Editorial

Alternatives to left lateral segment for pediatric liver transplantation, or required surgeon toolkit?

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We read with great interest the systematic review on modified grafts for pediatric liver transplantation by Gavriilidis *et al.* (1) recently published in *Hepatobiliary Surgery and Nutrition*. The authors aimed to review existing literature related to liver transplantation (LT) in small pediatric recipients using modified left lateral segment (LLS) grafts—reduced/hyper-reduced LLS or monosegments—and how comparable these techniques are to the standard practice using LLS. We congratulate the authors on their publication and would like to highlight some important findings of this study.

Gavriilidis *et al.*'s (1) systematic review included a final cohort of 330 small pediatric recipients of modified LLS over two decades. The discrepancy between years evaluated and number of reported cases included in the systematic review is striking, and somehow not surprising. In the Unites States alone, the pre-transplant mortality amongst candidates younger than 1 year is reported to be 21.7 deaths per 100 patient-years (2). Such unacceptably high mortality rate is a clear indication that feasible solutions to increase access to transplantation for small pediatric candidates are long overdue. However, the heterogeneity on recipients' characteristics and technical complexity of the proposed strategies makes it a challenging task. In addition, the selection of one technique *vs* the other in the setting of small pediatric recipients is also driven by surgeon's expertise, previous training and comfort level with one particular technique. Nonetheless, data analyzed in this systematic review suggests that reduced/hyper-reduced LLS and monosegments represent feasible options for LT in small pediatric recipients, achieving similar rates of vascular complications and overall graft and patient survival rates as the standard LLS practice. This qualitative synthesis also corroborates the common practice of ensuring graft-to-recipient weight ratio (GRWR) below 4% to mitigate the risk of large-for-size syndrome in this patient population.

But, which one is better? The results presented by the authors highlight that alternatives modalities do not have to be comparable, but rather complementary. Liver transplant for small pediatric recipients should not follow a "one-size-fits all" strategy. Instead, a dynamic approach takes into account the unique challenges of each patient. As the authors state, the cohort was fairly heterogeneous, so it would have been interesting to see results of comparisons between subgroups based on age, weight or GRWR. In addition, reporting further recipients' baseline key characteristics, such as pre-transplant abdominal girth, disease severity and time on the waitlist would have provided additional insights on the role of modified LLS grafts under these specific scenarios. Previous reports

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have found that even in the setting of high GRWR, LLS provide faster access to transplantation to sicker patients while achieving similar postoperative outcomes, including graft and patient survivals (3). Others have emphasized the potential benefit of modified grafts in the setting of small pediatric recipients with acute liver failure and inherited metabolic disorders, as they usually present with significant edema and small abdominal cavity (4). Thus, further studies and availability of more granular data is needed to reach more specific recommendations and reproducible guidelines for technique selection. In the meantime, knowledge and surgical adeptness of all available modalities may represent our best strategy to ensure favorable outcomes for all small pediatric recipients.

This brings us to our final remark. In agreement with the authors, there are many technical differences between monosegments and reduced/hyper-reduced LLS that limits its direct comparison. However, it was interesting to see that only a few of the included studies provided information of some of the most controversial aspects that potentially differentiate these techniques from the standard LLS. For instance, out of the 16 included studies, only nine included information on abdominal wall closure rate. It is important to note, that neither monosegments, not reduced/hyper-reduced grafts reached 100% closure rate. For many, achieving primary abdominal wall closure is one of the benefits of modified LLS. However, in our experience, as well as others, delayed abdominal closure does not negatively impact long-term outcomes (3,5,6). More importantly, the associated risks of more technically challenging procedures, such as bile leaks, are not an easy compromise and should not be overlooked. The fact that no information on biliary complications rates was mentioned in the systematic review indicate that technical-related complications may be, in fact, an overlooked aspect that needs further attention. Thus, a more in-depth assessment of key technical aspects such as *in-situ vs. ex-situ* graft modification, planes for transection, type of biliary anastomosis and vessels size mismatch would allow for future quantitative meta-analyses and stronger evidence to standardize practices for graft and recipient selection. Nonetheless, Gavriilidis *et al.*'s (1) systematic review serves as a baseline point, and transplant teams are encouraged to report their experience with high degree of detail to achieve this goal.

Finally, we would like to reinforce the importance of continuous learning, adoption of new techniques and patient-center care to reach excellence in pediatric liver transplantation. Moreover, we thank the authors for their important contribution regarding the management of this vulnerable population.

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