



Why do multiple arteries in left lobe liver grafts need special attention?

Mettu Srinivas Reddy¹ · Rajnikanth Patcha¹

Received: 27 June 2021 / Accepted: 14 July 2021 / Published online: 29 July 2021
© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2021

Dear Editor,

We read the article by Puri et al. titled 'Anatomical Basis for Selective Multiple Arterial Reconstructions in Living Donor Liver Transplantation' published in your journal [1]. The authors have performed a retrospective analysis of all living donor liver transplantations (LDLT) in their center and showed that reconstruction of a single artery in a partial graft with multiple arteries is safe as long as there is brisk back bleed from the smaller artery. While the anatomical basis for this is well known, the present paper with its excellent illustrations describes it with great clarity.

One of the main concerns during implantation of a liver graft with multiple arteries is biliary complications (BC) developing due to insufficient blood supply to the graft duct when a single artery is reconstructed. The authors in their discussion briefly mentioned literature reports of a higher incidence of BC in left lobe (LL) grafts with multiple arteries. This is a very valid point and deserves a more detailed exploration based on anatomical and surgical considerations.

The segment four artery arises as a separate artery from the left hepatic artery in nearly 40% of all livers, leading to multiple arteries in as many LL grafts [2]. The segment four artery when arising separately is usually smaller compared to the 2/3 artery. As the main location of cross-connections in the left side is in the Rex recess, back flow from segment 4 artery is usually not as brisk as from a right accessory artery in a right lobe graft.

The second point relates to the line of bile duct division in the three major graft types. In the right lobe (RL) graft, the duct is transected on the cut surface, and the duct immediately enters the graft parenchyma. This ensures good blood

supply to the duct from both hilar plate and intrahepatic arterial collaterals even when a single artery is reconstructed. This is also true for the left lateral segment (LLS) graft, where the duct is again transected on the cut surface close to the Rex recess. It is only in the case of the LL graft where the duct is transected close to the primary biliary confluence to obtain a common graft duct orifice does the graft duct travel a variable distance in the hilum before the segmental ducts enter the parenchyma (Fig. 1). The arterial supply to the transverse part of LHD in this extrahepatic course is entirely dependent on the arterial plexus, and if this is insufficient, then there is a risk of biliary ischemia and biliary complications. It is in this setting that reconstruction of the second smaller artery carries greater clinical significance. Obviously, this may not be of concern if the line of duct transection is moved further left and separate segment 4 and segment 2/3 orifices are obtained or a Roux-en-Y hepaticojejunostomy is planned when the shortfall in duct vascularity is compensated by the vascularity of the Roux limb.

As the authors have pointed out, this difference has been borne out in literature on outcomes of left lobe grafts with dual arteries with some predominantly LL graft series reporting higher complications rates in grafts with single artery reconstruction [3, 4]. However, much larger series or ideally a multicenter study to look at the risk of biliary complications in left lobe grafts with multiple arteries is needed to clearly bring out this difference. Hence, while we agree with the authors that single artery reconstruction is usually sufficient in a majority of cases, in the setting of a LL graft with a separate segment 4 artery and a single left hepatic duct orifice, it is preferable to reconstruct the segment 4 artery despite the additional technical challenge.

✉ Mettu Srinivas Reddy
smettu.reddy@gmail.com

¹ Institute of Liver Disease and Transplantation, Gleneagles
Global Hospital and Health City, Cheran Nagar,
Chennai 600100, India

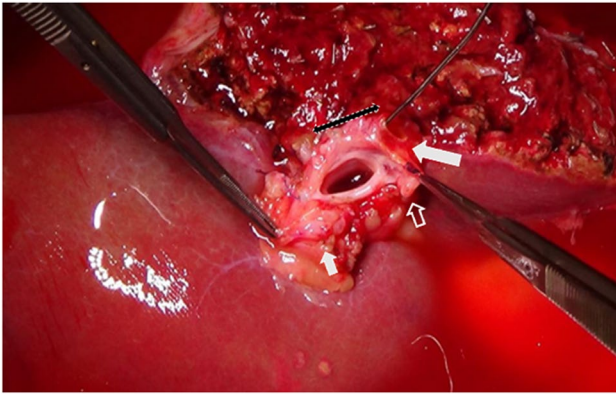


Fig. 1 Intraoperative photograph showing the hilum of a left lobe graft. The segment 2/3 artery is marked by the solid small arrow, while the segment 4 artery is marked by the hollow arrow. The bile duct orifice is marked by the longer arrow. The double-headed black arrow identifies the extrahepatic portion of the left hepatic duct which is entirely dependent on the peribiliary vascular plexus formed by the segment 2/3 and segment 4 arteries for its blood supply and may be at risk of ischemia when a single artery is reconstructed

Authors' contributions Both authors contributed to this work.

Declarations

Conflict of interest The authors declare no competing interests.

References

1. Puri Y, Palaniappan K, Rammohan A, Narasimhan G, Rajalingam R, Cherukuru R et al (2021) Anatomical basis for selective multiple arterial reconstructions in living donor liver transplantation. *Langenbecks Arch Surg*. <https://doi.org/10.1007/s00423-021-02176-y>
2. Jin GY, Yu HC, Lim H-S, Moon JI, Lee JH, Chung JW et al (2008) Anatomical variations of the origin of the segment 4 hepatic artery and their clinical implications. *Liver Transpl* 14(8):1180–1184
3. Uchiyama H, Harada N, Sanefuji K, Kayashima H, Taketomi A, Soejima Y et al (2010) Dual hepatic artery reconstruction in living donor liver transplantation using a left hepatic graft with 2 hepatic arterial stumps. *Surgery* 147(6):878–886
4. Sugawara Y, Tamura S, Kaneko J, Iida T, Mihara M, Makuuchi M et al (2011) Single artery reconstruction in left liver transplantation. *Surgery* 149(6):841–845

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.