

Flood Syndrome

Jia Li Lee^{a, c}, Jeffrey Jiang^b

Abstract

Flood syndrome refers to the exsanguination of ascitic fluid following the spontaneous rupture of an umbilical hernia, and is a rare complication of liver cirrhosis with ascites. In this case report, we describe a 67-year-old patient with Flood syndrome who was initially managed conservatively in a community hospital run by primary care physicians, prior to transfer to a tertiary hospital for specialist surgical review and management. We also performed a literature review of the current treatment modalities to manage this condition.

Keywords: Flood syndrome; Spontaneous umbilical hernia rupture; Liver cirrhosis

Introduction

Approximately 20% of patients with ascites eventually develop umbilical hernias as a result of raised intra-abdominal pressure, weakening of anterior abdominal wall muscles from poor nutrition [1, 2], and supraumbilical fascial defect due to possible recanalization of the umbilical vein secondary to portal hypertension [3].

Flood syndrome was first described by Johnson in 1901 and the term was coined by Frank B. Flood in 1961 [4]. It is a rare complication of liver cirrhosis with ascites and is frequently (> 75%) preceded by cutaneous infection and/or skin necrosis or ulceration and precipitated by raised intra-abdominal pressure [5], which includes vomiting, coughing, and straining with defecation [6].

It is important to recognize Flood syndrome as complications such as bowel incarceration, hemodynamic instability, electrolyte abnormalities and infection including cellulitis and peritonitis [7] can arise, amounting to a mortality rate of 30% [8]. This case report describes the progress and management of a patient with Flood syndrome admitted to a community hospital.

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^aDepartment of Family Medicine, National University Health System Singapore, Singapore 119228, Singapore

^bMedical Department, St Luke's Hospital, Singapore 659674, Singapore

^cCorresponding Author: Jia Li Lee, Department of Family Medicine, National University Health System Singapore, Singapore 119228, Singapore.
Email: Jia_Li_Lee@nuhs.edu.sg

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Case Report

The patient is a 67-year-old Chinese male with a past medical history of Child's C11 MELD 18 alcoholic liver cirrhosis, diagnosed in 2008, complicated by ascites with previous paracentesis (August 2019), esophageal varices, splenomegaly with anemia and thrombocytopenia, hepato-renal syndrome and a reducible umbilical hernia. He did not have any other significant medical conditions. His significant medications include propranolol 5 mg every morning, frusemide 20 mg every morning, spironolactone 75 mg every morning, omeprazole 20 mg twice a day and lactulose 10 mL every morning.

He was admitted to an acute hospital for *Klebsiella* bacteremia secondary to a perianal abscess and was treated with intravenous antibiotics and an incision and drainage of the abscess. He also underwent abdominal paracentesis in September 2020 for worsening ascites which was causing abdominal discomfort. This was his second paracentesis since he was diagnosed with liver cirrhosis. During this admission, he was also noted to have hepatorenal syndrome - acute kidney injury (serum creatinine rose from 68 to 198 $\mu\text{mol/L}$) which responded well to terlipressin and intravenous albumin. He was then transferred to a community hospital for stepdown care for his perianal wound management.

Physical examination revealed a soft and non-tender abdomen that was distended. Shifting dullness and fluid thrill were demonstrated. There was a 4-cm reducible and non-tender umbilical hernia that was not incarcerated nor strangulated. The hernia had a superficial ulcer but did not have any bleeding or pus (Fig. 1). The perianal wound was granulating well and

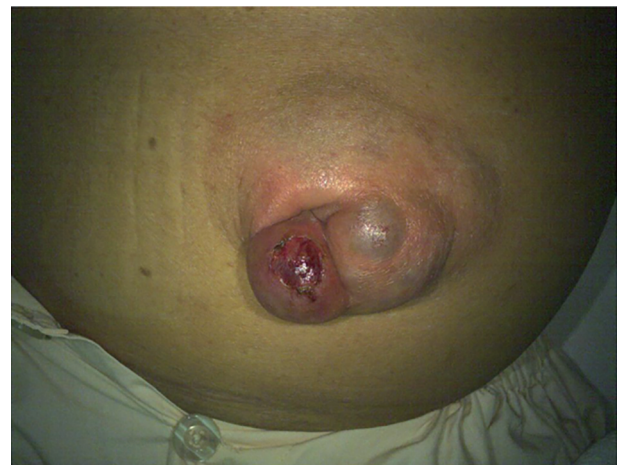


Figure 1. Ulcerated umbilical hernia.



