Conventional anatomic suture repair versus lightweight mesh repair in the management of complicated umbilical hernia in cirrhotic patients: a randomized control trial

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Background
Umbilical hernia occurs in 20% of patients with liver cirrhosis. The occurrence of a complication on top of the hernia is a challenging situation. The aim of this study was to compare the conventional anatomical suture repair versus partially absorbable lightweight mesh repair in cirrhotic patients with umbilical hernia undergoing emergency surgery.

Patients and methods
This prospective randomized study was carried out on 70 cirrhotic patients presented with complicated umbilical hernia in the period from September 2015 to September 2020. The patients were divided randomly into two groups, 35 patients each. Mesh group underwent hernioplasty using the lightweight mesh (polyglecaprone/polypropulene), while suture group underwent herniorrhaphy.

Results
There were 14 women and 56 men, the mean age was 56.2±6.2 years. Twelve patients were Child A and 58 patients were Child B. Hernia incarceration was the commonest presentation in 45 patients. There was no statistically significant difference between both groups as regards the mean operative time. The mean hospital stay was 5±2.5 days in mesh-group patients versus 6.7±2.1 days in suture group (P=0.043). Wound seroma occurred in 17.2% of sutured group and 8.6% in the mesh group.

Conclusion
Partially absorbable lightweight mesh repair in cirrhotic patients with complicated umbilical hernia can be performed with minimal wound-related morbidity and a significantly lower rate of recurrence, in comparison with suture group.

Keywords:
cirrhotic patients, complicated umbilical hernia, ULTRAPRO partially absorbable lightweight mesh repair

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Introduction

Cirrhosis represents the final common histologic pathway for a wide variety of chronic liver diseases. The most common causes of cirrhosis include hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease, primary biliary cirrhosis, and primary sclerosing cholangitis [1]. The prevalence of umbilical hernia in cirrhotic patients is up to 20% [2].

Traditionally, the surgical treatment of umbilical hernia in those patients was avoided, unless extremely symptomatic or their hernias were irreducible. Urgent surgery becomes necessary in the patient whose hernia has been complicated by bowel incarceration [3]. Moreover, conservative treatment is also associated with a strong likelihood of emergency situations, such as incarceration or rupture of the hernial sac. Thus, controversies regarding the appropriate treatment modality and timing of hernia repair in cirrhotic patients persist [2].

Herniorrhaphy, in patients with cirrhosis, carries potential risks, such as wound complications as bleeding from coagulation defect, infection from low immunity, and liver failure that occurs because of anesthesia-induced reduction in hepatic blood flow. However, these risks become acceptable in patients with severe symptoms from their hernia [3,4].

There has been reluctance to use a nonabsorbable synthetic mesh for repair of complicated hernia due to high potentials for contamination, wound infection, and mesh removal [5]. Some investigators have observed that a permanent mesh can be used in complicated hernias in cirrhotic patients even with

ascites with minimal morbidity and a lower rate of recurrence [6].

We hypothesized that the application of the partially absorbable mesh in cirrhotic patients with complicated umbilical hernia could be an effective treatment of the problem with low morbidity. The aim of this randomized controlled trial was to compare the conventional anatomical suture repair versus the partially absorbable lightweight mesh repair in cirrhotic patients with umbilical hernia undergoing emergency surgery.

