

Laparoscopic totally extraperitoneal (TEP) inguinal hernia repair in patients with liver cirrhosis accompanied by ascites

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Abstract

To investigate the feasibility, efficacy, and safety of laparoscopic totally extraperitoneal (TEP) repair in patients with inguinal hernia accompanied by liver cirrhosis.

Between October 2015 and May 2018, 17 patients with liver cirrhosis who underwent TEP repair were included in this study. The baseline characteristics, perioperative data, and recurrence were retrospectively reviewed.

Seventeen patients with a mean duration of 18.23 ± 16.80 months were enrolled. All TEP repairs were successful without conversion to trans-abdominal pre-peritoneal (TAPP) surgery or open repair, but 4 patients had peritoneum rupture during dissection. The mean operation time was 54.23 ± 10.51 minutes for unilateral hernia and 101.25 ± 13.77 minutes for bilateral hernias. We found 2 cases with contralateral inguinal hernia and 2 cases with obturator hernia during surgery. The rate of complication was 17.65% (3/17), 2 of 3 cases were Child-Turcotte-Pugh C with large ascites. During a follow-up of 19.29 ± 9.01 months, no patients had recurrence and chronic pain, but 2 patients died because of the progression of underlying liver disease.

Early and elective inguinal hernia repair is feasible and effective for patients with liver cirrhosis. TEP is a feasible and safe repair option for cirrhotic patients in experienced hands.

Abbreviations: ASA = American Society of Anesthesiologists, CTP = Child-Turcotte-Pugh, GOV = gastroesophageal varices, HS = hypersplenism, LC = liver cirrhosis, TAPP = trans-abdominal pre-peritoneal, TEP = totally extraperitoneal, TIPS = transjugular intrahepatic portosystemic shunting.

Keywords: inguinal hernia, liver cirrhosis, totally extraperitoneal (TEP)

1. Introduction

The prevalence of abdominal hernias in liver cirrhosis (LC) patients has been reported up to 20% and as high as 40% in case of major ascites, which is remarkably higher than the general population.^[1,2] In end-stage LC patients, the refractory ascites increases the intra-abdominal pressure, and the malnutrition leads to attenuation of abdominal wall fascia and weakness of muscle, these factors contribute to the development of abdominal hernia. Recent studies have reported that LC patients with hernia

were twice more likely to undergo emergency surgery compared to non-cirrhotic patients, and emergency herniorrhaphy experienced a greater than 7-fold mortality than elective procedure in cirrhotic patients.^[3,4]

Because of the limited hepatic reserve, elevated perioperative complications, and high recurrence, the conservative treatment was preferred for LC patients in the past.^[2,5] However, several studies have demonstrated that early selective hernia repair could decrease the perioperative complication, shorten the length of stay, and improve the quality of life.^[4,6] The herniorrhaphy with local anesthesia is widely used at present due to the restrictions of general anesthesia or spinal anesthesia in LC patients.^[7,8] With the rapid development of perioperative management and laparoscopic technique, laparoscopic inguinal hernia repair was gradually applied in LC patients. Recent multiple studies showed that laparoscopic hernia repair was associated with similar short-term outcomes and lower complications compared to open repair.^[3,9,10]

Totally extraperitoneal (TEP) repair allows exploration of the myopectineal orifices and placement of the mesh, avoids peritoneum incision.^[11] Whether TEP is safe and potentially affords superior outcomes in LC patients is unknown. The purpose of this study was to investigate the feasibility, efficacy, and safety of TEP repair in patients with liver cirrhosis.

2. Materials and methods

This study received our institutional review board approval (20180411) and informed consent was obtained from each patient included in this study. We retrospectively analyzed the medical records of 17 LC patients with inguinal hernia who

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underwent TEP repair between October 2015 and May 2018. Liver cirrhosis was diagnosed by histological test, or a combination of clinical manifestation, physical examination, CT scans, or ultrasound findings.^[12] Inguinal hernia was diagnosed based on physical examination and ultrasonography. Age, gender, etiology of liver cirrhosis, duration of symptoms, Child-Turcotte-Pugh (CTP) classification, American Society of Anesthesiologists (ASA) class, preoperative laboratory tests of patients were recorded carefully.

