MPD1043/8

NHS Blood and Transplant

National Standards

for Organ Retrieval

from Deceased Donors

Caring Expert Quality

National Standards for Organ Retrieval from Deceased Donors
Authors – Kathy Zalewska & Rutger Ploeg

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Summary of Changes

Version 8

- Document has been reviewed and rewritten in full.

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Glossary

Advisory Groups
NHSBT ODT has established solid organ Advisory Groups (AGs) (shown below) that are the key fora for clinicians and scientists to meet with representatives from NHS Blood and Transplant (NHSBT), commissioners and Departments of Health and others to review and develop policies, assess outcomes, and work with partners and stakeholders to improve outcomes for patients. ODT has also established the National Organ Donation Committee (NODC) and the National Retrieval Group (NRG) that are advisory and operational bodies within ODT including all operational ODT staff as well as advisory clinician-stakeholders necessary to prepare, review and carry out the policies and tasks of organ donation, donor management and organ retrieval.

In addition, ODT has established the Advisory Group Chairs Committee including the Chairs of the respective AGs and Chairs of NODC and NRG to advise ODT SMT.
The Advisory Groups advise and NODC and NRG report to the Organ Donation and Transplantation (ODT) Senior Management Team (SMT):

- **CTAG – Cardiothoracic Advisory Group**
- **KAG – Kidney Advisory Group**
- **LAG – Liver Advisory Group**
- **MCTAG – Multi-visceral & Composite Tissue Advisory Group**
- **NRG – National Retrieval Group**
- **NODC – National Organ Donation Committee**
- **PAG – Pancreas Advisory Group**
- **RINTAG – Research, Innovation & Novel Technologies Advisory Group**
  RINTAG is a new AG that provides NHSBT and other stakeholders with an overview of current innovations and supports the implementation of appropriately approved and funded research, innovations and service development, horizon scanning and works with commissioners and others to ensure the introduction of novel approaches to improve the outcomes of patients undergoing solid organ transplantation, in line with the UK Strategy 'Taking Organ Transplantation to 2020'.

CLODs
Clinical Leads for Organ Donation

Contract Review Meeting
An annual meeting between NHSBT Commissioners and the NORS Centre key contacts, as well as any key members of the NORS Team, to discuss finance, activity, clinical governance and any ad hoc agenda items.

DBD
Donation after brain death

DCD
Donation after circulatory death

EOS
Electronic Offering System

HTA
Human Tissue Authority

Incident
Any event in the organ donation and/or transplantation process which can or does affect the donor, recipient safety or the quality of the organs for transplantation.

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National Retrieval Group
The National Retrieval Group (NRG) is a structural body within ODT to advise SMT on policies as regards organ retrieval and carry out operational tasks to coordinate the activities that are part of the National Organ Retrieval Service (NORS) which plays a vital role within the organ retrieval and transplantation pathway and helps to facilitate organ transplantation as a realistic option for people on the transplant waiting list.

National Organ Donation Committee

NHSBT
NHS Blood and Transplant organisation

NORS
National Organ Retrieval Service

NORS Centre
The NHS Trust at which the NORS Team is based. Key contacts at the NORS Centre include:

- NORS Team Clinical Lead – a surgeon, usually a senior consultant, who is responsible for overseeing and managing the clinical performance of the NORS Team.
- NORS Management Lead – a named individual who is responsible for the operational management of the NORS Team.
- NORS Finance Lead – a named individual who is responsible for completion and submission of quarterly finance returns.

NORS Team
A commissioned group led by a competent Lead Surgeon (as defined by the NORS Training Curriculum accredited by the Royal College of Surgeons of England {RCS Eng}) that performs organ retrievals. The team includes the following members:

- Lead Surgeon – a surgeon who is competent in retrieval, either certified following RCS (Eng) accredited training or by the Grandfather Clause*.
- Surgical Assistance – a healthcare professional who provides support to the Lead Surgeon.
- Organ Preservation Practitioner – a theatre practitioner who is capable of performing preservation, perfusion and packing of organs.
- Scrub Practitioner – a theatre practitioner who provides expert assistance to the surgical team in theatre.

  * (*Practising members of a NORS team as at 1st April 2014 are automatically deemed to be 'certified and competent'*)

National Transport Contract
This is the contract between NHSBT (the Commissioner) and a transport provider (identified by a procurement tender), to provide transport for NORS Teams and unaccompanied organs.

ODT Hub Information Services
ODT Hub Information Services retrieves and provides information from and to those in the wider donation and transplantation community to make transplants happen, ensure patient safety and fulfil statutory obligations.

ODT Hub Operations (formerly the Duty Office)
Hub Operations provides a link in the transplant process between the Organ Donation Services Teams and transplant communities.

Perioperative Staff
The Organ Preservation Practitioners and Scrub Practitioners.

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RCPOC
Recipient Centre Point of Contact

Regulations
The Quality and Safety of Organs Intended for Transplantation Regulations 2012 and The Quality and Safety of Organs Intended for Transplantation (Amendment) Regulations 2014.
http://www.legislation.gov.uk/uksi/2014/1459/contents/made

The Human Tissue (Quality and Safety for Human Application) Regulations 2007 (As Amended).
https://www.hta.gov.uk/sites/default/files/Q&S_Human_Application_Regs_2007.pdf

SACs
Specialty Advisory Committees

SN-OD
Specialist Nurse - Organ Donation

Workforce Tariff
Also known as “the Tariff”, this is a sum of money paid to the NORS Centre for providing a NORS Team when not on-call, or as a second team (e.g. when the primary team is attending a donor). This payment is made to cover the cost of the workforce; transport and consumables are reimbursed separately.