Figure 2. Ascitic fluid leaking from a ruptured umbilical hernia, being held up by staff wearing blue gloves.

clean. He was otherwise hemodynamically stable and had no signs of hepatic encephalopathy or sepsis.

During his third week of admission to the community hospital, the patient reported a spontaneous leakage of straw-colored fluid from his umbilical hernia. On examination, there was copious amounts of ascitic fluid extruding from the ruptured skin of the umbilical hernia which developed at the ulcer site (Fig. 2). The clinical diagnosis was Flood syndrome. He was initially managed with compressive gauze but a urostomy bag (Fig. 3) was subsequently utilized in view of high volume of output (estimated 1 L per day).

A computed tomography (CT) scan of his abdomen prior to his transfer to the hospital already revealed generalized ascites and a large hernia with a small abdominal-cutaneous tract forming (Fig. 4). Blood tests performed did not reveal any acute drop in hemoglobin from his baseline. The hemoglobin level was 10.8 g/dL, total white count was $6.34 \times 10^9/L$, platelet count was $65 \times 10^9/L$, serum creatinine was 68 $\mu\text{mol/L}$, estimated glomerular filtration rate (eGFR) was 94 mL/min, sodium was 132 mmol/L, potassium was 5.0 mmol/L, urea was 7.2 mmol/L, albumin was 27 g/L, total bilirubin was 57 $\mu\text{mol/L}$, aspartate transaminase was 80 U/L, alanine transaminase was 30 U/L, alkaline phosphatase was 134 U/L and international normalized ratio (INR) was 1.28.

In view of the persistently high output from the umbilical hernia, the patient was transferred back to the acute hospital for surgical review and management. In view of the large size



Figure 3. Urostomy bag utilized to monitor ascitic fluid output from Flood syndrome.

of the hernia, the patient was not suitable for bedside hernia repair. He was offered hernia repair under general anesthesia and transjugular intrahepatic portosystemic shunting (TIPS) but he declined the procedures in view of the risks. The patient was thus treated conservatively with optimization of spironolactone and furosemide and given intravenous albumin infusions. Paracentesis performed drained about 2.5 L during his 5 days of hospital admission. He was also started on oral ciprofloxacin for spontaneous bacterial peritonitis prophylaxis. Eventually after 5 days of inpatient treatment, he was discharged with the colostomy bag and for outpatient wound care at the community hospital's outpatient clinic.

During follow-up review about 11 months later, the patient continued to be drinking half to one bottle of red wine daily. He had no re-hospitalizations and his umbilical hernia wound had healed with no recurrence of ascitic fluid leakage (Fig. 5). At the time of submission of the article, the patient underwent three previous paracenteses and did not require further therapeutic paracentesis after discharge nor re-hospitalization.

Discussion

Flood syndrome refers to the exsanguination of ascitic fluid following the spontaneous rupture of an umbilical hernia. Due to the rarity of this condition, there is no standardized treatment protocol [9], with current literature being limited to case

