

Living donor liver transplantation in the United States: The way forward

Helen S. Te¹ | Abhinav Humar²

¹Center for Liver Diseases, University of Chicago Medicine, Chicago, Illinois, USA

²Thomas E. Starzl Transplantation Institute, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA

Correspondence

Helen S. Te, Center for Liver Diseases, University of Chicago Medicine, Chicago, IL, USA.

Email: hte@bsd.uchicago.edu

The success of the first living donor liver transplant (LDLT) performed in a child in Brisbane¹ followed shortly by a series of twenty successful pediatric cases in Chicago² opened the door for LDLT to become a viable alternative to deceased donor liver transplantation (DDLT), not just for children but also for adults. In fact, LDLT has catapulted to become the main mode of liver transplantation in Asia³ and the Middle East,⁴ where religious beliefs, cultural norms, organ shortage, and political factors have limited the availability of deceased donors. Yet, despite a consistent growth of liver transplantation in the United States (US) over the past four decades, LDLT remains only a small fraction (<10%) of annual liver transplant volumes.⁵

Living donor liver transplantation has similar or superior graft and patient survival rates when compared to DDLT,^{6,7} but widespread adoption of this procedure in the US has remained fraught with many challenges, particularly in the adult population. For this reason, the Living Donor Community of Practice, the Liver and Intestinal Community of Practice, and the Psychosocial and Ethics Community of Practice of the American Society of Transplantation collaborated to hold a consensus conference where national and international leaders in the field gathered to share knowledge and experience. The participants were tasked to identify current barriers that limit the use of this procedure and to formulate effective strategies that will improve access to this life-saving option. The results of the collaborative work and consensus conference are summarized in the six articles included in this special issue.

To set the stage, the first paper "Living donor liver transplantation: A multi-disciplinary collaboration towards growth, consensus, and a change in culture" describes the entire collaborative process, including the administration of a survey of liver transplant centers, an analysis of the transplant registry, and the conduct of the consensus conference. It describes the selection of participants, identifies the domains

discussed, and outlines the modified Delphi methodology used in arriving at consensus. At the end of the conference, strategies to overcome the existing barriers were offered, built around a core that rests on the need for a cultural change to one that embraces LDLT.⁸

To prepare for the consensus conference, a survey was administered to liver transplant professionals to solicit individual attitudes as well as perceived facilitators and barriers of LDLT amongst liver transplant centers in the US. The survey results are reported in the paper, "A survey of transplant providers regarding attitudes, barriers, and facilitators to living donor liver transplantation in the United States." The majority of respondents recognize that LDLT mitigates organ shortage, but the procedure is infrequently offered as the best first option to patients in need of liver transplantation. Centers without LDLT programs identify the lack of surgical expertise and institutional support as barriers to offering LDLT, while centers with LDLT programs identify recipient and donor selection factors as the obstacles.⁹

In addition to the survey, an analysis of the Scientific Registry of Transplant Recipients (SRTR) database was performed to determine the influence of recipient characteristics on the selection of LDLT versus DDLT in liver transplant centers that performed both procedures. The findings are outlined in the paper, "Variation in adult living donor liver transplantation in the United States: Identifying opportunities for increased utilization." On the background of a low overall LDLT rate at 4.4%, practices are widely variable amongst the liver transplant centers, with some centers performing one LDLT only and other centers electing LDLT in 60% of their liver transplants. Some recipient characteristics, such as older age, male sex, and obesity, are noted to be associated with lesser likelihood of LDLT. In addition, racial and ethnic minorities, public health insurance, lower educational achievement, and Northwest and Southeast residence are also associated with less access to LDLT. The authors call attention to the need for further

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2023 The Authors. *Clinical Transplantation* published by John Wiley & Sons Ltd.

investigation into the social determinants that contribute to disparity in access to LDLT and for further outreach to foster LDLT amongst these populations so as to promote fair access to LDLT.¹⁰

During the conference, participants explored barriers encountered in the engagement of institutional stakeholders in LDLT and in the donor and recipient selection process. The discussions are recapped in the paper, "Living donor liver transplant candidate and donor selection and engagement: Meeting report from the living donor liver transplant consensus conference." Education to counter insufficient awareness and reinforcement of engagement amongst patients, providers, and institutions are advocated. Moreover, future research to fill in data gaps and to standardize donor and candidate selection and additional resources to support the post-donation management of living donors are also recommended.¹¹

Despite technical advances in LDLT that have led to excellent outcomes, at least half of potential living liver donors are still declined for various reasons, mostly medical or technical. In the paper, "Advances and innovations in living donor liver transplant techniques, matching and surgical training: Meeting report from the living donor liver transplant consensus conference," the authors pinpoint the most pressing medical barriers to LDLT utilization, which included surgical techniques and donor and recipient matching. The development of robust training pathways that provide more exposure to LDLT is projected to increase the number of proficient LDLT surgeons across the country. Furthermore, utilization of emerging data to better guide recipient and donor selection and creation of a formal liver paired exchange program are expected to mitigate donor-recipient mismatches, as has been accomplished in the living donor kidney transplantation community.¹²

