

# Surgical Management of Spontaneous Rupture of Umbilical Hernia Using Biological Mesh

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When two cirrhotic patients with intractable ascites presented with ruptured umbilical hernias, these surgeons sought to mitigate the increased risk of postoperative complications by incorporating the use of biological mesh into the open repair procedure.

**U**mbilical hernias are reported to occur in up to 20% of adults who have cirrhosis and up to 40% of those with ascites.<sup>1,2</sup> While spontaneous perforation of an umbilical hernia in a cirrhotic patient with ascites is uncommon, it carries with it high rates of morbidity and mortality. The mortality rate is 60% for patients treated nonoperatively and 14% for those who undergo surgical repair.<sup>3</sup>

Patients with cirrhosis—especially those with intractable ascites—are considered to be high risk surgical candidates and incur increased morbidity and mortality after any type of operation.<sup>4,5</sup> The physiologic consequences associated with cirrhosis and ascites include poor wound healing, altered hemostasis and body water balance, and changes in the immune system resulting in increased suscep-

tibility to infections. Furthermore, cirrhotic patients with intractable ascites have reduced hepatic reserve and poor tolerance of surgical and anesthetic stresses. It is desirable, therefore, to limit the number of operations performed in such patients. When a surgical procedure is indicated, attention must be paid to the technique, materials, and timing to prevent negative outcomes.

In this article, we report two cases of spontaneous rupture of umbilical hernias that occurred in patients with cirrhosis and ascites. Each patient underwent emergent surgical repair of the umbilical defect using biological mesh. To the best of our knowledge, the use of biological mesh in surgical repair of a ruptured umbilical hernia in a patient with cirrhosis and intractable ascites has not been described previously in the literature. Following the case presentations, we provide a brief review of this clinical problem and its management.

## CASE 1

### Initial exam

A 53-year-old man presented to the emergency department (ED) of a

large, tertiary care, academically affiliated VA medical center with fluid draining freely from an umbilical hernia defect. He had Child-Pugh Class C cirrhosis secondary to hepatitis C viral (HCV) infection and alcohol abuse. His Model for End-Stage Liver Disease (MELD) score was 16.

His recent medical history was significant for a hospital admission for hepatic encephalopathy two weeks earlier. During that admission he was noted to have mild erythema of the skin overlying the umbilical hernia, and he began a course of levofloxacin for prophylaxis against spontaneous bacterial peritonitis.

Physical examination in the ED revealed mild hypotension (blood pressure, 92/53 mm Hg). He was afebrile, awake, alert, and in no acute distress. The examination was remarkable for moderate erythema of the periumbilical skin and the presence of a skin opening less than 1 cm in diameter in the umbilicus, through which copious amounts of clear, odorless, ascitic fluid was leaking. Significant results of initial laboratory testing included a low platelet count and hemoglobin level; a prolonged prothrombin time, with an INR of 1.4; an elevated blood

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**Table. Significant laboratory values for the two patients**

Measurement	Patient 1 values	Patient 2 values	Reference range
White blood cell count, in cells/mm <sup>3</sup>	6,000	6,600	2,300–8,600
Hemoglobin, in g/dL	11	14.3	14–18
Platelet count, in cells/mm <sup>3</sup>	138,000	138,000	150,000–450,000
Prothrombin time, in seconds	16.5	14	10.3–13.3
INR <sup>a</sup>	1.4	1.2	–
Sodium, in mmol/L	135	135	135–145
Potassium, in mmol/L	3.6	4.3	3.5–5.1
Chloride, in mmol/L	100	100	98–107
Serum bicarbonate, in mmol/L	26	33	21–32
BUN, <sup>b</sup> in mmol/L	15	16	7–26
Glucose, <sup>c</sup> in mg/dL	111	120	70–99
Creatinine, in mg/dL	1.4	0.9	0.8–1.4
Albumin, in mg/dL	1.7	2.4	3.4–4.7
Bilirubin, in mg/dL	2.1	1.8	0–1.0

<sup>a</sup>INR = international normalized ratio. <sup>b</sup>BUN = blood urea nitrogen. <sup>c</sup>Not fasting.

glucose level (nonfasting); a low albumin level; and an elevated bilirubin level (Table).

### Treatment course

Following informed consent, the patient underwent emergent, open repair of his umbilical hernia. A 3-cm, semicircular (or elliptical) infraumbilical incision was made. The hernia sac was identified and noted to contain no bowel contents. The sac was ligated and excised. The redundant erythematous umbilical skin was excised.

