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NEPHROLOGY – CASE REPORT

Hemoperfusion plus continuous veno-venous hemofiltration in a pregnant woman with severe acute pancreatitis: a case report

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Abstract Severe acute pancreatitis is a common critical disease, which may cause severe complications such as sepsis and multiple organ dysfunction syndrome (MODS), and has a high mortality. A 31-year-old woman with 25-weeks pregnancy presented with hyperlipidemic pancreatitis, sepsis and MODS. Based on conventional treatment, 125 h of continuous veno-venous hemofiltration (CVVH) and 3 sessions of hemoperfusion (HP) were carried out. The treatment turned out to be very successful. We suggest that early intervention by blood purification therapy, and CVVH combined with HP could be effective in severe acute pancreatitis.

Keywords Continuous veno-venous hemofiltration · Hemoperfusion · Multiple organ dysfunction syndrome · Severe acute pancreatitis

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Background

The incidence of acute pancreatitis in pregnancy varies from 1 in 1,000 to 1 in 1,000 births [1]. The etiological factors of acute pancreatitis during pregnancy are similar to those in the general population, which is most often associated with gallstone disease or hypertriglyceridemia[2]. With the advances of diagnostic techniques and therapeutic methods, maternal and fetal outcomes have significantly improved. A single-center experience spanning over 10 years reported 34 cases of acute pancreatitis with no maternal deaths and a fetal mortality rate of only 4.7% [3]. However, treatment of acute pancreatitis is not standardized and mainly supportive, and severe acute pancreatitis is still a significant clinical problem for all physicians. Continuous renal replacement therapy (CRRT), including a variety of blood purification techniques, which can remove water, nitrogenous wastes, and even inflammatory mediators, slowly and steadily, has been widely used in patients with critical conditions such as severe acute pancreatitis. In this report, we describe a case of a 25-week pregnant woman with hyperlipidemic pancreatitis, who was successfully treated with continuous veno-venous hemofiltration (CVVH) combined with hemoperfusion (HP).

Case report

This patient was a 31-year-old woman with 25-weeks pregnancy after in vitro fertilization (IVF) and with

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no previous pregnancy history. After several hours of abdominal pain, she was admitted to a local hospital. With conservative therapies, the symptoms worsened, complicated by fever (>38°C). One day later, she was addressed to the emergency department of our hospital. Physical examination on admission indicated: T 39.2°C, HR 156 bpm, BP 82/47 mmHg, respiratory rate 42 bpm. The 24 h urine volume was 200 ml, and mental status was impaired. Diffuse rales could be heard in both lungs. The abdomen showed diffuse and rebound tenderness. Bowel sounds were absent, and the uterine fundus was difficult to palpate. Obstetric examination suggested fetal death and bloody vaginal discharges were seen. Laboratory tests found: WBC 14.16×10^9/L, with a high neutrophil percentage of 93.4%, platelet count 78×10^9/L, plasma glucose 12.87 mmol/L, albumin 32.2 g/L, TG (triglyceride) 51.54 mmol/L, CHOL (cholesterol) 17.40 mmol/L, serum creatinine (sCr) 56 umol/L, BUN 2.65 mmol/L, amylase 572 IU/L, lipase 1,416 IU/L, plasma lactate 8.4 mmol/L, and urine ketone 4 + . Arterial blood gas in room air showed pH 7.230, PaO_2 72 mmHg, and $PaCO_2$ 42 mmHg. The APACHE II score was 23. A CT scan demonstrated acute pancreatitis and patchy infiltrates in both lungs, with mild pleural effusion. The patient was diagnosed with hyperlipidemic pancreatitis, multiple organ dysfunction syndrome (MODS), septic shock, and diabetic ketoacidosis (with diabetes being previously diagnosed during the pregnancy).

