Simultaneous Heart and Kidney Transplantation for LVAD-supported Patients With Chronic Kidney Disease?

Sumita Barua, MBBS,[1,2,3] Christopher S. Hayward, MD,[1,2,3,4] and Peter S. Macdonald, MD, PhD[1,2,3]

Renal dysfunction is a well-established risk factor for heart transplant mortality, for which simultaneous heart kidney transplantation (SHKT) has been widely adopted. Current consensus recommends consideration for SHKT based on an estimated glomerular filtration rate (eGFR) <30 mL/min/1.73 m^2, or presence of additional risk factors such as small kidney size or proteinuria in those with higher eGFR.[1] There is graduated benefit based on the degree of renal dysfunction, with superior survival in patients requiring pretransplant dialysis proceeding to SHKT (median 12.4 y), compared with their heart alone transplant (HAT) counterparts (median 9.9 y).[2] As a consequence, SHKT numbers have increased exponentially, with a 650% increase in activity over the 20-y period from 2000 to 2019.[2] Organ availability will inevitably limit this ongoing increase, as SHKT diverts available organs away from patients with end-stage kidney disease. Moreover, a recent retrospective analysis of the UNOS Registry found that many patients who met the consensus guideline for SHKT had excellent posttransplant outcomes after HAT.[3] This is of particular importance as the OPTN/SRTR 2020 annual data reports for transplantation described median time to heart transplant of 2.7 mo, whereas the median has not been calculable in kidney transplants since 2009 as <50% of each year's cohort has undergone transplant.[4,5]

Received 13 July 2023. Revision received 20 July 2023.

Accepted 21 July 2023.

[1] Heart Lung Transplant Unit, St. Vincent's Hospital Sydney, Darlinghurst, NSW, Australia.

[2] School of Medicine, St. Vincent's Clinical School, University of New South Wales, Kensington, NSW, Australia.

[3] Victor Chang Cardiac Research Institute, Darlinghurst, NSW, Australia.

[4] Faculty of Health, University of Technology Sydney, Sydney, NSW, Australia.

S.B. wrote the first draft of the commentary. C.S.H. reviewed the accepted article by Fraser et al (reference 9 in the commentary) and then helped to revise the draft commentary prepared by S.B. P.M. undertook further revision of the commentary. All three authors then agreed with the final submitted version of the article.

P.S.M. has received "in kind" support from Transmedics and XVIVO through provision of research modules for preclinical research on donor heart preservation. The other authors declare no conflicts of interest.

Correspondence: Peter S. Macdonald, MD, PhD, St. Vincent's Hospital Sydney, Level 4, Xavier Building, 390 Victoria St, Darlinghurst, NSW 2010, Australia. (peter.macdonald@svha.org.au).

ISSN: 0041-1337/20/1082-331

DOI: 10.1097/TP.0000000000004782

In 2018, there was a change to the heart allocation policy (HAP) in the United States, aimed at reducing waitlist times for the highest priority patients and reducing waitlist mortality. Under the new HAP, patients on temporary mechanical circulatory support are given the highest priority, whereas patients supported with durable left ventricular assist device (LVAD) in the absence of complications are listed at status 4. Overall, the waitlist time has decreased from 112 to 39 d.[6] Even among durable LVAD patients, median waitlist has decreased from 140 to 37 d, with the important caveat that the majority of transplanted patients belonged to higher status categories, indicating they had already experienced complications.[6] Stable status 4 LVAD patients had a lower incidence of transplantation at 360 d.[6] UNOS registry analysis suggests no difference in waitlist survival in bridge to transplant (BTT) LVAD patients since the new HAP; however, 1-y posttransplantation survival appears worse (91.7% old era versus 83.4% new era, log-rank $P < 0.001$).[7]

Outcomes in patients supported with durable LVAD proceeding to SHKT also appear less promising since the change in HAP. In a recent UNOS analysis of BTT LVAD patients with stage 3 or higher chronic kidney disease (CKD), survival at 1 y was 80.3% following SHKT, compared with 88.3% following HAT, with this difference persisting out to 5 y (65.5% versus 75.7%, respectively).[8] Among LVAD patients receiving pretransplant dialysis, 1-y survival was reported as unacceptably low for both HAT and SHKT (82.6% for HAT and 76.3% for SHKT).[8]

In this issue of *Transplantation*, Fraser et al have further analyzed the UNOS registry to describe the discrepant outcomes in LVAD patients proceeding to SHKT compared with HAT, with a specific focus upon differences in posttransplant outcomes following the new HAP in 2018.[9] They compared outcomes following SHKT before and after the HAP change, as well as SHKT compared with HAT for each era. Their analysis highlights the evolution in practice, with SHKT constituting 13.6% of transplants following the new HAP, compared with only 0.03% prior. Patients in the new era proceeding to SHKT appeared to have higher eGFR and were less likely to be on dialysis. However, the authors highlight these patients may have been sicker than their historic counterparts, with more frequent requirement for intensive care unit admission prior to transplant. The salient finding is of worse 1-y survival in SHKT patients following the change in HAP. Furthermore, they noted a difference in survival between SHKT and HAT following the policy change, a difference that was not apparent under the old HAP.

