TRANSPLANT INTERNATIONAL

Transplant International ISSN 0934-0874

LETTER TO THE EDITORS

Reuse of liver allografts from brain-dead liver transplant recipients

doi:10.1111/tri.12079

Sirs,

A unique method of expanding the donor pool is to reuse allograft from recipients. Although there are case reports documenting retransplantation of livers, the concept has not been routinely adopted [1–7]. From June 2007, we implemented a policy of reusing liver allografts. We present three cases and extrapolate from our experience the potential for liver reprocurement.

The first of our recipients was a 17-year-old girl with acute liver failure (ALF) after acetaminophen overdose. The patient progressed to grade 4 encephalopathy, severe coagulopathy, and renal failure. The intracranial pressure (ICP) ranged from 15 to 20 mmHg and the cerebral perfusion pressure ranged from 50 to 60 mmHg. A liver graft (Table 1) was procured in a standard fashion and the piggyback technique with a lateral cavoplasty was used to perform the recipient operation. The anastomosis involved the donor proper hepatic artery to the recipient common hepatic artery; 5 units of packed red blood cells (PRBC) and 8 units of fresh frozen plasma (FFP) were necessary. Postoperatively, the recipient progressed to brain-death. The family consented to organ donation. The second recipient of this liver was a 61-year-old white man with hepatitis C virus (HCV) and hepatocellular carcinoma (HCC – within Milan criteria) [United Network of Organ Sharing (UNOS) Model for End-Stage Liver Disease (MELD) score – 25 and the laboratory MELD score – 16]. After liver procurement, the inferior vena cava at the site of lateral cavoplasty was over-sewn. The recipient operation was done with the standard caval replacement technique. The hepatic artery was anastomosed without a conduit and the bile duct anastomosis was performed with a T-tube. No blood products were necessary. The patient was discharged from hospital on postoperative day 8.

The first recipient in our second case was a 17-year-old boy (Table 1), with ALF from acetaminophen toxicity. He developed grade 4 encephalopathy; however, severe coagulopathy precluded ICP monitoring. A CT scan revealed mild cerebral edema and brainstem reflexes were intact. A liver allograft (Table 1) was transplanted with vena caval replacement. The hepatic artery was anastomosed without a conduit. The biliary anastomosis was end-to-end without a T-tube; 14 units of PRBC, 23 units of FFP, 10 units of cryoprecipitate, and factor VII were transfused. The patient, however, progressed to brain-death. The family consented for donation. The second recipient of this liver was a 57-year-old African-American man with HCV cirrhosis and HCC within Milan criteria [UNOS MELD score – 25 and laboratory MELD score – 9]. The transplant was done with a standard caval replacement technique. The hepatic artery was anastomosed without a conduit and the biliary anastomosis was performed end-to-end without a T-tube. Two units of PRBC and FFP were transfused. Liver enzymes normalized on day 20 (Table 1). The patient was discharged 10 days after surgery. He had one episode of acute cellular rejection after 14 months, treated with steroids.

The first recipient in our third case was a 16-year-old African-American boy with ALF after an overdose of an unknown drug, presenting with severe acidosis and coagulopathy. The donor liver (Table 1) had completely replaced right and left hepatic arteries, which were reconstructed on the back table. The transplant involved the piggyback technique; the suprahepatic vena cava was anastomosed to the ostia of the hepatic veins. The patient made an uneventful recovery. Fifty-two months following transplantation, the patient was declared brain-dead from a gunshot to the head. The family consented to donation. The second recipient of this liver was a 34-year-old African-American woman with cirrhosis from autoimmune hepatitis [MELD score of 40]. She had type 1 diabetes mellitus and renal failure requiring dialysis. The liver was procured with careful hilar dissection to avoid disturbance to the blood supply of the bile duct. The liver was transplanted using a standard technique with anastomoses of supra and infrahepatic vena cava. The donor's common hepatic artery (without disturbing the reconstructed replaced vessels) was anastomosed to the recipient's common hepatic artery and the bile duct was anastomosed in an end-to-end fashion. The right kid-

Table 1. Peri-opeartive details and outcome of transplants.