2.1. Preoperative management

Patients' clinical condition and risks were evaluated prior to surgery. Patients' coagulopathy was corrected by intramuscular vitamin K1 or infusion of fresh frozen plasma until prothrombin time was near or with normal range. Appropriate diuretics, infusion of albumin and intermittent paracentesis were adopted to control ascites. Ascites was divided into 3 levels (small, few collection of fluids, largest dimension generally <3 cm; moderate, multiple collections of fluids, smallest dimension >3 cm; large, generalized fluids, floating bowel^[8]). The nutritional support and liver protectants were given to improve liver function. All patients were prophylactically given 1 g of intravenous cefazolin 30 minutes prior to surgery.^[12]

2.2. Surgical procedure

All patients were advised to conduct urine catheterization prior to surgery. Under general anesthesia, a 1-cm vertical skin incision was made just inferior to the umbilicus, the rectus muscle was retracted laterally to develop the extraperitoneal space clearly, followed by a curved clamp. The clamp advanced towards the intersection of the superior 1/3 of the line between umbilicus and symphysis pubis, then a 5 mm incision was made at the point. The first 5-mm trocar was inserted along the clamp, then a 10 mm camera trocar was placed through the infraumbilical incision into the extraperitoneal space. A 15–20° Trendelenburg and unaffected decubitus position was maintained to alleviate external compression from abdominal visceral. The extraperitoneal cavity was slowly inflated with CO₂ at 10 to 12 mm Hg pressure, then a 30° laparoscope was inserted through 10 mm camera port and a blunt forceps was inserted through the first 5 mm port. The dissection with blunt forceps was adopted to clarify the preperitoneal cavity under direct laparoscopic observation. After identification of pubic symphysis and Cooper ligament, the third 5 mm trocar was inserted at the intersection of inferior 1/3 of the line between umbilicus and symphysis pubis. Then the separation of extraperitoneal space was began laterally to expose the hernia sac and epigastric vessels. During spermatic cord and vessels skeletonization, the proximal hernia sac was ligated firstly, then hernia sac was separated carefully all the way back to peritoneum reflection. If peritoneum ruptured during the dissection, the tear was clamped and ligated with absorbable suture immediately, and the leaked ascites was evacuated. In a large indirect hernia, the hernia sac was divided after ligation if the complete dissection was difficult. The mesh (ProGripTM, 15 cm × 9 cm, Covidien, France) was rolled and inserted through the camera port to cover all hernia orifices (indirect orifice, Hasselbach area, femoral canal orifice and obturator orifice) and tacked to the abdominal wall.^[13] 2–0 absorbable suture was used to close the anterior rectus fascia with no placement of drains and skin incision was closed with 3–0 suture.

2.3. Post-operative management

All patients continued to receive nutritional support, ascites management, and protection of hepatic function. In addition, local compression of affected inguinal region was performed to alleviate pain and prevent scrotum or labia major edema. Seroma or hematoma was assessed by ultrasonography the third day after surgery. All patients were discharged within 1 week after the operation. Pain was evaluated by visual analogue scale, hernia recurrence and local edema were assessed by ultrasound at 1 month, 6 months, 12 months, and 24 months postoperatively.

3. Results

Of the 17 patients, there were 16 men and 1 woman, with a mean age of 58.35 ± 10.09 years (range, 36–72 years) and a mean duration of 18.23 ± 16.80 months (range, 1–48 months). Of the 4 recurrent cases, 1 patient with direct, indirect, and femoral hernia had ipsilateral indirect hernia open repair 2 years ago, 1 patient with direct and obturator hernia had a history of ipsilateral femoral hernia open repair, the other 2 cases had left indirect hernia repair, even 3 patients of which had mesh implantation. The cause of liver cirrhosis was as follows: hepatitis B (n = 14, 82.35%), hepatitis C (n = 1, 5.89%), alcohol (n = 2, 11.76%). The study population consists of 9 patients with small ascites, 5 cases with moderate ascites, and 3 patients with large ascites. The perioperative risk was assessed according to the American Society of Anesthesiologists, 6 patients and 11 patients were ASA II, ASA III, respectively. Seven of the patients were classified as CTP A, 7 patients as CTP B, and 3 patients as CTP C. The comorbidity other than liver cirrhosis were present in 88.24% of cases (15/17), the most common of which was gastroesophageal varices (GOV), which was in 47.06% of cases (8/17). This was followed by hypersplenism (HS) in 6 cases (35.29%) and hepatocellular carcinoma in 4 patients (23.53%). The demographics of the studied population are shown in Table 1.