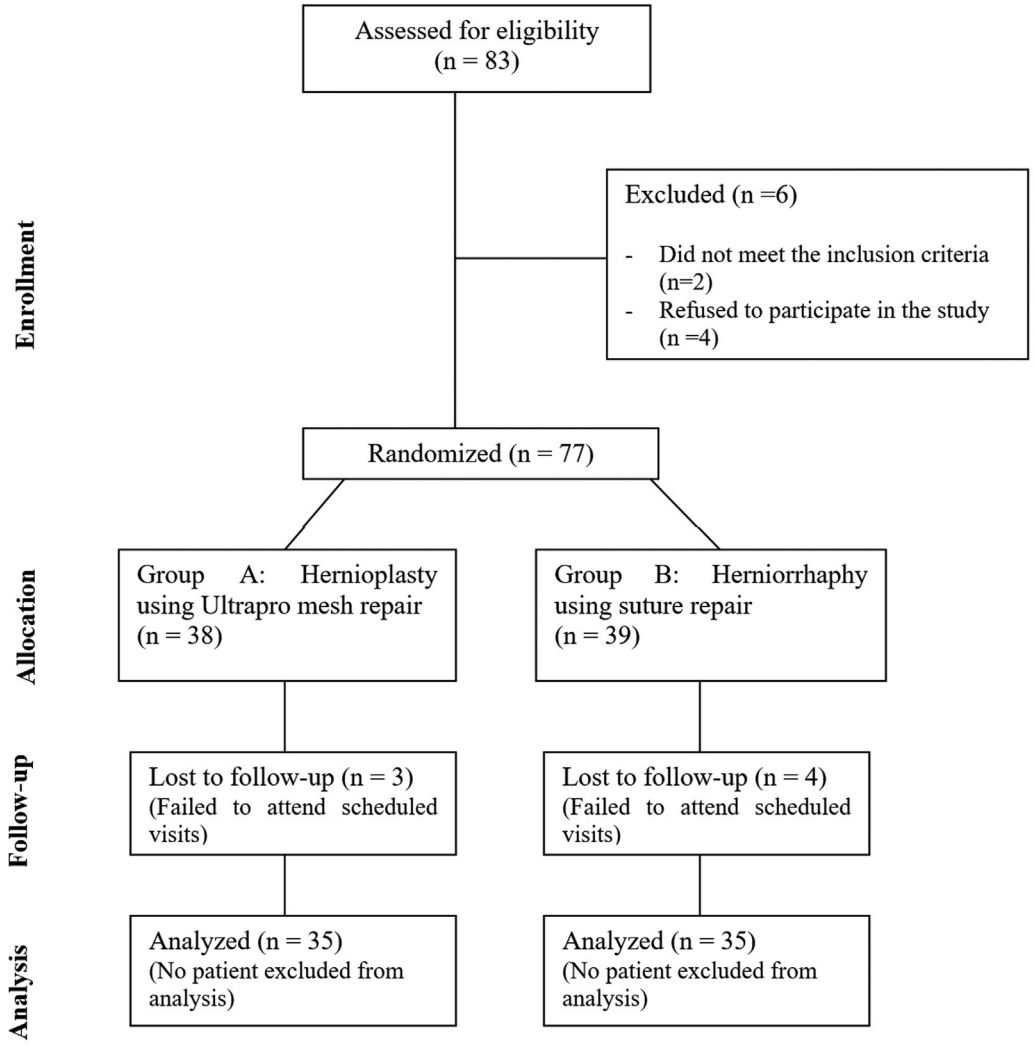
Patients and methods

Eighty-three patients were eligible for the study protocol. Two patients did not meet the inclusion criteria, and another four patients refused to participate in the study. Seventy-seven patients presenting with complicated umbilical hernia were enrolled. Seven patients were lost in the follow-up and were further excluded. Figure 1 demonstrates the CONSORT flowchart of patients in the trial.

This prospective randomized controlled study was carried out on 70 cirrhotic patients who underwent emergency surgery for complicated umbilical hernia from September 2015 to September 2020 at the Department of Surgical Emergency at the Main University Hospital, the Faculty of Medicine of Alexandria University, Egypt. The study protocol was approved by the ethics committee of our institution. All patients were informed about the procedure, possible complications, and a consent was signed.

Each complication was diagnosed by clinical examination, ultrasonography, and/or computed tomography scans (CT) of the abdomen and pelvis. CT was ordered in some cases to exclude the presence of intraabdominal masses as hepatocellular carcinoma.

Figure 1



CONSORT diagram showing the flow of participants through the study.

The severity of cirrhosis was assessed according to the Child–Pugh classification by laboratory data, imaging, liver biopsy, or intraoperative findings.

The target-study population consisted of patients with Child–Pugh Class A or B adult cirrhotic patients with complicated umbilical hernias, incarceration (Fig. 2), hernia inflammation with ulceration (Fig. 3), or rupture. On the other hand, the exclusion criteria included patients with Child–Pugh C, marked ascites, uncomplicated umbilical hernia, grade IV or more score by the American Association of Anaesthesiology, peritonitis, hepatocellular carcinoma, and severe heart disease.