	Age (Years)	Height (cm)	Weight (kg)	BMI	Blood type	Peak AST (IU/l)	Terminal AST (IU/l)	Peak ALT (IU/l)	Terminal ALT (IU/l)	Peak Bilirubin (mg/dl)	Terminal Bilirubin (mg/dl)	Terminal Na (mEq/l)	Terminal Creatinine (mg/dl)	Terminal INR	Positive serologies	CIT (Minutes)	IS	Survival
Case 1																		
D 1	16	177.8	60	18.9	A	151	78	76	26	1.3	1.3	148	0.7	2.2	CMV EBV	NA	NA	NA
R 1	17	165	50	18.3	A	8483	101	7469	467	4.3	1	149	2.8	1.51	CMV EBV HBC	217	T/S/M	4 days
R 2	61	182.9	89	26.6	A	947	38	174	79	2.9	1.7	143	1.2	1.0	CMV EBV HCV	106	E/S/M	34 months
Case 2																		
D 1	17	180	84.8	26	A	88	50	40	39	0.2	0.2	147	1	1.3	EBV HBSab	NA	NA	NA
R 1	17	185	90	26.2	A	5736	79	5838	388	4.3	0.7	151	1	1.3	CMV EBV HBSab	240	T/S/M	6 days
R 2	57	180.3	92.5	25.8	A	697	46	915	79	4.7	1	140	1.7	1.1	CMV HCV	180	T/S/M	61 months
Case 3																		
D 1	25	160.6	50	18.9	O	130	77	78	39	1.0	0.9	160	1.1	1.3	CMV	NA	NA	NA
R 1	16	178	68	21.4	O	69	45	69	31	0.9	0.9	148	0.7	1.3	EBV	332	T/S/M	52 months
R 2	34	169.9	68	23.5	O	198	33	84	41	13.6	1.8	145	1.2	1.2	CMV EBV	300	T/S/M	14 months

D1 – First donor, R1 – first recipient who progressed to brain-death and donor for the last recipient, R2 – second and final recipient.
Peak and terminal enzyme values in D1 are before donation; for R1 after the transplant and before being declared brain-dead and donation; for R2 after the transplant and at the discharge.
BMI, body mass index; IS, immunosuppression; T, tacrolimus; S, steroids; M, mycophenolate mofetil; E, everolimus; CMV, cytomegalovirus IgG; EBV, Ebstein Barr virus IgG; CIT, cold ischemic time; HBC, hepatitis B core IgG; HBSab, hepatitis B surface antibody IgG; HCV, hepatitis C IgG; NA, not applicable.

ney was also transplanted. Liver enzymes were normal on postoperative day 4, and the patient was discharged to a rehabilitation center after 14 days. Thirteen months after transplantation, the patient developed new-onset ascites with narrowing of the suprahepatic vena cava and balloon dilation failed. At the operation, the suprahepatic vena caval anastomosis was opened, no stricture was noted at the anastomotic site; however, a stricture was present at the previous anastomotic site of the hepatic vein ostia and the donor cava of the first recipient. The excess caval tissue was excised after total vascular exclusion and hepatic vein ostia widened. Two months later, the patient developed a hepatic abscess (left lateral segment), thrombosis of the replaced left hepatic artery, and underwent a left lateral segmentectomy. The ascites resolved, but the patient developed intractable hyperglycaemia and multiple intra-abdominal abscesses and succumbed to systemic sepsis. At that time she was 14 months post liver transplant with a functioning liver allograft.

Reuse of the liver allograft poses challenges in appropriate selection of graft and recipient. Rentsch *et al.* suggested that these allografts should be classified as extended criteria [5]. The available literature provides some evidence for using these grafts [1–7]. The decision to transplant patients with elevated ICP, and borderline neurological activity in the setting of ALF as in 2 of 3 second donors in our series is a difficult one. Brain-death has been reported to be as high as 22% in a large ALF series [8]. According to the 2010 UNOS annual report in the 5 years leading up to and including 2008, a median of 355 patients with acute hepatic necrosis were transplanted with an adjusted 3-month patient survival rate of 90.6% in 2007–2008, [9], implying that up to 34 organs might have been available for retransplantation. Apart from ALF, many liver transplant recipients suffer from complications such as intracerebral hemorrhage and progress to brain-death and could be considered [2,10]. In conclusion, we propose that the reuse of liver allografts should be encouraged.

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Funding

None.

Conflict of interest

None.

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