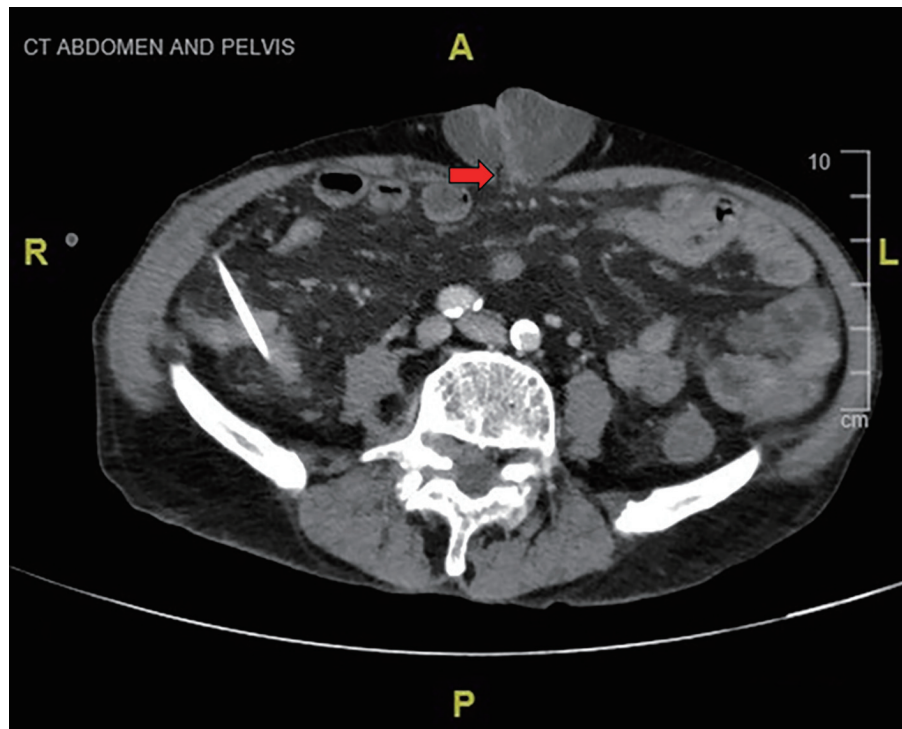


Figure 4. CT scan of abdomen revealing an umbilical hernia with a small abdominal-cutaneous tract forming (red arrow). CT: computed tomography.

reports or case series (Table 1 [1-27]). Table 1 describes the interventions and various outcomes observed based on information obtained from case reports and case series published in the literature.

Treatment of Flood syndrome typically begins with fluid



Figure 5. Healed umbilical hernia wound (11 months after hospital discharge).

resuscitation and antibiotics [6], wound care such as sterile occlusive dressing application [10] or placement of an ostomy pouch [1]. Non-invasive management also includes nutritional optimization, antibiotics, avoiding hepatotoxic medications [8].

This is followed by consideration of methods for reducing ascitic pressure on the hernia wound, and hernia defect repair including use of fibrin glue [26, 27] or umbilical herniorrhaphy (either elective after medical optimization or emergency) [1].

Ascitic management includes alcohol abstinence in alcohol-related cirrhosis, restriction of sodium intake (80 - 120 mmol per day), diuretics (aldosterone antagonists, loop diuretics and amiloride) with close monitoring of electrolytes and renal function and paracentesis (large volume paracentesis with albumin infusion to prevent circulatory dysfunction) [12, 28]. In patients with refractory ascites, treatment options include large volume paracentesis with albumin, diuretic treatment, peritoneovenous shunting (PVS), insertion of transjugular intrahepatic portosystemic shunt and consideration of liver transplantation [28].

TIPS involves the creation of a low resistance communication between the high-pressure intrahepatic branch of the portal vein and low-pressure hepatic vein under angiographic guidance, thereby reducing portal pressure and ascites. TIPS also has beneficial effects on the cardiovascular system, renal function, nitrogen balance and body weight. However, it is associated with complications including hepatic encephalopathy, shunt thrombosis and stenosis. Moreover, it is not suitable in patients with severe liver disease (serum bilirubin > 5 mg/dL, INR > 2 or Child-Pugh score > 11, current hepatic encephala-

Table 1. Summary of Management of Cases of Flood Syndrome Published in the Literature