While LDLT undoubtedly benefits the recipient, it subjects the healthy donor to a high-risk procedure that carries a .4% mortality rate and ~40% complication rate¹³ with no direct medical gains to the donor. Most donors do derive improved self-esteem, psychological growth, and improved relationships from the donation process, but many also sustain physical issues and financial difficulties.¹⁴ In the paper, "Financial, policy, and ethical barriers to the expansion of living donor liver transplant in the United States: Meeting report from the living donor liver transplant consensus conference," the authors examine the roles of financial strains, regulatory and oversight policies, and ethical controversies in the growth of LDLT in the US. Proposed strategies to overcome the challenges include the expansion of financial resources and public policy changes that promote financial neutrality for donors, optimization of the informed consent process, and further research into long-term physical and mental outcomes of non-directed living liver donors.¹⁵

Living donor liver transplantation is a valuable option for patients in need of a liver transplant. However, barriers related to medical, ethical, financial, and psychosocial factors impede its widespread adoption in the US. The papers in this issue specifically address these barriers with workable interventions through education, policy changes, enhanced infrastructure and resources, and research to provide better guidance to center practices. These interventions are crucial for improving access to LDLT and maximizing its potential benefits. Specifically, the LDLT focus needs to shift from "awareness of its existence"

to "full acknowledgment and acceptance of its benefit" at multiple levels, including the community, policymakers, healthcare institutions, transplant teams, other medical providers, transplant candidates, and potential donors. In essence, the dictum that needs to be practiced from here onward is, "LDLT is the best option."⁸

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

None.

REFERENCES

- Strong RW, Lynch SV, Ong TH, Matsunami H, Koido Y, Balderson GA. Successful liver transplantation from a living donor to her son. *N Engl J Med*. 1990;322(21):1505-1507. doi:10.1056/NEJM199005243222106
- Broelsch CE, Whittington PF, Emond JC, et al. Liver transplantation in children from living related donors. Surgical techniques and results. *Ann Surg*. 1991;214(4):428-437; discussion 437-9. doi:10.1097/00000658-199110000-00007
- Hibi T, Wei Chieh AK, Chi-Yan Chan A, Bhangu P. Current status of liver transplantation in Asia. *Int J Surg*. 2020;82S:4-8. doi:10.1016/j.ijso.2020.05.071
- Lankarani KB, Hosseini SAM. The status of liver transplantation in the Middle East. *Clin Liver Dis (Hoboken)*. 2019;14(6):215-218. doi:10.1002/cld.889
- Organ Procurement and Transplantation Network. National data: Accessed on 6/19/23. <https://optn.transplant.hrsa.gov/data/view-data-reports/national-data/#>
- Barbetta A, Aljehani M, Kim M, et al. Meta-analysis and meta-regression of outcomes for adult living donor liver transplantation versus deceased donor liver transplantation. *Am J Transplant*. 2021;21(7):2399-2412. doi:10.1111/ajt.16440
- Barbetta A, Butler C, Barhouma S, et al. Living donor versus deceased donor pediatric liver transplantation: a systematic review and meta-analysis. *Transplant Direct*. 2021;7(10):e767. doi:10.1097/TXD.0000000000001219
- Liapakis A, Jesse MT, Pillai A, et al. Living donor liver transplantation: a multi-disciplinary collaboration towards growth, consensus, and a change in culture. *Clin Transplant*. 2023:e14953. doi:10.1111/ctr.14953
- Liapakis A, Agbim U, Bittermann T, et al. A survey of transplant providers regarding attitudes, barriers, and facilitators to living donor liver transplantation in the United States. *Clin Transplant*. 2023:e14967. doi:10.1111/ctr.14967
- Lentine KL, Tanaka T, Xiao H, et al. Variation in adult living donor liver transplantation in the United States: identifying opportunities for increased utilization. *Clin Transplant*. 2023:e14924. doi:10.1111/ctr.14924
- Jesse MT, Jackson WE, Liapakis A, et al. Living donor liver transplant candidate and donor selection and engagement: meeting report from the living donor liver transplant consensus conference. *Clin Transplant*. 2023:e14954. doi:10.1111/ctr.14954
- Sturdevant M, Ganesh S, Samstein B, et al. Advances and innovations in living donor liver transplant techniques, matching and surgical training: meeting report from the living donor liver transplant consensus conference. *Clin Transplant*. 2023:e14968. doi:10.1111/ctr.14968
- Abecassis MM, Fisher RA, Olthoff KM, et al. Complications of living donor hepatic lobectomy—a comprehensive report. *Am J Transplant*. 2012;12(5):1208-1217. doi:10.1111/j.1600-6143.2011.03972.x
- Dew MA, DiMartini AF, Ladner DP, et al. Psychosocial outcomes 3 to 10 years after donation in the adult to adult living donor

- liver transplantation cohort study. *Transplantation*. 2016;100(6):1257-1269. doi:[10.1097/TP.0000000000001144](https://doi.org/10.1097/TP.0000000000001144)
15. Pillai A, Verna EC, Parikh ND, et al. Financial, policy, and ethical barriers to the expansion of living donor liver transplant: meeting report from a living donor liver transplant consensus conference. *Clin Transplant*. 2023:e14955. doi:[10.1111/ctr.14955](https://doi.org/10.1111/ctr.14955)

How to cite this article: Te HS, Humar A. Living donor liver transplantation in the United States: The way forward. *Clin Transplant*. 2023;e15068. <https://doi.org/10.1111/ctr.15068>