

At-a-Glance

- **Proposed Region 2 Split Liver Alternative Allocation System**
- **Liver and Intestinal Organ Transplantation Committee**

Region 2 is proposing a variance, or Alternative Allocation System (AAS), to Policy 3.6.11 (Allocation of Livers for Segmental Transplantation). Under this AAS, if a candidate in Region 2 is suitable for a segmental transplant, the transplant center may accept a liver offer and transplant the right lobe of that liver into that suitable candidate (known as the index patient). Then center would then be allowed to transplant the left segment of that liver into another medically suitable patient listed at the same center or at an affiliated pediatric institution. The index patient is defined as the first candidate for whom a deceased donor liver is offered and accepted, in accordance with the match run, who is medically suitable and willing to accept a segmental liver. This AAS should increase the number of transplants, allowing a single liver to be divided into two segments for transplantation, and thus removing two patients from the waiting list instead of one.

- **Affected Groups**

Region 2 Directors of Organ Procurement
Region 2 OPO Executive Directors
Region 2 OPO Medical Directors
Region 2 OPO Coordinators
Region 2 Transplant Administrators
Region 2 Transplant Data Coordinators
Region 2 Transplant Physicians/Surgeons
Region 2 PR/Public Education Staff
Region 2 Transplant Program Directors
Region 2 Transplant Social Workers
Region 2 Organ Candidates
Region 2 Donor Family Members

- **Specific Requests for Comment**

The Liver Committee and Region 2 are seeking comments on the feasibility of this AAS, and any potential unintended consequences.

Proposed Region 2 Split Liver Alternative Allocation System

Liver and Intestinal Organ Transplantation Committee

Summary and Goals of the Proposal:

Region 2 is proposing a variance, or alternative allocation system (AAS) to Policy 3.6.11 (Allocation of Livers for Segmental Transplantation). Under this AAS, if a candidate in Region 2 is suitable for a segmental transplant, the transplant center may accept a liver offer and transplant the right lobe of that liver into that suitable candidate (known as the index patient). Then center would then be allowed to transplant the left segment of that liver into another medically suitable patient listed at the same center or at an affiliated pediatric institution. The index patient is defined as the first candidate for whom a deceased donor liver is offered and accepted, in accordance with the match run, who is medically suitable and willing to accept a segmental liver. This AAS should increase the number of transplants, allowing a single liver to be divided into two segments for transplantation, and thus removing two patients from the waiting list instead of one. The AAS will hopefully reduce waiting times for liver candidates overall, because the liver pool would be expanded by splitting livers that otherwise would not be split.

Background and Significance of the Proposal:

Small children with end-stage liver disease suffer the most from the extreme shortage of deceased donor organs due to the difficulty of finding size-matched donors. The allocation of organs from small pediatric donors to multiorgan recipients has recently made the problem even worse for small pediatric candidates who do not have the option of a living donor transplant. Two of the largest-volume pediatric intestine transplant programs reside within the region, as do multiple pediatric liver transplant programs, which means pediatric candidates in this region may suffer disproportionately.

Split-liver transplantation (SLT), a procedure where one deceased donor liver is divided to provide for two recipients, would immediately expand the existing deceased donor pool. This is done by dividing appropriate donor livers in such a way that a surgeon can transplant the left lateral liver graft into a small child and then transplant the right extended liver graft into a medically suitable adult or teenager. Since its introduction in 1988, improved donor and recipient selection for SLT have increased the donor pool and decreased pediatric pretransplant mortality. To date, the principal beneficiaries of SLT have been adult/pediatric recipient pairs with excellent outcomes reported. This innovative technique **did not harm the adult recipient pool**¹.

While the results of SLT are comparable to whole organ transplantation, surgeons rarely employ this technique for a variety of reasons. Significant obstacles to the widespread application of SLT exist and the transplant community must resolve these obstacles before greater utilization can be realized². The major obstacle is the experience and skill of the surgeon. Although splitting a liver maximizes the number of patients receiving an organ transplant, it may increase the morbidity and mortality for the individual patient who receives the split liver.