There were 13 unilateral cases (6 left, 7 right) and 4 bilateral cases. 2 bilateral cases were found prior to surgery and 2 bilateral cases were discovered during surgery. TEP was successfully performed in all patients, and there was no conversion to TAPP or open repair. However, peritoneum rupture was found in 4 patients (23.53%) during dissection of hernia sac. These 4 patients continued TEP after peritoneal tear was ligated with absorbable sutures. The mean surgical time was 54.23 ± 10.51 minutes (range, 40–78 minutes) for unilateral hernia and 101.25 ± 13.77 minutes (range, 85–115 minutes) for bilateral hernia. The average length of stay was 4.24 days (range, 3–10 days), of which 1 patient was hospitalized for 10 days because of postoperative pneumonia and 1 patient had a 9 days hospitalization for scrotal swelling. 58.82% (10/17) of patients was indirect hernia, and 4 patients had combined hernia. Of 4 combined cases, 2 cases were combined with obturator hernia. (Table 2)

7 patients suffered pain on standing for a long time at the third day after surgery, and the average pain score was 3.88 ± 1.76 (range, 1–7), no one had chronic pain during follow-up. There were 3 cases of postoperative complications, including 1 case of seroma, 1 case of scrotal swelling and 1 case of pneumonia. Patients with seroma or scrotal swelling were treated conservatively, the swelling were resolved in 1 month. The patient with pneumonia was treated with antibiotic and mucolytics and improved at discharge. 2 of 3 patients were CTP C with large ascites. During a mean follow-up of 19.29 ± 9.01 months, no patients developed recurrence. However, 1 LC patient with

Table 1**Basic characteristics of the study population.**

Patients no.	Age (yr)	gender	CTP class	ASA class	Type	Duration (months)	Etiology	Ascites	Comorbidity
1	67	Male	A	II	Primary	5	Hepatitis B	Small	GOV, HS, BPH
2	49	Male	C	III	Primary	2	Hepatitis B	Moderate	GOV, HS
3	50	Male	C	III	Primary	1	Hepatitis C	Large	GOV, HCC
4	56	Male	B	III	Primary	48	Alcohol	Moderate	HCC
5	49	Male	B	II	Primary	24	Hepatitis B	Small	GOV
6	57	Male	A	II	Primary	36	Hepatitis B	Small	No
7	67	female	B	III	Recurrent	36	Hepatitis B	Large	GOV, diabetes
8	65	Male	B	II	Recurrent	24	Hepatitis B	Moderate	HS
9	52	Male	B	III	Primary	36	hepatitis B	Moderate	GOV, HS
10	51	Male	A	III	Primary	12	Hepatitis B	Small	HS
11	36	Male	A	II	Primary	5	Alcohol	Small	No
12	68	Male	B	III	Primary	1	Hepatitis B	Moderate	HCC
13	51	Male	C	III	Primary	5	Hepatitis B	Large	HCC, COPD
14	72	Male	B	III	Primary	12	Hepatitis B	Small	GOV, HS
15	65	Male	A	III	Recurrent	3	Hepatitis B	Small	AF, GOV
16	67	Male	A	III	Recurrent	12	Hepatitis B	Small	Diabetes
17	70	Male	A	II	Primary	48	Hepatitis B	Small	HBP

AF=atrial fibrillation, ASA=American Society of Anesthesiologists, BPH=benign prostate hyperplasia, COPD=chronic obstructive pulmonary disease, CTP=Child-Turcotte-Pugh, GOV=gastroesophageal varices, HBP=high blood pressure, HCC=hepatocellular carcinoma, HS=hypersplenism, TIPS=transjugular intrahepatic portosystemic shunt.

