

Hypothermic Versus Normothermic In Situ Regional Perfusion Using The Extracorporeal Membrane Oxygenation (ECMO) Technique In Donation After Circulatory Death (DCD) In Kidney And Liver Transplantation: A Systematic Review



Pengel LHM^{1,2}, Pall KT¹, O'Callaghan JM^{1,2},
on behalf of the Consortium for Organ Preservation Europe (COPE).



¹Centre for Evidence in Transplantation, Royal College of Surgeons of England and the London School of Hygiene and Tropical Medicine, University of London, and the ²Nuffield Department of Surgical Sciences, University of Oxford, UK.
www.transplantevidence.com

Background

Donation after circulatory death (DCD) donors represent a large potential source of donors that could help address the organ shortage. We systematically reviewed the evidence for hypothermic (HRP) and normothermic (NRP) in situ regional perfusion using the extracorporeal membrane oxygenation (ECMO) technique in DCD kidneys and livers.

Methods

Registration

The systematic review was registered with PROSPERO, the international prospective register of systematic reviews (ID: CRD42013004034).

Eligibility criteria

Types of studies

All clinical study designs and publication types, including conference abstracts, were included. Studies did not have to report on a direct comparison of NRP versus HRP.

Types of participants and interventions

All human adult kidney and liver DCD donors who underwent a period of in situ NRP or HRP using the ECMO technique. Studies were excluded when it was explicitly stated that donors were brain dead donors.

Types of outcome measures

Studies had to report on one or more of the prespecified primary (patient and/or graft survival, discard rate and technical complications) and organ specified secondary outcomes.

Identification of studies

Medline, Embase, the Transplant Library database and the Cochrane Central Register of Controlled Trials were searched. No language or publication date restrictions were applied. To identify ongoing trials we also searched the International Clinical Trials Registry Platform.

Methodological quality

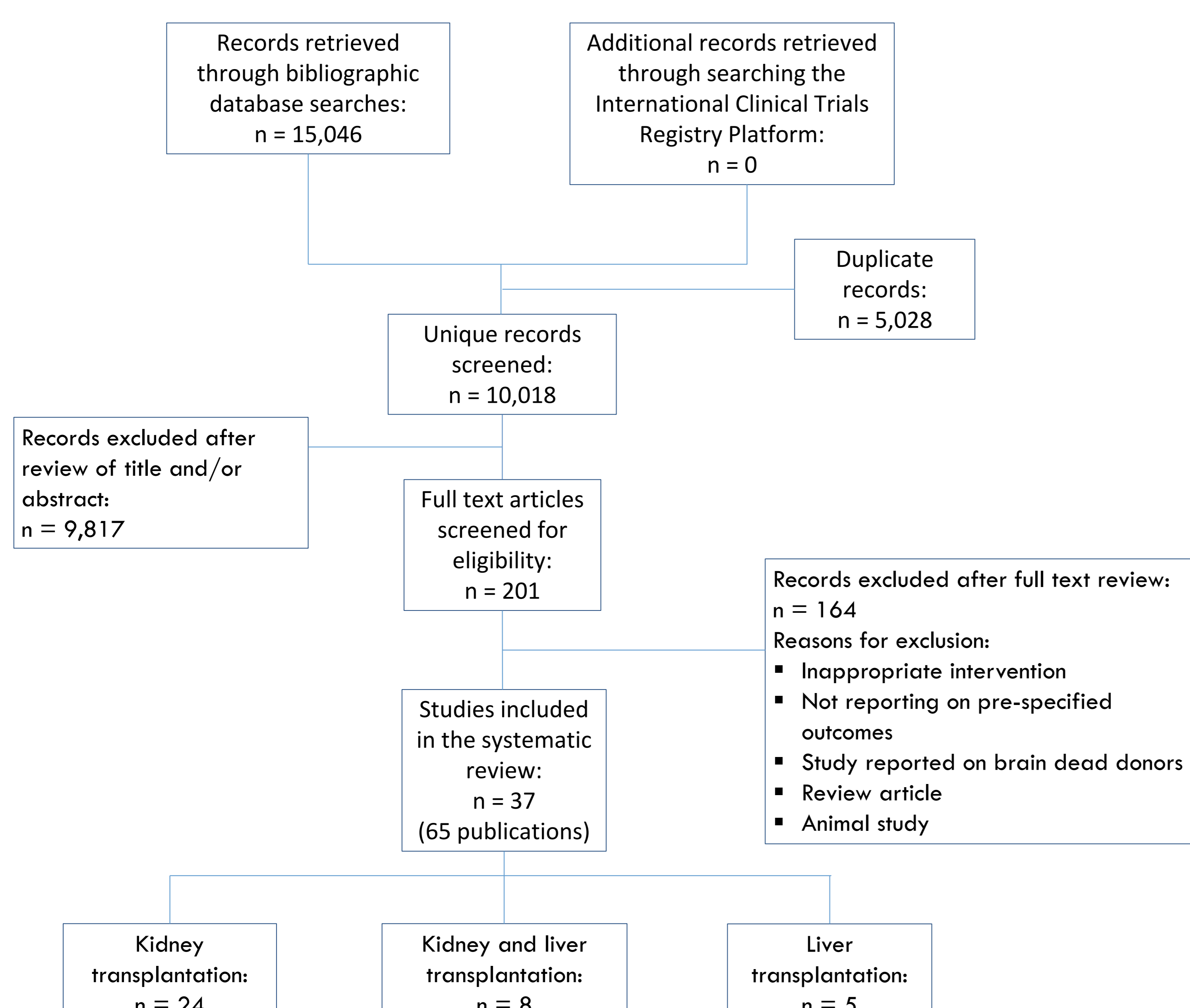
Methodological quality of cohort studies was evaluated with the Newcastle-Ottawa scale¹. Case series were assessed with a quality appraisal tool for case series consisting of 18 items which was developed using a modified Delphi technique². The quality was independently assessed by two reviewers.

