Transpl Int (2003) 16: 207–209
DOI 10.1007/s00147-002-0513-y

Daniela Kniepeiss
Florian Iberer
Barbara Grasser
Silvia Schaffellner
Vanessa Stadlbauer
Rudolf Stauber
Karl-Heinz Tscheliessnigg

Simultaneous coronary artery bypass grafting and orthotopic liver transplantation

Received: 24 August 2001
Revised: 24 September 2002
Accepted: 10 October 2002
Published online: 11 February 2003

D. Kniepeiss (✉) · F. Iberer · B. Grasser
S. Schaffellner · V. Stadlbauer
R. Stauber · K.-H. Tscheliessnigg
Department of Surgery,
Division of Transplantation, Karl-Franzens
University of Graz, Auenbruggerplatz
29Postfach 898036, Graz, Austria
E-mail: daniela.kniepeiss@kfunigraz.ac.at
Tel.: +43-316-38581224
Fax: +43-316-3854446

Dear Editors:

Advanced coronary artery disease (CAD) has traditionally been considered an absolute contra-indication to orthotopic liver transplantation [1] because of the operative risk, the potential for reduced survival, and the limited number of transplant resources [2]. The morbidity and mortality associated with liver transplantation (LTx) is higher in patients with CAD [3] and is equally high in medically and surgically treated patients. Patients found to have mild or moderate CAD should receive aggressive medical therapy and, if necessary and feasible, be treated by percutaneous or surgical intervention before LTx to correct obstructive coronary lesions [5]. Furthermore, liver failure increases the risk for coronary artery bypass grafting. Recent data suggest that the prevalence of CAD in patients with cirrhosis hepatitis is much greater than previously believed [4]. Prospective studies regarding optimal screening strategies for the presence of CAD, as well as indications, timing, and outcomes of interventional therapy in patients with advanced cirrhosis, are lacking and much needed.

We report a case of simultaneous coronary artery bypass grafting and LTx. Our patient was a 47-year-old man suffering from Child-C cirrhosis secondary to hepatitis B and CAD with 60% left main coronary artery stenosis and 95% right coronary artery stenosis. Both simultaneous coronary artery bypass grafting and LTx were rejected as single procedures by the respective surgeons. A bilateral Babcock procedure had been performed years before. Laboratory values at the time of admission were: ASAT 53 U/l, ALAT 36 U/l, GGT 121 U/l, AP 178 U/l, bilirubin 1.73 mg/dl, CHE 854 U/l, albumin 2.6 g/dl, Quick 54%, and AT III 30%.

The waiting time for the liver graft amounted to 52 days. The donor was a 32-year-old man. The cause of death was spontaneous subarachnoid hemorrhage, and laboratory values were: ASAT 8 U/l, ALAT 6 U/l, GGT 8 U/l, AP 84 U/l, bilirubin 0.57 mg/dl, CHE 3765 U/l, albumin 1.5 g/dl, Quick 99%, and AT III 63%. Liver procurement was by the single aortic perfusion technique with 3,000 ml of UW solution. Additionally, both saphenous veins were harvested. Back-table donor liver preparation included inferior caval vein closure at the level of the lowest hepatic vein by running suture.

The recipient procedure was started with median sternotomy. Before the pericardium was opened, the left and right internal mammary arteries were dissected. The abdomen was opened by an upper transverse abdominal incision and liver dissection commenced. The liver

presented as severe, end-stage cirrhosis with substantial port-caval collateral blood flow.

During recipient liver preparation, acute coronary insufficiency, biventricular dilatation, and low cardiac output occurred. Emergency cardiopulmonary bypass and extracorporeal circulation were established with standard aortic and right atrial cannulas. Heart frequency and size normalized under bypass conditions within minutes. Subsequently, recipient liver dissection under full heparinization (ACT higher than 400 s) was continued. In order to reduce blood loss, we first identified and rapidly dissected the bile duct, hepatic artery, and portal vein. After mobilization, the liver was separated from the caval vein. Partial longitudinal caval vein clamping preceded liver removal. The liver veins were closed with running monofile sutures. LTx was performed via the piggyback technique under cardiopulmonary bypass conditions. End-to-side donor and recipient caval anastomosis and immediate unclamping were done. Subsequently, portal vein and hepatic artery anastomosis were performed.