hepatic carcinoma and 1 patient of CTP C died in the 9th, 13th month after hernia repair. The deaths were more likely caused by the progression of underlying liver disease rather than by the hernia operation. (Table 3)

4. Discussion

Inguinal hernia is one of the most common diseases worldwide, and the lifetime prevalence of inguinal hernia is 27% to 43% in men and 3% to 6% in women.^[11] It is reasonable to infer that the prevalence and complicated hernias in LC patients is higher than general population as a result of weakened abdominal wall and increased intra-abdominal pressure. In our study, we found that 4 patients were with bilateral hernias and 4 patients were with at least 2 types of hernias, the incidence was similar to those reported previously.^[8,12] Obturator hernia is a rare entity, the incidence of obturator hernia ranges from 0.05% to 1.4% of all

hernias, but we found 2 cases with small defect during surgery. Ascites is a potential risk factor of obturator hernia.^[14] Andraus reported LC patients were at increased risk for incarceration, strangulation and recurrence.^[15]

The optimal timing and method for inguinal hernia repair in patients with liver cirrhosis is still unclear.^[16] Because of the limited hepatic reserve and poor nutrition status, LC patients are at a higher risk of wound infection or bleeding. On the other hand, their fear of surgery and short life expectancy predispose them to refuse surgery. Carbonell reported that the perioperative mortality was similar between cirrhotic and non-cirrhotic patients, but emergent operation experienced a greater than 7-fold mortality compared to elective repair.^[2] Recent studies showed that elective hernia repair in LC patients was not associated with increased perioperative complication and recurrence, but it improved the living quality of cirrhotic patients remarkably.^[2,5,6,12]

Table 2**Perioperative outcomes in 17 patients with liver cirrhosis.**

Patients no.	Location	Type of hernia	Size of defect	Peritoneum rupture	Operation time	Length of stay
1	Right	Indirect	3 cm	No	45 min	3d
2	Left	Indirect	1 cm	No	40 min	3d
3	Left	Indirect	3.5 cm	Yes	58 min	10d
4	Left	Indirect	3.6 cm	No	50 min	3d
5	Left	Indirect	5 cm	Yes	62 min	3d
6	Right	Indirect	2 cm	No	50 min	3d
7	Left	Indirect,	2.4 cm	No	48 min	5d
8	Right	Indirect, direct, femoral	2 cm, 2 cm, 3 cm	No	78 min	5d
9	Bilateral	Left direct, right indirect	Left 3 cm right 2 cm	No	95 min	6d
10	Right	Indirect	3.6 cm	No	50 min	4d
11	Right	Indirect	4.0 cm	Yes	70 min	3d
12	Right	Indirect	3.5 cm	No	52 min	3d
13	Bilateral	Direct, indirect	Left 3.0cm, 2.2 cm Right 3.2cm,2.8 cm	Yes	110 min	9d
14	Right	Indirect, femoral	2.8cm, 1.6 cm	No	55 min	3d
15	Bilateral	Left indirect, right direct	Left 2.6 cm Right 1.9 cm	No	85 min	3d
16	Left	Direct, obturator	3.2cm 1.2 cm	No	47 min	3d
17	Bilateral	Indirect, obturator	Left 3.8cm, 1.1 cm Right 2.3cm,1.3 cm	No	115 min	3d

Table 3
Early and late complications during follow-up.

Complications	N (%)
Seroma	1 (5.88%)
Pneumonia	1 (5.88%)
Scrotal swelling	1 (5.885)
Early postoperative pain	7 (41.18%)
Mean pain scores	3.88 ± 1.76
Chronic pain	0
Recurrence	0
Mortality	2 (11.76%)