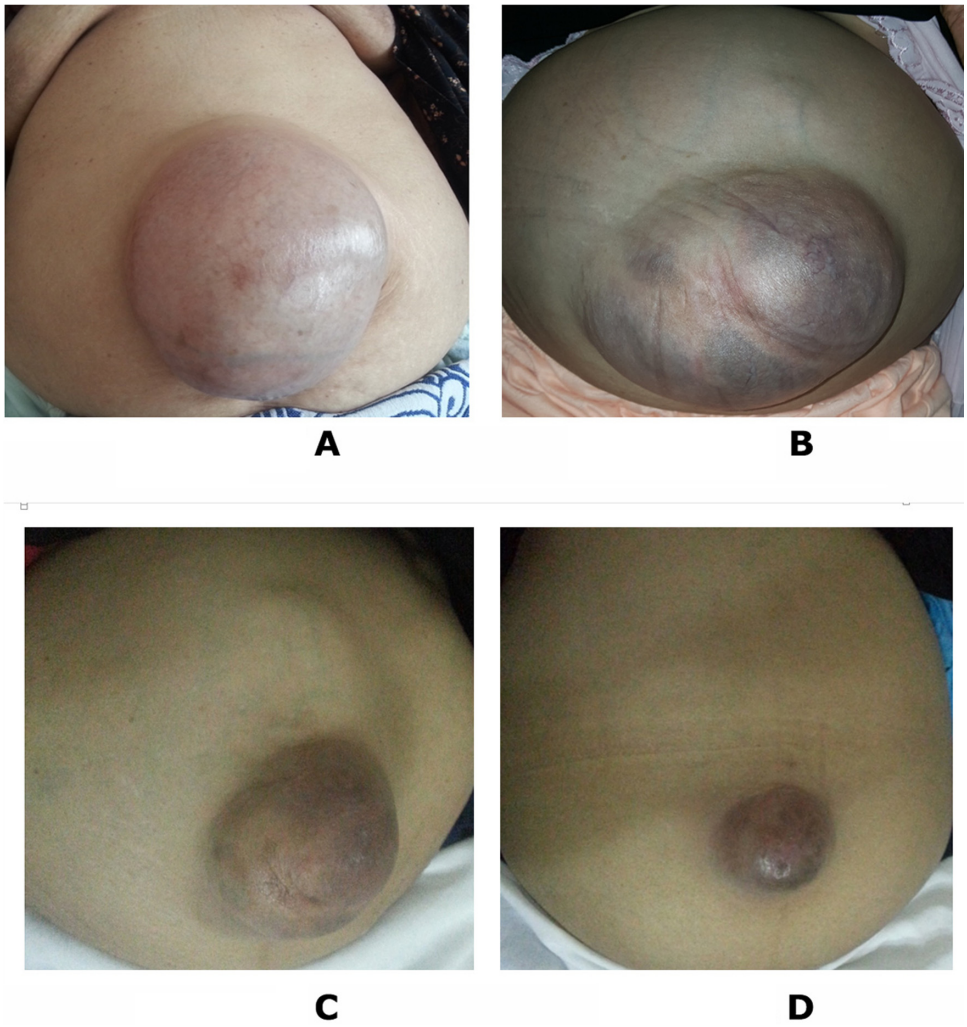
Preoperative preparation

Preoperative preparation included correction of fluid and electrolyte imbalance, correction of coagulation deficits, albumin, and fresh frozen plasma transfusion when indicated. Correction of the coagulation defect was carried out by vitamin K intravenous injection every 8 h and fresh frozen plasma. Albumin was indicated in those with hypoalbuminemia, one bottle of human albumin 20%, 50 ml, every 12 h. Fresh frozen plasma was indicated in both hypoalbuminemia and coagulation defect, 2 U, every 12 h, and intraoperatively. It was transfused over 1-h duration followed by one ampoule of furosemide. Our patients had no or minimal ascites, one ampoule of furosemide every 12 h was given as a prophylactic measure. Intravenous ceftriaxone, 2 g, was administered within 1 h before the surgical procedure to be continued for 5 days postoperatively.