Aorto-coronary bypass grafting of the heart was done after liver implantation. After aortic cross-clamping, cold crystalloid cardioplegia (St. Thomas solution), and pericardial cooling, cardiac arrest was achieved. The left anterior coronary artery was grafted by left internal mammary artery/coronary artery end-to-side anastomosis. Right coronary artery hypoplasia indicated no grafting of the right artery. We grafted the left circumflex coronary artery, using the donor saphenous vein. The right mammary artery was considered too short for this procedure. After a cardiac ischemia time of 30 min, the aortic cross-clamp was removed, and sinus rhythm was established within 1 min. A side-biting clamp was placed on the aorta, and proximal anastomosis was performed. The weaning from cardiopulmonary bypass was uneventful, and cannulas were removed by standard technique. Finally, end-to-end recipient and donor bile duct anastomosis was done. The initial function of the heart and liver was excellent.

Immunosuppressive therapy consisted of low-dose lymphoglobulin induction therapy and cortisone taper for 7 days. Low-dose tacrolimus and mycophenolate mofetil were started after 1 and 6 days, respectively. After the first week, tacrolimus and mycophenolate mofetil levels were 7.2 ng/ml and 2.2 μg/ml.

The total operating time was 12 h, liver cold ischemia time 4 h, and warm ischemia time 75 min. Cardiopulmonary bypass time was 6 h. Fifty-four banked blood units, 29 units of fresh frozen plasma, and six platelet concentrates were used. The amount of 4,757 ml of blood was sucked to the cell saver. The patient was extubated after 12 h. On day 1, laboratory values were: ASAT 86 U/l, ALAT 57 U/l, GGT 14 U/l, AP 68 U/l, bilirubin 3.88 mg/dl, CHE 3542 U/l, albumin 3.2 g/dl, Quick 70%, and AT III 62%. The patient recovered very well and was discharged from the hospital on day 14 after transplantation.

Sixteen months after the procedure, the patient is still in favorable condition. Normal cardiac (ejection fraction, wall motility, and valve function) and liver function is observed. Liver parameters are normal (ASAT 6 U/l, ALAT 8 U/l, GGT 8 U/l, AP 89 U/l, bilirubin 0.37 mg/dl, CHE 5237 U/l, albumin 4.6 g/dl, Quick 104%, and AT III 102%). Liver ultrasound shows good flow for the hepatic artery and portal vein. Intra- and extrahepatic bile ducts are normal.

Operative treatment of patients with end-stage liver disease and CAD is hampered by the inherent contra-indication of both diseases for the operative treatment of the other. On the one hand, LTx on patients with CAD is at the highest risk of intra-operative coronary insufficiency and heart failure. On the other hand, end-stage liver failure increases the surgical risk of bleeding and metabolic complications after coronary artery bypass grafting. Before simultaneous procedures are undertaken, the feasibility of appropriate coronary artery bypass grafting should be proved by coronary angiogram and myocardial scintigraphy.

To avoid recipient liver dissection under full heparinization it was decided that LTx be performed before coronary artery bypass grafting. In this case, due to acute coronary insufficiency, emergency cardiopulmonary bypass and extracorporeal circulation had to be established. Recipient hepatectomy under cardiopulmonary bypass conditions with complete heparin-induced antagonization of coagulation was feasible. The circulatory stress of hepatectomy reduces coronary blood flow and might induce acute ischemic heart failure. The optimal timing of initiation of cardiopulmonary bypass before or after recipient hepatectomy remains unclear. Hepatectomy without cardiopulmonary bypass might induce fatal ventricular dilatation. Excessive bleeding is the main disadvantage of hepatectomy during bypass.

Simultaneous coronary artery bypass grafting and orthotopic LTx was successful in this patient. The procedure is possible and offers a therapy option for patients with end-stage liver disease and CAD. In selected cases, severe CAD should not be an absolute contra-indication to LTx.

References

1. Benedetti E, Massad MG, Chami Y, Wiley T, Layden TJ (1999) Is the presence of surgically treatable coronary artery disease a contraindication to liver transplantation? Clin Transplant 13: 59–61
2. Carey WD, Dumot JA, Pimentel RR, Barnes DS, Hobbs RE, Henderson JM, Vogt DP, Mayes JT, Westveer MK, Easley KA (1995) The prevalence of coronary artery disease in liver transplant candidates over age 50. Transplantation 59:859–864
3. Eckhoff DE, Frenette L, Sellers MT, McGuire BM, Contreras JL, Bynon JS, McGiffin DC (2001) Combined cardiac surgery and liver transplantation. Liver Transpl 7:60–61
4. Keeffe BG, Valantine H, Keeffe EB (2001) Detection and treatment of coronary artery disease in liver transplant candidates. Liver Transpl 7:755–761
5. Plotkin JS, Scott VL, Pinna A, Dobsch BP, De Wolf AM, Kang Y (1996) Morbidity and mortality in patients with coronary artery disease undergoing orthotopic liver transplantation. Liver Transpl Surg 2:426–430