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Extracorporeal circulation for repair of suprahepatic vena cava stenosis after liver transplantation

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Dear Editors:

Suprahepatic vena cava stenosis after liver transplantation is a typical complication of the piggyback technique. Although this technique offers many advantages (e.g., maintenance of caval blood stream, no congestion of abdominal organs), the possibility of grave complications remains. Even abdominal-organ dysfunction and failure cannot be excluded. Liver congestion and a difficult surgical approach further reduce the chance of successful surgical repair.

Suprahepatic vena cava stenosis [3, 4] after liver transplantation increases abdominal venous pressure and reduces venous return. The increased abdominal venous pressure may cause congestion of dependent areas, including intra-abdominal organs. Trans-stenotic gradients higher than 7–10 mmHg may result in organ (liver, kidney, and small bowel) dysfunction and failure. Impaired venous return and elevated venous pressure restrain the maintenance of adequate tissue perfusion. The degree of organ dysfunction is influenced by individual organ tolerance to the congestion and the development of collateral circulation.

While there are several potential situations in which suprahepatic vena cava stenosis can occur [3, 4], the resultant requirement for repair is usually burdened with the difficult surgical approach to cavo-caval anastomosis. In addition, liver congestion further reduces the chance of successful surgical repair. On the other hand, angioplasty and stenting of the stenosis [1] is hampered by several disadvantages – substantial complications (perforation, bleeding, thrombosis, stenosis) and the availability of an interventional radiologist. We investigated the technique of surgical repair of suprahepatic caval stenosis.

Case reports: from August 1998 to October 2000, 28 liver transplantations were carried out at the Karl-Franzens University of Graz using a modified piggyback technique [2, 4, 5], with 25 of the patients being alive and well. Two of them (7.1%) showed evidence of suprahepatic caval stenosis after liver transplantation.

The first patient was a 26-year-old man with primary sclerosing cholangitis. Liver transplantation was performed successfully by means of the piggyback technique. Laboratory values on the 1st day after the procedure were: ASAT, 146 U/l; ALAT, 147 U/l; GGT, 22 U/l; CHE, 1,900 U/l; AP, 164 U/l; bilirubin, 7.0 mg/dl; Quick, 50%; ATIII, 58%. Approximately 2 weeks after liver transplantation the patient developed kidney dysfunction (creatinine: 3.8 mg/dl), pancreatitis (amylase: 326 U/l), and lower limb and scrotal edema. Angiography confirmed the diagnosis, but angioplasty failed because it was impracticable. Sixteen days after liver transplantation, surgical repair using extracorporeal circulation was performed.

The second patient was a 56-year-old woman with alcohol-induced

cirrhosis with hepatorenal syndrome and portal vein thrombosis. Liver transplantation was performed by means of the piggyback technique. Laboratory values on the 1st day after the procedure were: ASAT, 477 U/l; ALAT, 522 U/l; GGT, 15 U/l; CHE, 2,943 U/l; AP, 81 U/l; bilirubin, 4.36 mg/dl; Quick, 40%; ATIII, 53%. Worsening liver function (ASAT, 1,147 U/l; ALAT, 1,294 U/l; GGT, 12 U/l; CHE, 1,976 U/l; AP, 77 U/l; bilirubin, 4.05 mg/dl; Quick, 27%; ATIII, 34%) immediately after liver transplantation was diagnosed as suprahepatic vena cava stenosis, which was initially treated via stenting of the stenosis. This reduced the transcaval gradient, but resulted in occluded central hepatic veins. Surgical repair was initiated 24 h later.

The technique of surgical repair of suprahepatic caval stenosis: after re-laparotomy, the indication for suprahepatic caval vein repair was confirmed by direct measurement of the infra- and suprahepatic caval vein pressure. The laparotomy was extended by a vertical midline skin incision to the suprasternal notch. After standard median sternotomy, the pericardium was opened longitudinally in the midline. Pericardial stay sutures were applied. The diaphragm was divided in the midline, and the intrapericardial vena cava was dissected. Standard extracorporeal bypass technique using a Biomedicus 500 centrifugal pump, a standard oxygenator, and two cardiotomy suction lines was applied. Aortic cannulation was done within the pericardial reflection. A standard aortic cannula was used and connected to the heart–lung machine. Tape was passed around the intrapericardial superior and inferior vena cava. A venous cannula was introduced to the right atrium and advanced into the superior vena cava. A second venous cannula was inserted into the femoral vein and advanced into the inferior vena cava. Caval and femoral lines were then connected to the heart–lung machine by a Y-connector. Cardioplegia and cooling were not performed. After initiation of the cardiopulmonary bypass, the superior caval tape was snugged down. This diverted all superior caval venous return to the oxygenator. Tape was passed around the infrahepatic vena cava and was left open except during caval stenosis opening and repair.

The stenosis was easily exposed by the additional sternotomy. The infrahepatic caval vein was crossclamped. The right atrium was then opened at the junction with the inferior vena cava. The remaining venous backflow originating mainly from coronary sinus and liver perfusion was evacuated by means of a cardiotomy sucker that was forwarded into the right atrium. The right atrial incision was extended to the suprahepatic vena cava and through the caval stenosis. Sutures resulting in caval stenosis were removed and secured. A second cardiotomy suction line was forwarded to the central liver veins. A Gore-Tex patch was adapted to the length of the atrio-caval incision. The size of the patch was determined carefully to avoid re-stenosis of the caval vein. The incision was closed with the patch, using a running non-absorbable monofilament suture. Standard procedures were used to re-establish cardiopulmonary circulation and to remove the aortic and venous cannulas.

Initiating extracorporeal circulation resulted in an immediately improved liver and kidney function. Both patients recovered well, with normal organ function and no edema. To date, they are alive and well. Liver and kidney function parameters are within normal ranges. No wound-healing problems occurred, and no complications related to the use of extracorporeal circulation were observed.

This technique offers excellent surgical access to the suprahepatic region. Furthermore, extracorporeal circulation and venous venting of the inferior caval vein enables crossclamping of the infrahepatic vena cava without impairment of the renal backflow. Liver perfusion via the portal vein and the hepatic artery can be maintained throughout surgical repair, during which further ischemic damage of the liver can be avoided.

References

1. Althaus SJ, Perkins JD, Soltes G, Glickerman D (1996) Use of a wallstent in successful treatment of IVC obstruction following liver transplantation. Transplantation 61:669–672
2. Calne RY, Williams R (1968) Liver transplantation in man. I. Observations on technique and organization in five cases. Br Med J 4:535–540
3. Lerut JP, Tzakis AG, Bron KM, Gordon RD, Iwatsuki S, Esquivel CO, Makowka L, Todo S, Starzl TE (1987) Complications of venous reconstruction in human orthotopic liver transplantation. Ann Surg 205:404–414
4. Lerut JP, Molle G, Donataccio M, De Kock M, Ciccarelli O, Laterre PF, Van Leeuw V, Boulier P, Ville de Goyet J de, Reding R, Gibbs P, Otte JB (1997) Cavocaval liver transplantation without venovenous bypass and without temporary portocaval shunting: the ideal technique for adult liver grafting? Transpl Int 10:171–179
5. Tzakis AG, Todo S, Starzl TE (1989) Orthotopic liver transplantation with preservation of inferior vena cava. Ann Surg 210:649–652