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Useful Information

1. ***Associated Documents***
2. ***Incident Reporting***
3. ***Other Useful Links***
4. ***National Operating Procedures***

1. Associated Documents

- Contraindications to Organ Donation – A Guide for SN-ODs - POL188 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/6455/contraindications_to_organ_donation.pdf)
- Pregnancy in Donation - MPD891 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4978/pregnancy_in_donation_mpd891.pdf)
- Theatre Manual for Deceased Organ Donors - SOP5499 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/10887/theatre-manual-sop5499.pdf)
- Physical Assessment - MPD873 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4562/physical_assessment_mpd873.pdf)
- NHSBT Organ Offering Protocol – MPD1119 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4980/organ_offering_protocol.pdf)
- Organise Solid Organ Retrieval - MPD884 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4940/organising_solid_organ_retrieval_mpd884.pdf)
- Responsibilities of Clinicians for the Acceptance of Organs from Deceased Donors - POL192 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4977/nhsbt_responsibilities_acceptance_organs_deceased_donors.pdf)
- National Organ Retrieval (NORS) Mobilisation Process – SOP4574 *
- Completion Guidelines for Retrieval Team Information Form FRM4125 - INF1365*
- Retrieval Team Information – FRM4125 *
- ODT Flight Authorisation Processes for Flights over £10,000 - MPD1234 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4610/mpd1234_odt_flight_authorisation_process_for_flight_over_10000.pdf)
- Organ Donation and Transplantation Peak Activity Policy – POL224 *
- NHSBT Surgical Safety Checklist - FRM4135 *
- Guidance and Principles, Donor Organ Photographs - MPD1100 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/11333/guidance-and-principles-donor-organ-photographs-mpd1100.pdf)
- Findings During Retrieval Requiring Histopathology Assessment - SOP5352 https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/6500/sop5352-findings-during-retrieval-requiring-histopathology-assessment.pdf
- Heart Retrieval on Behalf of NHSBT Tissue Services for Valves from a Deceased Donor - INF195 *
- Medical Records Entries for Proceeding and Non- Proceeding Organ and/or Tissue Donation - MPD910 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4554/medical_records_entries_for_proceeding_and_non_proceeding_organ_and_or_tissue_donation_mpd910.pdf)
- Organ Handover Form - FRM4217 *
- Minimum Operating Standards – Patient Identifiable Data – Hub Operations - MPD1086 *
- Reporting an Organ Donation or Transplantation Incident to NHSBT – SOP3888 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4578/reporting_an_organ_donation_or_transplantation_incicent_sop3888.pdf)
- Basic Guidelines for Theatre Staff at Donor Hospital – INF1424 (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/10888/basic-guidelines-for-theatre-staff-at-donor-hospital-inf1424.pdf)

* Those associated documents without active links are not applicable to non-NHSBT staff and therefore only accessible via NHSBT controlled documents library.

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2. Incident Reporting

An incident may occur within the chain of organ donation and transplantation for which there is a legal requirement to report under the Regulations. Additionally, an incident may occur for which organisations may benefit from organisational or national learning.

All incidents should be reported to the ODT Directorate of NHSBT using the following link: https://safe.nhsbt.nhs.uk/IncidentSubmission.

All UK establishments licensed under the Regulations - The requirement to report serious adverse events (SAEs) and serious adverse reactions (SARs) applies to all UK establishments licensed under the Regulations, regardless of geographical location or whether they are a private or an NHS organisation.

SAEARs Definitions

Serious Adverse Event

A serious adverse event (SAE) is defined in the Regulations as 'any undesired and unexpected occurrence associated with any stage of the chain from donation to transplantation that might lead to the transmission of a communicable disease, to death or life-threatening, disabling or incapacitating conditions for patients or which results in, or prolongs, hospitalisation or morbidity.

SAEs that may influence the quality and safety of an organ, and that may be attributed to the testing, characterisation, procurement, preservation and transport of organs, must be reported and investigated.

Serious Adverse Reaction

A Serious Adverse Reaction (SAR) is defined in the Regulations as 'an unintended response, including a communicable disease, in the living donor or in the recipient that might be associated with any stage of the chain from donation to transplantation that is fatal, life-threatening, disabling, incapacitating, or which results in, or prolongs, hospitalisation or morbidity'.

SARs observed during or after transplantation, which may be connected to the testing, characterisation, procurement, preservation and transport of organs, must be reported and investigated.

In accordance with The Human Tissue (Quality and Safety for Human Application) Regulations 2007 (https://www.hta.gov.uk/sites/default/files/Q&S_Human_Application_Regs_2007.pdf) serious adverse events and reactions relating to whole organs retrieved with the intention of being transplanted as tissues (whole heart for valves, pancreas for islets and liver for hepatocytes) must be reported. To this aim, incidents involving such tissues must also be reported via the ODT Directorate of NHSBT (https://safe.nhsbt.nhs.uk/IncidentSubmission).

3. Other Useful Links

Human Tissue Authority - https://www.hta.gov.uk/
British Transplantation Society - https://bts.org.uk/
NHS Blood and Transplant - http://www.nhsbt.nhs.uk/
ODT Clinical Website - http://www.odt.nhs.uk/
SaBTO - https://www.gov.uk/government/groups/advisory-committee-on-the-safety-of-blood-tissues-and-organs
ESOT - http://www.esot.org/
Academy of Medical Royal Colleges - http://www.aomrc.org.uk/
NORS Review 2015 - https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/1411/nors_review_report_2015.pdf
Taking Organ Transplantation to 2020 - http://www.nhsbt.nhs.uk/to2020/
Faculty of Intensive Care Medicine - https://www.ficm.ac.uk/standards-and-guidelines/access-standards-and-guidelines

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4. National Operating Procedures

Donor and Organ Characterisation, Assessment and Allocation in Deceased and Living Donation and Transplantation – NOP001
https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4387/donor_and_organ_characterisation_assessment_and_allocation_in_deceased_and_living_donatation_and_transplantation_-_nop001.pdf

Verification of Donor Identity Consent and Authorisation Organ and Donor Characterisation in deceased and Living Donation and Transplantation - NOP002
https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4391/verification_of_donor_identity_consent_and_authorisation_organ_and_donor_characterisation_in_deceased_and_living_donation_and_transplantation_-_nop002.pdf

Packaging Labelling and Transport of Organs in Deceased and Living Donation and Transplantation - NOP003
https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4389/packaging-_labelling_and_transport_of_organs_in_deceased_and_living_donation_and_transplantation_-_nop003.pdf

Management of Procurement Material and Equipment in Deceased and Living Donor and Transplantation - NOP004
https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4388/management_of_procurement_material_and_equipment_in_deceased_and_living_donor_and_transplantation_-_nop004.pdf

Activities to be Performed Under the Guidance of a Registered Medical Practitioner - NOP005
https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4386/activities_to_be_performed_under_the_guidance_of_a_registered_medical_practitioner_-_nop005.pdf

Transfer and Storage of Donor and Organ Characterisation Information and Storage of Traceability Data - NOP006
https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/4390/transfer_and_storage_of-_donor_and_organ_characterisation_information_and_storage_of_traceability_data_-_nop006.pdf

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MANAGEMENT PROCESS DESCRIPTION MPD1043/8 – Effective: 15/10/18

National Standards for Organ Retrieval from Deceased Donors
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Rationale & Policy Statement

The Rationale for National Standards
Standards are required to ensure that:

1. The best possible transplant outcomes are achieved for all organs offered by donors and their families.
2. Organs are retrieved in a timely and co-ordinated fashion.
3. All donors are managed by competent personnel whose objective is to optimise subsequent function of all organs retrieved for transplantation.
4. The retrieval operation is performed by competent surgical teams to ensure that the quality of transplantable organs is not compromised during the retrieval process and thereafter.
5. Members of the NORS Team act as ambassadors for transplantation and behave in a professional manner throughout the retrieval process.
6. Donor hospitals throughout the UK receive a rapid and efficient service, minimising disruption to their other services whilst ensuring that organ retrieval can proceed as soon as possible.
7. Respect for the donor and donor family is given the highest consideration throughout the retrieval process.
8. The quality of retrieval and the organs that are retrieved should reflect the principle that safety of transplant recipients is paramount.

