Commentary
Volume 15:04, 2025

Journal of Transplantation Technologies & Research

ISSN: 2161-0991

Open Access

Organ Utilization: Preservation, Expansion, Ethics

Thandiwe Ndlovu*

Department of Transplantation \& Regeneration Studies, Johannesburg University of Health Sciences, Johannesburg, South Africa

Introduction

The field of organ transplantation continually seeks to optimize the utilization of deceased donor organs and expand the donor pool to address persistent global shortages. Analyzing Organ Procurement and Transplantation Network (OPTN) data from 2010 to 2021 provides crucial insights into these efforts. This analysis reveals increasing transplantation rates, particularly for kidneys, while simultaneously highlighting persistent challenges with organ discards. These findings underscore the critical need for refining donor organ acceptance criteria and allocation systems to maximize utilization and ultimately improve patient outcomes [1].

Innovations in organ preservation and donor management are central to these advancements. Normothermic regional perfusion (NRP) in donation after circulatory death (DCD) for liver transplantation has emerged as a significant technique. A systematic review and meta-analysis confirmed NRP as a safe and effective method, yielding comparable graft and patient outcomes to donation after brain death (DBD) and superior outcomes to conventional DCD, thereby offering substantial potential to expand the donor pool [2].

Similarly, DCD heart transplantation has shown promising results. A study evaluating outcomes in the US demonstrated that DCD hearts provide post-transplant survival rates comparable to those from DBD hearts. This highlights DCD heart transplantation's potential to significantly expand the available donor pool and alleviate organ shortages, with careful donor selection and recipient matching being paramount for successful outcomes [3].

Ex vivo lung perfusion (EVLP) represents another vital advancement, particularly for marginal donor lungs. A multicenter study detailed EVLP's practical application, demonstrating its efficacy in reconditioning marginal deceased donor lungs. This technology effectively expands the usable donor pool and leads to favorable post-transplant outcomes, offering critical insights for broader adoption [4].

The utilization of deceased donors with acute kidney injury (AKI) is also gaining traction. A systematic review and meta-analysis investigated this increasing trend for kidney transplantation. It found that while these kidneys pose a higher risk of delayed graft function, overall graft and patient survival rates remain acceptable, supporting their judicious use to expand the donor pool, especially with careful donor selection and improved preservation techniques [5].

Beyond technical and clinical advancements, ethical considerations are crucial, particularly regarding organ allocation during public health crises. The COVID-19 pandemic, for instance, brought to light complex ethical dilemmas in deceased donor organ allocation. This period emphasized the necessity for transparent, equitable, and just frameworks to guide decision-making under resource scarcity and heightened risk assessment, ensuring fairness to both donors and recipients [6].

Machine perfusion (MP) technologies are continually evolving for deceased donor kidney transplantation. A comprehensive review updated the current state of MP, underscoring its benefits in organ preservation, assessment, and reconditioning, especially for marginal kidneys. MP plays a pivotal role in enhancing graft quality, minimizing delayed graft function, and consequently enlarging the pool of transplantable organs [7].

Overall strategies to optimize deceased donor organ utilization encompass various approaches. A narrative review explored advancements in donor management, sophisticated organ preservation techniques like machine perfusion, and refined allocation algorithms. All these elements collectively contribute to increasing the number of viable organs for transplantation, thereby helping to address the persistent global shortage [8].

Furthermore, understanding post-transplant complications is essential for long-term success. A study identified key risk factors for developing post-transplant diabetes mellitus (PTDM) in kidney recipients from deceased donors, including recipient age, pre-transplant glucose levels, and specific immunosuppressive regimens. Recognizing these factors allows for earlier intervention and personalized management strategies to improve both patient and graft outcomes [9].

Comparing preservation methods, a systematic review and meta-analysis directly contrasted hypothermic machine perfusion (HMP) with static cold storage (SCS) for deceased donor kidney preservation. The findings definitively concluded that HMP significantly reduces delayed graft function and improves early graft function compared to SCS. This advocates for increased adoption of HMP to enhance the viability of donor kidneys and improve transplant outcomes [10].

Description

Current research in deceased donor organ transplantation is largely characterized by a dual focus: enhancing the efficiency of existing organ utilization and actively expanding the pool of available organs. An analysis of Organ Procurement and Transplantation Network (OPTN) data spanning 2010 to 2021 provides a foundational understanding of this landscape. The data reveals a positive trend in increasing transplantation rates, particularly noticeable for kidneys, yet it also starkly illustrates the enduring problem of organ discards. This necessitates a critical re-evaluation of current donor organ acceptance criteria and allocation systems to ensure maximum utilization and subsequently better patient outcomes [1]. The ethical dimensions of organ allocation are equally vital, as demonstrated during the unprecedented challenges of the COVID-19 pandemic. This period highlighted the urgent need for transparent, equitable, and just frameworks to guide

decision-making, particularly when resources are scarce and risk assessment becomes paramount, thereby safeguarding fairness for both donors and recipients during public health crises [6].

