

Segmental Duodenal (D4) Necrosis Secondary to Falciform Ligament Hernia: A Case Report and Literature Review

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What is known on this subject?

What is known on this subject is that internal hernias are rare but clinically important and potentially overlooked causes of mechanical small bowel obstruction. Falciform ligament hernia may present with non-specific symptoms and can mimic gallbladder, biliary tract, or peptic ulcer disease, leading to diagnostic delay. Computed tomography plays a key role in diagnosis, while surgical management requires hernia reduction, repair of the defect, and careful assessment of associated ischemia or necrosis.

What this study adds?

This study adds that segmental D4 duodenal necrosis may develop in mechanical small bowel obstruction secondary to falciform ligament hernia, highlighting an extremely rare clinical scenario. It emphasizes that, beyond assessment of the herniated bowel segment, the duodenum should also be systematically explored because of possible retrograde pressure and duodenal stasis. The study also provides technical considerations for safe surgical management of D4 necrosis using a tension-free, well-vascularized duodenojejunostomy.

ABSTRACT

Falciform ligament hernia (FLH) is an exceedingly rare clinical entity among internal hernias, and its diagnosis is frequently established intraoperatively. This study presents the surgical management of a case of segmental necrosis of duodenal D4 that developed after herniation of the terminal ileum through a defect in the falciform ligament. A 75-year-old male patient presented with abdominal pain that had persisted for 20 days. Physical examination revealed abdominal distension, diffuse tenderness in all quadrants, and guarding. Contrast-enhanced abdominal computed tomography demonstrated small bowel obstruction caused by a small bowel loop herniating through a defect in the falciform ligament. During emergency laparotomy, an ileal loop, approximately 50 cm proximal to the ileocecal valve, was found to be herniated through the falciform ligament defect. After reduction, the small bowel loops appeared viable; however, necrosis involving a major portion of the bowel wall was detected in the duodenal D4 segment at the level of the ligament of Treitz. The necrotic segment was resected; the hernia defect was repaired; and a hand-sewn, double-layer, side-to-side duodenojejunostomy was performed between the proximal duodenum and the jejunum. The patient was discharged uneventfully on the 15th postoperative day. Control endoscopy at three months demonstrated a patent, satisfactory anastomotic line. Although FLH is rare, its non-specific clinical presentation may delay diagnosis, which may lead to serious consequences, including strangulation, ischemia, necrosis, and mortality. This case demonstrates that in SBO due to an internal hernia, not only the herniated loop but also the duodenum and the duodenojejunal junction proximal to the obstruction should be systematically evaluated. With early clinical suspicion, appropriate imaging, comprehensive exploration, and an experienced surgical approach, safe and effective outcomes can be achieved in this rare but potentially life-threatening condition.

Keywords: Duodenal necrosis, duodenojejunostomy, emergency surgery, falciform ligament hernia, internal hernias



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Introduction

Internal hernias are defined as the protrusion of intra-abdominal organs through a normal or pathological defect or fossa within the peritoneal cavity. Internal hernias are rare, with an incidence below 1% (1). Nevertheless, they have been reported to account for approximately 5.8% of all small bowel obstructions (SBOs) (1). Within this spectrum, falciform ligament hernia (FLH) is characterized by herniation of the small intestine, most frequently through an abnormal defect in the falciform ligament of the liver, and is an extremely rare entity (2). This type constitutes approximately 0.2% of all internal hernias and may lead to significant morbidity and mortality when diagnosed late (3). Diagnosis is usually based on clinical suspicion, and the definitive diagnosis is often established intraoperatively. However, contrast-enhanced abdominal computed tomography performed in emergency settings may facilitate preoperative diagnosis and contribute to the determination of the surgical treatment strategy (4,5).

The primary aim of this study is to present the surgical management of a case of segmental duodenal necrosis that developed following herniation of the terminal ileum through a falciform ligament defect. The secondary aim is to review the current literature on FLH and to discuss the diagnostic difficulties, potential complications, and surgical treatment approaches for this rare clinical presentation in light of current data.