This document specifies the Standards which all health care professionals involved in solid organ retrieval should follow in order to provide a high quality NORS in the UK.

The NORS Standards provide guidance for retrieval from adult, paediatric and neonatal donors, and cover the retrieval of deceased donor organs currently routinely transplanted in the UK. They include retrieval of heart, lung, liver, pancreas, kidney, and intestine (or combinations of those organs) from donors after brain death (DBD) and donors after circulatory death (DCD). They also cover retrieval of the heart for aortic/pulmonary valves, pancreas for islets, liver for hepatocytes, and removal of tissue required to facilitate transplantation i.e. spleen, lymph nodes, blood, blood vessels and fascia.

The NORS Standards do not cover retrieval of organs from uncontrolled DCD donors or from living donors, nor do they cover retrieval of tissue such as corneas, bone and skin. Emerging opportunities, including the retrieval and subsequent transplantation of vascularised composite allografts (VCA), i.e. abdominal wall, limbs and uterus, are not yet included.

Retrieval of organs intended to be transplanted as tissue/cells (whole heart for valves, pancreas for islets and liver for hepatocytes) are covered by these Standards. Tissue procurement is in accordance with The Human Tissue (Quality and Safety for Human Application) Regulations 2007 (as Amended) (https://www.hta.gov.uk/sites/default/files/Q&S_Human_Application_Regs_2007.pdf) and covered by a Third Party Agreement (Schedule 9 of the NORS contract) between individual NORS teams and NHSBT (Human Application HTA licence number 11018).

On rare occasions when a NORS team attends a donor resident in a non-EU third party country (Jersey, Guernsey or Isle of Man), retrieval of whole heart for valves, pancreas for islets and/or liver for hepatocytes is carried out to the same standards as in the UK – ensuring equivalence as required by the *Implementing Directive 2004/23/EC as regards the procedures for verifying the equivalent standards of quality and safety of imported tissues and cells*, Annex IV.(https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1428582345653&uri=OJ:JOL_2015_093_R_0007).

As NHSBT facilitates research, the NORS Standards already provide guidance in relation to the support of research for transplantation/healthcare.

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Use of this document

All associated links within this document should be read in conjunction with these National Standards and should not be saved locally in order to ensure that the most up-to-date version is accessed.

National Organ Retrieval Service

The NORS is a vital part of the donation and transplantation pathway, which makes organ transplantation a realistic option for patients on the transplant waiting list.

The service was established by NHSBT in April 2010 and since then NORS has been very successful, playing a role in contributing to the increase in deceased donors and organ transplants. As a key component of the organ donation and transplantation infrastructure, it provides an important, national, 24-hour service for retrieving organs from deceased donors in the UK.

NHSBT uniquely commissions the service on behalf of the four UK Health Departments, who contribute funding for the provision of an integrated UK-wide retrieval service.

A review of the Service in 2014/15 made a series of recommendations, with a view to ensuring that NORS continues providing a high-quality organ retrieval service, comprised of skilled professionals, while delivering value for money. The review board acknowledged and appreciated the commitment and dedication of the healthcare professionals involved in the service, which is often delivered in challenging circumstances and unfamiliar environments, across the UK, day and night.

The NORS Review report can be found here.

The strategy for organ donation and transplantation (Taking Organ Transplantation to 2020 {TOT2020}) aims to continue to increase the number of deceased organ donors, but also outlines specific recommendations aimed at increasing the number of organ transplants. The strategy can be found online at: https://www.nhsbt.nhs.uk/tot2020/.

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1. Donor Assessment & Offering

1.1 NHSBT has a Memorandum of Understanding in place with all donor hospitals in the UK to adhere to the core standards underpinned by the four key outcomes from the TOT2020 strategy and in Scotland the National Strategy to 2020 for Organ Donation as published by the Scottish Government Health Directorate.

1.2 Every potential donor hospital in the UK will have access to a SN-OD who, in collaboration with the consultant intensivist, will be responsible for assessing the patient, approaching the family and ensuring that appropriate consent/authorisation has been ascertained, and for organising and co-ordinating organ retrieval at that hospital in collaboration with ODT Hub Operations.

1.3 The donor hospital will ensure that the diagnosis and confirmation of death in potential organ donors will be:

a) conducted by appropriately trained and experienced clinical staff in compliance with accepted national professional standards; and

b) recorded clearly and accurately in the patient's medical records.

These requirements apply to both the diagnosis of death using neurological criteria in potential DBD donors and the diagnosis of death using circulatory criteria in potential DCD donors.

1.4 The SN-OD will ensure that the necessary tests for the diagnosis and confirmation of death have been completed and documented correctly by the appropriate clinical staff at the donor hospital.

1.5 The SN-OD will ensure that death has been diagnosed and confirmed by appropriate clinical staff at the donor hospital and documented correctly in the patient's notes.

a) For DBD donation death is diagnosed using neurological criteria. SN-ODs should examine the documentation relating to this diagnosis as soon as possible and always before the patient is transferred to theatre. Any apparent errors or uncertainties should be resolved with the senior medical staff caring for the donor as quickly as possible and in a fashion that does not delay or jeopardise organ retrieval. Should the SN-OD become aware that the patient is exhibiting spontaneous or spinal reflex activity on the ICU, he/she will highlight this to the caring team. The SN-OD will make relevant staff aware of NHSBTs Safety Alert on the subject if required (Appendix 1).

b) For DCD donation, death is confirmed after five minutes of continuous absence of cardio-respiratory function. SN-ODs must ensure that the clinician who confirms death using circulatory criteria makes an entry to this effect in clinical records and that this is signed, timed and dated.

