FALCIFORM LIGAMENT HERNIATION TREATED WITH COMBINED TRANS-PERITONEAL LAPAROSCOPIC DISSECTION AND ABDOMINAL WALL REPAIR BY HAND-INTERRUPTED SUTURE: A CASE SERIES REPORT AND REVIEW OF LITERATURE

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Falciform ligament hernia is a very rare internal hernia and is difficult to diagnose before surgery. Most reported cases are incisional hernias secondary to prior abdominal surgery. We report three cases of primary falciform ligament herniation into the epigastric region that was repaired by the intra-peritoneal laparoscopic approach combined with an extra-abdominal small skin incision. All laparoscopic procedures were performed without conversion to laparotomy, and all specimens were histopathologically diagnosed as lipomas. Three patients successfully recovered and were discharged on surgical days 2, 2, and 5, respectively. There were no complicationor recurrence during the 12-month follow-up. This technique is safe and feasible for repairing midline abdominal wall herniation. If the hernia orifice is less than 2cm in diameter, the abdominal wall defect may be improved by this procedure using Safil 1.0 or Vicryl 1.0 suture without mesh.

Keywords: Case series, herniation, falciform ligament, laparoscopic.

I. INTRODUCTION

An epigastric hernia is defined as a hernia with the centre of the defect in the midline above the umbilicus up to the xiphoid process.[1,2] It accounts for 1.6 - 3.6% of abdominal wall hernias.[1] The hernial sac is usually empty or contains a small part of only the greater omentum. Falciform ligament herniated into the epigastric fascial defect has rarely been reported in the literature, and most reported cases do not involve a primary hernia.[3-5] Lacroix described the first in 1962.[6] Falciform ligament hernias have only been reported in some other case reports in the English literature. In 2010, Jacob et al. claimed to inform the world's first case of epigastric hernia involving the falciform ligament repaired through laparoscopy.[3] It is unclear whether the falciform ligament had incorporated into the defect during the prior hernia repair or manifested as a separate and new distinctive event. Another case series presents two individuals with falciform ligament incarceration with a history of cholecystectomy.[7] The hernia in these cases may have been secondary to the previous incision-related abdominal wall weakness and not primary in origin.

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Minimally invasive surgery may cause less pain, scarring, and damage to healthy tissue, and the patient may have a faster recovery than with traditional surgery. In addition, if the laparotomy is not wide enough, it is difficult to explore the entire abdominal cavity. According to the European Society of Hernia Surgery, abdominal wall restoration combined with the placement of an artificial mesh is recommended for large abdominal wall hernias and weak abdominal muscles, so there is a high risk of recurrence when sutured. But this treatment requires consumables and metal pins to fix the mesh.[2] Because of that difficulty in clinical practice, we apply the surgical technique introduced in this article. Laparoscopic surgery aims to locate herniated viscera and treat by hand suture with a small incision less than 3 cm. Successful surgery in three patients ensures the effectiveness of the treatment and offers the advantages of minimally invasive surgery. The article aims to describe the technique and results of surgery combined with laparoscopic and hand sutures from outside the abdomen to treat hernia of the midline abdominal wall in the epigastrium.

We report three primary epigastric hernias containing falciform and round ligaments. This procedure not only guarantees positive outcomes but also has the benefit of being less invasive.

II. CASE PRESENTATION

From January 2020 to December 2022, four midline abdominal wall hernias were performed by laparoscopic surgery at Bachmai Hospital. All patients with surgical indications at our hospital had blood tests to determine their peripheral blood cells, prothrombin, fibrinogen, liver and kidney functions, blood type (ABO, Rh), and urinalysis. Simultaneously, the patient underwent echocardiography and electrocardiography. In addition, an abdominal CT or MRI scan were performed to establish the location and visceral hernia through the abdominal wall. We conducted the results of the technique combined with an intra-peritoneal laparoscopic and extra minimal abdominal incision on three patients with primary epigastric hernias containing falciform and round ligaments. The minimum incision is an incision equal to the thickness of the abdominal wall. It allows laparoscopic organ removal, making several anastomoses and suturing the fascia with the minimum opening.

These patients were operated on by a surgical team led by a gastroenterologist surgeon. The patients' demographics are summarised in Table 1.

All laparoscopic procedures were performed without conversion to laparotomy, and all specimens were histopathologically diagnosed as lipomas. All patients were found to be healthy at 1-year follow-up.

Operative technique: Patients are placed on their back with their knees flexed and legs separated and strapped to supporting pads. This position can be adjusted by tilting up the head and right side of the operating bed for a better view of the operative field. The TV screen is on the right, the surgeon is in the centre, and the camera operator is on the patient's left. The procedure was performed using three ports. The first port (10mm) was inserted using the Hasson technique at the umbilicus region. The second and third ports (5mm and 10mm) were placed equal to the navel along the right anterior axillary line (Figure 1B). Pneumoperitoneum was maintained between 10 and 12mmHg.

