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CASE REPORT

Re-use of a liver allograft; an exceptional opportunity to enlarge the organ donor pool

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Abstract Liver allograft re-use is an exceptional way of enlarging the donor pool. We describe here a case of a re-used liver allograft, originating from an insulin-intoxicated donor and transplanted at first into a recipient presenting with hyperacute liver failure due to paracetamol intoxication. Because the original recipient developed an irreversible cerebral oedema, the allograft was re-implanted electively 55.5 h later into a patient with post-viral C cirrhosis and solitary hepatocarcinoma. Both donor and recipient operations were technically successful; liver function after the second use of the graft was normal.

Keywords Acute liver failure · Allograft re-use · Liver transplantation · Organ donor · Poisoned donor

Introduction

The use of grafts from organ-transplant recipients represents an exceptional situation in which it is possible to enlarge the scarce donor pool [1, 7, 9]. Re-use of a liver allograft has rarely been reported in the literature.

We report the re-use of a liver allograft originating from an intoxicated donor and grafted initially into a patient with acute liver failure due to paracetamol intoxication.

Case report

The first allograft recipient of this organ was a 47-year-old man admitted with hyperacute liver failure due to a suicide attempt by paracetamol intoxication. There was no information available about the quality and exact timing of drug ingestion. On admission, he was unconscious and already deeply jaundiced; his Glasgow coma score was 9. Liver biochemistry was severely disturbed; total bilirubin level was 9.9 mg/l, GGT 727 UI/l, AST 45,685 UI/l. Creatinine was 3.1 mg/dl; INR 6.9 and factor V 21%. Lactic acid was 8.9 mmol/l.

The serum paracetamol level found at admission was 18 μg/ml; 8 h later, this level was 14.94 μg/ml. Supportive treatment with *N*-acetyl-cysteine was started (bolus of 150 mg/kg followed by 200 mg/kg per day) between these two doses. His haemodynamic situation was unstable, and he became neurologically unreactive. A cerebral CT scan revealed moderate oedema. Evoked potentials and EEG corresponded to grade 2 and III to IV, respectively. He was urgently listed for liver transplantation (LT). Meanwhile, his neurological condition deteriorated further, and haemodialysis became necessary because of anuria. EEG progressed to grade IVb but somatosensory evoked potentials remained well structured, despite increased latency (grade 2). Intracranial pressure, monitored with a Caminot probe, rose to 25 mmHg. A donor became available despite the development of mydriasis at the time, LT was still judged to be indicated, because evoked potentials remained unchanged [13].

Table 1 Literature review of reused livers (*NA* non-available, *MP* methylprednisolone, *CIT* coldischaemia time, *WIT* warm ischaemia

Year	Donor characteristics		Characteristics of first recipient					
Reference	Age (years)	Cause of death	Diagnosis	Age (years)	CIT (minimum)	WIT (minimum)	Transplant procedure	Cause of death
1996 [9]	40	Stab wound	Primary biliary cirrhosis	57	112	60	NA	Cerebral bleeding
1996 [9]	22	Cerebral trauma	Primary sclerosing cholangitis	54	260	58	NA	Cerebral bleeding
1996 [9]	23	Cerebral trauma	Re-LT chronic rejection	51	115	65	NA	Cerebral bleeding
1996 [12]	24	Cerebral trauma	Re-LT chronic rejection	24	NA	NA	LT-IVC preservation	Cerebral bleeding
1997 [3]	65	Cerebral trauma	Alcohol-induced cirrhosis	55	314	< 51	LT-IVC preservation	Cerebral bleeding
1997 [4]	NA	Cerebral bleeding	Cryptogenic cirrhosis	NA	720		Classical LT	Cerebral bleeding
2002	15	Suicide by insulin intoxication	Suicide by paracetamol intoxication	47	569	41	LT-IVC preservation	Cerebral oedema

Delay between hospital admission and LT was 48 h. The allograft originated from a 15-year-old boy who had commited suicide through insulin intoxication. Recipient hepatectomy was carried out with inferior vena cava preservation; neither veno-venous bypass nor temporary porta-caval shunt was used. The liver allograft was implanted orthotopically by the cavo-caval anastomosis technique. Surgery took 450 min; cold and warm ischaemia times were 569 and 41 min, respectively, and 863 ml of packed red cells and 600 ml of fresh-frozen plasma were administered during the transplantation procedure. Reperfusion biopsy at the end of the procedure was normal.

Liver-graft function normalised rapidly, but unfortunately the neurological status of the recipient deteriorated further (Fig. 1). Twenty-four hours after implantation, he was declared brain dead. Because of the excellent early liver-graft function in a perfectly haemodynamically stable recipient, it was decided to consider this recipient as a potential multi-organ cadaveric donor. The heart was successfully transplanted in Germany and the liver was re-used for a 53-year-old local recipient with post-viral C cirrhosis and solitary hepatocellular carcinoma.

In order to procure the liver graft rapidly, we transected and cannulated the portal vein and perfused it with UW-solution. Next, the artery was transected at the level of the recipient's common hepatic artery, and the inferior vena cava was resected, including the previous cavo-caval anastomosis. Ex-situ perfusion of the artery, portal vein and bile ducts followed. The second recipient hepatectomy was also carried out with inferior vena cava preservation, and the graft was implanted by the cavo-caval technique. Operating time was 443 min; cold and warm ischaemia times were 744 and 44 min, respectively. Delay between the first and second implantation of this liver was 55.5 h.

