

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Falciform ligament hernia: combination of key CT findings [☆]

Tomonori Matsuura, MD^{*}, Nozomi Satani, MD, Ryo Tamura, MD, Yuriko Kagaya, MD, Takayuki Yamada, MD

Division of Radiology, Tohoku Medical and Pharmaceutical University, 1-15-1 Fukumuro, Miyagino, Sendai, Miyagi 983-8536, Japan

ARTICLE INFO

Article history:

Received 22 February 2023

Accepted 26 February 2023

Keywords:

Falciform ligament hernia

Internal hernia

Double beak sign

Round ligament of the liver

ABSTRACT

A male patient in his early 90s with no history of abdominal surgery was referred to us for abdominal pain and vomiting. An abdominal computed tomography (CT) demonstrated dilated small bowel with a double beak sign and poorly enhanced wall, which indicated a closed-loop obstruction that leads to strangulation. A closed-loop bowel was located in front of the anterior and medial segments of the liver and to the right of the round ligament of the liver on axial images. Sagittal images revealed that the round ligament has deviated downward and 2 adjacent narrowed intestines were located at its cranial side. These CT findings suggested the hernia orifice was in the falciform ligament. Emergency surgery for highly suspected bowel ischemia revealed the falciform ligament hernia. A combination of the CT findings played a key role, including the double beak sign, the location of the closed-loop small bowel, and the downward deviation of the round ligament, although preoperative CT diagnosis of falciform ligament hernia is a diagnostic challenge.

© 2023 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

The falciform ligament hernia is an extremely rare internal hernia with a congenital or acquired tear of the falciform ligament as the hernia portal [1]. It can degenerate into intestinal strangulation and ischemia and can require emergency surgical treatment. The correct diagnosis is imperative for proper treatment. However, the falciform ligament hernia is difficult to diagnose from clinical findings and symptoms like other internal hernias. Computed tomography (CT) has been useful

for demonstrating the falciform ligament hernia [2–5]. Here, we report a case of a falciform ligament hernia that we preoperatively diagnose by considering the round ligament of the liver on CT.

Case report

A male patient in his early 90s was admitted to our hospital with a chief complaint of abdominal pain and vomiting af-

[☆] Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

^{*} Corresponding author.

E-mail address: t.matsuura@tohoku-mpu.ac.jp (T. Matsuura).