The 2-cm fascial defect was repaired using biological mesh (AlloDerm Regenerative Tissue Matrix, LifeCell Corporation, Branchburg, NJ) placed posterior to the abdominal wall fascia and secured using 0-0 polydioxanone (PDS II, Ethicon Inc., Somerville, NJ) sutures. The sutures were placed in an interrupted fashion through the full thickness of the mesh and then parachuted into the peritoneal cavity. A suture-passer was

used to place the sutures just above the abdominal wall fascia (within the subcutaneous tissues). The mesh extended beyond the defect by 4 cm in all directions. After irrigation of the wound, the fascia was closed using 0-0 polypropylene (Prolene, Ethicon Inc.) sutures in a figure of eight fashion, the subcutaneous tissues were closed using 3-0 poliglecaprone 25 (Monocryl, Ethicon Inc., Somerville, NJ) sutures, and a new umbilicus was created using 4-0 Monocryl sutures.

Two days after the surgery the patient was discharged home. A transjugular intrahepatic portosystemic shunting (TIPS) procedure was recommended to manage the ascites postoperatively.

## CASE 2

### Initial exam

Within six months, another 53-year-old man presented to the ED of the

same VA medical center with a similar problem: free drainage of ascitic fluid from an umbilical hernia defect. He said he had heard and felt a “pop” when he coughed while eating dinner the night before. He had Child-Pugh class B cirrhosis secondary to HCV infection and alcohol abuse. His MELD score was 10.

During the previous year, he had experienced a marked increase in his ascites, necessitating large-volume paracentesis. In fact, one week prior to the spontaneous rupture of his umbilical hernia, he had been admitted to the VA medical center for medical management of his ascites, which consisted of high dose diuretic therapy and large-volume paracentesis to help decrease his marked abdominal distention. During this admission, it was also noted that he had erythema of the skin overlying the umbilical hernia, for which he began a course of cephalexin.

Physical examination in the ED revealed that the patient had stable vital

signs and was afebrile. He was awake, alert, and in no acute distress. The examination was significant for erythema of the umbilical skin and for the presence of an umbilical skin opening less than 2 cm in diameter, through which clear, odorless ascitic fluid was freely leaking. Results of initial laboratory testing were similar to those of the first patient, except that the second patient's hemoglobin was at the lower limit of normal, his serum bicarbonate level was slightly higher (just above normal), and his creatinine level was slightly lower (but still within normal limits) (Table).

### Treatment course

After informed consent was obtained, the patient was taken to the operating room and underwent an open repair procedure similar to that of the first patient. A 5-cm, horizontal incision was made just under the umbilicus. The hernia sac was identified and noted to contain no bowel contents. The sac was ligated and excised.

The 1.5-cm hernia was repaired using AlloDerm Regenerative Tissue Matrix placed posterior to the abdominal wall fascia using 0-0 Prolene sutures. The sutures were placed in an interrupted fashion through full thickness of the mesh and then parachuted down into the peritoneal cavity. A suture-passer was used to place the sutures just above the anterior abdominal fascia (within the subcutaneous tissues). The mesh extended beyond the defect by 4 cm in all directions. After irrigation of the wound, the fascia was closed using 0-0 Prolene sutures placed in an interrupted fashion, thus completing the hernia repair. The redundant umbilical skin was excised and a new umbilicus created.

Postoperatively, the patient recovered well and was discharged to an extended care facility (due to his per-

formance status, comorbidities, and need for assistance with activities of daily living). A TIPS procedure was recommended to manage the large volume of ascites.

### ABOUT THE CONDITION

The first report of spontaneous rupture of an umbilical hernia with drainage of ascites was published by Johnson in 1901.<sup>6</sup> Several reports of spontaneous rupture in patients with cirrhosis and ascites have followed.

The development of umbilical hernias is multifactorial and likely includes acquired and genetic causes. In patients with hepatitis-related cirrhosis, ascites is the major risk factor contributing to the development of umbilical hernia. Ascites leads to a marked increase in intra-abdominal pressure, which, if unchecked, results in the stretching of the overlying skin around the umbilicus. This stretching, in turn, can cause superficial skin changes, such as erythema and ulceration, that often herald the spontaneous rupture of the umbilical hernia with leakage of ascites.

frequently due to insufficient adherence to treatment. Furthermore, many cirrhotic patients have multiple comorbidities that necessitate other methods of managing ascites. Such alternative interventions include large-volume paracentesis, TIPS, peritoneovenous shunting (PVS), and liver transplantation.

