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Case Report

A Case of Living Donor Liver Transplant Recipient Treated With Novel Blood Purification "Plasma Diafiltration"

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Blood purification therapy is indispensable for liver transplant recipients. The case of a living donor liver transplant recipient who represented graft insufficiency and was supported by novel blood purification "plasma diafiltration" immediately after operation is presented. A 60-year-old woman was referred for living donor liver transplant because of liver cirrhosis due to hepatitis C. Elective living donor liver transplant was performed, but the graft was small for size. Thus, the signs of graft insufficiency appeared immediately after the operation, and plasma diafiltration was used as a bridge to graft regeneration. After plasma diafiltration was started, the recipient recovered promptly, and withdrawal was performed 35 hours after induction without any complications. Plasma diafiltration is a useful and safe liver support for liver transplant recipients, including immediately after liver transplantation.

Key words: Artificial organ support – Graft insufficiency – Liver support – Small-for-size graft syndrome

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Plasma diafiltration (PDF) is a blood purification therapy developed by Nakae *et al*, in which simple plasma exchange (PE) is performed with a membrane plasma separator (Evacure EC-2A plasma separator; Kuraray, Tokyo, Japan) while dialysate flows outside the hollow fibers.[1] In acute liver failure, the efficacy of PDF has been reported as bridge therapy to liver regeneration or as bridge therapy for transplantation.[2,3]

For liver transplantation recipients, the needs for plasmapheresis are not only for preoperative management but also for postoperative management, because of small-for-size graft syndrome, primary nonfunction, and blood type incompatible cases.[4,5] These reports involved conventional plasmapheresis such as PE, continuous hemodiafiltration (CHDF), or hemodialysis (HD).[4,5] However, in such situations, novel and more efficient plasmapheresis is needed not only for medical but also for economic reasons.

A case of living donor liver transplantation (LDLT) using small-for-size graft in which PDF was used as postoperative plasmapheresis for acute graft functional insufficiency is presented.

Case Report

A 60-year old woman with decompensated liver failure due to hepatitis C virus–related liver cirrhosis was referred to our hospital for living donor liver transplantation. Her model for end-stage liver disease (MELD) score was 20, and the Child-Pugh classification was C (12 points). The donor candidate was her daughter, and she could only donate her extended left hemiliver because of safety concerns about donor residual liver volume. Elective LDLT with splenectomy was performed because of portal venous decompression for portal hypertension owing to a small-for-size graft (graft recipient weight ratio = 0.54%; graft volume/standard liver volume = 31.0%). Immediately after LDLT, the arterial blood lactate value increased rapidly from 1.5 mmol/L to 13.1 mmol/L. Taking into consideration the graft size mismatch, the elevated lactate value was strongly suspected to be related to graft function insufficiency due to graft insufficiency. Thus, it was decided to perform PDF in the intensive care unit (ICU) as a supplement to the graft until regeneration could occur.

An Evacure EC-2A plasma separator was used. The PDF was performed continuously, with a blood flow rate of 80 mL/min. Filtered replacement fluid for artificial kidneys (Sublood-BS; Fuso Pharmaceutical, Osaka, Japan) was infused at a dialysate flow rate of 400 mL/h and a replacement flow rate of 280 mL/h. Fresh frozen plasma (FFP) was infused intravenously at 120 mL/h, and nafamostat mesilate (Futhan; Torii Pharmaceutical, Tokyo, Japan) was used as an anticoagulant (Fig. 1).[2,3]

PDF was started 6 hours after the operation and continued for 35 hours. During PDF, the recipient's hemodynamic state was stable. After PDF was started, blood lactate and total bilirubin levels decreased immediately, and coagulation system parameters improved. The recipient's postoperative course and treatment are shown in Fig. 2. After PDF, CHDF was applied for renal insufficiency and was