¹ Kim JS, Broering DC, Tustas RY, Fischer L, Ganschow R, Burdelski M, Rogiers X. Split liver transplantation: past, present and future. *Pediatr Transplant*. 2004 Dec;8(6):644-8.

² Renz JF, Yersiz H, Reichert PR, Hisatake GM, Farmer DG, Emond JC, Busuttil RW. Split-liver transplantation: a review. *Am J Transplant*. 2003 Nov;3(11):1323-35.

Because split liver transplantation is so technically challenging, and because they are responsible for the lives of their transplant patients, surgeons typically wish to perform the surgery themselves. However, the current OPTN/UNOS allocation requires that a split liver must be offered sequentially down the combined OPO-wide liver match run, rather than just to the center that performs the split. This policy therefore poses another major obstacle to splitting. When the match run sequence requires that the left lobe or left lateral segment must be offered to another center, surgeons will often abandon the split. Transplant centers often do not see the benefit of increasing the risk of morbidity for the right lobe recipient, when the remaining liver segment is sent to another center. Thus, the current incentive, both in terms of workload and potential outcome for the patient, is for the surgeon to accept the entire liver for a single patient when the offer is made.

Region 2 wants to increase liver availability and ensure the best outcome in graft survival. They hope to do this by allowing the surgeon to split appropriate livers, transplanting the right lobe in the index patient at their center, and using the left lateral segment (that the surgeon is already familiar with since he/she split the graft) in another medically suitable candidate at the same center (or affiliated pediatric center).

The Region 2 programs estimate that no more than 10 percent of its liver donors might be used for these types of splits because the variance does not affect the current sharing system of whole liver transplants when needed and appropriate. Nationally, it is estimated that split liver transplantation technique including the pediatric splits, although attractive, will apply to less than 25 % of the donors.³

Advantages of the Proposed AAS

SLT was developed because of organ scarcity and an increased number of deaths on the waiting list. The gap between organ supply and recipient demand has never been greater. This has renewed interest in increasing the application of traditional adult/pediatric SLT and performance of adult/adult SLT.²

This AAS will allow for more transplants since to a single liver will be divided into two segments for transplantation; removing two patients from the waiting list instead of one. Without the AAS, these grafts would likely be transplanted into a single adult as a whole organ transplant.

Process for AAS Approval

Policy 3.4.8.1 (Application) states that “Applications to allocate organs using alternative point assignment systems or to distribute organs using sharing arrangements or ALUs are submitted to the appropriate organ-specific committees for consideration before being issued for public comment according to processes for public comment. Such applications are then reconsidered by the relevant Committee in light of public comment. Final applications to allocate organs locally using alternative point assignments or to distribute organs using sharing arrangements or ALUs must be presented to and approved by the Board of Directors before they can be implemented or used in organ allocation/distribution.”⁴

In November 2009, the Liver and Intestinal Organ Transplantation Committee approved circulating this AAS for public comment, citing the Final Rule’s requirement that allocation policies “shall seek to

³ Liver transplantation in adults. Durand F, Belghiti J. Med Sci (Paris). 2005 Jan;21(1):89-94.

⁴ http://optn.transplant.hrsa.gov/PoliciesandBylaws2/policies/pdfs/policy_8.pdf

achieve the best use of donated organs.”⁵ During a subsequent call in February 2010, Committee members raised several concerns about the potential lack of transparency in the acceptance process, and suggested that the AAS review should include information about which candidates are bypassed in the split liver allocation. Others were concerned about the degree of informed consent required for a candidate to understand that he/she is being offered a whole liver, but is being asked to accept only part of the liver in order to benefit another patient (i.e., a child) on the list. Committee members felt that the index patient should receive the liver even if the final decision is to keep the whole liver. Ultimately, the Committee still agreed that the proposal should be circulated for public comment, with these concerns noted. The Policy Oversight Committee also reviewed the AAS proposal and approved its distribution for public comment.