Re-vascularisation of the re-used liver was rapid and homogenous, and there was rapid biliary production. During the transplant procedure, 672 ml of packed red cells and 800 ml of fresh-frozen plasma were administered. Immunosuppression was tacrolimus-based. Reperfusion biopsy at the end of the procedure showed specific hepatic phenomena with some pericholangitis and some centrolobular cellular necrosis. Routine liver biopsy on day 7 post-LT showed moderate rejection, which resolved spontaneously.

The patient was extubated 4 h after the procedure and discharged 12 days post-LT. At day 43 he developed a steroid-responsive rejection. Now, 22 months post-LT, he is doing well despite HCV allograft recurrence.

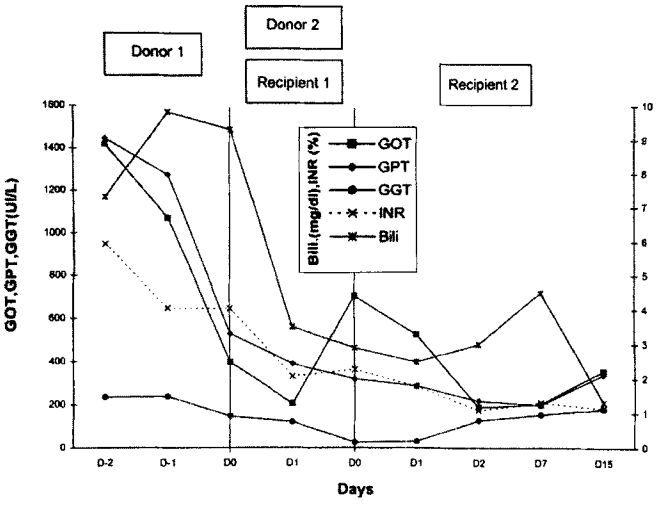

Fig. 1 Biochemical evolution of liver tests of the re-used liver graft

Discussion

In order to overcome liver allograft shortage, various techniques, such as split liver and living related liver transplantation have been developed. Other rather exceptional methods include domino liver transplantation mainly using livers originating from patients with familial amyloid polyneuropathy or primary hyperoxaluria [6, 9], or the re-use of cadaveric allografts [11]. The latter procedure represents a particular domino situation in which the initial allograft recipient becomes the donor.

The use of grafts procured from organ-transplant recipients has been reported rarely; most of these cases are kidneys, only a few concern hearts and livers [1, 2, 5, 7, 8, 9, 10, 11, 12]. The first case of a re-used liver allograft was reported in 1991 by Moreno Gonzalez et al. Since then, five other cases have been reported in detail by groups in Madrid (2×) [9], Creteil-Paris (1×) [12], Barcelona (1×) [3] and Essen (1×) [4]. The interval between the

time, *re-LT* liver re-transplantation)

Interval	Characteristics of second recipient							
	Diagnosis	Age (years)	CIT (minimum)	WIT (minimum)	Maximum GOT (UI/l)	Transplant procedure	Follow-up	Rejection
22 h	Re-LT chronic rejection	29	100	50	500	NA	Dead 48 months. recurrent cholangioca.	
43 h	Re-LT chronic rejection	32	90	62	±450	NA	Dead 4 months. Sepsis (bile duct lesion)	Liver abscess after biopsy
45 h	Post-viral C cirrhosis and HCCa	56	60	55	±150	NA	Alive 25 months	Day 10 OKT3
5 Days	Alcohol-induced cirrhosis	53	360	NA	35	LT-IVC preservation	Alive 6 months	Day ? MP
5 Days	Post-viral C cirrhosis	58	660	< 55	NA	LT-IVC preservation	Alive 14 months	
24 h	Re-LT HBV recurrence	47.5	600	NA	420	Classical LT	Alive 5 months	Day 7 MP
55.5 h	Post-viral C cirrhosis and HCCa	54	744	44	526	LT-IVC preservation	Alive 22 months. Stenosis right bile duct	Day 43 MP

first and second graft implantation varied from 1–5 days, and cold ischaemia times ranged from 1–11 h.

All re-used livers had excellent early graft function, even when the second cold ischaemia time exceeded 10 h (three cases, including ours; Table 1). We did not encounter any major immunological problems. These excellent results may be explained by the fact that these case reports represent a very selected organ-donor group and also by the fact that these grafts might benefit from protective ischemic pre-conditioning, as described in major hepatic-resection procedures [2].

Our report is singular, inasmuch as the graft originated from two poisoned donors (insulin or paracetamol), and the second graft ischaemia time reached more than 12 h. We considered that LT was not contra-indicated in the first patient, despite pupil-dilation at the time of donor availability, due to the preserved cerebral perfusion pressure and the persistence of well-structured somato-sensory evoked potentials.

The data in the literature, as well as our own case report, show that liver re-use should be considered as a rare but valuable resource, extending the organ pool. It should be utilised on the condition that the graft has been functioning in a haemodynamically stable patient and that there is no macroscopic abnormality at the time of the second explantation of the organ. The final decision to re-use a liver graft should thus be taken at surgical exploration of the graft in the first recipient. Explantation of other organs, such as heart and kidney, should also be carefully considered [9].

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