Two-stage liver transplantation in a surgically complicated liver failure patient after hepatic tumor resection
-A case report-

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Two-stage liver transplantation, involving a total hepatectomy with a temporary portocaval shunt followed by liver transplantation, requires intensive perioperative care, especially during the prolonged anhepatic period. The pathophysiology and management of this prolonged anhepatic state is not fully elucidated and the proper management during this period is a great challenge to clinicians in the intensive care unit and anesthesiologists. We report a case and management of a total hepatectomy with a temporary portocaval shunt followed by living-donor liver transplantation in a patient with a surgically complicated liver failure after a hepatic tumor resection. (Korean J Anesthesiol 2010; 59: 348-352)

Key Words: Anhepatic, Hepatectomy, Liver failure, Liver transplantation, Portocaval shunt, Two-stage procedure.

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the immediate postoperative period and was listed for an emergency LT.

A preoperative laboratory and radiology evaluation before the tumor resection were within the normal limits except for an elevated liver function profile (aspartate aminotransferase 170 U/L, alanine aminotransferase 100 U/L) due to the underlying Klatskin tumor. The bleeding diatheses at the intensive care unit (ICU) were as follows: hemoglobin and platelet count decreased from 10.4 g/dl and 103 x 10^9/µl to 4.8 g/dl and 60 x 10^9/µl, respectively, within the first hour at the ICU. Prothrombin time (PT) expressed in the international normal range (INR), activated partial thrombin time (aPTT), fibrinogen, fibrin degradation product, D-dimer, antithrombin III activity, plasminogen activity, protein C activity were 2.03 (normal [nl], 0.9 – 1.1), 104.5 seconds (nl, 29 – 42 seconds), 97 mg/dl (nl, 180 – 380 mg/dl), >5 µg/ml (nl, <5 µg/ml), 3.23 µg/ml (nl, 0 – 0.5 µg/ml), 41% (nl, 83 – 123%), 30% (nl, 75 – 112%), 43% (nl, 80 – 161%), respectively. Metabolic acidosis of pH <7.15 with a progressively deteriorating base deficit >15 mmol/L and exacerbating hypocalcemia <0.8 mol/l and hyperglycemia >200 mg/dl were observed throughout the ICU stay. Continuous infusions of calcium gluconate at 1 mg/kg/hr and 5% albumin were given. Bicarbonate and insulin were given intermittently at the discretion of the clinician. At the ICU, exsanguinating bleeding of more than 1,000 ml/hr was seen through a drainage immediately after the tumor resection. During the 11 hour stay at the ICU before receiving a total hepatectomy, more than 25 units of packed red blood cells, 16 units of each fresh frozen plasma, cryoprecipitate and platelet concentrates were administered along with a continuous infusion of 10 µg/kg/min dopamine, 0.35 µg/kg/min norepinephrine to maintain the systolic blood pressure between 50 and 80 mmHg, and the diastolic blood pressure between 30 and 65 mmHg. The urine output was maintained between 20 and 100 ml/hr during the ICU stay. The patient was indicated to undergo a total hepatectomy with a temporary portocaval shunt while awaiting a liver graft due to the uncontrollable bleeding and hepatic toxic syndrome, which was postulated to be caused by acute hepatic necrosis and the resultant coagulation abnormality. During the two hour and 40 minute surgical procedure, crystalloid 8,100 ml, packed red blood cells eight units, fresh frozen plasma four units, platelet concentrates eight units and cryoprecipitate six units were administered to replace the estimated blood loss of 4,500 ml. The total urine output was 330 ml.

After the total hepatectomy and portocaval shunt, the patient was placed at the ICU and medical care for the anhepatic state was provided. During the anhepatic period, an hourly monitoring of the arterial blood gas analysis with an intermittent the ionic calcium level and dieresis were the primary concern of the ICU management. Arterial blood gas analyses showed an alleviation of the metabolic acidosis from arterial pH <7.15 and base deficit >15 mmol/L during the acute liver failure status to pH 7.15 – 7.25 and base deficit of 10-15 mmol/L during the anhepatic period. Metabolic acidosis was accompanied by slight hyperchloremia ranging 110 – 115 mmol/L (nl, <108 mmol/L). However, the potassium level was within the normal range of 3.5 – 3.8 mmol/L throughout the ICU stay before the hepatectomy. The magnesium level decreased only slightly ranging 1.6 – 1.7 mg/dl and the sodium level was maintained between 144 and 146 mmol/L. Persistent ionic hypocalcemia <0.8 mmol/L was observed despite the continuous infusion of calcium gluconate supplementation at 1 mg/kg/hr. Other continuous supplementations including sodium bicarbonate, magnesium, 5% albumin and dextrose solution were provided as needed. There was no rapid correction of hyponatremia or an increase in the sodium level owing to the use of sodium bicarbonate in this case. There were no neurological deficits following the abnormal changes in sodium level or signs of hepatic encephalopathy, even though comprehensive neurological examinations were not feasible due to the patient’s sedated and intubated condition. The serum glucose level was maintained between 100 and 200 mg/dl. A warm blanket was applied to maintain the normal body temperature. An inotropic support with a continuous infusion of 5 µg/kg/min dopamine maintained the systolic blood pressure between 80 and 100 mmHg and diastolic blood pressure between 60 and 80 mmHg. At the discretion of the ICU specialist, 12 units of packed red blood cells, 10 units of fresh frozen plasma, 16 units of platelet concentrates and 14 units of cryoprecipitate were given over an 11-hour period at the ICU before the liver transplant. An elevated creatinine level of 1.58 mg/dl and urine out of <10 ml/hr were observed, but continuous renal replacement therapy (CRRT) was not applied. The coagulation profile during the anhepatic period showed a prolongation of PT (INR) around 2, aPTT around 100 s and fibrinogen <100 mg/dl. Cytokine or other toxin related laboratory analyses were not performed in this patient. No artificial liver support, such as molecular adsorbent recirculating system (MARS), was applied in this patient because she was not considered a suitable candidate.

The patient was anhepatic for 15 hours before reperfusion of the liver in the living donor liver transplantation. Anesthesia was induced and maintained with desflurane at an oxygen fraction of 0.5 under routine monitoring with electrocardiography, Spo2, radial and femoral arterial pressure, pulmonary arterial pressure and cardiac output. Continuous vasoactive support with 5 µg/kg/min dopamine and 0.1 – 0.2 µg/kg/min norepinephrine were maintained. The hemodynamic profile was stable throughout the operation before and after reperfusion of the transplanted liver. During the seven hour and 40 minute LT operation, 7,500