1.6 The SN-OD will seek confirmation from the caring consultant that they have liaised where necessary with the Coroner/Procurator Fiscal to ensure that there is no objection to organ retrieval going ahead.

1.7 If a female donor is of child-bearing age, the possibility of pregnancy should be explored by the SN-OD in accordance with the schedule laid out in MPD891 and any associated deviations. If the donor is known or confirmed to be pregnant then donation must not proceed.

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1.8 The SN-OD will ensure that appropriate investigations (e.g. blood group, microbiology, ECG) are performed before the retrieval operation and that the results of these investigations are available for the surgeons to review in theatre.

1.9 The SN-OD should record details of any blood or blood products the donor received during their hospital stay and request a pre-transfusion sample where appropriate.

1.10 ODT Hub Operations will ensure that all potential donor organs are offered to transplant centres subject to any absolute contra-indications specified by relevant organ Advisory Groups (e.g. disseminated malignancy). NHSBT Contraindications to Organ Donation: (https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/6455/contraindications_to_organ_donation.pdf).

1.11 Organ offers will be made in accordance with the ODT Patient Selection and Allocation Policies (https://www.odt.nhs.uk/transplantation/tools-policies-and-guidance/policies-and-guidance/) and the NHSBT Organ Offering Protocol (MPD1119). Organ offers will be moved onto the next centre in the offering sequence if the offering time has expired. In exceptional circumstances extensions to offer response times can be granted by ODT Hub Operations Shift Manager either on site or on-call, the on-call Regional Manager and the SN-OD as long as this does not result in unacceptable delays to donation.

1.12 For organs offered outside the UK, ODT Hub Operations must inform the respective transplant centre(s) that the retrieval will be carried out by a NORS Team. The transplanting centre may send representation (i.e. a surgeon with/without assistance) to participate in or observe the retrieval procedure pending agreement of the responsible NORS Lead Surgeon. Participation must not delay the retrieval process or prejudice the chance of donation occurring.

1.13 In the event that a potential DCD donor is subsequently diagnosed with brainstem death during preparations for retrieval and consent/authorisation for DBD donation is given, donation may be delayed whilst the SN-OD or ODT Hub Operations offers the heart and any other organs that have been turned down because DCD donation was initially anticipated, provided that the donor family/hospital agrees to such a delay. If recipients for DCD organs from that donor have already been identified and notified, then their transplant centres may retain those organs for use in those identified recipients.

1.14 A potential DBD or DCD donor kidney will only be deemed unsuitable for transplantation if the organ has been offered and declined by all transplant centres through the Fast Track Scheme.

1.15 A potential DBD cardiothoracic organ donor will only be deemed unsuitable for transplantation if the organs are declined because of grossly subnormal organ function by at least four transplant centres in the cardiothoracic offering sequence.

1.16 For potential liver, pancreas and intestinal organ donors, a DBD or DCD donor organ will only be deemed unsuitable for transplantation if all potential transplant centres decline the organ except where the Liver, Pancreas and Bowel Advisory Groups have notified NHSBT of absolute contra-indications to donation.

1.17 Well-functioning organs declined for other reasons (e.g. hepatitis C positive donor, Hep B surface antigen positive donor, HIV positive donor/HCV positive donor, HTLV positive donor) will be automatically simultaneously offered to those centres which have agreed to participate.

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1.18 A nominated RCPOC at the transplant centre e.g. recipient co-ordinator, transplant nurse or clinician, must be available at all times to liaise with the SN-OD and the NORS Team.

1.19 Transplant centres must provide NHSBT with a primary and secondary method of communication for the receipt of organ offers in line with the NHSBT Organ Offering Protocol, one of which must be a contact telephone number which must be available 24 hours a day. Other options are an email address, pager or mobile number for texts. Transplant centres must also have access to EOS to view the documented donor data.

1.20 If there is no response from that telephone or pager after 45 minutes of trying to make contact, then the on-call NHSBT Regional Manager, SN-OD or ODT Hub Operations may move on to offer the organ to another transplant centre.

1.21 Whilst transthoracic and/or transoesophageal echocardiography and short clinical films of function in situ are considered desirable by some cardiothoracic transplant centres, they are not mandatory investigations for cardiothoracic NORS Teams. Transplant centres may be required to make a judgement on whether or not to accept a heart based upon the information available without these investigations.

1.22 A consultant transplant surgeon must be available at all times to receive donor organ specific information from ODT Hub Operations and/or SN-ODs and to relay recipient specific information to the NORS Team.

1.23 The names and contact numbers of both the recipient co-ordinator and the accepting and transplanting consultant surgeons must be supplied to the SN-OD when an offer of a donor organ is accepted.

1.24 Transplant surgeons accepting an organ offer should be mindful of the guidance given by The Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) regarding the risks of disease transmission from donors with specific infections or tumours.

1.25 It is the responsibility of all transplant surgeons to review the full Donor Characterisation data on EOS prior to implantation in order to have a clear understanding of the relevant donor information.

1.26 Transplant centres must adhere to the offering timeframes for responding to an organ offer as outlined in the NHSBT Organ Offering Protocol (MPD1119):

Cardiothoracic – 45 minutes for full offer, then 30 minutes if provisional offer has already been received or for urgent offers following receipt of HLA.

Liver - 45 minutes for full offer, then 30 minutes if provisional offer has already been received.
Kidney - 45 minutes for a kidney offer, then 30 minutes following receipt of anatomy.

Intestine - 45 minutes for an intestine offer.

Pancreas – 45 minutes for a pancreas offer.

If the offering time has expired and no response has been received from the transplant centre, ODT Hub Operations will move on to offering to the next transplant centre in the offering sequence.

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If unsuccessful, organ offers will then be moved on to the next transplant centre in the offering sequence. Transplant centres may contact ODT Hub Operations to request an extension to the offer response time, although this will only be granted in exceptional circumstances and must be approved by the on-call ODT Hub Operations Shift Manager who will escalate, if appropriate, to the on-call Regional Manager.

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2. NORS Co-ordination & Mobilisation

2.1 Organ retrievals in the UK will be carried out by a commissioned NORS Team, which includes at least one competent abdominal and one competent cardiothoracic surgeon as appropriate. When organs are accepted by non-UK transplant centres they may send representation (i.e. a surgeon with/without assistance) to participate in or observe the retrieval procedure pending agreement of the responsible NORS Lead Surgeon. Participation must not delay the retrieval process or prejudice the chance of donation occurring.

