Incidence and treatment of hepatic artery complications after orthotopic liver transplantation

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Methods

From February 1999 to May 2002, OLTs were performed in 72 patients with an average age of 40.2±13.6 years (range 11 to 68 years), 56 males and 16 females. Indications for OLT included post-inflammatory liver cirrhosis complicated with liver function failure (2 cases), cholangiocarcinoma (2 cases), primary sclerosing cholangitis (2 cases), Budd-Chiari syndrome complicated with liver function failure (2 cases), choanalgiacercomia (2 cases), alcoholic cirrhosis (one case) and secondary hepatic malignancy (gallbladder cancer) (one case).

Results

The overall incidence of arterial complications in 72 patients after OLTs was 1.4 % (1/72). One 3 cm pseudoaneurysm at the side of anastomotic site of hepatic artery was found by urgent arteriogram due to hemoperitoneum secondary to bile leakage after OLT. Subsequently the pseudoaneurysm was successfully embolized and the blood flow toward the donor liver in hepatic artery remained. The overall postoperative 30-day mortality rate was 8.33 %. The one-year survival rate was 83.72 % in 50 patients with benign diseases and 71.43 % in 22 patients with malignant diseases following OLT. No death associated with complications of hepatic artery occurred.

Conclusion

Careful preoperative evaluations and intraoperative microsurgical technique for hepatic artery reconstructions are the keys in prevention of hepatic artery complications after OLT.
confluence of the donors and recipients in 22 out of the 72 cases. End-to-end anastomosis was done between the proper hepatic artery of the donors and recipients in 18 out of the 72 cases, and the remaining anastomosis was performed between the proper hepatic artery of the donors and the right hepatic artery or the common hepatic artery of the recipients respectively in 6 and 5 out of the 72 cases. Anastomoses were performed between the proper hepatic artery of the donors and the splenic artery, between the left gastric artery and the left hepatic artery of the recipients in one case each, and between the splenic artery of the donors and the proper hepatic artery, the common hepatic artery or the left hepatic artery of the recipients in 6, 4 and one case respectively, between the common hepatic artery of the donors and the proper hepatic artery or the left hepatic artery of the recipients in 3 and one case respectively, and between the coeliac trunk of the donors and the common hepatic artery of the recipients in 3 cases. Arterial reconstruction was performed by microsurgical techniques with interrupted 7-0/8-0 monofilament polypropylene suture under 3.5 x loupe magnification, interposition grafting with same donor’s part of common hepatic conduit was used selectively in one case with end-to-end anastomosis between the proper hepatic arteries of the donors and recipients when anastomotic thrombosis was suspected before closure of the abdominal incision[14,15]. Diagnosis of complications of hepatic artery after OLTs was based on the clinical presentations, ultrasound findings and arteriography of hepatic artery. The hepatic artery was detected with routine duplex sonography intraoperatively after completion of hepatic artery reconstruction and daily in the first week after OLTs[16,17]. When the patients had elevated hepatic enzymes, cholestasis, bile leakage and high fever in the absence of acute rejection and drug toxicity, spiral CT scan or angiography of hepatic artery should be considered. No anticoagulable pharmacotherapy to maintain arterial patency was used intraoperatively and postoperatively in this group, but laboratory examination of coagulation state should be done regularly. All the patients received immunosuppressive therapy including cyclosporine or FK506 regimens and were followed up from 3 to 34 months. Hepatic artery of liver transplant patients was detected regularly by duplex ultrasound scan three or six months after discharge.

Statistical methods
The Kaplan-Meier method was used to calculate survival rate, and statistical calculations for mean values and standard deviations were performed using the SPSS software package.

RESULTS
The overall incidence of arterial complications in the 72 patients after OLTs was 1.4 % (1/72) and no HAT and hepatic artery stenosis were found after OLTs. A 3 cm anastomotic pseudoaneurysm of hepatic artery was found in 1 case by urgent arteriogram due to hemoperitoneum secondary to bile leakage about one month after OLT. The pseudoaneurysm at the side of anastomotic site of hepatic artery was successfully embolized, and blood flow toward the donor liver in hepatic artery remained. This patient was fully recovered and discharged one month later when bile leakage was stopped. The patient was doing well 1 year after OLT. The overall postoperative 30-day mortality rate was 8.33 % (6 deaths in 72 patients). The one-year survival rate was 83.72 % in 50 patients with benign diseases and was 71.43 % in 22 patients with malignant diseases after OLTs. No death occurred due to complications of hepatic artery.

