Emergency Peritoneal Dialysis in a Ventilated Patient with Liver Cirrhosis

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Abstract

High mortality rates are often observed among patients with liver cirrhosis admitted to an intensive care unit (ICU). Thus, the decision to treat such patients with aggressive life-support methods such as mechanical ventilation, vasopressors, and renal replacement therapy (RRT) is frequently questioned. A 77-year-old woman with hepatitis C-related cirrhosis, Child-Pugh category C, was admitted to the ICU because of respiratory failure. Ventilator weaning was difficult because of pulmonary compression by massive intractable ascites. The patient also presented with acute kidney injury (AKI), and thus, RRT was indicated. Six days after emergency peritoneal dialysis (PD), she was extubated. The mortality rate among ventilated patients with liver cirrhosis and AKI is extremely high. Ventilator weaning and extubation is often very difficult in these patients because of intractable ascites. Once RRT is indicated, emergency PD may be an effective strategy to relieve the patient of discomfort caused by massive ascites, eliminate uremic toxins, and facilitate smooth extubation of the patient.

KEY WORDS: liver cirrhosis, respiratory failure, acute kidney injury, peritoneal dialysis, renal replacement therapy

Introduction

Most patients with cirrhosis die of liver-related causes. The terminal events are either acute bleeding or infections in at least one-third of such patients [1]. In an intensive care unit (ICU) setting, mortality is extremely high among patients with multiple organ failures (1, 2). Thus, the decision regarding treatment with aggressive life-support methods such as mechanical ventilation, vasopressors, and renal replacement therapy (RRT) is frequently questioned, because ventilated patients with liver cirrhosis often develop multiple organ failure (3). Moreover, hemodialysis seems ineffective in patients treated with mechanical ventilation (4).

We present the case of a ventilated patient with liver cirrhosis who was unable to wean from the ventilator unit because of massive intractable ascites complicated with acute kidney injury (AKI). Six days after emergency peritoneal dialysis (PD), the endotracheal tube was smoothly removed.

Case Report

A 77-year-old Asian woman had a history of hepatitis C virus-related liver cirrhosis, Child-Pugh category C. She also had type 2 diabetes and was previously treated with insulin glargine, 22 units per day; repaglinide, 1 mg 3 times daily; and acarbose, 50 mg 3 times daily. Before admission, her serum blood urea nitrogen (BUN) and creatinine levels were 20 mg/dL and 1.5 mg/dL, respectively.

She visited our emergency room because of poor appetite and dizziness; a hyperglycemic episode was suspected on admission. However, severe abdominal fullness with severe ascites formation and progressive dyspnea were noted during subsequent days. Because of aspiration pneumonia and acute...
respiratory distress, she was intubated and supported by a ventilator on the 23rd day of hospitalization. After she was transferred to the ICU, she was treated with strong antibiotics, massive diuretics infusion (furosemide continuous drip, 20 mg/h), and frequently, with abdominal paracentesis. The endotracheal tube was removed and she was transferred to a general ward on the 47th day. At the time of transference, her serum BUN and creatinine levels were 99 mg/dL and 1.7 mg/dL, respectively. On the next day, she was again intubated owing to loss of consciousness caused by hypercapnia and was transferred again to the ICU.

In the second course of ICU treatment, ventilator weaning was more difficult than in the previous course because of pulmonary compression by massive ascites despite aggressive treatment with furosemide continuous drip (20 mg/h), albumin infusion, and massive paracentesis. The results of the laboratory tests performed on the 58th day of hospitalization were as follows: hemoglobin, 9.0 g/dL; white blood cell, $7.7 \times 10^3 / \mu L$; platelet count, $89 \times 10^3 / \mu L$; albumin, 3.2 g/dL; total bilirubin, 3.7 mg/dL; BUN, 124 mg/dL; creatinine, 2.3 mg/dL; potassium, 5.3 mEq/L; sodium, 153 mEq/L; and international normalized ratio (INR), 1.14. RRT was indicated owing to severe azotemia-related consciousness disturbance and bleeding tendency without evidence of elevated serum iron level. Further, a Tenckhoff peritoneal catheter was implanted under general anesthesia. During the procedure, total blood loss was approximately 100 mL and ascites drainage was approximately 4,300 mL.

![Figure 1](image-url)
The patient’s body weight and systolic blood pressure (SBP) decreased from 68 to 61.3 kg (Fig. 1A) and from 139 to 107 mmHg, respectively. Consequently, the dose of antihypertensive agents and diuretics was immediately reduced owing to both the low blood pressure and considerable body weight loss. We initially used 2,500 mL of 1.5% dextrose dialysate solution per day for irrigation for the first 4 days and then performed an automated PD using 5,000 mL 1.5% dextrose dialysate solution per day from the sixth day after the operation. Subsequently, chest radiography was performed, and the results showed re-expansion of lung space after complete ascites drainage. Smooth weaning from the ventilator was observed, and the endotracheal tube was removed on the sixth day after the operation.

