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LETTER TO THE EDITORS

Hepatic artery reconstruction using radial artery interposition graft in living donor liver transplantation

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Sirs,

Living donor liver transplantation has become an important modality in treating patients with end-stage liver disease, unresectable hepatocellular carcinoma, and hepatic metabolic disorders [1,2]. Unfortunately, the expansion of LDLT similarly increases the likelihood of encountering various vascular anomalies, most importantly, hepatic artery intimal dissection and thromboses [3].

The management of these predicaments can present an immense challenge in performing the graft implantation and can eventuate in devastating outcomes [4–7]. Although several vessels, including the right gastroepiploic artery (RGEA) and branches from the left gastric artery (LGA) [8], are obtainable for hepatic artery reconstruction, these vessels are likewise, in certain occasions, afflicted by varying degrees of injuries, thromboses, and small size. In such scenario, an interposition graft is used for the hepatic artery repair. Our aim was to describe our experience in performing hepatic artery reconstruction using radial artery grafts.

From January 1994 to May 2009, a total of 450 LDLT were performed in Chang Gung Memorial Hospital, Kaohsiung Medical Center, Taiwan. Seven radial artery interposition grafts were utilized in seven patients for hepatic artery reconstruction. The patients included four men and three women with a mean age of 21.0 ± 25.2 years old (6 months–49 years). The indications for liver transplantation consisted of biliary atresia in three, progressive familiar intrahepatic cholestasis in one, and hepatitis B and C-related liver cirrhosis in three. Four left lobes and three right lobes from living donors were used for liver transplantations. During the evaluation, a particular emphasis is given on the suitability of hepatic artery anatomy, size, and flow. The anatomy and size of right gastroepiploic artery is likewise routinely assessed prior to the surgery.

Prior to the hepatic artery reconstruction, the recipients' arteries as well as the donors' were explored and assessed for size, length, presence of intimal dissection, and flow. If the vessels were unsuitable for reconstruction (severe intimal dissection and unacceptably shortened), we routinely used the right gastroepiploic artery (RGEA) as an alternative conduit for reconstructing graft's hepatic artery. However, if the RGEA was not suitable for anastomosis, we then procured the radial artery and used it as an interposition graft to reconstruct the graft's hepatic artery. Except in case no 3, where the radial artery graft was procured from a deceased donor, the patency of both the radial and ulnar arteries was evaluated by performing Allen test on the donors' nondominant forearm.

Of the 450 recipients, 432 used native hepatic arteries, 12 RGEA, 4 LGA, and 2 primarily radial artery interposition grafts; and five recipients received radial artery interposition grafts for HAT. Table 1 shows a total of seven radial artery interposition grafts were procured from the five original living liver donors, one from a patient's father, different from the initial liver donor (case 1), and one from a deceased donor (case 3). Two radial artery grafts were used primarily in two transplantations (case 3 and 6). The recipients' hepatic artery had a severe ID in one case, and was unacceptably shortened after removing the injured segments in the other. The other five radial artery grafts were used for reconstruction to salvage the hepatic graft following an episode of hepatic artery thrombosis (HAT). The causes of HAT in these cases were similarly attributed to intimal dissections found in four patients and intimal thickening in one case. The length of both the grafts' and recipients' hepatic arteries in these cases was unacceptably reduced thereby requiring an interposition graft to complete the reconstruction. Moreover, all other alternative vessels including the right gastroepiploic arteries and left gastric arteries were deemed unsuitable for reconstruction in all these cases.

The mean time for the recognition of HAT after the initial transplantation was 9.6 ± 5.0 days (5–14 days). The average time interval between the diagnosis of HAT and revascularization using the interposition grafts was 3.83 ± 0.63 h (3.12–4.58 h).

The vascular grafts had a mean length of 49 ± 55 mm (15–170 mm). The radial artery grafts were used to bridge the grafts' and recipients' hepatic arteries in all but one case. In the latter case, a 170 mm radial artery graft was used as a conduit to connect the graft's right hepatic artery

Table 1. Demographics.

Case	Age/sex	Diagnosis	Living donor	Lobe utilized	Donor artery diameter	RA graft donor/ recipient anastomosis diameter	Recipient artery diameter	Type of HA intimal dissection	Days to HAT	Time to revascularization in hours	RA donor	RA length	Follow-up
1	1 year 3 months/F	BA	Mother	Left	RHA 2.0 mm	3.0 mm/3.0 mm	LHA 2.0 mm	Moderate	14	3.12	Father	30 mm	1.5 mos
2	6 months/M	PFIC	Mother	Left	LHA 2.5 mm	2.5 mm/2.5 mm	RHA 2.0 mm	Severe	6	3.58	OLD	15 mm	38 mos
3*	47 years/M	HBV Cirrhosis, HCC	Son	Right	RHA 3.0 mm	4.0 mm/4.0 mm	RHA 3.0 mm	Moderate	NA	NA	Deceased Donor	20 mm	7 mos
4	48 years/F	HCV Cirrhosis	Son	Right	RHA 2.5 mm	2.5 mm/3.0 mm	GEA 2.5 mm	Severe	16	4.58	OLD	170 mm	13 mos
5	9 months/F	BA	Mother	Left	LHA 2.5 mm	1.5 mm/2.0 mm	LHA 2.5 mm	Moderate	5	4.42	OLD	40 mm	14 mos
6*	49 years/M	HBV Cirrhosis	Wife	Right	RHA 3.0 mm	3.0 mm/3.0 mm	GEA 2.5 mm	Severe	NA	NA	OLD	50 mm	13 mos
7	9 months/F	BA	Mother	Left	LHA 1.5 mm	2.0 mm/2.0 mm	LHA 1.8 mm	Intimal thickening	7	3.48	OLD	20 mm	4 mos

NA, not applicable; RA, radial artery; HA, hepatic artery; HAT, hepatic artery thrombosis; BA- biliary atresia; PFIC, progressive familial intrahepatic cholestasis; HBV- hepatitis B virus; HCV, hepatitis C virus; HCC, hepatocellular carcinoma; GEA, gastroesophageal artery; RHA, right hepatic artery; LHA, left hepatic artery; ICA, ileocolic artery; OLD, original living donor.
*Refers to cases in which the radial artery was used primarily for hepatic artery reconstruction (the radial artery in most cases were used after an episode of hepatic artery thrombosis to salvage the graft).

and the recipient's ileocolic artery to salvage the graft following an episode of HAT. The procedure was carried out as no other arteries were found suitable for reconstruction. The mean diameter of the donor artery, the end of radial artery graft anastomosed to donor artery, the end of radial artery graft anastomosed to recipient artery, and the recipient artery was 2.43 ± 0.53 mm (1.5–3.0 mm); 2.64 ± 0.80 mm (1.5–4.0 mm); 2.79 ± 0.70 mm (2.0–4.0 mm), and 2.33 ± 0.42 mm (1.8–3.0 mm), respectively. There was no obvious discrepancy between the size of either end of the radial arteries to that of the donors' and recipients' hepatic arteries.

The mean follow-up for all patients with radial artery grafts was 12.9 ± 12.0 months. No complications were noted at the radial artery donor site. There was no graft loss in these patients. All vascular grafts remained unoccluded with sufficient flow at the time of the last follow-up.

The radial artery graft is a suitable vessel that is used for hepatic artery reconstruction when the recipients' native hepatic arteries, the LGA and gastroepiploic arteries are anomalous, or extremely short for anastomosis. It offers the advantages of providing a considerable length, an appropriate diameter and excellent long-term patency.

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