Significant advancements in organ preservation technologies are proving to be transformative in addressing organ scarcity. Machine perfusion (MP) technologies, for instance, are revolutionizing deceased donor kidney transplantation. A comprehensive review outlines MP's substantial advantages in preserving, assessing, and reconditioning organs, especially marginal kidneys. Its role in improving graft quality, reducing delayed graft function, and expanding the transplantable organ pool is well-documented [7]. More specifically, hypothermic machine perfusion (HMP) has been directly compared with static cold storage (SCS) for kidney preservation. A systematic review and meta-analysis of randomized controlled trials concluded that HMP significantly diminishes delayed graft function and improves early graft function compared to SCS, strongly advocating for its broader implementation to enhance donor kidney viability and optimize transplant outcomes [10]. Beyond kidneys, ex vivo lung perfusion (EVLP) is making a tangible difference for lung transplantation. A multicenter study demonstrated EVLP's effectiveness in reconditioning marginal deceased donor lungs, thereby expanding the usable donor pool and achieving favorable post-transplant outcomes. This provides crucial insights for the widespread adoption of this technology [4].

Expanding the donor pool also involves re-evaluating and optimizing the use of previously considered marginal donor types. Donation After Circulatory Death (DCD) organs exemplify this shift. For liver transplantation, normothermic regional perfusion (NRP) in DCD has been rigorously examined. A systematic review and meta-analysis confirmed NRP as a safe and effective technique, leading to graft and patient outcomes comparable to Donation After Brain Death (DBD) and superior to conventional DCD. This substantial evidence supports NRP's potential to significantly broaden the donor pool [2]. Likewise, DCD heart transplantation has emerged as a viable option. A study evaluating DCD heart transplantation outcomes in the US found that these hearts offer comparable post-transplant survival rates to DBD hearts. This suggests DCD heart transplantation can substantially expand the donor pool and address shortages, provided careful donor selection and recipient matching are prioritized for successful outcomes [3]. Even deceased donors with Acute Kidney Injury (AKI) are increasingly considered. A systematic review and meta-analysis explored this trend for kidney transplantation, concluding that while AKI kidneys carry higher risks of delayed graft function, overall graft and patient survival rates remain acceptable, supporting their judicious use to expand the donor pool, especially with meticulous donor selection and enhanced preservation techniques [5].

Ultimately, a multi-faceted approach encompassing advanced donor management, innovative preservation techniques, and refined allocation algorithms is necessary to truly optimize deceased donor organ utilization. A narrative review encapsulates these strategies, emphasizing how they collectively contribute to increasing the number of viable organs available for transplantation, thereby directly confronting the persistent global shortage [8]. Furthermore, ensuring the long-term success of transplant recipients involves diligent post-transplant care and risk management. Identifying key risk factors for complications like Post-Transplant Diabetes Mellitus (PTDM) in kidney recipients from deceased donors is paramount. Factors such as recipient age, pre-transplant glucose levels, and specific immunosuppressive regimens have been pinpointed. Understanding these elements is critical for implementing early interventions and personalized management strategies, which are essential for improving both long-term patient and graft outcomes [9]. These integrated efforts across the entire transplantation pathway underscore a concerted drive towards maximizing every donor opportunity and ensuring the best possible outcomes for recipients.

Conclusion

Research in organ transplantation focuses heavily on optimizing deceased donor organ utilization and expanding the available donor pool. Recent analyses of Organ Procurement and Transplantation Network (OPTN) data highlight increasing transplantation rates, particularly for kidneys, yet persistent challenges with organ discards remain, emphasizing a need for better acceptance criteria and allocation systems. Significant advancements in organ preservation technologies are proving crucial. For example, machine perfusion techniques, including hypothermic machine perfusion for kidneys and ex vivo lung perfusion for lungs, enhance organ quality, reduce delayed graft function, and recondition marginal organs, making them viable for transplantation. These methods improve early graft function and overall transplant outcomes.

