Classification of Portal Vein Anatomy for Partial Liver Transplantation

Y. Kishi, Y. Sugawara, J. Kaneko, Y. Matsui, N. Akamatsu, and M. Makuuchi

ABSTRACT

The anatomy of the portal vein is usually classified as 3 to 5 patterns and simple compared with the anatomy of the hepatic artery. The variety of portal vein anatomy was examined in 287 living donors for liver transplantation. More than 90% of donors showed a normal bifurcation type; 6% showed the trifurcation type. Only 3% displayed a separate origin of the right paramedian and the right lateral branches. There was no anomalous pattern that had not been reported previously. In our series, we conclude that it is rare for 2 or more stumps of portal vein to appear in partial liver transplantation. The frequency is much less if the left liver or the right lateral liver graft is used for adult-to-adult living donor liver transplantation.

Compared with the anatomy of the hepatic artery, portal vein anatomy seems to be less variable. Previous reports showed 3 to 5 patterns of branching of the portal vein, mainly with regard to the existence of a main trunk of the right portal branch. The classification is almost the same for the anatomy of the portal vein in partial liver transplantation.\textsuperscript{1-5} A representative classification was reported by Nakamura et al.\textsuperscript{2} They referred to anatomy that was inappropriate for right liver transplantation. We have, however, no experience of rejecting a living donor on the grounds of portal vein anatomy. We herein classified the portal vein anatomy of 287 donor cases according to Nakamura's report to examine the frequency of these branching patterns.

PATIENTS AND METHODS

From January 1996 to June 2004, 287 consecutive living donor liver transplantations were performed at our institution. We retrospectively reviewed the preoperative computed tomographs and angiographs of all donors. Portal vein anatomy was classified according to Nakamura. In brief, Type A was the usual bifurcation type; Type B was the trifurcation pattern without the trunk of a right branch of the portal vein; In Types C and D, a right paramedian sector branch or a right lateral sector branch bifurcates separately from the left portal vein. The difference was that the right paramedian branch originated from the proximal, or extraparenchymal, site of the left portal vein in Type C, whereas it originated from a distal, or intraparenchymal, site in Type D. In Type E, branches of segment 8 and 5 originated separately from the left portal vein.\textsuperscript{2}

RESULTS

The frequency of each type of anatomy is shown in Table 1. In total, 91% belonged to the normal pattern Type A. We did not observe any Type E anatomy. Eight donors were classified to Types C and D. Right liver harvest was performed only in 1 case of Type C, in which case, an anastomosis of the portal vein was performed as shown in Fig 1. At bench surgery, a slit added to the medial side of each stump of the portal vein was sutured together to make 1 orifice. On the recipient side, the bifurcation of the right paramedian and lateral branch was cut and sutured longitudinally to make 1 orifice. Then each orifice was sutured together in an end-to-end anastomosis. Postoperatively, no thrombus occurred during a follow-up of 4 months.

DISCUSSION

In our experience, the frequency of 2 or more stumps of portal vein was low. It was less frequent if a right lateral sector graft was selected. It is easily understandable that Type E anatomy is inappropriate for a right liver transplantation, but this anomaly is rare.\textsuperscript{2-4} Then, the rejection of a living donor due to an anomaly of portal vein occurs rarely. Several anomalies that are inappropriate for right liver

From the Artificial Organ and Transplantation Division, Department of Surgery, Graduate School of Medicine, University of Tokyo, Tokyo, Japan.


Address reprint requests to Y. Sugawara, MD, Artificial Organ and Transplantation Division, Department of Surgery, Graduate School of Medicine, University of Tokyo, Tokyo, Japan. E-mail: yasusuga-tky@umin.ac.jp

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graft harvesting other than Type E, included an anomaly related to a right-sided umbilical portion. In this type of anomaly, portal flow to the left medial sector may be sacrificed. However, the anatomy of left medial branch is difficult to determine. In fact, Lee et al reported a donor of right liver with a left-sided gall bladder, leaving the portal branch to the left medial sector intact. In this anomaly, left liver harvesting must be performed carefully because there is a possibility of misinterpreting the trunk of right paramedian and left portal vein as a branch of left portal vein. Another anomaly is an accessory right posterior portal vein. In this type of anomaly, right liver harvesting is usually possible with the appearance of 2 stumps of portal vein branches. However, if this anomaly coexists with Types C or D anatomy, a right liver graft may be inappropriate.

Table 1. Frequency of Each Type of Portal Vein Anatomy

<table>
<thead>
<tr>
<th>Graft</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left liver</td>
<td>150</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Right liver</td>
<td>99</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Right lateral</td>
<td>12</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total (%)</td>
<td>261</td>
<td>18</td>
<td>6</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Although experience with more cases of living donor liver transplantation may reveal a new type of portal vein anatomy, the occurrence of a right liver graft having 2 or more portal vein stumps is not important if a left liver or right lateral sector graft is considered as an alternative for adult to adult living donor liver transplantation.

REFERENCES
