



# Is the exposure to liver transplantation worthwhile for trainees in liver surgery?

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*Comment on:* Chan ACY, Chok KSH, Dai J, *et al.* Transferability of Liver Transplantation Experience to Complex Liver Resection for Locally Advanced Hepatobiliary Malignancy-Lessons Learnt From 3 Decades of Single Center Experience. *Ann Surg* 2022;275:e690-7.

Submitted Aug 17, 2022. Accepted for publication Sep 05, 2022.

doi: [10.21037/hbsn-22-377](https://doi.org/10.21037/hbsn-22-377)

View this article at: <https://dx.doi.org/10.21037/hbsn-22-377>

In the May 2022 issue of *Annals of Surgery*, Albert C. Y. Chan and colleagues reported interesting results on the effect of liver transplantation (LT) experience in performing complex liver resection (CLR) (1). By considering 1,452 LT and 222 CLR over a period of 24 years, performed in a worldwide recognized center for LT and liver surgery, they had 25.2% major complications and 6.3% mortality after CLR. Interestingly, they found that the more experience in LT, the less risk of postoperative complications after CLR. They also indicated the cutoff of 95 LT; meaning that at below such number, the rate of complications after CLR significantly increased (1).

The topic of the effect of LT experience in CLR is an old matter of debate among liver surgeons. While everybody agrees on the general formula—the more experience, the less complications—which is sustained by a large body of the surgical literature (2-4), such analyses suffer from some methodological limitations, among which are the collinearity with other important determinants of hospital mortality, such as the so-called failure to rescue, meaning that the decrease in mortality is also dependent on the improvement of postoperative care, the quality of which is closely related to some specific hospital characteristics (i.e., specialized intensive care unit, high nurse-to-patient ratio) (5). Consistent with these observations, the outcome of CLR is influenced by the quality of the anesthesiology and intensive care team, which may be more technically and culturally prepared where such CLR are performed

independently by a liver transplantation service.

Along this line, while the operator experience is certainly a determinant of the perioperative outcome, the cases of CLR reported by Chan and colleagues should be statistically matched to minimize selection biases. Though LT is a complex procedure, it can be considered more straightforward in comparison to CLR, which can differ from one another. Having abundant experience in LT certainly increases operator confidence in performing major or extended liver resection with added complex vascular and/or biliary resections and reconstructions. However, a more tempered analysis would be the comparison of CLR outcomes performed by non-LT surgeons to those performed by LT surgeons, again with matched patient case-mix.

Dissecting the number reported by Chan *et al.* (1), it emerges that only a mean of nine CLR per year were performed over 24 years, indicating that those cases were probably not only complex but also rare in terms of tumor histology and tumor presentations—representing, then, a small proportion of the whole series of liver resections performed routinely. The complexity of the tumoral presentations of those cases herein included is well represented by the data on the use of total vascular exclusion (TVE), blood loss, blood replacement, and length of the operations, the numbers for which are far from those of the standard hepatectomy (1). Of note, CLR have already been reported without the use of TVE, with minimal blood loss and blood replacement, and more importantly with

minimal—if not zero—mortality (6,7), including in a non-LT center (8).

The liver is a complex organ, and the anatomy should be mastered when performing CLR to minimize misinterpretations and mistakes that can be the source of postoperative complications. In the last years, significant improvements have been reported using 3D simulation software, the efficacy of which has been demonstrated, particularly for trainees (9). Indeed, simulation study of the liver anatomy, with all its variants, the intra- and extrahepatic vascular contacts, the ability to measure total liver volume and future liver remnant, and the capacity to design the resection plan in a tailored fashion is something that, while difficult to quantify in numbers, is changing the learning process in surgery.

A potential downside of having abundant experience in LT when performing liver resection is an increased tendency to perform extended hepatectomy with or without vascular or biliary resection and reconstruction, even in cases that might be completed without such invasiveness. It is known that these large resections are associated with increased risks even in expert hands, and more efforts should be made to limit these operations to very specific cases.

Certainly, the study by Chan *et al.* (1) showed how LT experience has a positive impact when facing CLR. As stated by the authors, the immediate implication is that trainees in liver surgery should rotate for a period in a liver transplantation center where direct exposure to LT is facilitated. Additionally, such rotation should be offered during residency in general surgery to provide residents with a breadth of experience in manipulating the liver, the liver pedicle, and the inferior vena cava, even if only a proportion of them will pursue a career in liver surgery. In this sense, achieving some experience in multiorgan retrieval for transplantation is a good learning experience.

In conclusion, the work of Chan and colleagues is much appreciated. Liver transplant experience as complimentary to liver surgery can be definitively supported. Conversely, whether CLR should be performed by transplant surgeons cannot be equally supported if non-transplant liver surgeons have their own experience and capability in performing CLR, and work in institutions where all the professionals involved in the care of liver patients are technically and culturally prepared.

## Acknowledgments

*Funding:* None.

## Footnote

*Provenance and Peer Review:* This article was commissioned by the editorial office, *Hepatobiliary Surgery and Nutrition*. The article did not undergo external peer review.

*Conflicts of Interest:* Both authors have completed the ICMJE uniform disclosure form (available at <https://hbsn.amegroups.com/article/view/10.21037/hbsn-22-377/coif>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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**Cite this article as:** Donadon M, Baroffio P. Is the exposure to liver transplantation worthwhile for trainees in liver surgery? *HepatoBiliary Surg Nutr* 2022;11(5):746-748. doi: 10.21037/hbsn-22-377