<https://doi.org/10.1016/j.radcr.2023.02.058>

1930-0433/© 2023 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

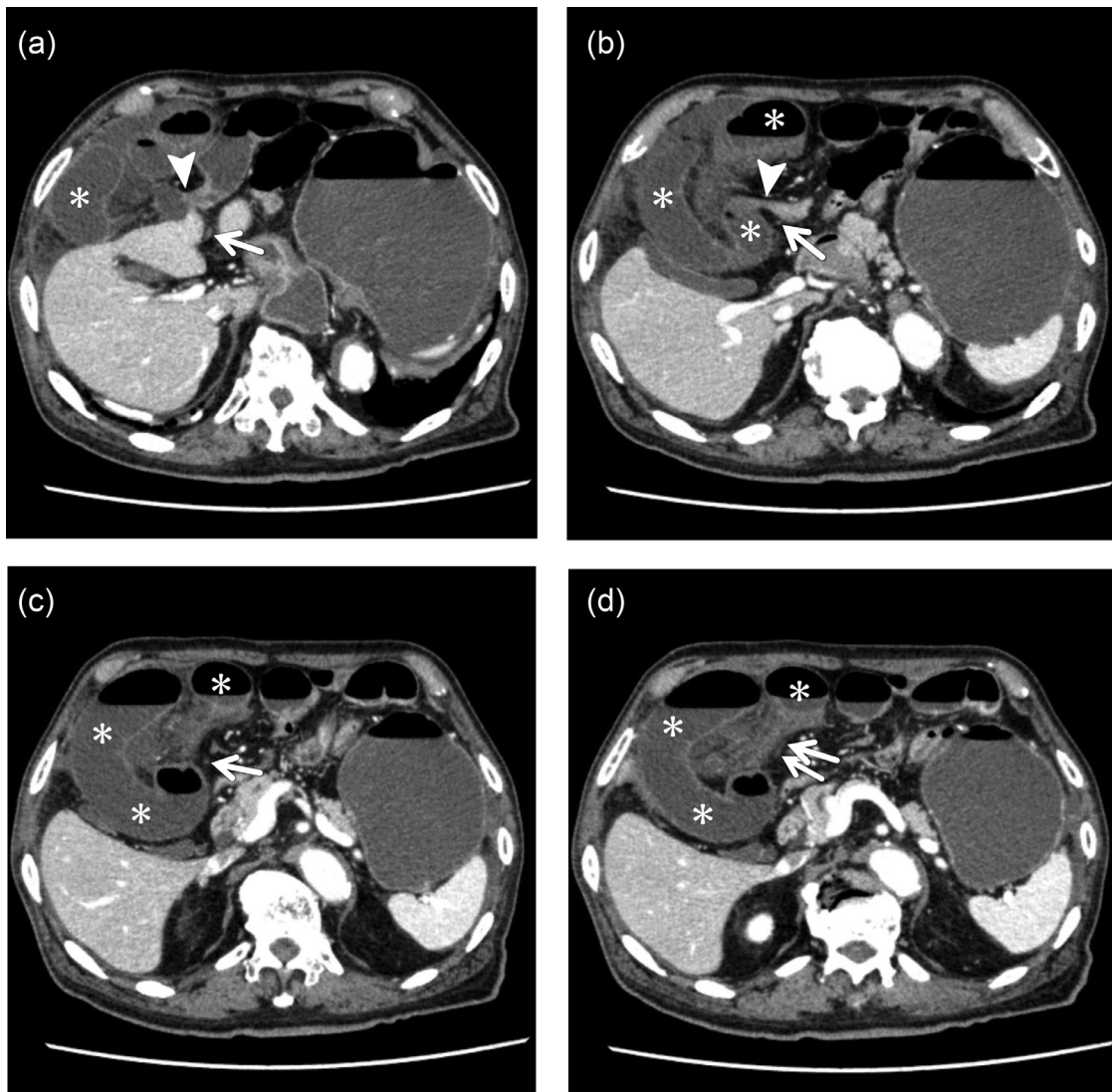


Fig. 1 – Contrast-enhanced CT. Cranial (A) to caudal (D) axial CT images show a double beak sign (arrowhead) in front of the medial segment of the liver; the closed-loop small bowel (asterisk) is seen in the right side of the round ligament (arrow).

ter defecation. His past medical history included Alzheimer's disease, pulmonary emphysema, and angina pectoris, but he had no history of abdominal surgery. The abdomen was soft with epigastric tenderness, and bowel sounds were decreased. Blood tests showed normal findings.

An abdominal CT demonstrated dilated stomach and small intestine with air-fluid levels. A double beak sign on the anterior surface of the liver in the right upper abdomen indicated a closed-loop obstruction (Fig. 1). A closed-loop intestine with a poorly enhanced wall was located to the right of the round ligament of the liver, which was associated with edematous mesentery on axial images. Two adjacent narrowed intestines were located at the cranial side of the round ligament that was displaced more caudal than usual on sagittal images (Fig. 2C). These CT findings suggested strangulating small bowel obstruction. The patient had no history of abdominal surgeries, indicating the absence of any adhesive intestinal obstruction, thus suggesting an internal hernia. The hernia orifice was implied to be in the falciform ligament be-

cause the hernia orifice was located superior to the caudally deviated round ligament and the closed-loop intestine was localized on the right side of the round ligament. Emergency surgery was performed because bowel ischemia was highly suspected.

A dilated small intestinal loop was observed at laparotomy. A defect was found in the falciform ligament, and the small intestine passed through the defect from the left to right (Fig. 3). The falciform ligament was dissected and the hiatus was opened after releasing the strangulation. The color of the closed loop improved and the intestine was preserved after repositioning the small intestine.

Discussion

CT is an essential tool for diagnosing the falciform ligament hernia. A combination of the provided CT findings, including a

