Closed-System, Automated Continuous Peritoneal Dialysis in Severe Acute Pancreatitis

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Background: The effect of peritoneal dialysis on severe acute pancreatitis has been controversial, due to the increased risk of late complications, such as sepsis and retroperitoneal abscess that might relate to dialysis procedures. We speculated that a closed-system, automated continuous peritoneal dialysis (C-SACPD) method could decrease bacterial infections caused by repeated dialysis procedures.

Methods: We prospectively applied C-SACPD to 7 patients hospitalized with severe acute pancreatitis, having Ranson scores of 3 or higher and positive for ascites.

Results: Six patients were completely cured and discharged. Among these surviving patients, Ranson scores ranged from 3 to 6 (average, 4.7), and peritoneal dialysis was continued for 9 to 34 days (average, 16), until the dark color of the drained dialysate had cleared. Of the 11 prognostic factors indicated by the Ranson score, hypocalcemia required a longer duration of peritoneal dialysis. Only 1 patient died, due to respiratory failure. This patient had a Ranson score of 8, and a low serum calcium level of 3.0 mg/dL that calcium supplementation failed to correct. There were no deaths due to infection. The mortality rate in this study (14.2%) was lower than that found in all but 1 of 18 recent reports of severe acute pancreatitis treated with continuous peritoneal dialysis.

Conclusions: C-SACPD is an effective therapy for the treatment of severe acute pancreatitis with pancreatic ascites.

Clin Exper Nephrol 1998;2:151-154

Key words: severe acute pancreatitis, Ranson score, closed-system, automated peritoneal dialysis, continuous peritoneal dialysis

Severe acute pancreatitis is a rare, but life-threatening and catastrophic disease. Freidell (1960) reported the first trial of peritoneal dialysis for severe acute pancreatitis, but the patient did not survive.1 Wall (1965) reported the survival of 2 of 3 patients with severe acute pancreatitis undergoing peritoneal dialysis.2 In 1974, Ranson et al. reported that early surgical intervention for the treatment of severe acute pancreatitis resulted in increased mortality, that peritoneal dialysis was effective for severe acute pancreatitis, and that 11 prognostic factors were useful for judgement of the severity of acute pancreatitis (Table 1).3 In 1980, Stone and Fabian reported that the mortality of severe acute pancreatitis treated with peritoneal dialysis (14.9%) was lower than that without peritoneal dialysis (25%), in a controlled study.4 Following these excellent reports, many authors have reported the efficacy of peritoneal dialysis for patients with severe acute pancreatitis, postulating that its effect may be due to the removal of harmful intraperitoneal substances, such as protease and other enzymes.4-21 Mayer et al. stirred controversy in 1985, however, by concluding that peritoneal dialysis was not effective for severe acute pancreatitis in their controlled study, which showed no difference in mortality between a peritoneal-dialysis group and a non–peritoneal-dialysis group.18 The frequent occurrence of bacterial infections, such as sepsis and retroperitoneal abscess, in the peritoneal-dialysis group might adversely affect mortality.22 We speculated that closed-system, automated continuous peri-
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Continuous peritoneal dialysis (C-SACPD) could prevent these bacterial infections, and might reduce the mortality rate of severe acute pancreatitis.

**PATIENTS AND METHODS**

**Patients**

All 7 consecutive patients with severe acute pancreatitis treated in the intensive care unit of the Tokyo Metropolitan Fuchu Hospital between October 1992 and March 1996 were enrolled in this study. Severe acute pancreatitis was defined as a Ranson score of 3 or higher, with pancreatic ascites, detected by CT. Five of the patients were men and 2 were women, with a mean age for all patients of 55 years (range, 28 to 77 years). The causes of pancreatitis were alcoholism in 4 cases, gallstones in 2 cases, and unknown in 1.

**Treatments**

Just after the diagnosis of severe acute pancreatitis was established, a Tenckhoff catheter was inserted into the intraperitoneal cavity, under local infiltration anesthesia. After the pancreatic ascites fluid was drained, C-SACPD was started. The procedures were done using the Dianeal® (PD-2 1.5, 2.5, 4.25) and PAC-X Cycle® (Baxter Healthcare, Deerfield, IL, USA) in 6 cases, and with Perisate 360® and Cycler® (JMS, Hiroshima, Japan) in 1 case. Automated peritoneal dialysis was initially set up for a 500 to 2000 mL/hour exchange rate, with subsequent adjustment of the settings, according to changes in water balance, electrolyte balance, and hemodynamics.

Manual adjustments were frequently needed to cope with difficulties involving introduction of peritoneal dialysate or drainage. The dialysate potassium concentration was kept at 4.0 mmol/L by adding potassium chloride. Peritoneal dialysis was continued until the drained dialysate was clear. All patients were fitted with a central venous catheter, nasogastric tube, and indwelling urinary catheter. They received oxygen, intravenous hyperalimentation, and decompression by the nasogastric tube, and intravenous administration of broad-spectrum antibiotics, an H₂-receptor antagonist, and a protease inhibitor.

**RESULTS**

The average period from the onset of pancreatitis to the start of C-SACPD was 93 hours (range, 24 to 144 hours) (Table 2). In 6 patients, whose Ranson’s scores ranged from 3 to 6 (average, 4.7), C-SACPD was performed for an average of 17 days (range, 9 to 34 days). In each of these cases, pancreatitis was completely cured and a recovered discharge was obtained (Table 3). Three of these 6 surviving patients were not alert and needed intratracheal intubation with mechanical ventilation. The other 3 were alert from the start of treatment, and obtained dramatic pain relief after the first peritoneal dialysis.

One patient died due to sudden respiratory distress and ventricular fibrillation on the second hospital day. This patient had a Ranson score of 8, with a surprisingly low serum calcium level of 3.0 mg/dL that intravenous supplementation had failed to correct. In the 6 surviving patients, the degree of hypocalcemia and duration of peritoneal dialysis showed a weak correlation (r = 0.547, P = 0.261), suggesting that hypocalcemia is a prognostic factor of disease.

Since all patients presented with mild-to-moderate fevers, positive C-reactive protein, and leukocytosis, which might have indicated the presence of bacterial infections, all were treated with antibiotics. Bacterial examinations of the dialysis fluid and blood gave no positive results. Development of a late retroperitoneal abscess occurred in only 1 case, and that was cured by percutaneous drainage. Bacterial cultures were all negative, and there were no deaths due to bacterial infection, suggesting that continuous peritoneal dialysis using C-SACPD might have decreased the risk of bacterial infection.

**DISCUSSION**

In this study, severe acute pancreatitis had a mortality rate of 14.2% when treated by our continuous peritoneal dialysis method. This was a lower rate of mortality than that shown in all but 1 of the previous reports (Table 4). The mean mortality rate for patients treated with continuous or intermittent peritoneal dialysis for severe acute pancreatitis in the