2.2 ODT Hub Operations will hold a record of all NORS Team movements and will mobilise the NORS Team in accordance with the current mobilisation guidance and advise the SN-OD in line with SOP4574. The SN-OD must ensure that all communication about mobilisation should be directed via ODT Hub Operations.

2.3 The appropriate NORS Team will always be required to attend a retrieval, however, where specialist and/or additional expertise is required (for example in paediatric liver and/or kidney donors equal or younger than 2 years of age), a surgeon from the transplanting centre may offer, or be asked, to attend and participate in the retrieval operation performed by the NORS Team providing this does not delay the retrieval process and prejudice the chance of donation occurring. The HTA-A form will be completed by the UK NORS Team Lead Surgeon and payment for consumables will be made to the attending NORS Team.

2.4 Should specialist retrieval expertise be required for certain recipients, these patients must be identified and agreed with the relevant solid organ Advisory Group at the time of listing of the recipient by his/her transplant centre.

2.5 The only exceptions to 2.3 and 2.4 are:

a) Small cardiothoracic donors (height <145cm **OR** weight <40kg) where the specialist team will attend (Newcastle or Papworth) and be paid for transport/consumables.
b) Complex congenital recipients (listed as such with NHSBT) – the NORS Team of the accepting transplant centre may attend instead of the closest available on-call NORS Team and be paid for transport/consumables.
c) Adult donors outside the UK – if the local organ retrieval team is unable to attend, one of the on-call NORS Teams will be asked to travel and retrieve the respective organ(s). In paediatric cardiothoracic donors, one of the specialist NORS Team (Newcastle or Papworth) will retrieve abroad. In special cases where additional retrieval expertise is required, i.e. paediatric liver and/or kidney donor <2 years, a dedicated surgeon from the accepting paediatric UK transplant centre may join the abdominal NORS Team to attend and be paid for transport/consumables.
d) Multi-visceral donors - these will be attended by the accepting intestinal transplant centre which must retrieve all abdominal organs, not just the small bowel, as a second abdominal NORS Team will not be mobilised. If the planned multi-visceral retrieval is cancelled prior to the accepting intestinal retrieval team leaving base then the SN-OD, in collaboration with ODT Hub Operations, should arrange for the on-call NORS Team to attend to retrieve. If the accepting intestinal retrieval team has either arrived or is near the donor hospital, then they must attend to retrieve all abdominal organs.

2.6 The NORS Teams are not expected to attend uncontrolled DCD donors.

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2.7 It is standard practice for NORS Teams to travel by road. Air transport may, however, be used if:

- Road travel is not possible (e.g. for Northern Ireland or for Gibraltar).
- Estimated road travel time is over four hours (unless there are exceptional circumstances).
- Organ viability might be compromised by any delay.

If travel time is estimated to be between three and four hours, ODT Hub Operations will decide whether a flight can be booked, taking into account the flight cost, likely mobilisation time of flight, efficiency and time saving, and distance by road between airport and hospital.

2.8 Once consent/authorisation (MPD902) for donation is ascertained the SN-OD will arrange organ retrieval in accordance with SOP5499.

2.9 The timing of the retrieval operation will be arranged between the SN-OD and the respective NORS Team Lead, when assigned by the Hub Operations, in good collaboration, and based on the proximity/availability of the NORS Team to the donor hospital, stability of the donor, wishes of the family, availability of resources at the donor hospital, and time required to prepare recipients for surgery. ODT Hub Operations will keep the NORS Team and the transplanting centre informed of any delays.

A theatre time can be set and the NORS Teams mobilised once one cardiothoracic AND one abdominal organ has been accepted or, where no cardiothoracic organs are to be retrieved, once one abdominal organ has been accepted.

The NORS Team is not supposed to be mobilised or booked to attend a donor over five hours in advance of the theatre time. In special circumstances, ODT Hub Operations may deviate from this rule but the reason must be documented.

2.10 NORS Teams will not routinely be mobilised to donor hospitals more than three hours distance by road. If the closest available team is more than three hours away, ODT Hub Operations will predict when a closer team will become available and advise the specialist nurse to await and adjust the start time of the retrieval operation if this is clinically appropriate.

2.11 If a situation arises where it is predicted that a NORS Team would be mobilised for a retrieval taking place more than three hours distance from that team's base, ODT Hub Operations will check with the relevant SN-OD whether a geographically closer donor for that Team to called out has been registered.

2.12 Concerns or conflicts relating to NORS Team co-ordination will be escalated and reported to the next meeting of the NHSBT National Retrieval Group.

2.13 In cases where HLA typing is not yet available, and a kidney matching run has not been performed and the SN-OD considers it highly likely that the kidneys will be placed for transplantation, it is acceptable for the SN-OD to request that the NORS Team is mobilised prior to an organ being accepted for transplantation. The final decision to mobilise will be with the NORS Team in accordance with paragraph 2.9 above.

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2.14 NORS Teams must be able to leave the NORS Centre within one hour of call out by ODT Hub Operations; however, the mobilisation time must take into consideration travel time, family wishes, complex recipients, and planned theatre time.

2.15 Trusts/Hospitals which participate as a NORS Centre must provide fully staffed NORS Teams which are available 24 hours per day, 7 days per week assigned to be on call for organ retrieval without any interfering elective or other (transplantation) commitments.

2.16 If requested, each NORS Centre must be prepared to provide a team (fully staffed at the time of mobilisation) for more than one donor per day, although they will not be required to attend simultaneous donations.

2.17 If required, teams are permitted a total of 2 hours to rest between retrievals (1 hour to rest, 1 hour to restock/mobilise) before leaving for a further retrieval, although this rest period is not mandatory.

2.18 NORS Teams will be asked to attend sequential or "back-to-back" retrievals only by the Hub Operations if this team is the only team left or if it is the most efficient use of NORS Teams in a particular donor situation and the shift patterns of the team members allow it. If the team does not have sufficient equipment, the transport provider can be asked to return to base to collect additional kit.

2.19 On occasions, if an additional NORS Team is required, NORS Centres may be asked to mobilise a team when they are not on-call, or to mobilise a second team if the first team is out retrieving. NORS Centres are not obliged to mobilise a team in these cases but will be paid a one-off sum to cover their workforce costs if they are willing and able to do this. Transport and consumables will be paid in addition to the workforce.

2.20 A NORS Centre Point of Contact from each NORS Centre must be available 24 hours to receive calls from ODT Hub Operations and to mobilise the NORS Team when called upon to do so.