Policy 3.4.8.1 also states that “In cases where unanimity cannot be achieved at the local level, applications to allocate organs using either an alternative point assignment system, sharing agreement or ALU must have approval of 75% of the Member OPOs and or transplant centers.” In this case, 18 of 23 of the potential participants (78%) are in agreement with the AAS.

Supporting Evidence and/or Modeling:

Research shows that outcomes for recipients of split liver grafts for pediatric/adult splits are similar to that of whole liver transplantation.⁶ Adult/adult SLT is showing promising results as well. Individual center data on adult/adult SLT are summarized in the table below. The Paul Brousse group has reported the largest series on adult/adult SLT⁷. In 1996, Bismuth reported 1- year patient and graft survival of 79% and 78%, respectively, on 27 SLT grafts, with the routine application of *ex vivo* SLT increasing overall graft availability at their center by 28%.⁸ A later series comparing 1- and 2-year SLT patient and graft survival to adults receiving deceased donor whole-organ transplantation over the same time period demonstrated right- and left-SLT graft 1-year recipient survival of 74% and 88% respectively, with 1-year graft survival of 74% for right-SLT vs. 75% for left-SLT recipients.

Expected Impact on Program Goals, Strategic Plan, and Adherence to OPTN Final Rule:

This AAS is intended to achieve the best use of donated organs, achieve equitable organ allocation, and maximize the number of donors and transplants. The AAS will increase the donor pool by encouraging a transplant center that receives a liver offer to split the liver and use it in two adult recipients or an adult and a child, rather than using the entire organ in one recipient.

⁵ 42 CFR Part 121, see http://optn.transplant.hrsa.gov/policiesAndBylaws/final_rule.asp

⁶ Azoulay D, Astarcioglu I, Bismuth H et al. Split-liver transplantation. The Paul Brousse policy. *Ann Surg* 1996; 224: 737-746; discussion 746-748.

⁷ Azoulay D, Marin-Hargreaves G, Castaing D, Bismuth H. Ex situ splitting of the liver: the versatile Paul Brousse technique. *Arch Surg* 2001; 136: 956-961.

⁸ Azoulay D, Castaing D, Adam R et al. Split-liver transplantation for two adult recipients: feasibility and long-term outcomes. *Ann Surg* 2001; 233: 565-574.

**Table 1
Adult/Adult Split-Liver Transplantation²**

Center	Author	Year	N	Recipient Survival	Graft Survival	Comp
Ulsan ⁹	Hwang	2004	2	100%	100%	N/A
Minneapolis ¹⁰	Humar	2001	18	89%	89%	43%
Villejuif ⁵	Azoulay	2001	34	81%	75%	24%
Minneapolis ¹¹	Humar	2001	12	83%	83%	58%
Hamburg ¹²	Broering	2001	12	93%	85%	N/A
Genoa ¹³	Andorno	2001	10	100%	80%	N/A
Bergamo ¹⁴	Colledan	2000	8	87%	63%	75%
Eppendorf ¹⁵	Gundlach	2000	4	100%	100%	N/A
Villejuif ⁴	Azoulay	1996	27	79%	78%	37%

Comp = overall complication rate

N/A = data not reported

Expected Impact on organ allocation and waiting times for transplant candidates waiting times

The potential impact is not known, but the AAS is not expected to make a difference in waiting times for any specific blood type. Overall, all waiting times would be expected to decrease if more people are transplanted. Region 2 liver programs will reassess the program after 12 months in order to see if waiting times of any particular blood group were adversely affected.

Expected Impact on organ allocation and waiting times among the various categories of medical urgency

The AAS will potentially reduce waiting times for patients overall because the liver pool would be expanded by splitting livers that otherwise would not be split.