Technique	Description	Study design	Outcomes	Reference
Medical management Conservative	Salt restriction, diuretics, sterile dressings, antibiotics	Case report	Death: 2 months after from rupture of esophageal varices.	[25]
	Ostomy pouch, diuretics and antibiotics	Case report	Survived with complications: recurrent admissions, spontaneous bacterial peritonitis, hyponatremia, and renal injury.	[1]
Fibrin glue	Pressure dressings, diuretics and antibiotics	Case series: two cases, with one case managed conservatively	Survived with good outcome: underwent PVS due to refractory ascites, 2 years' follow-up with no recurrence of ascitic leak.	[20]
	Five milliliters fibrin glue into the fascial defect and diuretics	Case report	Survived with good outcome: no recurrence in 12 months' follow-up.	[26]
Surgical management	Five milliliters fibrin glue into the base of the ulcerated leaking of the hernia after ascitic drainage	Case report	Survived with good outcome: no recurrence in 4 months' follow-up.	[27]
	Percutaneous abdominal drain for secondary intention closure of the defect	Pigtail drain	Survived with good outcome.	[4]
Partial splenic embolization and temporary percutaneous peritoneal drainage	Pigtail drain	Case report	Survived with complications: discharged with drain however defaulted follow-up and represented in 6 weeks with peritonitis.	[9]
	16 Fr. Drain inserted in the left lower abdominal quadrant. Partial splenic embolization using gelatin sponge and microcoils.	Case report	Survived with good outcome.	[24]
PVS	Closure of fascial defect and PVS, either simultaneous or sequential.	Case series: four patients had spontaneous umbilical hernia rupture.	Survived with good outcome: three patients at 3 - 19 months' follow-up. Death: one patient died 2 years later from gastrointestinal bleed.	[23]
	Peritoneovenous shunting under local anesthesia.	Case series: one patient underwent hernia repair.	Survived with good outcome: at 2 years' follow-up.	[20]
TIPS	TIPS without hernia repair.	Case report	Survived with complications: acute kidney injury and septic shock secondary to cholecystitis, subsequently recovered.	[7]
	TIPS before surgical umbilical hernia repair.	Case report	Survived with good outcome.	[5]
		Retrospective chart review: four patients had TIPS before hernia repair.	Survived with good outcome: two patients. Survived with complications: one patient had worsening encephalopathy; one underwent liver transplant for liver decompensation.	[3]
		Case series	Survived with good outcome: no recurrence at 5 - 13 months' follow-up.	[22]
		Case series: two patients	Survived with good outcome.	[2]

Table 1. Summary of Management of Cases of Flood Syndrome Published in the Literature - (continued)

Technique	Description	Study design	Outcomes	Reference
		Retrospective chart review: four patients.	Survived with good outcome: two patients. Survived with complications: one patient had worsening encephalopathy requiring supportive care; one patient had liver decompensation requiring liver transplant.	[3]
Umbilical hernia repair/closure	Primary repair without mesh, excision of excessive necrotic skin.	Case series: eight patients	Death: one patient. Survived with complications: two patients had liver decompensation requiring liver transplant. Survived with good outcome: five patients.	[2]
	In all cases, with one exception, a primary repair with non-absorbable Nylon, interrupted sutures, without mesh. One patient had elective repair with onlay polypropylene mesh.	Case series	Survived with complications: nine patients (wound infection, antibiotics allergy, ileus, and liver transplant). Survived with good outcome: one patient at 54 months' follow-up. Survived with good outcome at 9 months' follow-up.	[17]
	Primary open surgical repair of umbilical hernia with JP drain placement.	Case report	Survived with good outcome at 8 months' follow-up.	[18]
	Umbilical herniorrhaphy without mesh and drain insertion.	Case report	Survived with complications: acute kidney injury, spontaneous pneumothorax, failure to thrive - discharged to hospice care.	[15]
	Closure of umbilical defect.	Case report	Survived with good outcome: discharged 2 days later with oral antibiotics.	[11]
	Emergent repair no drain insertion.	Retrospective chart review: two patients	Survived with complications: one patient had ascitic leak underwent TIPS on POD 5, one had liver decompensation requiring liver transplant.	[3]
	Debridement of necrotic skin overlying the hernia, running closure of the fascia with continuous non-absorbable suture (2-0 polypropylene), and primary closure of the skin.	Case series	Death: one patient (colonic dilatation and liver failure). Survived with complications: one patient (wound infection which healed). Survived with good outcome: seven patients.	[13]
	Resection of infarcted omentum and primary closure of hernia defect with interrupted 1-0 nylon sutures.	Case report	Survived with complications: aspiration pneumonia, decompensated liver disease, feed intolerance, spontaneous bacterial peritonitis - discharged after 32 days of hospitalization with no hernia recurrence.	[8]
	Excision of ulcerated umbilical skin, hernial sac and ring, and primary closure of incision.	Case report	Survived with complications: alcohol withdrawal syndrome, discharged on day 7 of admission.	[14]
	Excision of necrotic skin and hernia sac, closure of umbilical defect with polydioxanone sutures, insertion of abdominal drain.	Case series	Survived with complications: recurrent hernia defect with incarcerated bowel; underwent resection of strangulated omentum and closure of hernia defect with onlay monofilament polypropylene mesh, prosthetic mesh infection and bacterial peritonitis; readmission 1 year later with refractory ascites and encephalopathy.	[16]