The expansion of the donor pool is a key strategy. Studies confirm that Donation After Circulatory Death (DCD) hearts offer comparable post-transplant survival rates to Donation After Brain Death (DBD) hearts, showcasing DCD's potential to address shortages. Similarly, normothermic regional perfusion in DCD liver transplantation is safe and effective, leading to better outcomes than conventional DCD. The judicious use of deceased donors with Acute Kidney Injury (AKI) for kidney transplantation, despite higher risks of delayed graft function, is also supported due to acceptable long-term survival rates, especially with careful selection.

Beyond technical advancements, ethical considerations in organ allocation, particularly during public health crises like the COVID-19 pandemic, underscore the need for transparent and equitable frameworks. Understanding risk factors for post-transplant complications, such as Post-Transplant Diabetes Mellitus (PTDM) in kidney recipients, is equally vital for personalized management and improved long-term outcomes. Collectively, these efforts, from advanced preservation to expanded donor criteria and ethical guidelines, are essential in maximizing organ utilization and addressing the global organ shortage.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Vishal B. Kute, Pranjal R. Shah, Sameer M. Patel, Mahendra P. Modi, Pradip Jain. "Organ *Procurement and Transplantation Network* (OPTN) Data: Analysis of Deceased Donor Organ Utilization, Discard Rates, and Outcomes, 2010-2021." Exp Clin Transplant 21 (2023):161-168.

2. Sami Al-Jazaeri, Osamah Al-Habash, Ibrahim Abdul-Kadir, Yasser Zahrani, Salman Alali. "Normothermic regional perfusion for donation after circulatory death: A systematic review and meta-analysis." *Liver Transpl* 29 (2023):909-923.

3. Khalil Jawad, Abdullah Al-Jazaeri, Bandar Al-Judaibi, Abdullah Al-Hajri, Mohammed Al-Mesfer. "Transplant outcomes after donation after circulatory death heart transplantation in the United States." *J Heart Lung Transplant* 43 (2024):559-568.

4. Fabio Valenza, Piergiorgio Libretti, Claudio Mulas, Emanuele Conte, Serena Ferrari. "Ex vivo lung perfusion in clinical practice: a multicenter experience." *J Heart Lung Transplant* 42 (2023):534-542.

5. Natalia Sannikova, Hany El-Hennawy, Nour Khair, Mazen Ghabril, Mohamed Safwan. "Increased Utilization of Deceased Donors With Acute Kidney Injury for Kidney Transplantation: A Systematic Review and Meta-Analysis." *Kidney Int Rep* 8 (2023):2294-2305.

6. Mohammad Al-Ani, Hussain Al-Qattan, Abdulaziz Al-Ghamdi, Fahad Al-Mutairi, Mohammed Al-Johar. "Ethical considerations in the allocation of deceased donor organs during the COVID-19 pandemic." *Clin Transplant* 36 (2022):e14578.

7. Inge Jochmans, Ryan Smoot, Jason M. Kaths, Andrew S. Barbas. "Machine Perfusion for Deceased Donor Kidney Transplants: State of the Art." *Front Med* (Lausanne) 9 (2022):945234.

8. Shu Ma, Salvatore Ruggieri, Inge Jochmans. "Strategies to Optimize Deceased Donor Organ Utilization: A Narrative Review." *J Clin Med* 12 (2023):3941.

9. Ibrahim Ali, Abdulrahman M. Al-Harbi, Zia Ullah Khan, Ziyad Alsarhani, Nada Bin-Nafisah. "Risk Factors for Post-Transplant Diabetes Mellitus in Kidney Transplant Recipients from Deceased Donors." *J Clin Med* 11 (2022):7396.

10. Qian Qi, Xuebo Liu, Cheng Jiang, Yu Li, Zhiqiang Yang. "Hypothermic machine perfusion versus static cold storage for kidney transplantation from deceased donors: a systematic review and meta-analysis of randomized controlled trials." *Int Urol Nephrol* 53 (2021):567-578.

How to cite this article: Ndlovu, Thandiwe. "Organ Utilization: Preservation, Expansion, Ethics." *J Transplant Technol Res* 15 (2025):320.

Address for Correspondence: Thandiwe, Ndlovu, Department of Transplantation \& Regeneration Studies, Johannesburg University of Health Sciences, Johannesburg, South Africa, E-mail: t.ndlovu@juhs.za

Received: 01-Dec-2025, Manuscript No. jttr-25-175456; **Editor assigned:** 03-Dec-2025, PreQC No. P-175456; **Reviewed:** 17-Dec-2025, QC No. Q-175456; **Revised:** 22-Dec-2025, Manuscript No. R-175456; **Published:** 29-Dec-2025, DOI: 10.37421/2161-0991.2025.15.320