Postulated reasons for era-based differences in SHKT survival are the lower waitlist status for clinically stable LVAD patients, with higher priority only applied once patients had experienced life-threatening complications. These complications increase the risk of life-threatening complications such as vasoplegia and massive blood loss in the immediate posttransplant period.[10] An unintended consequence of the change in HAP is increased ischemic time and travel distances for donor hearts, potentially increasing the risk of severe primary graft dysfunction.[7] This risk could be mitigated by oxygenated machine perfusion of donor hearts, which reduces ischemic time and importantly allows the surgeon more time to explant the recipient heart and ensure hemostasis before implantation of the donor heart.[11]

Another important consideration is whether changes in practice with wider adoption of SHKT is resulting in more comorbid patients proceeding to dual organ transplantation. Posttransplant dialysis data were not reported in the present study, which may be important, as severe acute kidney injury with requirement for dialysis has historically favored survival in SHKT compared with HAT patients.[2] It is also unclear whether the short-term difference in survival continues beyond the first year, although the early separation in survival curves with parallel trajectory, in conjunction with previous data published by Atkin et al suggests that it does.[8]

There appears to be a clear and alarming signal for increased mortality following SHKT in durable LVAD recipients with CKD, possibly related to the change in HAP, resulting in rapid transplantation of patients with major LVAD-related complications and delayed transplantation of clinically stable LVAD-supported patients. If ongoing analysis suggests the change in HAP has negatively impacted the posttransplant survival of BTT LVAD patients with or without CKD, efforts to better risk stratify and reprioritize these patients will be necessary to reverse this trajectory. One potential alternative approach for urgently listed LVAD patients with CKD is kidney after heart transplantation with a safety net as proposed in the recently published American Heart Association Scientific Statement on dual organ transplantation.[12] Better identification of adverse prognostic factors in LVAD-supported patients with CKD and better preservation of donor organs are key.

REFERENCES

1. Kobashigawa J, Dadhania DM, Farr M, et al; Consensus Conference Participants. Consensus conference on heart-kidney transplantation. *Am J Transplant*. 2021;21:2459–2467.
2. Agarwal KA, Patel H, Agrawal N, et al. Cardiac outcomes in isolated heart and simultaneous kidney and heart transplants in the United States. *Kidney Inter Reports*. 2021;6:2348–2357.
3. Kumar A, Bonnell LN, Thomas CP. Severely reduced kidney function assessed by a single eGFR determination at the time of an isolated heart transplant does not predict inevitable posttransplant ESKD. *Transplantation*. 2023;107:981–987.
4. Colvin M, Smith JM, Ahn Y, et al. OPTN/SRTR 2020 annual data report: heart. *Am J Transplant*. 2022;22:350–437.
5. Lentine KL, Smith JM, Hart A, et al. OPTN/SRTR 2020 annual data report: kidney. *Am J Transplant*. 2022;22(Suppl 2):21–136.
6. Maitra Neil S, Dugger Samuel J, Balachandran Isabel C, et al. Impact of the 2018 UNOS heart transplant policy changes on patient outcomes. *JACC: Heart Failure*. 2023;11:491–503.
7. Mullan Clancy W, Chouairi F, Sen S, et al. Changes in use of left ventricular assist devices as bridge to transplantation with new heart allocation policy. *JACC: Heart Failure*. 2021;9:420–429.
8. Atkins J, Hess NR, Fu S, et al. Outcomes in patients with LVADs undergoing simultaneous heart-kidney transplantation. *J Card Fail*. 2022;28:1584–1592.
9. Fraser M, Agadamag AC, Riad S, et al. Survival after simultaneous heart-kidney transplant in recipients with a durable LVAD and chronic kidney disease: effect of the 2018 heart allocation policy change. *Transplantation*. 2024;108:524–529.
10. Asleh R, Alnsasra H, Daly RC, et al. Predictors and clinical outcomes of vasoplegia in patients bridged to heart transplantation with continuous-flow left ventricular assist devices. *J Am Heart Assoc*. 2019;8:e013108.
11. Chew HC, Macdonald PS, Dhital KK. The donor heart and organ perfusion technology. *J Thorac Dis*. 2019;11(Suppl 6):S938–S945.
12. Kittleson MM, Sharma KS, Brennan DC, et al. Dual-organ transplantation: indications, evaluation, and outcomes for heart-kidney and heart-liver transplantation: a scientific statement from the American Heart Association. *Circulation*. 2023;148:622–663.