic surgeon[19].

Conclusion

Early preoperative diagnosis is crucial to prevent life-threatening bowel necrosis. Clinicians should include it in differentials when patient present with symptoms of acute intestinal obstruction. CT is essential for diagnosis and guiding emergency surgical repair of hernia and thus should be considered a mandatory test in such presentations. Radiologists can play a key role in timely diagnosis, enhancing patient outcomes by guiding appropriate surgical interventions. Thus, radiologists should provide appropriate guidance to the surgeons preoperatively to prevent irreversible damage to the bowel wall and mesentery. Timely diagnosis and surgical intervention are imperative to prevent complications and enhance patient outcomes.

Strengths and limitations of the study

The case report describes the detailed presentation of a rare case of internal supravesical hernia leading to small-bowel obstruction, highlighting the importance of CT scans in the diagnosis and the multidisciplinary approach to patient care. The comprehensive discussion covers the clinical presentation, diagnostic challenges, surgical management, and postoperative outcomes, providing valuable insights for clinicians encountering similar cases. The inclusion of relevant laboratory findings and imaging results enhances the understanding of the case and its management. However, the single case presentation may not fully capture the variability and complexity of supravesical hernias in different clinical settings. Nonetheless, the study contributes to the existing literature on this condition and underscores the need for further research and clinical awareness.

Ethical approval

None.

Consent

Written informed consent was obtained from the parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

A.P., I.T. and L.K. wrote the original manuscript, reviewed, and edited the original manuscript. M.B., S.D., S.K.J., A.N. and J.K.S. reviewed and edited the original manuscript.

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