Successful adult-to-adult living donor liver transplantation using liver allograft after the resection of hemangioma: A suggestive case for a further expansion of living donor pool

Yasuharu Onishi*, Hideya Kamei, Hisashi Imai, Nobuhiko Kurata, Tomohide Hori, Yasuhiro Ogura
Department of Transplantation Surgery, Nagoya University Hospital, Nagoya, Japan

A R T I C L E   I N F O

Article history:
Received 13 July 2015
Received in revised form 17 September 2015
Accepted 30 September 2015
Available online 8 October 2015

Keywords:
Hemangioma
Liver graft
Adult-to-adult
Living donor
Liver transplantation
Donor pool

A B S T R A C T

INTRODUCTION: Hepatic hemangioma is one of the most common benign liver tumors. There are few published reports regarding liver transplantation using liver allografts with hemangioma.

PRESENTATION OF CASE: A 45-year-old man was evaluated as a living donor for 19-year-old son with cirrhosis due to hepatic fibrosis. Preoperative investigations revealed 20 and 7 mm hemangiomas, at segment 2 (S2) and 4 (S4) respectively. Considering the anatomical relation of S2 hemangioma and Glisson 2, liver graft was designed as left lobe excluded S2 hemangioma by partial resection. Estimated graft recipient weight ratio (GRWR) even after partial resection of hemangioma was reasonable. During the donor operation, a partial hepatic resection of S2 hemangioma was performed. Intraoperative pathologic findings revealed a cavernous hemangioma, and then, the left hepatic graft with the caudate lobe was harvested. Actual GRWR was 0.90%. Donor’s postoperative course was uneventful. Recipient’s postoperative course was almost uneventful. Postoperative computed tomography of the recipient showed a graft regeneration without increase or recurrence of hemangioma.

DISCUSSION: Organ shortage is a major concern in the field of liver transplantation. A novel donor source with a further option is extremely crucial for a guarantee of liver transplantation. We experienced the first case of adult-to-adult living donor liver transplantation using liver allograft after the resection of hemangioma.

CONCLUSION: We advocate that the use of liver allograft with hemangiomas in adult-to-adult LDLT settings can be remarkable strategy to reduce the problem of organ shortage without any unfavorable consequences in both living donor and recipient.

© 2015 The Authors. Published by Elsevier Ltd. on behalf of Surgical Associates Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Because the usage of extended criteria for donation of liver transplantation has been needed due to donor organ scarcity for transplantation [1], liver grafts from marginal donors including liver with benign tumors have been accepted as treatment options. Hepatic hemangioma is one of the most common benign tumors of the liver, as described up to 7% in autopsy findings [2].

The hemangioma usually remains asymptomatic [3] and has a benign course [4–6], although symptomatic hemangiomas may rarely require either interventional or surgical treatment [7–9]. There are few published reports regarding liver transplantation using liver allografts with hemangiomas [10–16]. In not only deceased donor liver transplantation but also living donor liver transplantation (LDLT), liver allografts with hemangiomas have been utilized for transplantation. However, in LDLT setting, there are only two published reports about liver allografts with hemangioma, and they were both liver transplants for pediatric recipients [12,15]. Until now, there has been no report in adult-to-adult LDLT with liver grafts with hemangioma.

We present here the first report of successful adult-to-adult LDLT using liver allograft with hemangioma.

2. Presentation of case

A 19-year-old male was admitted with liver failure due to congenital hepatic fibrosis. A prior diagnosis of congenital hepatic fibrosis had been established by gastroenterologists before 13 years. His liver function deteriorated progressively, with the
following laboratory findings: serum total bilirubin 25.2 mg/dl, prothrombin time-international normalized ratio 1.78, aspartate aminotransaminase 119 IU/l, and alanine aminotransferase 71 IU/l. No rupture of esophageal and gastric varices was seen. However, he had some critical episodes of grade 2 hepatic encephalopathy, and intensive cares including plasma exchange was seriously required. The preoperative liver profile was evaluated as Child-Pugh classification of grade C (11 points) and an MELD (Model for End Stage Liver Disease) score of 34 points.