Data extraction

Data were extracted regarding the study design, donor and recipient, intervention (preservation time, temperature and pressure or flow), preservation solution, immunosuppressive therapies, follow up, primary and secondary outcomes, and source of funding.

Results

The search identified 10,018 unique references of which 37 studies met our inclusion criteria (Figure).



Included studies

- There were two cohort studies, 28 case series and seven case reports.
- The number of donors included in the reports ranged from 1- 641 and the number of recipients from 1-374.
- The reported hypothermic temperature ranged from 2-22°C and normothermic temperature ranged from 27-37.5°C.

Methodological quality

Cohort studies

The two cohort studies showed acceptable methodological quality with total Newcastle-Ottawa scores of seven or eight out of a total of nine points.

Case series

- Quality items addressed by most reports were: description of the hypothesis or aim, length of follow up, loss during follow up, estimates of variability of relevant outcomes and conclusions that were supported by the results
- Quality items addressed by less than half of the reports: whether consecutive recruitment was used, adequate description of the characteristics of the recipient, intervention or outcomes, competing interests and funding sources

Outcomes for Kidney Donors

Included in the Table below are data from case series of HRP and NRP in kidney donors.

Outcome	Hypothermic Regional Perfusion	Normothermic Regional Perfusion
Patient survival	75%-100% (5 case series; follow-up up to 6 years)	97%-100% (6 case series; follow-up up to 3 years)
Graft survival	75%-100% (9 case series; follow-up up to 5 years)	75%-100% (9 case series; follow-up up to 3 years)
Delayed graft function	21%-87% (9 case series)	8%-88% (9 case series)
Discard rate*	0-57% (7 case series)	0-73% (11 case series)
Primary non-function	0-6.5% (6 case series)	0-25% (6 case series)

*Reasons for nonretrieval of kidneys or discard of kidneys after procurement were poor perfusion, ischemia, serology, and morphological and anatomic aspects.

Outcomes for Liver Donors

Included in the Table below are data from case series of NRP in liver donors.

Outcome	Hypothermic Regional Perfusion	Normothermic Regional Perfusion
Patient survival	No data from case series	77%-82% (4 case series; follow-up up to 7 years)
Graft survival	No data from case series	62%-71% (3 case series; follow-up up to 5 years)
Incidence of biliary complications*	No data from case series	1%-18% (5 case series)
Discard rate**	No data from case series	0-73% (11 case series)

* Reported biliary complications were ischemic cholangiopathy, anastomotic biliary strictures and intrahepatic cholangiopathy

** Reasons for the discard of livers included steatosis, cirrhosis, inadequate appearance after washout, technical complications, surgical judgement, donor history and long WIT.

Conclusions

The available evidence of HRP and NRP in DCD kidney and liver donors is of a low level but suggests that there are good outcomes for transplant recipients, although results were achieved at the expense of high discard rates. However there is a need for a well-designed trial to evaluate this technology further.

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References

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