
doi: 10.21037/acs-2024-dcd-0065

**Cite this article as:** Schumer EM, Slaughter MS. The cardiac surgeon perspective—cardiac transplantation following donation after circulatory death: expanding the donor pool. Ann Cardiothorac Surg 2024. doi: 10.21037/acs-2024-dcd-0065

Editorial

# The cardiac surgeon perspective—cardiac transplantation following donation after circulatory death: expanding the donor pool

**Erin M. Schumer, Mark S. Slaughter**

Department of Cardiovascular and Thoracic Surgery, University of Louisville, Louisville, KY, USA

*Correspondence to:* Mark S. Slaughter, MD. Department of Cardiovascular and Thoracic Surgery, University of Louisville, 201 Abraham Flexner Way, Suite 1200, Louisville, KY 40202, USA. Email: mark.slaughter@louisville.edu.

**Keywords:** Heart transplant; donation after circulatory death (DCD); cardiac transplantation

Submitted Apr 26, 2024. Accepted for publication May 07, 2024. Published online Jul 09, 2024.
doi: 10.21037/acs-2024-dcd-0065
**View this article at:** https://dx.doi.org/10.21037/acs-2024-dcd-0065

The number of heart transplants performed in the United States annually continues to increase, reaching over 4,000 in 2022. This increase was mostly driven by the 68% increase in the use of donation after circulatory death (DCD) donors with a smaller increase of 4.6% in donation after brain death (DBD) donors (1). Some of this increase is also related to liberalization of qualifications of potential recipients, such as increased age and comorbidities that were previously prohibitive [human immunodeficiency virus (HIV), hepatitis C] but now are treatable. Meanwhile, implantations of durable left ventricular assist devices (LVADs) continue to decline (1,2). Altogether, despite increases in heart transplantation, the current incidence of surgical treatment of end-stage heart failure does not meet the need of patients suffering from advanced heart failure.

While DCD donor use is becoming more prevalent, several limitations limit widespread adoption and standardization. First, the method of procurement is essentially evolving into two camps: (I) normothermic regional perfusion (NRP) and (II) direct procurement and perfusion (DPP). At the current time, no difference in outcomes has been demonstrated between these two methods (3). DPP currently requires use of the Organ Care System (OCS) Heart (Transmedics, Inc., Andover, MA, USA), a portable, normothermic perfusion device, which is currently the only U.S. Food and Drug Administration (FDA) approved extracorporeal perfusion device. In the prospective, randomized EXPAND trial, there was no significant difference in 1-year survival between DCD donors using the OCS Heart, and DBD donors preserved with traditional cold storage (4). Currently, the OCS Heart can no longer be bought by individual programs, and TransMedics, Inc. has developed their own procurement company, the National OCS Program, that must be utilized in order to use the OCS Heart system. While this does offer some advantages including reduced use of an institution's own personnel, programs have to give up control of the procurement to an unknown entity, and the cost may be prohibitive to small and medium volume programs. NRP, on the other hand, requires more personnel resources from one's own institution, which again may be difficult for small to medium size programs, but keeps control of the procurement with the implanting team and is less costly than DPP. An additional advantage of NRP is the ability to assess the donor heart in real time rather than relying solely on lactate measurements from the OCS technology.

Recent advancements in cold storage technology have also bolstered outcomes with DCD heart transplant. The SherpaPak Cardiac Transport System (Paragonix Technologies, Inc., Waltham, MA, USA) has demonstrated a decreased incidence of primary graft dysfunction (PGD) (5) and reduced use of post-transplant mechanical circulatory support (6) compared to traditional ice cold storage, which has emboldened programs to push the