A 45-year-old male was evaluated as a living donor for his son. The liver function tests of the donor were totally within the normal range with no evidence of any coagulopathy. Donor preoperative computed tomography and magnetic resonance imaging revealed 20 mm and 7 mm hemangiomas, at segment 2 (S2) and 4 respectively (Fig. 1). Estimated left lobe volume with the caudate was 503 ml. Considering the anatomical relationship of S2 hemangioma and Glisson 2, liver graft was designed as the left lobe graft with caudate lobe excluded S2 hemangioma by partial resection (Fig. 2). Estimated graft volume after hemangioma partial resection was 482 ml, which accounted for 0.83% of graft recipient weight ratio (GRWR).

Thus, the recipient status was an end-stage liver disease (i.e., advanced liver cirrhosis), and this donor was only a candidate for this recipient. After an approval of institutional ethical committee, we scheduled LDLT for this case.

A LDLT donor and recipient procedure was performed as described elsewhere [17,18]. At the beginning of living donor operation, in vivo partial hepatic resection of the S2 hemangioma was performed without the Pringle maneuver. Intraoperative ultrasonography was used to identify the location of S2 hemangioma and Glisson 2 to avoid the injury to Glisson 2 structures (Fig. 3A). The resected specimen from the donor liver was confirmed to be a cavernous hemangioma by an intraoperative pathologic examination, and then, the left hepatic graft with caudate lobe was harvested. The donor operation time was 521 min, and the bleeding volume of the donor operation was 1250 ml, but most of the bleeding occurred after the resection of the hemangioma. The actual liver graft weight was 504 g, and resulting in an actual GRWR of 0.90%.

The recipient operation was performed with standard procedures. At the time of reperfusion, no bleeding was observed from the resection site of S2 hemangioma (Fig. 3B). Splenectomy was added in this case, because of the existence of splenic artery aneurysm. Recipient operation time was 632 min, and blood loss was 5320 ml.

The donor’s postoperative course was almost uneventful, and he was discharged from the hospital on the post-operative day (POD) 12. The recipient was discharged from the hospital on POD 31 without subsequent liver necrosis or bile leakage from the resection site of S2 hemangioma. However, on POD 39, the recipient was re-admitted to the hospital because of the intra-abdominal bleeding, and urgent operation was performed for hemostasis. The cause of bleeding was gastric varix rupture close to splenectomy site, and there was no bleeding sign from the resection site of S2 hemangioma.

Fig. 1. Preoperative contrast-enhanced abdominal computed tomography (A, B) and magnetic resonance imaging (C, D) of the donor liver with cavernous hemangiomas. S2 hemangioma was indicated by arrowheads, and S4 hemangioma was indicated by arrows.

Fig. 2. The 3D-image simulation. Hemangioma was shown in H, with partial resection margin.
gioma. He was discharged from hospital 8 weeks after the second operation with good general condition and liver graft function. He is currently doing well 2 years after the LDLT. Also, the recipient's CT scans on the post-operative 132 days and 19 months showed that the good regeneration of the liver graft without any recurrence or growth of hemangioma (Fig. 4).

3. Discussion

Although liver transplantation has been widely performed for end-stage liver failure, organ shortage is the greatest problem facing the field of organ transplantation today. Therefore, the usage of extended criteria donors for organ transplantation has become a necessity due to donor organ scarcity for transplantation [1]. Actually, the use of marginal or expanded pool donors was shown to have outcome similar to ideal liver graft [19]. In renal transplantation, Khurram et al. reported that use of kidneys after tumor resection seems a feasible source to increase the donor pool [20]. Thus, it is extremely important to try to use a novel donor source as a further option to increase the number of patients who might be able to receive a liver transplantation as well as kidney transplantation.

Hepatic hemangioma is one of the most common hepatic tumors. The Mayo Clinic team suggested that most liver hemangioma could be observed safely [4], and Farges et al. confirmed the statement [5]. However, there are few published reports regarding liver transplantation using liver allografts with hemangioma so far.