Case Report

A 75-year-old man presented to the emergency department with a 20-day history of abdominal pain. The patient had presented to various healthcare institutions on three separate occasions due to abdominal pain; at each visit, symptomatic treatment had been administered based on suspicion of gallbladder pathology. His medical history revealed no additional diseases or prior surgeries, other than a 40 pack-year smoking history. Physical examination demonstrated marked abdominal distension, diffuse tenderness in all quadrants, and guarding. Laboratory tests revealed leukocytes at $13 \times 10^9/L$, C-reactive protein at 50 mg/L, potassium at 2.9 mEq/L, and lactate at 2.1 mmol/L. Contrast-enhanced abdominal computed tomography showed SBO caused by a small bowel loop herniating through a falciform ligament defect (Figure 1a, b). Written informed consent was obtained from the patient, and emergency surgery was performed.

Conventional surgery was preferred due to the patient's low pulmonary reserve and marked dilatation of small-bowel loops. At laparotomy through a midline incision, an ileal

loop approximately 50 cm proximal to the ileocecal valve was observed to have herniated from right to left through a congenital defect in the falciform ligament. Upon reduction of the hernia, the proximal small bowel loops were notably dilated, but the bowel was observed to be viable (Figure 1c). Further exploration revealed necrosis of more than 50% of the duodenal circumference within an approximately 2-2.5 cm segment at the level of the ligament of Treitz (Figure 1d). During dissection of the ligament of Treitz, this necrotic area became perforated. To limit intra-abdominal contamination, the proximal and distal segments of the duodenum were temporarily clamped using bowel clamps (Figure 1d).

At this stage, the decision was made to repair the hernia defect in the falciform ligament and to perform a double-layer, hand-sewn duodenojejunostomy. After dissection of the ligament of Treitz using the Kocher and partial Cattell-Braasch maneuvers, a segmental resection of the distal duodenum (D4) and proximal jejunum was performed using a tissue GIA. Subsequently, a hand-sewn, double-layer, side-to-side duodenojejunostomy was performed between the proximal duodenum at the D3 level and the proximal jejunal loop. A 3/0 polydioxanone with a 19 mm round needle was used as suture material. Debridement was performed to limit intra-abdominal contamination, control the focus of infection, and obtain a culture from the intra-abdominal fluid. A nasojejunal tube was placed to reduce intraluminal pressure at the anastomotic line; additionally, drains were placed adjacent to the upper and lower borders of the anastomosis for early detection of possible leakage. The surgical procedure was completed without complications. The patient was discharged uneventfully on the 15th postoperative day. After discharge, the patient was followed up with weekly outpatient clinic visits during the first month, and then monthly until the third month. Follow-up during these visits included physical examination, clinical symptom assessment, and measurements of routine laboratory parameters. Control endoscopy, performed at the 3rd postoperative month, demonstrated a patent and satisfactory anastomotic line (Figure 1e).

Discussion

FLH are extremely rare clinical entities and can be difficult to diagnose due to their presentation with non-specific symptoms (5,6,7). However, their clinical significance is associated more with the difficulty in timely diagnosis and the risk of bowel strangulation than with their incidence. A literature search conducted in February 2026 using the keyword "falciform ligament hernia" in the PubMed and