DISCUSSION
Vascular reconstructions are critical to a successful outcome in orthotopic liver transplantation (OLT), complications associated with hepatic artery reconstructions are one of the major causes of graft loss and mortality after OLT. Hepatic artery complications after OLT include HAT, hepatic artery stenosis, hepatic artery pseudoaneurysm (HAP) and hepatic artery fistula. The early complications of hepatic artery were usually caused by technical problems[11-31]. The late complications of hepatic artery were usually associated with hypercoagulable state, overtransfusion of platelets and fresh-frozen plasma during the surgery, severe rejection and bile leakage[11,18,29]. The hepatic artery is relatively small (3 to 6 mm in diameter in adults) during the vascular reconstructions of OLT with a very fragile intima that requires highly careful atraumatic manipulating technique during the reconstruction of hepatic artery. The anatomical variations[20-22], diameter and length of hepatic artery, and injury to vessels including prolonged clamping of hepatic artery, kinking of a long artery, and hematoma of artery wall from improper flushing after clamping during operation, and the quality of recipient vessels and mismatch between donor and recipient arterial vessels should be carefully considered and managed preoperatively and intraoperatively[23-31]. The incidence of arterial complications after OLTs varied between 2 % and 25 % among the liver transplant patients[23]. HAT was most common[6,7], and caused irreversible graft damage and often required immediate revascularization of hepatic artery, even retransplantation of the liver[12,13]. HAP occurred in less than 1 % patients after OLT[20,24]. The incidence of hepatic artery complications was low in this group. The technique of microsurgical hepatic artery reconstruction contributed greatly to the reduction of incidence of HAT and hepatic stenosis[6,15,25]. Current HAT rate reported after hepatic arterial reconstruction was 1.44 % via the branch patch technique using the hepatic-gastrooduodenal bifurcation and interrupted suture of 7/0 monofilament polypropylene suture[6,20]. We found a single case of hepatic artery pseudoaneurysm whose opening was at the site of anastomotic site of hepatic artery as the complication following OLT and the pseudoaneurysm was embolized successfully. The reported incidence of pseudoaneurysm of hepatic artery was low, but this complication could be devastating with a high mortality rate due to massive bleeding that often required immediate revascularization[26,27], and even retransplantation[12,13]. Extrahaeparic pseudoaneurysms of hepatic artery were associated with local infection, bile leakage while intrahaeparic pseudoaneurysms were caused by liver punctures[28]. The most frequent presentations of hepatic artery pseudoaneurysm were hemorrhages including gastrointestinal hemorrhage, hemoperitoneum and hemobilia[19], which often occurred within the first two months after liver transplantation, and might lead to death due to massive bleeding or loss of the donor graft[3,28,29]. Although ultrasound and CT scanning were useful in the diagnosis of hepatic artery pseudoaneurysms[10,23,34], arteriography was more accurate[10,33], and might demonstrate clearly an anastomotic pseudoaneurysm of the hepatic artery with bleeding into peritoneum cavity or bile tract[12,29,35]. The treatment for hepatic artery pseudoaneurysm remains a challenging problem. The current treatment options include ligation or embolization, excision and immediate revascularization of hepatic arterial pseudoaneurysm with or without a donor iliac artery or autogenous saphenous vein, and retransplantation. However, ligation resulted in an extremely high morbidity and mortality[12,26,34,35], especially at the early stage after liver transplantation. The excision and immediate revascularization of hepatic arterial pseudoaneurysm appeared to be the best choice[26,27]. At the time of revascularization, bile leakage should be also repaired[28], and the donor iliac artery or autogenous saphenous vein was often used for arterial revascularization[34,35]. If an adequate donor
iliac artery or autogenous saphenous vein was not available, an autogenous radial artery could be used[36]. Embolization therapy of hepatic artery pseudoaneurysm after OLT was seldom reported. In our study, pseudoaneurysm at the side of the anastomotic site of hepatic artery was embolized successfully and the patency of the hepatic artery toward the donor liver remained, which salvaged the donor liver as well as the the recipient by the mini-invasive percutaneous endovascular techniques. This case provides a good example of safe and effective approach in the management of pseudoaneurysm of hepatic artery, but more experience is expected.

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