2.21 The NORS Centre is responsible for making cost-effective and timely transport arrangements for its NORS Team.

2.22 Perioperative staff (both abdominal and cardiothoracic) are responsible for taking all necessary equipment, preservation/perfusion fluids, drugs, ice, organ transfer boxes and documentation (organ specific HTA forms) for the retrieval process.

2.23 Every cardiothoracic NORS Team should bring the equipment needed for cardiac output and pressure measurements within the central circulation, DC cardioversion, and to perform bronchoscopy.

2.24 Robust, published duty rotas must be in place for all NORS team members including, when available, anaesthetic and donor care support, and for on-call Consultants and the NORS Centre Point of Contact.

2.25 Rotas must conform to European Working Time Directives and be made available to NHSBT upon reasonable request.

2.26 To enable the effective dispatch of NORS Teams, ODT Hub Operations will hold information regarding the availability of all NORS Teams. It is, therefore the responsibility of a designated member of the NORS Team to ensure that ODT Hub Operations is notified when the NORS Team has returned to base following any mobilisation.

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3. Retrieval Operations & Preservation

The following is intended as an overview of roles and responsibilities during DBD and DCD organ retrieval. Specific DCD guidance is below.

DCD Organ Retrieval Guidance

3.1 Stand down rules for NORS Teams during a DCD procedure: Following withdrawal of treatment from a potential controlled DCD donor, NORS Teams must wait as follows:

- Cardiothoracic NORS Teams must wait at least two hours for the onset of functional warm ischaemia (defined as systolic BP <50mmHg).
- Abdominal NORS Teams must wait at least three hours for the onset of functional warm ischaemia (defined as systolic BP <50mmHg).
- If the systolic blood pressure has not fallen <50mmHg after the times stated above, then teams may stand down at that stage.
- If, despite fast-tracking, transplant centres have declined all the offered-out organs prior to the moment of stand down, teams may stand down earlier.

3.2 Abdominal NORS Teams may wait longer than three hours from treatment withdrawal if progressive cardiovascular instability suggests that asystole is likely to occur.

3.3 Once the systolic BP has fallen below 50mmHg (i.e. onset of Functional Warm Ischaemia) the NORS Teams will wait 30 minutes before abandoning the liver and pancreas, one hour before abandoning the lungs, and three hours before abandoning the kidneys as deemed transplantable due to excessive warm ischaemia. If transplant centres have declined all the offered-out organs prior to the moment of scheduled abandoning, teams may abandon earlier.

3.4 If an abdominal NORS Team wishes to use normothermic regional perfusion in a DCD donor who is also a potential lung donor, its NORS Team Lead must first discuss the details with the cardiothoracic NORS Team Lead. The abdominal NORS Team will cannulate the abdominal aorta and IVC and the cardiothoracic NORS Team will then clamp the lower thoracic aorta and the IVC within the pericardium, and then immediately proceed to remove the lungs. The cardiothoracic NORS Team must maintain excellent haemostasis throughout and must not stand down until both teams are satisfied that there is no significant bleeding into the chest.

3.5 In the *very rare* circumstance should there be any return of cardiac contractility during DCD retrieval (except for the circumstances described in Appendix 2 where the arch vessels have already been clamped and normothermic regional perfusion commenced with the intention of restarting the heart):

- The retrieval team(s) should abandon all retrieval-related interventions immediately, including any form of ventilation, and stand away from the donor.
- The SN-OD should summon support from the donor hospital anaesthetic / critical care team as a matter of urgency.
- The donor hospital anaesthetic / critical care team should re-instate ECG and arterial pressure monitoring if practicable and consider the administration of analgesic and sedative agents to prevent the possibility of the patient suffering prior to the return of cardio-respiratory arrest.
- If all team members agree, it is permissible for organ retrieval to resume once death has been diagnosed. Any reinflation prior to lung retrieval must be delayed until at least 15 minutes after the final asystole.

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- The on-call Regional Manager should be called as soon as practicable and the incident should be reported through both the donor hospital and NHSBT incident reporting systems. The lead personnel involved in the incident should complete a comprehensive account of the incident in the patient's medical records.
- The patient's family must be informed of the incident and support and explanation offered.

NB: For guidance on lung retrieval from DCD donors see Appendix 2

Organ Retrieval Operation

Donor Hospital

3.6 The donor hospital will provide a fully equipped operating theatre for the retrieval procedure, including appropriate anaesthetic equipment and drugs to support the donor (as per Basic Guidelines for Theatre Staff at Donor Hospital – INF1424).

3.7 Donor hospitals should allow the retrieval procedure to start as soon as possible after the NORS Team has arrived.

3.8 The donor hospital will provide an anaesthetist to support deceased donors DBD donors in the operating theatre during the retrieval procedure.

3.9 The donor hospital will provide a suitable member of staff, such as a qualified theatre practitioner and/or operating department assistant, who is familiar with the theatre facilities and the whereabouts of the surgical and anaesthetic equipment, instruments and drugs which may be needed by the NORS surgeons and anaesthetist.

3.10 This/these individual(s) will remain in theatres during the retrieval procedure to aid the Scrub Practitioner (provided by the NORS Team) the anaesthetist and the Organ Preservation Practitioner (OPP) and assist the SN-OD with the final act of care.

SN-OD responsibilities

3.11 In conjunction with staff at the donor hospital the SN-OD will ensure that operating facilities for the retrieval operation and for the safe transfer of the donor to theatre have been arranged.

3.12 The SN-OD will maintain a presence in theatre to ensure continued co-ordination of the retrieval process.

3.13 The SN-OD should adhere to SOP5499 – Theatre Manual for Deceased Organ Donors ensuring that it is agreed prior to surgery commencing who will take responsibility for sample collection, for the correct packaging and labelling of organs and samples retrieved for transplant.

3.14 The SN-OD will ensure that appropriate consent/authorisation has been ascertained and recorded for the removal of individual organs prior to organ retrieval and that the retrieving surgeons have completed the peri-op section of the Retrieval Check List on DonorPath (or FRM4135 NHSBT Surgical Safety Checklist if DonorPath is unavailable), checked the identification of the donor, the consent/authorisation form and all other relevant documentation before commencing the retrieval operation.

3.15 The SN-OD must ensure that the pre-theatre section of the Retrieval Check List on DonorPath (or FRM4135 NHSBT Surgical Safety Checklist if DonorPath is unavailable) is completed before the start of the retrieval operation.