Large-volume paracentesis, in combination with diuretic therapy, can be performed every two weeks—but is often ineffective. Although PVS is an effective means of relieving ascites, it is associated with a substantial number of complications, such as infection, venous thrombosis, small bowel obstruction, and disseminated intravascular coagulation. The mortality rate associated with PVS for ascites among patients with cirrhosis has been reported to be as high as 50%.<sup>8</sup> TIPS is effective in controlling refractory ascites in 80% to 90% of cases,<sup>9</sup> and it may improve survival in patients with cirrhosis and refractory ascites. It often is reserved for patients who are being prepared for liver transplantation, however. Complications

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As such, the critical factor in preventing an umbilical hernia, or preventing recurrence after hernia repair, is effective management of the ascites. Current recommendations for managing ascites in cirrhotic patients include medical therapy with diuretics (furosemide or spironolactone) and sodium restriction.<sup>7</sup> All too often, however, medical management fails,

associated with TIPS are also numerous and include infection, hepatic encephalopathy, congestive heart failure, hemolysis, and death (mortality rate, 5%).<sup>7</sup> Additionally, the stents used in TIPS can occlude, with a reported one-year occlusion rate of 20%, requiring repeat TIPS procedures.<sup>7</sup>

When umbilical hernia develops secondary to ascites in a patient

with cirrhosis, surgical repair ideally should be performed electively prior to the onset of rupture. The mortality rate in patients undergoing elective repair was reported by Maniatis and Hunt to be 2%.<sup>8</sup> Emergent repair—necessitated by rupture, leak, incarceration, or strangulation—is associated with a mortality rate as high as 14%.<sup>3</sup> Additionally, the optimal timing of hernia repair is after the patient's ascites is under control. Repair without adequate control of ascites results in a very high recurrence rate—reported to be as high as 73%.<sup>7,9</sup> In these cases, PVS or TIPS can be performed postoperatively to help manage the ascites and reduce the umbilical hernia recurrence rate. Fagan and colleague developed a comprehensive algorithm for the management of umbilical hernias complicated by cirrhosis and ascites.<sup>4</sup>

Based on this algorithm, we recommended that our two patients undergo TIPS to manage their intractable ascites and reduce the chance of hernia recurrence. Unfortunately, neither of the patients has undergone TIPS thus far, but the ascites remains well controlled with medical treatment. Both patients are maintaining abstinence from alcohol. To date, there have been no signs or symptoms of umbilical hernia recurrence.

### Surgical technique

With regard to the technique used to repair a spontaneously ruptured umbilical hernia, we are the first to report open repair using a biological mesh in patients with cirrhosis and intractable ascites. The use of mesh has been almost prohibited in the acute setting in cirrhotic patients with ascites due to the high risk of infection of the mesh (for example, due to exposure to bowel contents, infected ascites, or bacteria in the skin). Most published reports of spontaneously

ruptured umbilical hernias describe primary suture repair. As Deysine and others have demonstrated, however, autogenous repair of ruptured umbilical hernias is associated with a recurrence rate of up to 40%.<sup>10</sup> As such, only the smallest of defects from these ruptures should be repaired with the primary suture procedure.<sup>10</sup>

Other authors have described the use of laparoscopic repair using synthetic mesh, but these were all cases in which there was no spontaneous rupture of the hernia.<sup>11,12</sup> Biological mesh is well known for resistance to infection,<sup>13,14</sup> and some of the biological mesh available has shown excellent tissue incorporation and strength.<sup>15,16</sup> Additionally, the ability of biological mesh to stretch may be especially beneficial for patients in whom the ongoing presence of ascites creates increased pressure on the abdominal wall and puts the hernia repair at high risk for failure.

Considering all of these factors, we chose to perform an open repair using biological mesh in our patients due to evidence of active inflammation and likely infection—specifically, the marked erythema of the periumbilical skin noted in both cases. It was our determination that repairing the hernias using synthetic mesh would unnecessarily place our patients at increased risk for mesh infection, which would then commit them and the surgeon to another operation to remove infected mesh. We chose AlloDerm Regenerative Tissue Matrix because it is available at our institution—and our personal experience with it has supported its resistance to infection and good tissue integration and growth.

The technique of parachuting the mesh with lateral or peripheral attachment follows the physical principle to distribute the tension around the attachment to the abdominal

wall, away from the fascial defect. The parachute technique reduces the tension on the fascia, which, in most cases, allows approximation of the defect to protect the mesh from exposure to the skin. Thus, this technique reduces both the risk of infection and the risk of hernia recurrence.

### IN SUMMARY

The current management of ascites in cirrhotic patients includes medical therapies and repeated paracentesis. Alternative modalities include TIPS, PVS, and liver transplantation. When ascites progresses to umbilical hernia, surgical repair is optimally performed electively prior to rupture and after control of ascites.

Failing these measures, spontaneous rupture of umbilical hernia necessitates emergent repair. While a variety of techniques and materials are available for hernia repair, the high risk of postoperative complications associated with the presence of cirrhosis and intractable ascites encourages us to explore the potential value of biological mesh. The two cases presented here illustrate the viability of using biological mesh in open surgical repair of spontaneously ruptured umbilical hernia in patients with these complex conditions. More research is needed to explore the benefits of this technique and to clarify its long-term outcomes. ●

### Author disclosures

*The authors report no actual or potential conflicts of interest with regard to this article.*

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