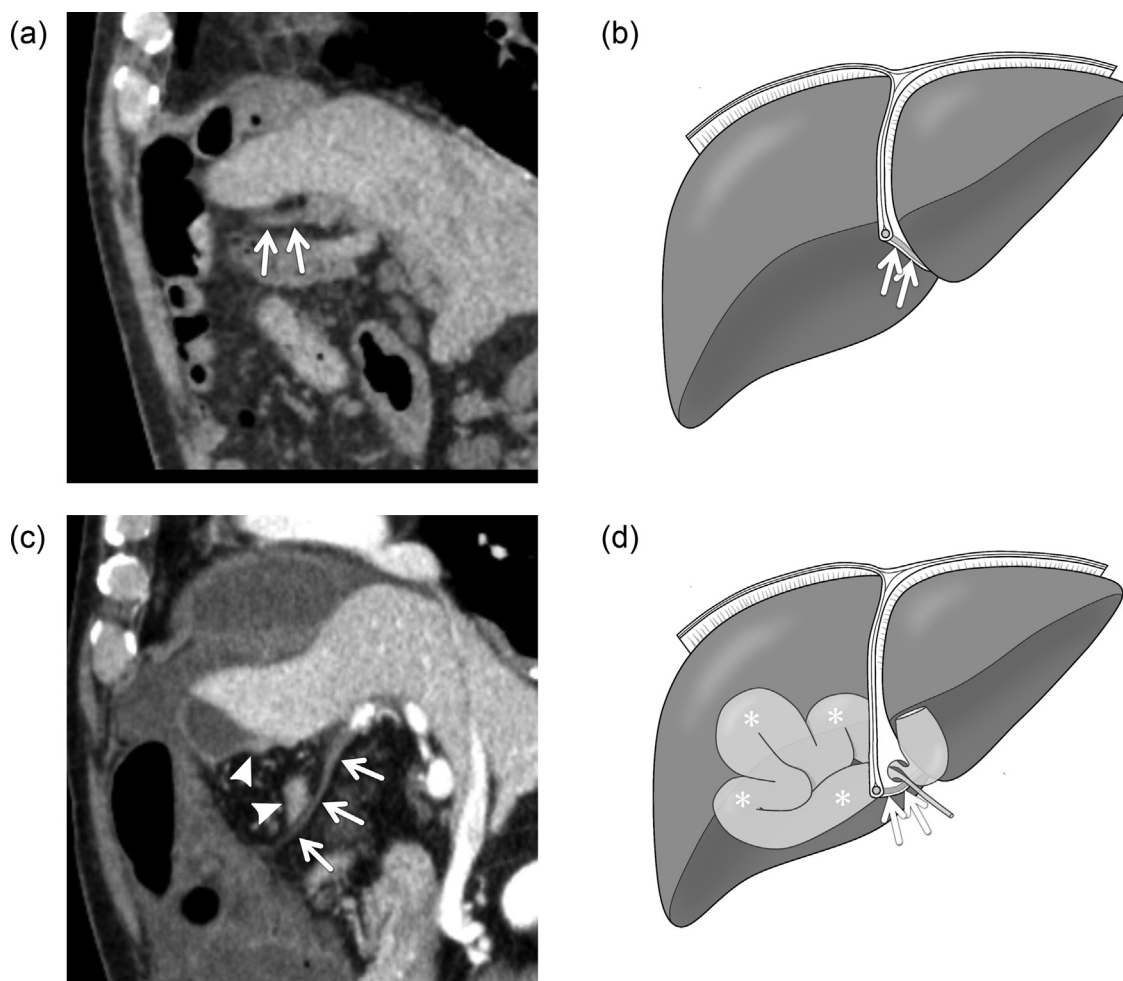


Fig. 2 – Sagittal CT image 2 months before admission (A) and drawing of nonpathologic status (B) shows normal anatomy of falciform ligament and round ligament (arrow). Sagittal CT image after admission (C) and drawing of the falciform ligament hernia (D) shows herniated small bowel (asterisk) through defect in falciform ligament and 2 narrowed intestines (arrowhead) above the round ligament (arrow). The round ligament of the liver is deviated inferiorly relative to normal status and the distance between round ligament and liver becomes larger.

double beak sign, the location of the closed-loop small bowel, and the downward deviation of the round ligament, played a key role in this case.

The beak sign has been a well-known sign of closed-loop obstruction [6]. It represents the tapering of the bowel at the transposition point of closed-loop obstruction. The double beak sign shows 2 adjacent collapsed loops that are recognized in patients with closed-loop obstruction due to an internal hernia [7], especially without a history of abdominal surgery. This sign was reported as one indicating nonsurgical treatment failure [8]. The location of the double beak sign, in this case, was also important in terms of relation to the round ligament, which will be discussed later.

Identifying the location of the closed-loop small bowel is mandatory to consider the falciform ligament hernia. A previous report revealed that a falciform ligament hernia should be considered when a closed-loop intestine is seen in front of or slightly caudal to the liver on CT [9]. Here, a closed-loop small bowel was observed in the front of the anterior and me-

dial segments of the liver, which was on the right side of the round ligament. The closed-loop small bowel that is localized in front of the anterior and medial segments of the liver suggests the falciform ligament hernia because the falciform ligament marks the border between the medial and lateral segments of the liver.

The identification of the falciform ligament is considered desirable for diagnosing the falciform ligament hernia. However, the falciform ligament is too thin to be depicted even on multidetector CT except in the case of massive ascites or a large amount of intra-abdominal gas. In contrast, the round ligament of the liver, which forms the lower border of the falciform ligament, can be depicted on CT. The round ligament is seen under normal conditions as a cord-like structure running ventrally along the inferior surface of the left hepatic lobe, and then off the anteroinferior surface of the liver, almost directly caudal toward the umbilicus on the sagittal image. Therefore, the location of the falciform ligament can be predicted by the position of the round ligament.