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3.16 The SN-OD must confirm the cross-clamp time with the transplant centre receiving the organs at the earliest opportunity after cross-clamp has occurred.

3.17 The SN-OD will record all the necessary key time points required for each of the organ specific donor record forms, including the time that each organ was removed from the operative field and placed in cold solution.

3.18 The SN-OD will ensure that the donor information has been fully completed on Donor Path. It is the SN-OD's responsibility to legibly record the donor demographics on the HTA Organ Specific forms.

3.19 The SN-OD will liaise with transplant centres via the nominated RCPOC, to keep them informed about the progress of the retrieval process, including cross- clamp times and alert them when the organs are dispatched from the donor hospital.

3.20 The SN-OD must document in the patient's medical records a note for the pathologist stating:

IMPORTANT NOTE FOR PATHOLOGIST REGARDS A POST MORTEM EXAMINATION:

If a post-mortem (PM) examination is performed the Pathologist must immediately contact NHS Blood and Transplant ODT Hub Operations on telephone number 0117 975 7580 if the PM identifies pathology that is, or may be, relevant for the health or future health of the transplant recipient(s) and/or the patient's family.

(SN-OD Name) Specialist Nurse – Organ Donation
(ODST Team Name) Organ Donation Services Team

3.21 The SN-OD will take responsibility for ensuring the correct organs are dispatched to the transplant centres and complete the Organ Handover Form FRM4217.

Organ Preservation Practitioner (OPP) Responsibilities

3.22 The OPP of the abdominal NORS Team is responsible for abdominal organ preservation; liver, kidneys and pancreas during organ retrieval. The OPP of the cardio-thoracic NORS Team is responsible for cardio-thoracic organ preservation; heart and lungs during organ retrieval.

3.23 The Abdominal Perfusion and Cardiothoracic Preservation Protocols for NORS Teams in the UK (Appendix 3), should be adhered to.

3.24 Packing and labelling of all specimens, particularly spleen and lymph nodes, as well as blood vessels is the responsibility of the Organ Preservation Practitioner. The individual taking responsibility for packing the organ and sealing the box must ensure that each sample accompanying the organ has three points of donor identification.

3.25 It is the responsibility of the OPP to ensure that the HTA Organ Specific forms and any necessary vessel forms have been fully completed by the surgeons and are dispatched with the retrieved organs and tissue to transplant centres.

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NORS Team Responsibilities

3.26 Members of the NORS Cardio-thoracic and Abdominal Team should be aware that they are ambassadors for organ donation, retrieval and transplantation and must behave in a professional and respectful manner throughout the retrieval process.

3.27 In recognition of the gift of donation, retrieval team leads may wish to acknowledge the donor. This needs to be culturally and emotionally sensitive, recognising that it may not always be appropriate or possible. Examples could be a moment's reflection in silence or a brief message of thanks given by the lead surgeon.

3.28 The NORS Team should keep a presence in theatre throughout the procedure, including any agreed or planned delays/breaks.

3.29 Before commencing the retrieval operation, the competent NORS Cardio-thoracic and Abdominal Team Lead Surgeon(s) must review the patient's medical notes. Cardiothoracic and Abdominal Lead Surgeons must participate in the NHSBT Surgical Safety Checklist and the pre-theatre briefing before knife-to-skin begins. In particular, they must:

a) Have a clear understanding of the donor information prior to the start of the retrieval.

b) Check the identity, blood group and virology status of the donor;

c) Identify that death has been diagnosed and confirmed using either neurological or circulatory criteria by appropriately trained and qualified clinical personnel in the local donor hospital, and that it has been documented in the patient's clinical records.

d) On the very rare occasions where there are concerns over how death has been confirmed using neurological criteria, these concerns should be raised with the SN-OD who will, in turn, liaise with the critical care team and escalate to on-call staff as necessary. Whilst retrieval team members have a right to be confident in the diagnosis, it should be recognised that the application and interpretation of the criteria used to diagnose death using neurological criteria falls out with their own area of expertise. Under no circumstances should NORS Team members act in a way that jeopardises organ retrieval or the confidence of other staff members in the integrity of the process.

e) Check that appropriate consent/authorisation has been documented for the organs and tissue to be retrieved. If there is a requirement to re-measure the donor's height this should be done in accordance with the NHSBT Physical Assessment Management Process Description (MPD873).

f) If after having reviewed the patients' medical notes the NORS Team Lead Surgeon(s) are concerned;
- About the clinical information in the medial notes and/or EOS.
- And/or finds information of concern in the medical notes not documented on EOS pre-operatively.

The NORS Team Lead Surgeon should urgently communicate the information to the SNOD. The SNOD should urgently inform the Hub Operations of the new information.

3.30 Cardiothoracic and Abdominal Lead Surgeons must participate in the NHSBT Surgical Safety Checklist and the pre-theatre briefing before knife-to-skin.

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3.31 Any novel or uncommon procedure or deviation from accepted protocols which might have an adverse impact on other organs retrieved from that donor can only be carried out after discussion and agreement of all parties involved in the retrieval.

3.32 If, for any reason, there is an unusual aspect which is not clear in previously agreed retrieval protocols, and agreement cannot be reached by the attending competent NORS Team Lead Surgeon(s), then a member of the NHSBT ODT Medical Team should be asked to arbitrate. This should be organised via the SN-OD and on-call NHSBT Regional Manager.

3.33 In some instances, review of anonymised photographs of the patient (e.g. unusual skin rash or mole) or organ(s) taken before, during or after retrieval will help the transplant surgeon in making the most appropriate decision as to whether to accept a retrieved organ for transplantation. NORS Teams are encouraged to record and send photographs of organs or tissues to the transplant surgeon where it is clinically appropriate, provided donor anonymity is protected (donor ID only - no patient identifiable information). If sending images via ODT Hub Operations, three points of ID must be sent (donor ID, donor hospital and donor's age – not date of birth). See MPD1100.

3.34 If the transplant surgeon wishes that an organ is placed on machine perfusion immediately after retrieval, then it is his/her responsibility to liaise with the retrieval surgeon to ensure that they are willing and competent to do this. Otherwise, the transplant surgeon should arrange for a competent member of his/her team to attend and place the organ on the machine. The travel and consumables are not part of the commissioned NORS service and will not be reimbursed by NHSBT. If the team attending is a NORS Team that is not on-call and is ONLY attending at their own request (i.e. not at the request of ODT Hub Operations) then the workforce tariff will not be paid. If machine perfusion is not possible then the retrieval surgeon must package the organ in static cold storage in accordance with standard protocols. It is the responsibility of the retrieval surgeon to ensure that the organs are either perfused or packed before leaving the theatre.