Table 1. Patients demographics who had laparoscopic surgery combined with hand-interrupted sutures

Case	Age (years)	Chief complaint	BMI (kg/m²)	CT-scanner* (mm)	Defect size (mm)	Incision length (cm)	OP time (min)	Complications	Hospital stay (days)	Pathology
1	63	Epigastric mass, increasing in size when coughing	25.2	43x23	1.5	2	32	No	2	Benign lipoma
2	60	Epigastric mass	24.5	35x32	2	2.5	54	No	2	Benign lipoma
3	82	Epigastric mass, increasing in size when coughing	27.4	30x37	1.5	3	40	No	5	Benign lipoma

*CT-scanner computed tomography scanner, OP operation, *size of hernia mass*

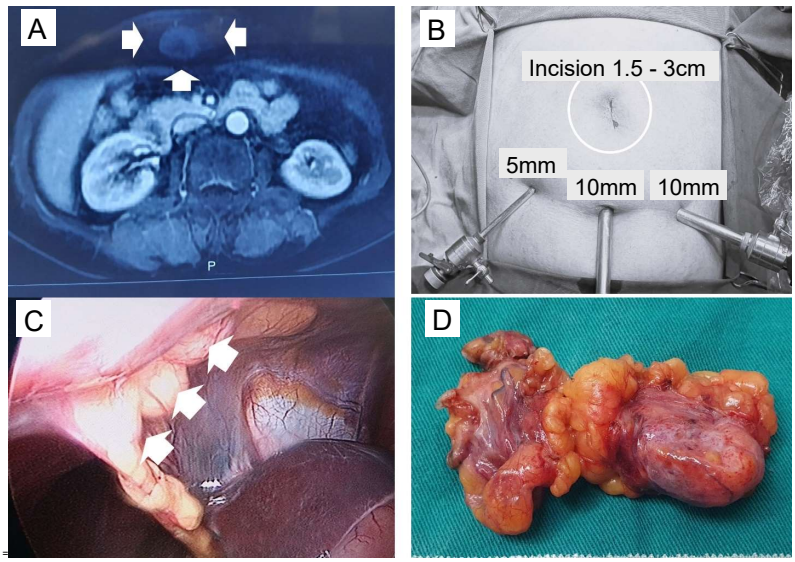

Figure 1. Illustrates imaging characteristics, surgical procedures, and intraoperative herniation of a male patient, 83 years old (No 3, date operation on November 14th 2022)
(A) Image of epigastric herniation on magnetic resonance imaging (White arrow); (B) Placement of trocars (two 10mm trocars and one 5mm trocar) and skin incision directly above the hernia; (C) Location of the hernia (White arrow); and (D) The specimen is fatty tissue

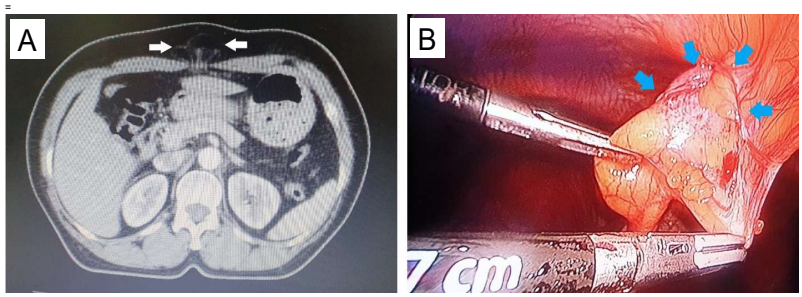

Figure 2. Illustrates imaging characteristics and surgical procedures of a male patient, 63 years old (No 1, date operation on September 9th 2020)
(A) Image of epigastric herniation on computed tomography (White arrow); (B) Location of the hernia (Blue arrow)

We utilized a unipolar electric knife and a Ligasure to dissect the peritoneum surrounding the hernia site. The falciform ligament was resected, the hernial orifice was exposed, and the hernia was pulled back into the abdomen (Figure 2B). We made a 1.5 - 3cm long skin incision above the hernia site (Figure 1B). The fascial and peritoneum were closed by 2 or 3 interrupted sutures using nonabsorbable sutures (B. Braun Safil 1 HR 40s 90cm Taper Heavy, Spain) under camera view. the specimen was placed in a plastic bag and it was removed via the navel trocar**.** Three patients successfully recovered and were discharged on surgical days 2, 2, and 5, respectively. There were no complication or recurrence during the 12-month

follow-up.