Randomization and surgical technique

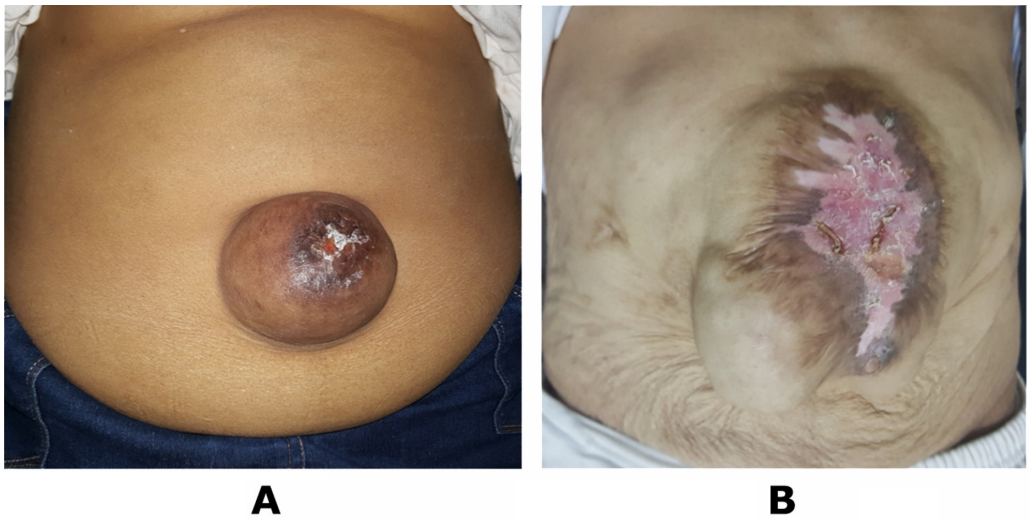
According to the type of reconstruction, patients were randomly divided into two equal groups of 35, using the closed-envelope technique. The choice of the method of repair was taken before the patient enters the operation room. A senior nurse opened a sealed envelope containing the name of the surgical repair to be carried out.

Figure 2



(a, b, c, d) incarcerated umbilical hernias.

Figure 3



(a, b) complicated umbilical hernias (skin inflammation with ulceration).

In the mesh group, 35 patients were repaired by the applications of only partially absorbable lightweight mesh (polyglecaprone/polypropulene as ULTRAPRO, Ethicon, LLC, Summerville, South Carolina, USA), made of polypropylene and polyglecaprone monofilaments with large pores (3–4 mm). The polyglecaprone monofilaments are absorbed within 90–120 days by hydrolysis. Its weight is 28 g/m^2 with dimensions of 15×15 cm. In the suture (control) group, 35 patients were repaired by conventional anatomical herniorrhaphy using polypropylene nonabsorbable suture number 1.

The decision of the anesthetic technique was left to the anesthetists. After that, an incision overlying the hernia was performed followed by dissection of the sac. In both techniques, flaps were raised separating the subcutaneous tissue from the anterior rectus sheath. The size of the hernial defect was measured intraoperatively, then the sac was opened followed by the release of the constriction ring, and lysis of the surrounding adhesions. Viable contents were returned to the abdominal cavity, while gangrenous small bowel was resected and anastomosed. A small amount of ascites, if present, were evacuated partially during surgery till it does not leak during wound closure. A small biopsy from the cirrhotic liver was taken from some patients after opening the peritoneum and sent for pathological examination for the degree of cirrhosis to guide postoperative treatment.