Because of her critical condition, the patient was transferred to ICU, where endotracheal intubation and assisted mechanical ventilation were administered. Besides general supportive measures (such as volume repletion, blood glucose control, antibiotics, and nutritional support), CVVH was immediately started, using a Diapact CRRT machine (B, Braun) and Diacap Acute M hemofilter (1.5 m^2). Replacement fluid of 3,000 ml/h was given by pre-dilution. Citrate was used as anticoagulant. Blood flow rate was set at 180–200 ml/min. Hemofilter was replaced every 24 h or if clotted prematurely. HP was carried out for 2 h daily, with a synthetic resin cartridge (HA-330I; Zhuhai Lizhu Group, Biological Material Co, Ltd., China) installed along the blood flow circuit, right after the hemofilter. The patient's general status improved progressively with CVVH and HP. After three sessions of HP and CVVH, the patient's consciousness recovered, and vital signs showed T 37.3°C, HR 112 bpm, BP 143/106 mmHg, respiratory rate 21 bpm. Laboratory tests revealed WBC 7.92×10^9/L, platelet count 64×10^9/L, plasma glucose 9.68 mmol/L, albumin 24.8 g/L, TG 7.42 mmol/L, CHOL 7.31 mmol/L, sCr 32 umol/l, BUN 2.30 mmol/L, amylase 72 IU/L, lipase 155 IU/L. The APACHE II score decreased to 11. The HP was discontinued, and CVVH performed for another 53 h until diuresis exceeded 2,000 ml. The patient's vital signs remained stable and laboratory parameters almost returned to normal (except for albumin, 26.6 g/L, which normalized several days later). Four days later, with the infection under control and an appropriate general condition of the patient, induction of labor was carefully performed in ICU, followed by ultrasound-guided uterine curettage. Abdominal CT scan indicated significant reduction of the pancreatic swelling. Soon after the withdrawal of the mechanical ventilation, the patient was transferred to the general ward, and, several days later, she was discharged in good health.

Discussion

Severe acute pancreatitis is a life-threatening condition which may cause systematic inflammatory response syndrome (SIRS), sepsis, and even MODS. The mechanism of MODS is complex. It is thought that a dysregulated immune response in critical illness plays a central role in the pathogenesis of MODS [4]. CVVH has been widely used in clinical practice, especially in critically-ill patients, with unstable hemodynamics and needing metabolic control. Michael Dunham [5] proposes that CRRT is associated with significant improvement in pulmonary gas exchange, hemodynamic instability, azotemia control, fluid overload, and nutritional support in patients with MODS and acute renal failure. Yekebas et al. [6] investigated the impact of different modalities on sepsis-induced alterations in the course of experimental pancreatitis, finding that CVVH can prevent sepsis and improve survival. Hao Wang et al. [7] applied continuous high volume hemofiltration in the treatment of patients with severe acute pancreatitis complicated with MODS and achieved satisfactory results. However, CVVH does not allow large molecules to pass through the

hemofilter. Rocon and his colleagues [8] proposed a "peak concentration hypothesis" of MODS and found that CVVH can be combined with plasma filtration absorption techniques to remove the excess circulating inflammatory mediators.

HP is another blood purification modality which can absorb pathogenic molecules in the blood flow circuit by sorbent materials installed in the hemoperfusion cartridge. Unlike CVVH, HP is more effective for removing middle and large molecules and toxins bound to proteins. For this reason, HP is wildly applied in drug overdose or intoxication cases [9]. Saotome et al. [10] reported a case of severe acute pancreatitis induced by alcohol abuse, using CTR-001 direct HP cartridge to perform cytokine apheresis and demonstrated that this treatment can effectively reduce the serum levels of pro-inflammatory cytokines during severe acute pancreatitis. A pilot study performed by Kobe et al. [11] using direct HP (CYT-860) in patients with hypercytokinemia reported significant decrease in blood level of cytokines and improvement of PaO_2/FiO_2. Besides, a prospective, pilot, before-and-after self-crossover clinical trial carried out by Mao et al. [12] investigated the effect of coupled plasma filtration adsorption (CPFA) on immune function of patients with MODS, finding that CPFA (using the resin cartridge HA-330I) was better than high-volume hemofiltration (HVHF) in increasing the ratios of anti-inflammatory to pro-inflammatory mediators, improving antigen presentation ability, and restoring leukocyte responsiveness. In our patient, we combined CVVH and broad-spectrum HP, assuming that HP can effectively remove excess endogenous and exogenous pathogenic molecules. The treatment was successful. After the first three days of treatment, the patient's general condition significantly improved and her laboratory parameters virtually normalized.