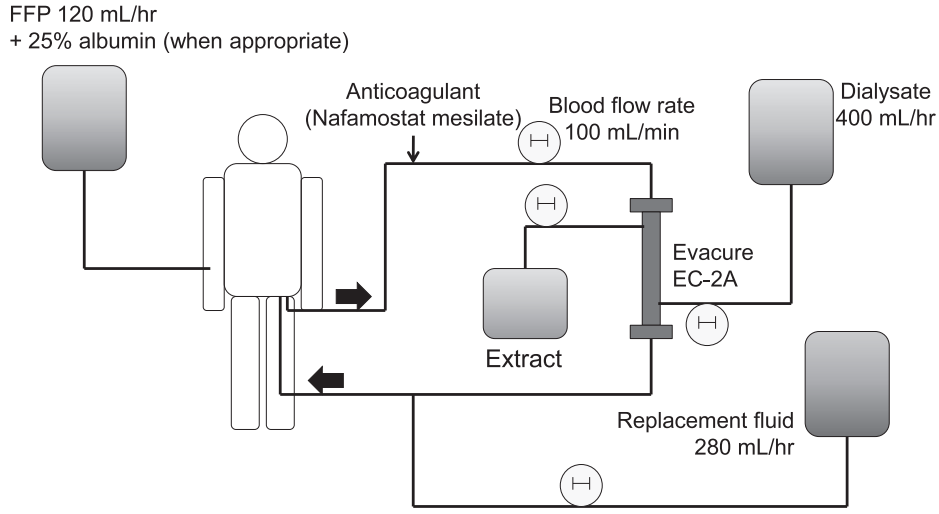

Fig. 1 Schematic representation of the flow of plasma diafiltration in this case.

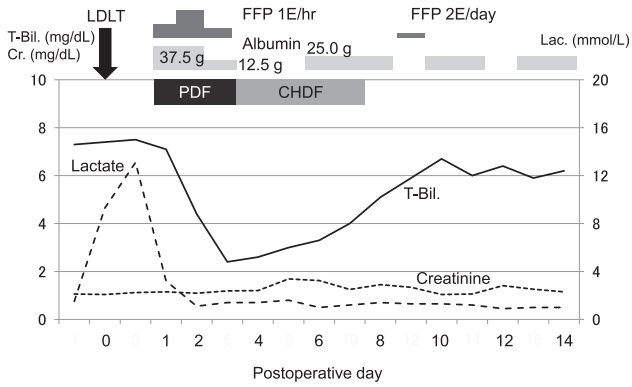

Fig. 2 Clinical course and treatment of the recipient. T-Bil, total bilirubin; Cre, creatinine; Lac, lactate.

withdrawn on postoperative day (POD) 7. The recipient recovered well with the graft and left the ICU on POD 14. She was discharged 11 weeks after the transplantation. Two years after LDLT, she is in good condition without any complications.

Discussion

In liver transplantation, perioperative blood purification is indispensable. Thus, various modalities have been used for patients perioperatively.[4–6] Especially in the domain of LDLT, its efficacy has been emphasized in cases such as ABO-incompatible transplantation and small-for-size graft syndrome. Until now, the efficacy of PE, CHDF, and MARS as bridge therapy until liver transplantation and until graft liver regeneration after transplantation has been reported.[4,5,7] There is no doubt that blood purification improves prognosis, but improvements and refinements are still required. In recent years, the effectiveness of PDF for acute liver failure as bridge therapy until liver transplantation has been reported.[3]

In the present case, despite splenectomy for portal venous decompression, clinical signs of poor graft function associated with graft size mismatch, such as elevation of blood lactate levels, were seen.[8] Thus, PDF was performed as a supplement to graft function until recovery. Immediately after PDF was started, blood lactate and bilirubin levels decreased promptly. After hyperbilirubinemia resolved, PDF was terminated, and then CHDF was started for volume overload and renal insufficiency. During this period, the blood bilirubin level increased gradually, while renal insufficiency was controlled satisfactorily. This clinical course suggests that the effect of PDF as bridge therapy until graft recovery is the same as for patients in acute liver failure.

PDF is a therapeutic modality to remove water soluble and low to intermediate-molecular weight, albumin-bound toxic factors.[1] Thus, applying PDF is the same as removal of the water-soluble substances by CHDF for hepatic-insufficiency patients. Actually, in the present case, the trends of the factors associated with renal function during PDF were the same as during CHDF. Thus, PDF may be a useful and simple blood purification therapy for postoperative hepatorenal syndrome, as indicated by a previous report.[9]

In addition, in the setting of simultaneously performing PE and CHDF, it is difficult to completely control an increased citric acid concentration, because a large dose of FFP is needed for PE. And yet, the dosage of FFP was becoming smaller with PDF. Actually, PDF was continued for 35 hours in this case, but no significant adverse effects of PDF were observed. In addition, use of smaller doses of FFP led to lower medical costs.[9]

For patients with severe liver failure who require organ support, MARS and/or Prometheus is performed to remove hepatotoxic and nephrotoxic substances in some countries.[10–12] However, these systems cost more and need more complicated preparation than PDF.[9] To apply blood purification therapy to critically ill patients, procedures and circuits should be simple from the perspective of safety. PDF is preferable to other blood purification methods with respect to efficacy and safety.

From our experience, PDF appears to be safe and useful for liver transplant recipients in the perioperative period, including the immediate postoperative period. Thus, PDF is a useful and safe liver support and may become a useful option for patients with liver failure, including liver transplant recipients. Further study, especially of PDF combined with liver transplantation, is needed.

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