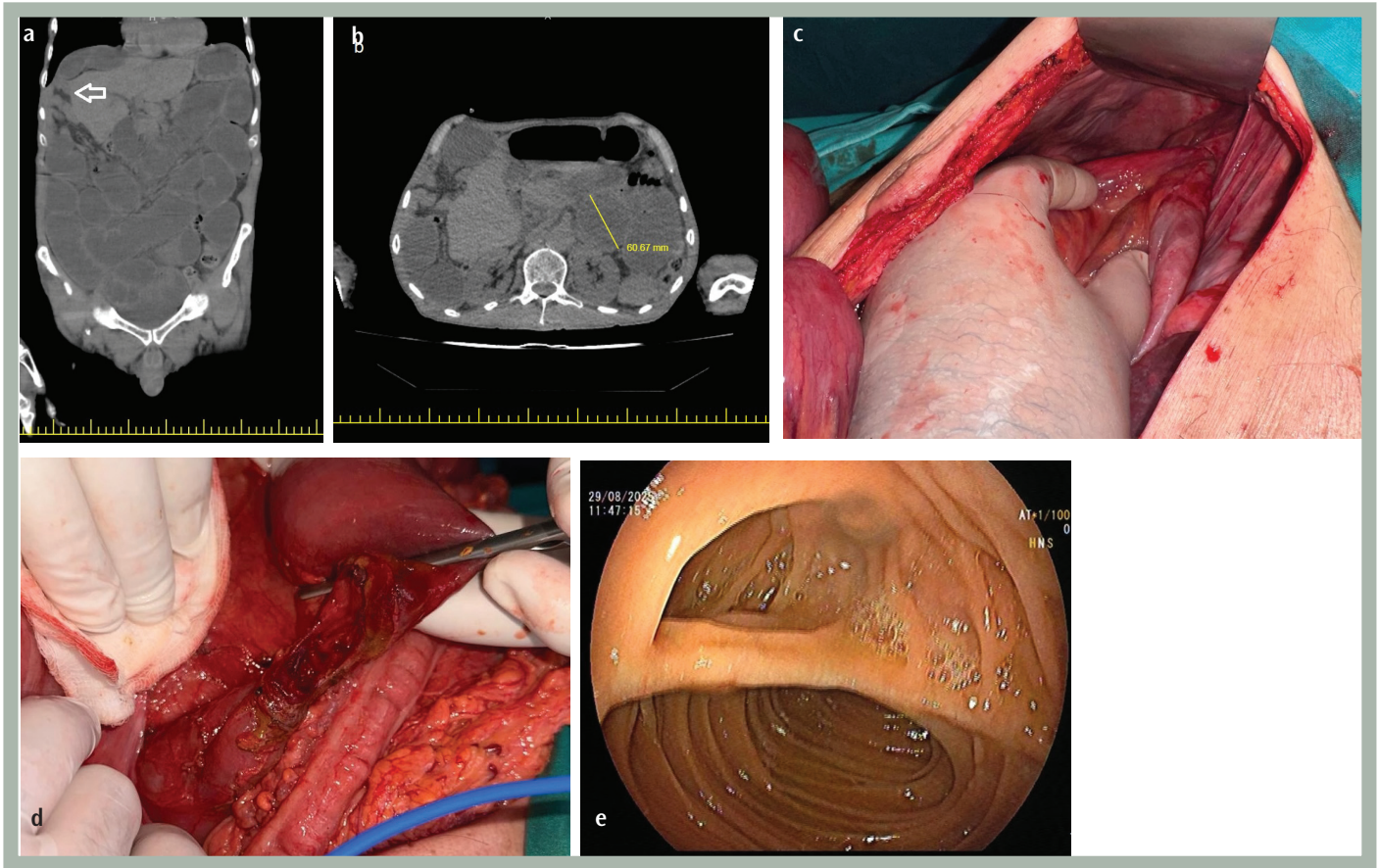


Figure 1. a) Coronal section computed tomography image (falciform ligament hernia defect marked with arrow), b); axial section computed tomography image (diameter of small bowel loop 60.67 mm), c); intraoperative falciform ligament hernia defect, d); intraoperative duodenum (D4) perforation image, e); postoperative endoscopic anastomosis image

Google Scholar databases identified 38 English-language studies reporting a total of 52 cases. To our knowledge, the present case represents the first report in the literature describing duodenal necrosis secondary to FLH.

The etiology of falciform ligament defects is diverse and may include congenital anomalies, trauma, inflammation, and iatrogenic causes (8). Variations in mesenteric length may create a predisposition, particularly for small bowel herniation (4). In the literature, the most commonly herniated organ is the small intestine, followed by the colon and omentum (5,6). Although FLH can occur in all age groups, the incidence is not considered to have a significant relationship with gender (5).

The most frequently reported symptom in the literature is abdominal pain (5,6). However, due to the absence of specific symptoms for the disease and the fact that clinical suspicion is the most important element in diagnosis, only approximately 20% of reported cases could be diagnosed preoperatively as FLH (5). Although approximately 50% of patients underwent diagnostic computed tomography, the sensitivity of computed

tomography in detecting this pathology has been reported to be 37.5% (5). The role of magnetic resonance imaging in diagnosis is limited and can be considered a safe alternative, particularly in situations where computed tomography is not preferred, such as pregnancy (5). Nevertheless, computed tomography is recommended as the first-line imaging modality in cases of acute abdominal pain with an unclear diagnosis (6).

