



Hepatic artery reconstruction technique in liver transplantation: experience with 3,000 cases

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1 Hepatic artery reconstruction (HAR) is the most valuable
2 step in correcting graft and recipient survival after liver
3 transplantation (LT). Hepatic artery thrombosis (HAT)
4 in immediate postoperative period may lead to fatal
5 complications. Hepatic allograft is partial in a living donor
6 liver transplantation (LDLT), and HAR is technically much
7 more difficult than deceased donor liver transplantation
8 (DDLT). The likelihood of HAT in LDLT is higher due to
9 the narrower diameters of arterial vessels.

10 Before the microsurgical HAR period, the incidence
11 of HAT was as high as 14–25% (1). HAR using operative
12 microscope (OM) was first applied by the Kyoto group,
13 in order to reduce the HAT incidence after LDLT (2).
14 HAT incidence after HAR with OM was reduced to 1.7%
15 (2,3). However, it is necessary to be careful when using the
16 literature data here. Because the 25% incidence of HAT
17 before OM belongs to the study on pediatric LDLT in
18 1991 of Broelsch *et al.* (1). In this study, hepatic artery flow
19 was provided with aortic conduit using the interposition
20 saphenous vein in 80% of the patients with HAT. Increased
21 experience in LDLT and using microsurgical instruments
22 with surgical loupes at 6 or greater magnification yielded
23 similar or better results in adult and pediatric LDLT than
24 those achieved with OM (4-6). Even the Kyoto group,
25 the inventor of HAR with OM, currently performs HA
26 anastomosis with surgical loupe (7).

27 Nevertheless, there is an ongoing debate that the hepatic

artery anastomosis should be performed with the OM or
surgical loupes. As a person who is used to both techniques,
I would like to mention some of the disadvantages of OM:

- (I) Setting up OM, which has a fairly large volume, is a time-consuming process and prevents the fluency of the operative stages.
- (II) Due to the deep working area in HAR, it is not an easy task to focus the OM and use the surgeon's hands effectively.
- (III) Diaphragmatic movements and heart pulsation make the artery anastomosis difficult. These difficulties are better handled with surgical loupe.
- (IV) There is an extremely limited field view with OM. There is no chance to interfere with problems such as hemorrhage outside the field of view (7).
- (V) It is very difficult to expose the graft hepatic arteries on a left lateral used for small infants because of the very small abdominal cavity relative to the hepatic graft. This is true for all left hepatic grafts. In these cases, it is extremely difficult to take proper position with operative microscope and perform HAR. Therefore, we mostly perform HAR before portal vein anastomosis in left grafts as HAR is challenging after portal vein anastomosis. Portal vein anastomosis is performed after HAR and re-perfusion is provided from the portal vein first, and HA is opened within a few minutes when

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hemodynamics stability restored.

(VI) With OM, you have to use the “a paired Acland double microvascular clip technique”. With surgical loupe and 2 separate bulldogs paired instead of Acland double microvascular clip, a clear view and safe suturing of the artery lumen will result in an easier anastomosis.

(VII) HAR with OM is mostly performed by surgeons other than transplant surgeons, like hand or plastic surgeons. This group of surgeons does not dominate the HA and its surrounding anatomy. These surgeons have not been involved in transplantation since the beginning of the operation. They are suddenly called from the social life, without responsibility and dedication to the operation and with a desire to return to their social life which is contradictory to long-term transplant surgery (8).

In our institute we used OM (×3–16) in our early experience but have modified our technique. We now use high power loupe magnification (×8–8.5) with microvascular instruments instead of OM for HAR. Our reports demonstrate, however, that in experienced hands, results of HAR using high-power loupe optics can be equivalent or even better to OM.

When HAT develops, more than half of LT patients need re-LT. When the HAT is recognized early, revascularization procedures come into question before re-transplantation. When HAT occurred, the alternatives to native HA for reanastomosis are splenic artery, interposition grafts, and LGA, according to our order of preference (9). There is no clear answer to the question of up to which day surgical revascularization can be performed in the early post-transplant period. Although surgical revascularization attempts have been performed until the second month after LT (10), the success rate of this procedure after the first 5 days is poor.

The use of LHA as a recipient artery in LDLT is controversial (11). We use LHA in HAR if the lumen is wide enough. More importantly, if you use left HA as the recipient artery in LDLT and do not dissect right HA from the biliary duct, posttransplant biliary complication rates will reduce (unpublished data).

Patients who underwent transarterial chemoembolization or transarterial radioembolization before transplantation may have a high incidence of HAT (12). Tissues must be carefully handled at the time of transplantation to prevent intimal dissection in these fragile vessels. However, this

problem has been overcome as experience increased.

Although double HA rate in right lobe grafts is very low and the left lobe grafts have often multiple arteries. Unlike the right lobe grafts, both of arteries must be anastomosed, when a left lobe graft has two arterial stumps, the dominant artery is reconstructed first. After the initial HAR, another reconstruction should be performed only if no pulsating flow is observed from the remnant artery. In our cases, single HAR in left lobe LDLT with two arterial stumps did not affect patient survival or the incidence of biliary complications. The experience and lessons from 3,000 LTs were shared and important points highlighted.

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