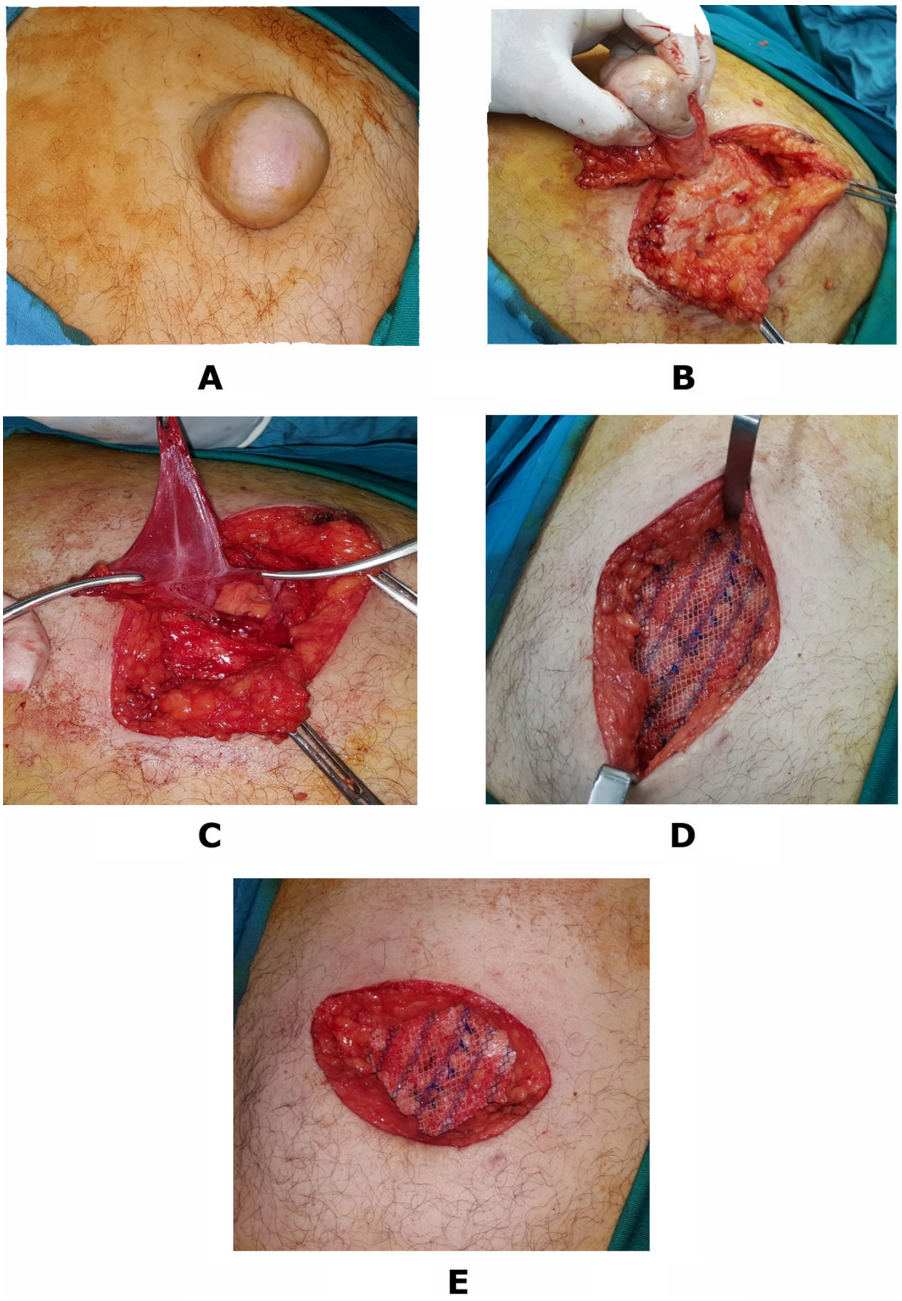
The peritoneal hernial defect was closed by absorbable interrupted (polyglactin) suture number 0 (Fig. 4). The surgical field was irrigated with normal saline before mesh placement to wash any residual debris or infection with changing of drapes and gloves. In the mesh group: patients were subjected to hernioplasty using the aforementioned lightweight mesh that was spread only over 15×15-cm space to cover all potential sites of recurrence in the abdominal wall. In the suture group: herniorrhaphy was performed by primary closure of the musculofascial planes followed by an extra-support row of interrupted polypropylene number 1 nonabsorbable sutures.

After repair, all redundant skin was removed, a closed suction drain (18 Fr) was inserted into the subcutaneous tissue and left until the daily output was less than 50 ml. Peritoneal drainage was done for patients with resection and anastomosis of the small intestines. The subcutaneous tissue was closed in layers followed by skin closure. Operative time was calculated from skin incision till the end of the operation.

In the postoperative period, patients were assisted to ambulate early and to wear abdominal binder. Prophylactic doses of subcutaneous Enoxaparin sodium 40 mg/0.4 ml were given 2 h before induction, 12 h after surgery, and then daily for 1 week. Subjective pain assessment using the visual analog scale was employed within 24 h postoperatively; all patients recorded the severity of pain from 0 (no pain) to 10 (most severe pain). All patients had no or slight ascites that were responsive to medical treatment by diuretics. Abdominal binder was advised for all patients in the postoperative period for 3 weeks.