All patients were informed about the procedure, including its risks and advantages. Written informed consent was obtained from all patients in our study. The private information of all enrolled patients was carefully protected. The study was conducted according to the Declaration of Helsinki guidelines. This study is in line with the PROCESS 2020 criteria.[8]

IV. DISCUSSION

The epigastric hernia is a hernia with the centre of the defect in the midline above the umbilicus and up to the xiphoid process. The guideline group divided umbilical and epigastric hernias according to defect diameter as small (0 - 1cm), medium (more than 1cm up to 4cm), and big (greater than 4cm).[2] In most individuals, an umbilical or epigastric hernia may be identified just with a physical examination. Ultrasound imaging, CT, and MRI are examples of diagnostic testing. It has been observed that further imaging increases the accuracy of the diagnosis to over 97%.[1,2] Furthermore, one study reported intraoperative laparoscopic assessment when measuring defect sizes in ventral hernias.[9] According to the literature, up to 90% of cases of primary epigastric hernias are operated with a small defect diameter of less than 2cm.[1]

Tear stresses on the aponeurotic fibres of the linea alba, which may occur during intensive sports, coughing, and vomiting, promote the formation of fat protrusions between their bundles.[2,6] Surgical exploration of the abdominal wall revealed a herniation of the falciform ligament, corrected by open repair. Approximately 3 - 5% of the population suffers epigastric hernias.[2] It is thought that epigastric hernias are two to three times more common in men, with a higher incidence in patients from 20 to 50 years old.[3,5,7]

Table 2. Case reports of epigastric hernia containing a falciform ligament

Case	Year	Author	Age	Gender	Origin	Diameter of the hernia orifice (cm)	Surgery	Repair method
1	2010	Jacob M[3]	55	F	Primary	3.0	Laparoscopic	Mesh
2	2018	Griffin O[7]	47	F	Incisional (post-OC)	N/A	Laparoscopic	Nonabsorbable barbed suture + mesh
3	2018	Griffin O[7]	45	F	Incisional (post-OC)	N/A	Laparoscopic	Nonabsorbable barbed suture + mesh
4	2020	Liang TJ[4]	66	F	Primary	1.5	Laparoscopic	Preperitoneal mesh placement

Case	Year	Author	Age	Gender	Origin	Diameter of the hernia orifice (cm)	Surgery	Repair method
5	2021	Takada[5]	74	F	Primary	1.0	Laparoscopic	Nonabsorbable barbed suture + mesh
6	2023	Our	63	F	Primary	1.5	Laparoscopic + hand suture	Absorbable suture
7	2023	Our	60	F	Primary	2	Laparoscopic + hand suture	Absorbable suture
8	2023	Our	82	F	Primary	1.5	Laparoscopic + hand suture	Absorbable suture

Abbreviations: LC, laparoscopic cholecystectomy; N/A, not available; OC, open cholecystectomy; M male; F female

Table 2 displays a case series of primary epigastric and incisional hernias, including the falciform ligament, from the English literature. Eight patients with primary epigastric hernia were female, which differs from the ratio of males to females in the previous publication. However, epigastric hernias are more common in adults, with a male-to-female ratio of around 9:0. Falciform ligament herniation was formerly classified as pre-peritoneal fat herniation and was often treated using open methods. With the advent of laparoscopic surgery, herniation of the midline falciform ligament may be treated with laparoscopic anterior mesh placement or total transperitoneal laparoscopic surgery.[3,4,7] Compared to open surgery, laparoscopic ventral hernia repair is associated with a lower incidence of surgical-site infection. Laparoscopic repair should be recommended for major (more than 4cm) umbilical or epigastric hernias or if the patient has a higher risk of wound infection.[2] The pooled findings of the laparoscopic procedures demonstrate a recurrence rate of 1.0% vs 2.6% and a complication rate of 25.2% compared to 10.2% in the pooled open mesh repair group.[10] However, a preperitoneal mesh with a 3cm overlap has been associated with lower recurrence rates in umbilical hernia repair with defects of 1 to 4cm.[2] In reality, laparoscopic placement of a preperitoneal mesh is a challenging procedure that requires extensive preperitoneal dissection and difficult suturing due to the nearness of the laparoscopic equipment to the abdominal wall.

Laparoscopic instruments located close to the abdominal wall are one of the difficulties when suturing the abdominal wall from the inside of the peritoneal cavity. The fastening movement is also difficult because of the need to tighten the thread strongly, which can affect laparoscopic instruments by breaking the instruments. In addition, with the intra-abdominal inflating pressure of 12mmHg, the abdominal wall tends to stretch, making it challenging to ensure certainty. To reduce these challenges, we combined laparoscopic exploration and

dissection of the hernia defect. The abdominal wall split was closed from the outside of the abdomen by hand-interrupted suture**.** We usually sew 2 to 4 stitches and tie by hand. To suture the hernia with the Reverdin needle will be easy without making a wide incision in the abdominal wall under the camera's view.[11]

Our surgical method showed promising results with a hospital stay of 2 - 5 days with no recurrence of the hernia after 12 months of follow-up. However, this method only applies to hernias with sizes from 1.5 to 2cm. And the method has limitations because it has yet to be evaluated for viability for abdominal wall defects more significant than 4cm in diameter.

V. CONCLUSION

For falciform ligament hernias, laparoscopic transperitoneal surgery combined with hand suturing from the outside of the abdomen to repair falciform ligament hernias is feasible and effective. If the hernia orifice is less than 2cm in diameter, the abdominal wall defect may be improved without the placement of an artificial mesh.

Conflicts of interest

The authors declare no conflict of interest.

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