limits of distance that they are willing to travel. The longest reported ischemic time currently is 7.5 hours with a distance of over 2,500 nautical miles in a DBD donor (7). A recent subanalysis of the GUARDIAN heart registry has also demonstrated that use of the SherpaPak for extended criteria DBD hearts reduced PGD rates with lower use of post-transplant mechanical circulatory support (8). These results could potentially be extrapolated to DCD, but further analysis and data acquisition will be required to determine the benefits of the SherpaPak in conjunction with DCD donor hearts. Another new preservation system is the XVIVO Heart Assist Transport (XHAT) system that has the potential to extend ischemic time even further. This technology utilizes an *ex vivo*, hypothermic perfusion system for the heart that has so far demonstrated acceptable post-transplant outcomes with ischemic times beyond 10 hours (9). The XHAT trial was recently approved by the U.S. Federal Drug Administration to include DCD heart transplants, and patient accrual is ongoing for the clinical trial, "Prospective, Multi-center, Single-Arm, Open-Label Study of Hearts Transplanted after Non-Ischemic Heart PRESERVation from Extended Donors". This device has the potential to supplant other perfusing preservation devices, but we will need to wait for the results of the trial.

In summary, the use of DCD donors for heart transplant continues to grow but much is still to be determined in relation to best methods and mid to long term outcomes. What is clear is that heart transplant programs will need to use DCD hearts to stay relevant in the current era of heart transplantation. As more DCD heart transplants are performed and with the addition of new centers utilizing DCD donors, it is imperative that we are transparent about our methods and outcomes in order to provide heart transplant patients with the best possible outcome. More experience and ongoing analysis of the current clinical outcomes will help determine the specific direction that DCD heart transplant takes in the United States.

## Acknowledgments

*Funding:* None.

## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.



## References

1. United Network for Organ Sharing. Another record year for heart transplants: Steep increases seen in DCD transplants in 2022. UNOS 2023. Accessed March 22, 2024. Available online: https://unos.org/news/in-focus/2022-heart-transplants-steep-increases-in-transplants-from-dcd-donors/
2. Morris AA, Khazanie P, Drazner MH, et al. Guidance for Timely and Appropriate Referral of Patients With Advanced Heart Failure: A Scientific Statement From the American Heart Association. Circulation 2021;144:e238-50.
3. Kwon JH, Ghannam AD, Shorbaji K, et al. Early Outcomes of Heart Transplantation Using Donation After Circulatory Death Donors in the United States. Circ Heart Fail 2022;15:e009844.
4. Schroder JN, Shah A, Pretorius V, et al. Expanding Heart Transplants from Donors After Circulatory Death (DCD) - Results of the First Randomized Controlled Trial Using the Organ Care System (OCS™) Heart - (OCS DCD Heart Trial). J Heart Lung Transplant 2022;41:S72.
5. Shudo Y, Leacche M, Copeland H, et al. A Paradigm Shift in Heart Preservation: Improved Post-transplant Outcomes in Recipients of Donor Hearts Preserved With the SherpaPak System. ASAIO J 2023;69:993-1000.
6. Baer J, Malhotra A, Dalia T, et al. (396) Sherpapak Reduces Mcs Use Post Heart Transplant in Long Donor Down and Ischemic Times. J Heart Lung Transplant 2023;42:S187.
7. Paragonix Technologies. Record-breaking Donor Heart Transplant Utilizing the Paragonix SherpaPak. 2023. Accessed April 20, 2024. Available online: https://www.paragonixtechnologies.com/news/record-breaking-donor-heart-transplant-utilizing-the-paragonix-sherpapak

8. Moayedifar R, Shudo Y, Kawabori M, et al. Recipient Outcomes With Extended Criteria Donors Using Advanced Heart Preservation: An Analysis of the GUARDIAN-Heart Registry. J Heart Lung Transplant 2024;43:673-80.
9. Lebreton G, Leprince P. Successful heart transplant after 12 h preservation aboard a commercial flight. Lancet 2024;403:1019.

**Cite this article as:** Schumer EM, Slaughter MS. The cardiac surgeon perspective—cardiac transplantation following donation after circulatory death: expanding the donor pool. Ann Cardiothorac Surg 2024. doi: 10.21037/acs-2024-dcd-0065



 