Expected Impact on organ allocation and waiting times for transplant candidates who are pediatric, female or represent racial minorities

⁹ Hwang S, Lee SG, Park KM, Kim KH, Ahn CS, Moon DB, Ha TY. A case report of split liver transplantation for two adult recipients in Korea. Division of Hepatopancreatobiliary Surgery and Liver Transplantation, Department of Surgery, Asan Medical Center, Ulsan University College of Medicine, Seoul 138-736, Korea. *Transplant Proc.* 2004 Nov;36(9):2736-40.

¹⁰ Humar A, Kandaswamy R, Sielaff T, Gruessner RW, Knaak M, Lake JR. Split-liver transplants for 2 adult recipients: an initial experience, American Transplant Congress, Transplant 2001, Chicago, IL, May 12-16, 2001.

¹¹ Humar A, Ramcharan T, Sielaff T et al. Split liver transplantation for two adult recipients: an initial experience. *Am J Transplant* 2001; 1: 366-372.

¹² Broering D, Gundlach M, Topp S, Mueller L, Rogiers X, In-situ full-right-full left splitting: the ultimate expansion of the adult donor pool, *Transplant* 2001, Chicago, IL. May 12-16, 2001.

¹³ Andorno E, Genzone A, Morelli N et al. On liver for two adults: in-situ split liver transplantation for two adult recipients. *Transplant Proc* 2001; 33: 1420-1422.

¹⁴ Colledan M, Broering D, Topp S, Sterneck M, Rogiers X. Split-cava technique: liver splitting for two adult recipients. *Liver Transpl* 2000; 6: 703-706.

¹⁵ Gundlach M, Broering D, Topp S, Sterneck M, Rogiers X. Split-cava technique: liver splitting for two adult recipients. *Liver Transpl* 2000;6: 703-706.

The AAS should not adversely affect any transplant candidates who are pediatric, female or represent racial minorities. The proposal will likely increase access for pediatric candidates and decrease their waiting times.

Plan for Evaluating the Proposal:

The Region will review the results after the first 10 splits. The cases will be reviewed at the next standing Region 2 meeting once the AAS is approved. However, if the retransplant rate exceeds 5 of the 20 grafts before the regional meeting, an automatic hold will be placed on the procedure until the results and surgical practices can be reviewed.

Additional Data Collection:

This proposal does not require additional data collection.

Expected Implementation Plan:

This proposal will not require programming in UNetSM.

Communication and Education Plan:

If approved, this AAS will be communicated to the liver transplant programs and OPOs in Region 2 through the consolidated policy notice that is distributed after each Board meeting.

Monitoring and Evaluation:

The Department of Evaluation and Quality Allocation (DEQ) Analysis staff will monitor each allocation to ensure the available liver was allocated according to approved AAS guidelines. If a member institution doesn't follow the outlined guidelines of the AAS, the DEQ may ask them to clarify allocation details. If DEQ staff identify a potential violation of OPTN/UNOS policies or bylaws, they will forward all related information to the Membership and Professional Standards Committee for review and due process.

Proposal:

If a transplant center in Region 2 accepts a liver for a candidate that is suitable for a segmental transplantation, the center shall be allowed to transplant a lobe into that institution's index patient and the other lobe into any other medically suitable listed patient at that institution or an affiliated pediatric institution. This AAS will only apply when the index patient will receive the right lobe of the liver. If the index patient is to receive the left lateral segment of the liver, then the right lobe of the liver will be allocated as per policy 3.6.11

- (i) in sequence, as determined by the deceased donor liver allocation algorithm set forth in Policy 3.6 (Allocation of Livers) and defining "local" based upon the Host OPO's local area, to the highest-ranking candidate on the waiting list of candidates; provided, however, that the Host OPO places the liver segment(s) by the time the donor organ procurement procedure has started, or

- (ii) into candidates listed with the recipient program or any medically appropriate candidate on the Waiting List, if, after reasonable attempts by the Host OPO to place the remaining portion(s) of the donor liver, the liver segment(s) is not placed by the time the donor organ procurement procedure has started.