After she was transferred to the general ward, we performed PD smoothly, with an adequate ultrafiltration volume (Fig. 1B). The patient’s urine output decreased remarkably and was almost zero 2 weeks later (Fig. 1C). Unfortunately, intractable hemorrhoid bleeding was noted and the patient died due to hypovolemic shock on the 20th day after the operation.

Discussion

We present the case of a ventilated patient with liver cirrhosis who showed persistent ventilator dependence owing to pulmonary compression by massive ascites. When severe azotemia emerged, emergency PD was performed, and the patient was successfully extubated 6 days later.

AKI is a common and critical event observed in patients with liver cirrhosis (5). In an ICU setting, AKI is an independent risk factor of death (6). Dealing with AKI in patients with cirrhosis, however, poses significant diagnostic, ethical, and treatment challenges for physicians. First, the accurate assessment of the glomerular filtration rate for diagnosis is difficult because serum creatinine is an unreliable and a delayed marker of renal function in such patients (7, 8). Second, the clinical signs of renal failure such as uremic encephalopathy may be difficult to diagnose because these signs closely resemble those of hepatic encephalopathy. Finally, the prognosis of type I hepatorenal syndrome complicated by AKI is poor and does not improve after RRT. However, other forms of AKI such as acute tubular necrosis may be improved by RRT, although they too have poor prognosis (9). In addition to AKI, respiratory failure is an important risk factor for death. The mortality rate among patients with failure of three non-hematologic organs is very high, nearly 90% (2), and hemodialysis is ineffective in patients with cirrhosis treated by mechanical ventilation (4). However, the withholding of RRT presents ethical problems when there is even a small chance of patient survival.

Intermittent hemodialysis (IHD) is potentially harmful to hemodynamic stability in patients with cirrhosis, especially because IHD is usually performed using inotropic agents. Therefore, continuous venovenous hemodialysis (CVVHD), with a much lower blood flow, is suggested as a preferred treatment for renal failure associated with potentially reversible acute liver damage (10). However, only patients without mechanical ventilation may benefit from these two modalities of RRT (4). PD is better tolerated than hemodialysis by patients with cirrhosis because it exerts less effects on hemodynamic stability, obviates the need for anticoagulants, and provides a method for ascites drainage (11). In addition, the risk of bacterial peritonitis and the outcome of patients with bacterial peritonitis is not worsened by the presence of cirrhosis (12). However, few studies have discussed the application of PD in ventilated patients with cirrhosis.

There is need for caution while implanting a PD catheter in a patient with cirrhosis. Bleeding remains the major concern because cirrhosis is known to be associated with thrombocytopenia and coagulation disorders. Platelet transfusions are useful for preventing bleeding, especially when the platelet count is below 50,000/mL. Transfusion of freshly frozen plasma also reverses moderate to severe coagulopathy (13). On the other hand, it is well known that uremia that causes platelet dysfunction increases the risk of bleeding. Frequent dialysis might improve platelet aggregation and bleeding time and prevent uremic platelet dysfunction (14). Intravenous infusion of cryoprecipitate, desmopressin and estrogens can also ameliorate active uremic bleeding (14). In our case, we did not treat the patient with platelet transfusion, hemodialysis, or infusion of cryoprecipitate, desmopressin or estrogens, before the operation. Although the extent of blood loss was small (100 mL), prolonged reddish dialysate drainage (5 days) and decrease in hemoglobin levels (from 9.0 to 5.5 g/dL) were observed. Therefore, prevention of bleeding by the above-mentioned therapies should be mandatory.

The process of catheter implantation will result in rapid and large amounts of ascites drainage. The amount of ascites drainage in our patient was 4,300 mL and total loss of body weight was approximately 6.7 kg after the procedure. This could considerably affect hemodynamic stability, which should be monitored closely. It has also been suggested that patients receiving large amounts of therapeutic paracentesis (> 5 L), should be administered albumin 8 g per litter tapped and followed by diuretics (15). Plasma expansion with frozen plasma and preemptive paracentesis might also be helpful in preventing abrupt hypotension. We gained some experience from this patient. First,
wound healing usually requires 2 weeks before PD can be performed in the general population. However, this does not seem to be the case for patients with cirrhosis and intractable ascites, and low-dose PD could be performed immediately because of the expansion of the abdominal cavity. Second, fluid balance was easily achieved because of concomitant ultrafiltration by PD and spontaneous ascites formation. Unfortunately, anuria seemed inevitable and diuretics were ineffective in the subsequent treatment (Fig. 1C).

**Conclusion**

The mortality rate among ventilated patients with cirrhosis complicated with AKI is extremely high. Ventilator weaning and extubation is very difficult in these patients because of intractable ascites. Once RRT is indicated, emergency PD may be a successful strategy to relieve the patient of discomfort caused by massive ascites, eliminate uremic toxins, and facilitate smooth extubation of the patient.

**References**