LC patients usually prefer to open hernia repair due to poor tolerance of general anesthesia. But they are often in poor coagulopathy, thrombocytopenia, and immunocompromised state, these factors increased blood loss and wound infection after surgery.^[17] Also, the peritoneum incision adds the risk of ascites leakage. 4 of 17 patients in this study were recurrent hernia, even 3 of 4 patients had mesh implantation and the shortest duration was 3 months. Several retrospective studies reported 3.5% to 11% of recurrence exists in LC patients with open repair.^[4,18] With the development of operative skills and techniques, Cobb reported laparoscopic procedure was safe for mild-moderate cirrhotic patients.^[17] Juo reported laparoscopic hernia repair was associated with similar short-term outcomes but lower complications and shorter length of stay compared to open repair in LC patients.^[3] The laparoscopic approach allows exploration of all lesion with hernia formation, even the contralateral inguinal lesion. Lee also showed that liver cirrhosis had a significantly higher risk of contralateral inguinal hernia than general population (HR 1.564, 95% CI 1.382–1.771),^[19] in this study we found 2 cases were with contralateral inguinal hernia and 2 obturator hernia during surgery, these hernias may be undetected during open repair

Compared with TAPP, there is less operation time, ascites leakage around Trocar site, mesh infection and migration, visceral injury and incisional hernia in TEP repair. Because TEP repair avoids peritoneum incision and suture. Meantime, TEP is less influenced by intraabdominal conditions because the procedure avoids entering into peritoneal cavity, such as peritoneal adhesion.^[20–22] But TEP may be associated with a high risk of extraperitoneal hematoma, collections in the Retzius space. In this retrospective study, all TEP repair was successfully performed and without conversion to TAPP or open repair, but peritoneum rupture occurred in 4 patients. In our experience, we found that rupture was associated with larger hernia sac, longer duration, and thinner peritoneum. To prevent repair failure or blurred vision due to peritoneum rupture and ascites leakage, ascites was controlled effectively by diuretics and albumin infusion before surgery, a 15–20° Trendelenburg and contralateral decubitus position was maintained during surgery, the proximal hernia was ligated firstly during spermatic cord and vessels skeletonization, and the rupture was rapidly ligated after rupture happened.

Inguinal hernia repair was a safe procedure and life-threatening complications were uncommon in patients with liver cirrhosis.^[12] The refractory ascites, comorbidity, low albumin level, prolonged thromboplastin time, operation time, and emergent surgery were significantly associated with complications.^[2] And Mitsuhiro reported the incidence of complications increased significantly in CTP C patients compares with CTP A or

CTP B patients.^[23] In our study 2 of 3 CTP class C patients had complications, the incidence of CTP C was significantly higher than it of class CTP A or B, and it was also in accordance with other studies.^[8,12] The CTP C patients are at high operative risk for increased postoperative morbidity in laparoscopic TEP repair under general anesthesia, the inguinal hernia repair with local anesthesia could be an alternative option for these high-risk patients to relieve pain and improve life quality.^[8,23] Moderate-large ascites is responsible for all 4 recurrent cases in our study. Byung also reported hernia recurred in 10% to 50% of patients with ascites, so ascites is not only a cause of inguinal hernia, but also a major risk factor of complications and hernia recurrence.^[7] In our center the diuretics, nutrition support, and intravenous albumin were used to control ascites. Other invasive interventions were also applied to control ascites, such as paracentesis, concentrated ascites reinfusion, transjugular intrahepatic portosystemic shunting (TIPS). Several randomized controlled trials showed that ascites was effectively controlled by TIPS with a 1-year mortality rate of less than 5%.^[24,25]

Hernia recurrence is one of the most important indicators for evaluating the efficacy of repair methods. Many factors contributed to recurrence, such as repair methods, missed hernias, inadequate dissection and mesh size, mesh lifting, high intraabdominal pressure, and surgeon's experience.^[26] No hernia recurred in the current study during follow-up, the incidence is lower than previously reported series.^[3,4] It should be stated that the surgeons were experienced in TEP repair, ascites were effectively controlled during perioperative stage, all patients received mesh placement, and a relatively short follow-up. These factors may lead to the lower rate of recurrence in our study. The limitations of this study include the small sample size, retrospective study design, and the absence of a comparison with the standard open hernia repair.

In conclusion, early and elective inguinal hernia repair is effective and feasible for patients with liver cirrhosis to prevent incarceration and improve quality of life. TEP is a feasible and safe repair option for cirrhotic patients in experienced hands, but prospective controlled studies are needed to assess the clinical benefits of TEP repair in cirrhotic patients.

Author contributions

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