Surgical-site infection (SSI) was defined as purulent discharge from the incision or local signs of inflammation. The primary endpoints were the

Figure 4



Patients presenting with incarcerated umbilical hernia (a), dissection of subcutaneous tissue from anterior rectus sheath (b), excision of the hernial sac (c), defect closure by only lightweight mesh (d, e).

wound complications and the recurrence rate. The secondary endpoints were the operative time, pain assessment, and the hospital stay.

All patients were followed up in the outpatient clinic every week for the first month, then every month for 1 year, and then every 3 months for 2 years. Liver-function tests, complete blood picture, and ultrasonography of the abdomen was performed every 3 months. Recurrence was diagnosed by physical examination or by ultrasound of the abdominal wall. Surgery-related mortality was considered if it occurred up to 1 month after surgery. After this period, mortality was linked to complications of cirrhosis rather than the surgical intervention.

Statistical analyses

The minimum sample size required was 65 cases at prevalence of 2.5%, accepting error 4%, at 0.05 level of significance, and 80% power. Categorical variables were reported as number and percentages. Comparison between different groups was tested using Student's t test, χ^2 analysis, and P value ($P<0.05$ indicates statistical significance). Statistical analyses were performed with SPSS 19.0 (SPSS Inc., Chicago, Illinois, USA).

Results

Seventy patients were included: 56 (80%) males and 14 (20%) females with a mean age±SD of 56.2±6.2 (45–68) years. The most common etiology of cirrhosis was hepatitis C infection in 33 cases. Regarding the Child–Pugh classification: the majority of patients were class B (58 patients, 82.8%), while class A was present in 12 (17.2%) patients. As demonstrated in Table 1, no significant difference was noted between both groups regarding the preoperative parameters.

In total, 45 (64.3%) patients presented with incarceration, 18 (25.7%) patients with ruptured hernia, and seven (10%) patients with hernial inflammation/ulceration. For the anesthetic approach, 45 (64.3%) patients were operated under spinal anesthesia, 21 (30%) patients under general anesthesia, and four (5.7%) patients under local anesthesia. In cases of incarceration (n=45), the contents were greater omentum in 26 (57.8%) cases, 16 of them required omentectomy. Small intestines were found in 19 (42.2%) cases, five of them required segmental resection and anastomosis. As illustrated in Table 2, the type of anesthesia, type of complication, defect size, and operative time were matched with no significant difference between both groups.

Table 2 also demonstrates the postoperative data of the studied patients. There was a statistically significant difference in the severity of postoperative pain and subsequent analgesic requirements between both groups. The pain severity ranged from 1 to 4 (mean 2.21±0.3) in mesh group and from 2 to 6 (mean 4.32 ±1.3) in suture group (P=0.041).

There were neither surgery-related deaths nor significant anesthetic or operative complications in both groups. Considering the postoperative complications, two (5.7%) patients in mesh group and six (17.2%) patients of suture group experienced upper variceal bleeding and were managed by endoscopic band ligation. SSI occurred in four (11.4%) cases of mesh group and six (17.2%) cases of suture group. All were controlled by proper antibiotics and frequent dressing without removal of the mesh. There was a lower incidence of seroma formation in the mesh group, but it did not reach the level of statistical significance. No statistical