In the surgical treatment of reported cases in the literature, conventional surgical approach was predominantly preferred, with this rate reported to be approximately 70% (5,6). However, in recent years, an increase in the use of minimally invasive techniques has been observed.

It must be emphasized that systematic and comprehensive exploration of the entire abdomen is critical in cases of SBO. Insufficient exploration may lead to overlooking not only ischemia or necrosis in the herniated bowel loop but also circulatory disturbances that may develop proximal to the obstruction.

The D3-D4 duodenal segments are retroperitoneal and fixed by the ligament of Treitz. Therefore, when pressure increases or distension develops, these segments cannot be mobilized to the same extent as other small-bowel loops. This anatomical fixation may predispose to duodenal stasis, ischemia, and necrosis by increasing local tension, intraluminal pressure, and venous congestion. Therefore, during exploration in SBO cases, the duodenum and the duodenojejunal junction should also be carefully evaluated. Otherwise, overlooked duodenal ischemia or necrosis may result in significant morbidity and mortality.

According to general principles of gastrointestinal anastomosis, success depends on meticulous suturing, elimination of tension, and establishment of adequate vascularization. In our case, because necrosis involved approximately 70% of the wall of the duodenal D4 segment, a duodenojejunostomy was planned. In cases where duodenojejunostomy is to be performed, the anatomical location and vascular supply characteristics of the duodenum are particularly important for the surgical decision (9).

While the D3 segment of the duodenum runs horizontally and lies to the right of the superior mesenteric vessels, the D4 segment lies to the left of the superior mesenteric axis and constitutes the final segment of the duodenum. The vascularization of the D2 and proximal D3 segments is primarily provided by the superior and inferior pancreaticoduodenal arcades, which originate from the gastroduodenal and superior mesenteric arteries. Therefore, the most suitable vascular bed for anastomosis is often found at these levels.

In contrast, the blood supply to the distal D3 and D4 segments is more limited and depends largely on collateral branches of the pancreaticoduodenal arcades and on the first left branches of the superior mesenteric artery. In approximately one-quarter of patients, the D4 segment lacks a distinct and independent arterial supply. This situation may increase the risk of perfusion insufficiency and anastomotic failure, particularly in anastomoses performed at this level (9).

Considering these anatomical and vascular characteristics, side-to-side duodenojejunostomy was preferred in our case to primary repair or segmental closure to achieve a tension-free, well-drained reconstruction.

In the literature, mortality has been reported in only three patients due to FLH (5,6,7). Thanks to advances in imaging methods, increased clinical awareness, and progress in surgical techniques, the prognosis of FLH is generally quite favorable (5,6). With early diagnosis and timely surgical intervention,

serious complications such as bowel strangulation, ischemia, and necrosis can be prevented; therefore, patients' postoperative recovery is uneventful in most cases.

Conclusion

FLH is difficult to diagnose because of its non-specific clinical presentation, and diagnostic delays may increase morbidity and the risk of mortality. The success of duodenojejunostomy performed in the presence of duodenal (D4) necrosis depends on detailed knowledge of duodenojejunal anatomy, the principles of tension-free and well-vascularized anastomosis, and experience in hepatopancreaticobiliary surgery. Within this framework, safe and effective outcomes can be achieved with early suspicion and a correct surgical strategy.

Ethics

Informed Consent: Written informed consent was obtained from the patient, and emergency surgery was performed.

Footnotes

Authorship Contributions

Surgical and Medical Practices: F.G., Y.Y.K., E.K., Concept: F.G., Y.Y.K., E.K., Design: F.G., Y.Y.K., E.K., Data Collection or Processing: F.G., Y.Y.K., E.K., Analysis or Interpretation: F.G., Y.Y.K., E.K., Literature Search: F.G., Y.Y.K., E.K., Writing: F.G., Y.Y.K., E.K.

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