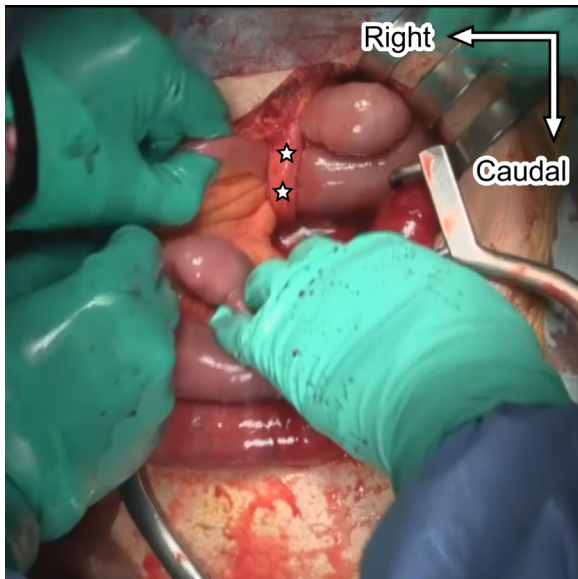


Fig. 3 – The hernia orifice was operatively observed in the falciform ligament (star). The direction of herniation was left to right.

Anatomic evaluation of the round ligament of the liver on CT is most important to correctly diagnose the falciform ligament hernia. The round ligament of the liver was found in a normal position before the onset of the falciform ligament hernia (Figs. 2A and B). The round ligament was deviated caudally and was away from the inferior surface of the liver after the onset of the hernia (Figs. 2C and D). Additionally, the double beak, which was recognized above the round ligament, deviated downward, which strongly suggested that the hernia orifice was seen above the round ligament, that is, a falciform ligament hernia. The deviation of the round ligament of the liver was an important indirect sign by the herniated small bowel penetrating the falciform ligament. Several authors have reported the usefulness of round ligament evaluation in the preoperative diagnosis of the falciform ligament hernia [2,4], but we are not aware of any reports in which deviation of the round ligament on CT is decisive in diagnosing the falciform ligament hernia.

In conclusion, preoperative CT diagnosis of a falciform ligament hernia is a diagnostic challenge because identifying the falciform ligament is usually difficult; however, a combination of the provided CT findings, including the double beak sign

that suggested the closed-loop obstruction, the location of the closed-loop small bowel, and the downward deviation of the round ligament, played a key role in this case.

Patient consent

Written informed consent was obtained for publication of this case report. We are retaining the agreement document with us for our own record.

REFERENCES

- [1] Egle J, Gupta A, Mittal V, Orfanou P, Silapaswan S. Internal hernias through the falciform ligament: a case series and comprehensive literature review of an increasingly common pathology. *Hernia* 2013;17(1):95–100. doi:10.1007/s10029-012-0990-6.
- [2] Baba K, Uemura K, Sumiyoshi T, Kobayashi T, Kondo Y, Tazuma S, et al. Falciform ligament hernia with specific abdominal symptom. *Clin J Gastroenterol* 2021;14(2):566–9. doi:10.1007/s12328-020-01323-0.
- [3] Shiozaki H, Sakurai S, Sudo K, Shimada G, Inoue H, Ohigashi S, et al. Pre-operative diagnosis and successful surgery of a strangulated internal hernia through a defect in the falciform ligament: a case report. *J Med Case Reports* 2012;6(1):206. doi:10.1186/1752-1947-6-206.
- [4] Coulier B, Broze B, Mailleux P, Maldague P. Small-bowel internal herniation through the falciform ligament: 64-row MDCT diagnosis. *Emerg Radiol* 2009;17(1):73. doi:10.1007/s10140-009-0793-y.
- [5] Sourtzis S, Canizares C, Thibeau J, Philippart P, Damry N. An unusual case of herniation of small bowel through an iatrogenic defect of the falciform ligament. *Eur Radiol* 2002;12(3):531–3. doi:10.1007/s003300100970.
- [6] Balthazar EJ. George W. Holmes lecture. CT of small-bowel obstruction. *Am J Roentgenol* 1994;162(2):255–61. doi:10.2214/ajr.162.2.8310906.
- [7] Metcalfe AM, DiSantis DJ, Alexander LF. The “double beak sign” on CT. *Abdom Radiol* 2021;46(4):1771–2. doi:10.1007/s00261-020-02814-x.
- [8] Millet I, Ruyer A, Alili C, Curros Doyon F, Molinari N, Pages E, et al. Adhesive small-bowel obstruction: value of CT in identifying findings associated with the effectiveness of nonsurgical treatment. *Radiology* 2014;273(2):425–32. doi:10.1148/radiol.14132872.
- [9] Doishita S, Takeshita T, Uchima Y, Kawasaki M, Shimono T, Yamashita A, et al. Internal hernias in the era of multidetector CT: correlation of imaging and surgical findings. *RadioGraphics* 2016;36(1):88–106. doi:10.1148/rg.2016150113.