Table 1 Preoperative data of studied patients in both groups

Parameters	Group A (mesh) (N=35) [n (%)]	Group B (suture) (N=35) [n (%)]	P value
Age (years)			
Mean±SD	54.5±5.7	56.2±6.2	0.432
Range	44–68	45–67	
Sex			
Male	29 (82.8)	27 (77.1)	0.500
Female	6 (17.2)	8 (22.9)	0.521
Comorbidities[a]	11 (31.4)	13 (37.1)	
Diabetes	5 (14.3)	6 (17.1)	0.653
Hypertension	2 (5.7)	3 (8.6)	0.532
IHD	4 (11.4)	3 (8.6)	0.431
COPD	1 (2.8)	2 (5.7)	0.500
ESRD	1 (2.8)	1 (2.8)	0.522
Etiology of cirrhosis			
Hepatitis C	17 (48.6)	16 (45.7)	0.533
Hepatitis B	3 (8.6)	1 (2.8)	0.544
Mixed C and B	15 (42.8)	17(48.6)	0.532
Cryptogenic	0	1 (2.8)	0.511
Laboratory data (mean±SD)			
Hemoglobin (g/dl)	12.2±2.6 (8.7–14.0)	11.2±3.4 (9.7–13.0)	0.411
Platelets (μl×1000)	140±6.2 (60–320)	130±5.5 (50–250)	0.542
Albumin (g/dl)	3.5±0.5 (2.1–4.3)	3.1±0.4 (2.8–3.9)	0.312
Total bilirubin (mg/dl)	2±0.3 (0.34–4.3)	1.7±0.5 (0.80–5.7)	0.151
INR	1.8±0.2 (1.21–1.87)	1.5±0.5 (1.61–2.27)	0.563
Child–Pugh classification			
Child A	4 (11.4)	8 (22.8)	0.400
Child B	31 (88.6)	27 (77.2)	0.421

[a]Patients may have more than one comorbidity. COPD, chronic obstructive pulmonary disorder; ESRD, end-stage renal disease; IHD, ischemic heart disease; INR, international normalized ratio.

Table 2 Operative and postoperative data of studied patients in both groups

Characteristic	Group A (mesh) (*N*=35) [*n* (%)]	Group B (suture) (*N*=35) [*n* (%)]	*P* value
Type of anesthesia			
Spinal	22 (62.8)	23 (65.7)	0.642
General	11 (31.5)	10 (28.6)	0.512
Local	2 (5.7)	2 (5.7)	0.532
Complication of umbilical hernia			
Hernia inflammation and ulceration	3 (8.6)	4 (11.4)	0.543
Ruptured hernia	9 (25.7)	9 (25.7)	0.632
Strangulation	23 (65.7)	22 (62.8)	0.631
Intestinal (19)	10	9	0.400
Omentum (26)	13	13	0.411
Resection anastomosis	3	2	0.87
Mean size of the defect	4.6±3.32	4.9±4.34	0.523
<3 cm	7 (20)	9 (25.7)	0.454
4–5 cm	19 (54.3)	15 (42.9)	0.511
6 cm or more	9 (25.7)	11 (31.4)	0.431
Operative time (min)			
Mean±SD	89.7±13.5	87.4±11.5	0.94
Range	65–125	60–115	
Pain assessment using VAS			
Mean±SD	2.21±0.3	4.32±1.3	0.041*
Minimum–maximum	1–4	2–6	
Hospital stay			
Minimum–maximum	3–8	5–9	0.043*
Mean±SD	5±2.5	6.7±2.1	
Postoperative complications			
Variceal bleeding	2 (5.7)	6 (17.2)	0.07
Wound seroma	3 (8.6)	6 (17.2)	0.61
Ascetic leak	5 (14.3)	8 (22.9)	0.35
Wound dehiscence	3 (8.6)	6 (17.2)	0.61
SSI	4 (11.4)	6 (17.2)	0.38

SSI, surgical-site infection; VAS, visual analog scale. *Statistical significance if *P* value less than 0.05.

difference was found in the other postoperative complications. However, patients in the suture group had a significantly longer hospital stay than mesh group (*P*=0.043).

The mean follow-up duration was 1.23 years, ranging from 6 to 36 months. There was a statistically significant difference between the two groups as regards hernia recurrence, no recurrence occurred in cases of mesh group, while recurrence was observed in five (14.2%) cases of suture group (*P*=0.031). Recurrent cases were of large defect with low risk of complications and were managed conservatively. During the follow-up, 15 (25%) cases patients died from cirrhotic complications, after more than 1 month after surgery, and four patients underwent liver transplantation.

Discussion

Umbilical hernia in adults is a common condition seen mainly in obese women, after multiparity and in patients with cirrhosis. The defect is acquired in over 90% of cases [7]. In cirrhotics, it is most likely to occur in the fifth and sixth decades of life [8]. The optimum management in cirrhotic patients whether accompanied by ascites or not, remains a matter of debate and poses challenges in the management due to the burden of the disease. If left untreated, it may grow to immense size and can induce life-threatening complications that mandate urgent surgical intervention [9–12]. The findings of this study have shown that patients repaired with partially absorbable lightweight mesh enjoyed a significantly shorter hospital stay, milder postoperative pain, and less requirement for analgesics, less incidence of wound seroma, earlier ambulation, and most importantly, no recurrences in the follow-up period.

