



RTAC Kidney Machine Perfusion Working Group

Position statement on cold storage of deceased donor kidneys for transplantation

Background

Current practices in kidney transplantation are associated with reduced organ utilisation from older, more comorbid, and donation after circulatory death donors where organ quality, ischaemia, delayed graft function, and graft survival are concerns.¹⁻³ In this context, clinical innovation that supports safe expansion of the donor and recipient pools is needed.

In early 2025, the Transplant Society of Australia and New Zealand (TSANZ) Renal Transplant Advisory Committee (RTAC) convened a working group to study the emerging role and implications of machine perfusion in kidney transplantation in Australia.

The Kidney Machine Perfusion Working Group, comprising surgical and medical representation from all Australian states involved in organ retrieval and kidney transplantation, reviewed the evidence regarding kidney organ perfusion strategies.

The working group acknowledged that a wide variety of machine perfusion strategies exist, and that the role and application of machine perfusion is likely to evolve with time. As an initial point of focus, given the Australian context, the working group sought to develop a position regarding the application of kidney machine perfusion in clinical care for improved cold storage.

Recommendations

The TSANZ RTAC Kidney Machine Perfusion Working Group recommends that:

- Continuous hypothermic oxygenated machine perfusion be supported for cold storage of deceased donor kidneys for transplantation, in preference to static cold storage.
- The preferred model of delivery is continuous hypothermic oxygenated machine perfusion, wherein kidneys are placed on pump at the point of retrieval and remain on pump until transplantation.
- Implementation of hypothermic oxygenated machine perfusion programs should be coordinated at the state level by kidney transplant and retrieval advisory



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committees.

- States to consider the adoption of a common technology platform to support intra- and eventual interstate sharing of perfused organs.
- Investment by state governments and health services involved in organ retrieval and transplantation is required to support procurement of devices, perfusion consumables, quality assurance and staffing models. Ongoing funding will be required to maintain perfusion programs.
- Adoption of hypothermic oxygenated machine perfusion is expected to improve graft outcomes, reduce delayed graft function, and enhance graft survival compared with static cold storage.⁴
- Anticipated broader system benefits include support for:
 - Improved organ utilisation and transplantation;
 - Delayed or complex transplant scenarios such as desensitisation, multi-organ transplantation, regional/remote recipients, theatre access challenges, workforce limitations, day-time surgery objectives, etc.;
 - Improved biopsy-based donor assessment.

Supporting Evidence

- A national paired-kidney registry analysis demonstrated that delayed graft function in donation after circulatory death kidney recipients is associated with significantly higher risk of graft loss, with 3-year death-censored graft survival 14% lower in recipients with delayed graft function.¹
- A national study found that 15% of kidneys retrieved from donation after circulatory death donors were not transplanted, with donor warm ischaemia and concerns regarding organ quality (elevated donor creatinine) as key drivers of non-utilisation.²
- The 2024 Organ and Tissue Authority Donation and Transplantation Activity Report highlighted a decline in organs transplanted per donor, despite an increasing donor pool, attributed to donor age and pathway.³
- A 2024 Cochrane review of 22 studies (4,007 participants) concluded that continuous hypothermic machine perfusion significantly reduces DGF (RR 0.78; 95% CI, 0.69–0.88) and improves one-year graft survival (HR 0.46; 95% CI, 0.29–0.75) compared to static cold storage.⁴ These benefits were consistent across



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donor types (donation after circulatory death and donation after brain death), and evident even when cold ischaemia times were short.

- In the randomised, double-blinded, paired COMPARE trial, the use of hypothermic oxygenated machine perfusion in donation after circulatory death donors over 50 years resulted in additional improvements in graft survival, one-year kidney function, and a reduced rate of acute rejection compared to non-oxygenated hypothermic machine perfusion.⁵
- Animal studies have demonstrated that oxygenation during hypothermic machine perfusion reduces endothelial injury, limits inflammation, preserves mitochondrial function, and improves post-transplant graft performance.^{6–12}

Emerging Technologies

- Normothermic machine perfusion is an emerging and sometimes complementary technology, however there is currently not enough evidence to provide a recommendation for its use outside of a research context.
- Normothermic regional perfusion is a donor-based strategy that is currently not employed in Australia, and we recognise that if implemented in the future, it may enhance donation after circulatory death kidney transplant outcomes.

Plain Language Summary

Kidney transplantation is the best treatment for people with kidney failure, but not all donated kidneys can be used. In Australia, many kidneys are not transplanted because of concerns about their quality, especially when they come from older or more medically complex donors, or from donors whose blood circulation has stopped before organ donation.

One promising technology to help preserve donated kidneys is called hypothermic oxygenated machine perfusion. This technique uses a machine to gently pump a cold, oxygenated solution through the kidney from the time it is removed from the donor until it is transplanted. This method better protects the kidney than traditional cold storage on ice.

International studies have shown that this approach can reduce the risk of delayed graft function (when the kidney doesn't start working right away) and improve how long the kidney lasts. In Australia, recent research has also shown that kidneys that experience delayed graft function are more likely to fail, and that many kidneys are not used because of concerns that might be addressed with better preservation methods like hypothermic oxygenated machine perfusion.



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Based on this evidence, the Transplant Society of Australia and New Zealand Renal Transplant Advisory Committee recommends that the use of hypothermic oxygenated machine perfusion is supported in preserving deceased donor kidneys. This may help improve outcomes for patients undergoing transplantation and increase clinician confidence in using traditionally under-utilised organs.



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