Table 1

| Case no. | Year | Reference | Author | Liver type | Donor type | Donor age | Recipient age | Recipient sex | Hemangioma | Resection | Site | Location | S2 | S4 | LDLT | S2, S4 | Size (cm) | Size (cm) | Location | Source | Backtable | Time | Site after transplantation |
|----------|------|----------|--------|------------|------------|-----------|--------------|---------------|-------------|-----------|-------|--------|------|-----|-------|------|---------|---------|----------|--------|----------|------|------------------------|
| 1        | 2005 | [11]     | Mo et al. | Deceased   | Deceased   | 54        | 30           | Male          | No          | No        | Right lobe | Posterior segment | 10.2 | 9.6 | No    | Done in operation, no | No recurrence, no change |
| 2        | 2005 | [12]     | Fachev et al. | Living   | Living   | 65        | 4            | Male          | No          | No        | Left lobe | Right lobe | 9.0 | 10.2 | No    | Done in operation, no | No recurrence, no change |
| 3        | 2006 | [13]     | Ascioppi et al. | Living   | Living   | 36        | 37           | Female        | No          | No        | Right lobe | Left lobe | 7.8 | 7.0 | No    | Done in operation, no | No recurrence, no change |
| 4        | 2013 | [14]     | Nikoobian et al. | Deceased | Deceased | 47        | 27           | Female        | No          | No        | Left lobe | Lateral segment | 2.0 | 1.7 | No    | Done in operation, no | No recurrence, no change |
| 5        | 2015 | [15]     | Shu et al. | Living   | Living   | 45        | 19           | Male          | No          | No        | Right lobe | S2, S4 | 2.3 | No    | Done in operation, no | No recurrence, no change |
| 6        | 2016 | [16]     | Onishi et al. | Open liver allograft | Open liver allograft | 45        | 19           | Male          | No          | No        | Right lobe | S2, S4 | 2.3 | No    | Done in operation, no | No recurrence, no change |

Fig. 3. (A) Donor operation. Ultrasound sonogram was used to confirm the location of S2 hemangioma and Glisson 2. Location of hemangioma was indicated by white arrows. (B) Final view of recipient operation. Note no Glisson 2 injured after partial resection of hemangioma.
Technically speaking, in order to resect the hemangioma, there are two surgical procedures, backtable resection \cite{10,11} or in vivo resection in the donor surgery \cite{15}. We chose in vivo resection during the donor operation, because we believe that in vivo procedure contains the easier anatomical resection of the tumor and the shorter cold ischemic time than backtable resection.

4. Conclusions

Our case is the first report of adult-to-adult transplantation using a living donor liver graft after the resection of hemangioma. Based on our experience, donor liver with hemangioma can be safely used even for adult-to-adult LDLT, while the follow-up is needed in case of the hemangioma remained in the transplanted liver. We advocate that liver allografts with hemangiomas should not be considered as a contraindication for adult-to-adult LDLT, and can be accepted as a potential liver allograft.

Conflict of interest

No financial conflicts of interest.

Funding

All authors did not receive any funding for this report.

Ethical approval

This case report is written based on institutional ethical committee.

Consent

Written informed consent was obtained from the patient for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Author contributions

Yasuharu Onishi contributed reports retrieval and drafting of this manuscript. Yasuharu Onishi, Hideya Kamei and Yasuhiro Ogura contributed surgical procedures of this case report. Hisashi Imai and Nobuhiko Kurata contributed acquisition of clinical data. Tomohide Hori contributed critical revision of this manuscript. Yasuhiro Ogura supervised this report. All authors read and approved the final manuscript.

Guarantor

The guarantor of this manuscript is Yasuhiro Onishi, corresponding author.

References

\begin{enumerate}
\item E. Mor, G.B. Klintmalm, T.A. Gonwa, H. Solomon, M.J. Holman, J.F. Gibbs, I. Watemberg, K.M. Goldstein, B.S. Husberg, The use of marginal donors for liver transplantation. A retrospective study of 365 liver donors, Transplantation 53 (1992) 383–386.
\item C.K. Charny, W.R. Jarnagin, L.H. Schwartz, H.S. Frommeyer, R.P. DeMatteo, Y. Fong, L.H. Blumgart, Management of 155 patients with benign liver tumours, Br. J. Surg. 88 (2001) 808–813.
\item P.A. Vageli, I. Klein, B. Gelb, B. Hameed, S.L. Moff, J.P. Simko, O.K. Fix, H. Eilers, J.R. Feiner, N.L. Ascher, C.E. Freise, N.M. Bass, Emergent orthotopic liver transplantation for hemorrhage from a giant cavernous hepatic hemangioma: case report and review, J. Gastrointest. Surg. 15 (2011) 209–214.
\item V.F. Trastek, J.A. van Heerden, P.F. Sheedy 2nd, M.A. Adson, Cavernous hemangiomas of the liver: resect or observe? Am. J. Surg. 145 (1983) 49–53.
\end{enumerate}
This Open Access article is published under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits non-commercial use, distribution and reproduction in any medium, provided the original author and source are credited.