Among the 70 patients, 80% were males and the mean age was 56.2±6.2 years. As mentioned by various authors [2,6,10], complicated umbilical hernia in cirrhotics is substantially more common in males and is seen more frequently around the sixth decade. This may be explained by the increased exposure to hepatitis viruses by males and the long time (years)

required for the pathological process of hepatitis to proceed to cirrhosis and present clinically.

According to Child–Pugh score, 58 cases were class B and 12 patients were class A. This is comparable with the study of Ammar [6], in which 59 cases were Child B, while 13 patients were classified as Child A. We excluded patients with Child C due to their bad general condition and the severe refractory ascites. They were managed either conservatively or via dealing with the strangulated bowel only followed by simple wound closure in the shortest operative time possible as those frail patients cannot withstand long operations and it is hazardous to put a mesh in this setting. To show the risks associated with Child C patients, Choi *et al.* [10] managed 10 cases with Child C presenting with umbilical hernia, two of them were complicated and underwent urgent surgery, but one of them died in the postoperative period from peritonitis and wound infection, three underwent elective surgery, and five patients were managed nonoperatively.

In the data presented herein, we consider the adoption of spinal anesthesia in our selected patients of grades A and B appropriate, unless the prothrombin activity is less than 60%. This method avoids the untoward effects of general anesthetics on the hepatic functions.

Incarceration was the most common indication of surgery for umbilical hernia in cirrhotic patients as it was present in 45 (60%) patients. This was similar to the study of Ammar [6] who reported incarceration in 60 (83.3%) patients, inflammation in seven, and rupture in five patients.

The use of partially absorbable lightweight mesh in complicated umbilical hernia in cirrhotic patients has not been studied before due to its recent launch. This type of mesh repair may reduce the risk of postoperative complications when compared with the conventional heavy-weight prolene mesh, particularly as regards seroma formation owing to the macroporous design promoting free-fluid flow-through to outside through the closed suction drain, thus reducing serum accumulation in the postoperative period. On the other hand, suture repair causes much more pain due to tension produced and from potential nerve entrapment. Also, it causes more bleeding from the dissection. Four out of six cases of SSI in herniorrhaphy group developed after accumulation of seroma.

In the current series, the hospital stay was significantly longer in suture group. This was attributed to wound complications that were more frequent in suture group. Ammar [6] reported a mean hospital stay of 4.4±1.9 days, while Choi *et al.* [10] observed a long hospital stay of 12 [7–20] days in the nine patients who underwent emergency operation.

A significantly low recurrence rate in mesh group was recorded, even with the presence of SSI. This could be explained by either the mesh properties, such as nature, design, and dimensions, or by the selection of patients, in particular ruling out those suffering graded as Child C – the nature of the mesh. In the study of Ammar [6], recurrence was significantly higher in herniorrhaphy group than the mesh group. In agreement, several series [13–15] concluded that mesh repair decreases the incidence of recurrence, even when the hernia is complicated by bowel strangulation [16,17].

The reported recurrence rate after herniorrhaphy varies from 0 to 40% [18–20]. The development of recurrence is influenced by a number of risk factors: some of them are under the control of the surgeon, while others are patient-specific and others are related to the postoperative complications. Patient-specific risks include advanced age, malnutrition, presence of ascites, obesity, and corticosteroid use. Technical aspects of wound closure also contribute to recurrent hernia formation. Wounds closed under tension are prone to fascial closure failure. Wound infection is one of the most significant prognostic factors for the development of recurrent hernia [16].

The limitations of the study were the small sample size from a single center, operations performed by different surgical teams with variable skills, the different etiologies of cirrhosis, and the selection bias.

Based on our institutional experience, this study represents our experience in the management of Child A and Child B cirrhotic patients who underwent repair of a complicated umbilical hernia. The placement of the partially absorbable lightweight mesh in this setting is safe with minimal wound-related complications, low morbidity rates, and low rate of recurrence. Further, prospective, randomized studies with a larger sample size are required to evaluate the safety and efficacy of this technique in complicated umbilical hernias.

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Conflicts of interest
There are no conflicts of interest.

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