The cause of severe acute pancreatitis is multifactorial. In this patient, with no history of alcohol consumption, chronic pancreatitis and gallstone disease (confirmed by the subsequent abdominal CT scan and ultrasound examination), the extremely high level of plasma triglycerides may have been the primary cause of pancreatitis. The mechanism of

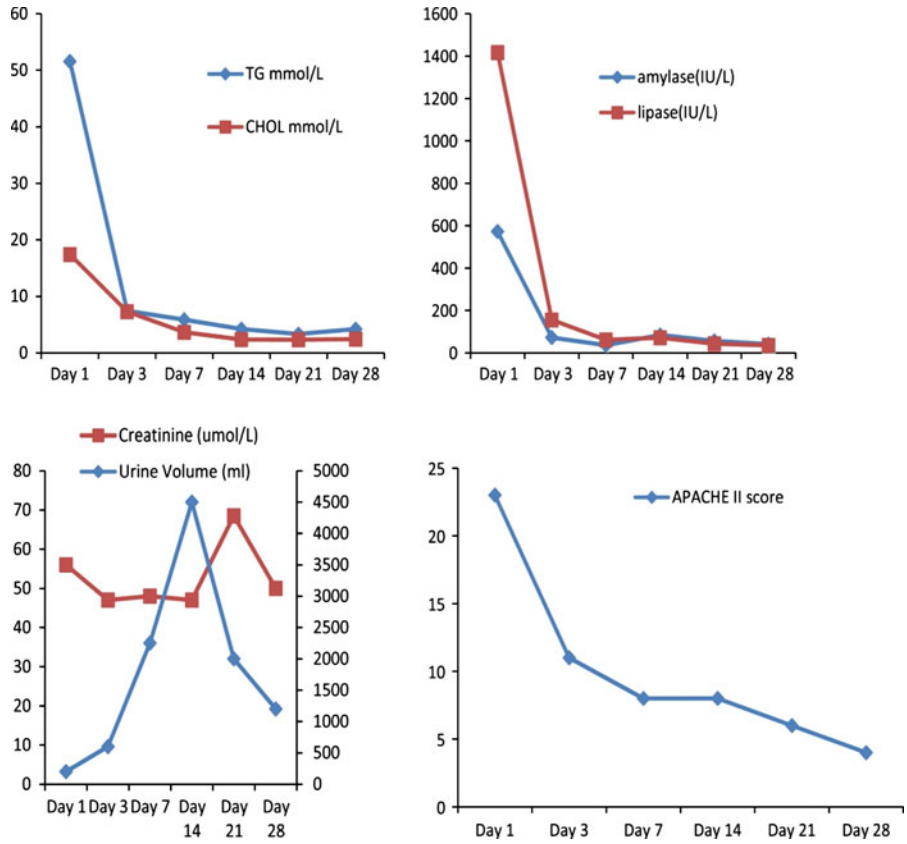

Fig. 1 The changing tendency of triglyceride (TG), cholesterol (CHOL), amylase, lipase, renal function, and APACHE II score during the treatment. We initiated CVVH and HP on Day 1 and discontinued HP on Day 3. CVVH was stopped on Day 7. Normal range: TG 0.29-1.83 mmol/L, CHOL 2.8-5.7 mmol/L, amylase 25-125 IU/L, lipase 13-60 IU/L

hypertriglyceridemia causing pancreatitis is not completely clear. Several studies suggest that toxic free fatty acids derived from plasma triglycerides induce local inflammation, leading to pancreatitis [13, 14]. HP may be more effective in clearing these fat-soluble factors because of its specific design. After receiving HP and CVVH treatments, the TG, CHOL, amylase, and lipase levels in our patient decreased dramatically (Fig. 1), explaining her rapid recovery.

Moreover, the patient developed no side effects such as coagulopathy, hypotension, thrombocytopenia, or hypocalcemia.

Conclusion

HP showed great efficacy in clearing TG, CHOL, amylase, and lipases, which may play central roles in the hyperlipidemic pancreatitis process. The early application of the blood purification technique is also critical. CVVH in combination with HP may successfully and rapidly control MODS, which probably can improve the survival rate of this severe disease. However, more clinical trials are warranted to evaluate the efficacy and safety of HP in severe acute pancreatitis treatment.

Conflict of interest There is no conflict of interest in this study.

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