Table 1. Summary of Management of Cases of Flood Syndrome Published in the Literature - (continued)

Technique	Description	Study design	Outcomes	Reference
	Excision of hernia sac and closure of peritoneum with polydioxanone sutures and hernial defect with 6 × 6 cm soft polypropylene sublay mesh.		Survived with good outcome.	
	Primary closure with drain insertion.	Case report	Survived with good outcome.	[12]
	Biomesh hernia repair.	Case report	Survived with good outcome.	[19]
	Beside closure of umbilical hernia ulcer and ascitic drain insertion.	Case report	Survived with complications: bacterial peritonitis treated with antibiotics - improvement in condition and discharged after 6 days.	[10]
	Closure of skin over umbilical hernia under local anesthesia with simple running nonabsorbable monofilament suture, defect in the skin overlying the recurrent umbilical hernia was oversewn.	Case series: one case underwent PVS.	Death: readmitted with umbilical hernia rupture 2 months later with acute renal failure and death.	[20]
	Exploratory laparotomy and umbilical wall defect repair.	Case report	Not mentioned.	[6]
	Resection of strangulated omentum and repair of abdominal wall defect.	Case report	Not mentioned.	[21]

POD: postoperative day; PVS: peritoneovenous shunting; TIPS: transjugular intrahepatic portosystemic shunting.

lopathy ≥ grade 2 or chronic hepatic encephalopathy) or severe extrahepatic conditions.

Deciding on subsequent treatment is difficult as supportive management is associated with a mortality rate of more than 60% [11], while surgical management involves high postoperative morbidity of up to 71% [3] and mortality of 20-60% [4], although immediate surgical intervention reduces the mortality to 6-20% [1]. Thus, in suitable patients, umbilical herniorrhaphy without mesh is recommended and should be followed by ascites control [29] as mentioned above. The repair is ideally performed after medical optimization [8] unless in emergency situations such as peritonitis [13], bowel incarceration or evisceration [14]. This is to minimize postoperative complications which include wound infection or dehiscence, ascitic fluid leakage, liver failure, bleeding, ileus, encephalopathy and hernia recurrence [1, 15]. Umbilical hernia repair should not be performed in patients with a patent umbilical vein due to risks of portal venous thrombosis and acute liver failure [16].

In the primary care setting, the prevention of umbilical hernia rupture can be achieved by optimizing ascites management with the use of diuretics, and avoidance of alcohol and non-steroidal anti-inflammatory drugs and angiotensin-converting enzyme inhibitors, and the cautionary use of other medications such as alpha-1 adrenergic receptor antagonists, dipyridamole and certain antibiotics [28]. Patients would also benefit from education on the complications of cirrhosis, good skin care and given advice on dietary salt and fluid restriction [1, 15].

Conclusion

Flood syndrome is a rare complication of liver cirrhosis with ascites which carries a high mortality rate. In the community hospital setting with no access to the surgical team, management options include medical therapy and local wound care. Primary care physicians can play a role in the prevention of umbilical hernia rupture with optimization of ascites management.

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Conflict of Interest

The authors have no conflict of interest to declare.

Informed Consent

Written informed consent has been obtained from the patient

for the publication of the case report and the relevant clinical information.

Author Contributions

Jia Li Lee contributed to the writing and editing of the manuscript. Jeffrey Jiang was the mentor and contributed to the design and critical revision of the manuscript.

Data Availability

The authors declare that data supporting the findings of this study are available within the article.

Abbreviations

TIPS: transjugular intrahepatic portosystemic shunting; PVS: peritoneovenous shunting; POD: postoperative day

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