3.35 All aspects of the retrieval operation should be conducted in accordance with appropriate infection control procedures.

3.36 In the case of donors with systemic infection, universal infection control measures must be taken. Refer to SaBTO guidance: https://www.gov.uk/government/collections/sabto-reports-and-guidance-documents.

3.37 After a laparotomy and/or thoracotomy have been undertaken, a thorough inspection of the organs should be performed both to exclude pathology such as malignancy or any other condition which might preclude organ transplantation or impact upon a recipient. Any pre-existing injury or abnormalities found at organ retrieval should be clearly documented in the donor's medical notes. The same information should be documented on the Witness 12 statements, if applicable.

3.38 Retrieval surgeons must take all reasonable steps to exclude malignancy in the donor. The entire gastro-intestinal tract, pancreas and liver must be examined at the start of the procedure. The kidneys should be inspected directly after retrieval by incising Gerota's fascia and clearing the fat adequately not only to confirm satisfactory organ perfusion but also to exclude renal tumours. Whenever possible, a median sternotomy as well as a laparotomy should be performed, and the lungs and thoracic oesophagus examined.

3.39 It is important that malignancy in a retrieved organ is identified before any other organ from that donor is transplanted.

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3.40 Care must be taken to avoid surgical injury to organs and their vasculature. In particular:

a) Ventilation (DBD) or lung inflation (DCD) should be interrupted during median sternotomy to prevent injury to the lungs.

b) The liver should be protected with a swab during median sternotomy and, during mobilisation; it should be retracted gently to prevent avulsion of its peritoneal attachments.

c) Handling of the pancreas should be kept to a minimum; during mobilisation the spleen should be used to act as a handle.

d) During kidney retrieval the ureters should be kept as long as possible together with sufficient soft tissue to preserve ureteric blood supply. Care must be taken not to exert undue traction on the renal pedicle.

e) The iliac arteries should not be pulled during removal to prevent dissection and disruption of the iliac arterial bifurcation.

3.41 Biliary tract: prior to retrieval, the gall bladder should be opened and gently sucked out. Repeated room temperature saline washes should be performed to clear the gall bladder of bile before the onset of cold ischaemia.

3.42 After flush-out through the aorta and before bagging the liver in the bowl, the common bile duct must be carefully but thoroughly flushed with UW solution using approximately 250 ml (Abdominal Perfusion and Preservations Protocol for NORS Teams in the UK (Appendix 3). This can be done according to preference of the NORS Team: either in situ before retrieval of the liver and ex situ on the back-table or just ex situ on the back-table. UW solution is used because it has a neutral pH; saline is not used since it has an acidic pH.

3.43 Ice slush should be used in the abdomen and chest around the organs to be retrieved.

3.44 NORS Teams are required to remove all allocated abdominal organs. Additional perfusion/packing should take place on the back table to prevent warm ischaemia time within the donor body.

3.45 Where the pancreas has been offered out, either for solid organ or for islet transplantation, and the NORS Team has concerns at time of retrieval about the quality of the organ, it has been agreed that the pancreas is to be removed in all instances to be properly inspected on the back-table by the Lead Surgeon to assess whether it appears suitable for transplantation or islet isolation. The Lead Surgeon's assessment will be conveyed to the Hub Operations that will inform the allocated centre and fast-track when appropriate. Additional photos may be of help to be sent to the receiving Transplant Team.

3.46 If there is an accessory right hepatic artery which cannot be safely preserved in its entirety either because it travels through the pancreas or gives a major branch to the pancreas then, as agreed by the Pancreas Advisory Group and the Liver Advisory Group, it can be divided at the duodenum. Before transecting it, the following applies:

a) The liver transplant centre should be informed by the SN-OD.
b) If the liver transplant centre agrees then divide the RHA at the duodenum.
c) If the liver transplant centre feels that there is a valid exception to this, then discussion needs to take place between the consultant liver and pancreas surgeons to agree the course of action.
d) The SN-OD should be informed of their decision within 30 minutes.

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3.47 Prior to insertion of the abdominal arterial perfusion cannula in DBD donors 300units/kg of heparin should be given intravenously at least 2 minutes before cannulation.

3.48 Please refer to the Abdominal Perfusion and Preservations Protocol for NORS Teams in the UK – revised September 2014 (Appendix 3) for guidance on organ flushing, preservation and packing. Abdominal organ perfusion is carried out by the OPP in attendance as outlined above.

3.49 All organs must be accompanied by appropriate specimens (blood samples, lymph node, and spleen) (see para 3.58 below) and by completed organ-specific NHSBT and blood group forms. Liver and pancreas/islets must always be accompanied by the blood vessels needed for reconstruction in the recipient. NORS Teams need to be aware that a pancreas declined for an islets recipient would still be offered as a whole organ for transplant.

3.50 Vessels to accompany the liver and pancreas should either be packed in a sterile small plastic container or sterile inner first bag submerged in preservation solution (not saline) that is then double bagged, with the second and third bag de-aired and remaining dry. It is important all bags are firmly tied. The vessels should not be placed in the bag/bowl with the organ but should be packaged separately by the OPP.

3.51 In cases of cardiothoracic retrieval, once the heart and/or lungs have been removed abdominal surgeons should interrupt their cold phase dissection to supply lymph node and spleen samples (see para 3.58 below) to the cardiothoracic NORS Team so that the heart and lungs can be shipped to transplant centres without delay.

3.52 NORS Teams intending to drain through the inferior cava into the dedicated ‘reservoir’ are asked to announce such intention and explain to the theatre team and to the SN-OD why they are doing this.

3.53 Standard practice under NORS is to retrieve abdominal organs separately unless indicated otherwise.

3.54 If there is an unintended breach of the gastro-intestinal tract during retrieval, this should be managed using a standard surgical approach of reducing contamination and decontaminating the cut edge of that part of the intestinal tract. This breach should be documented on the HTA-A Form and urgently communicated to ODT Hub Operations so that they can pass this information on to all the relevant transplant centres.

3.55 All abdominal organs (including liver, pancreas and both kidneys) that have been offered should be retrieved by the NORS team and inspected on the back-table.

3.56 NORS Teams will remove pancreas for islet transplant and liver for hepatocyte transplant but are not expected to retrieve tissue such as corneas, bone and skin. However, they should be aware that these may, on occasion, be retrieved in theatre by local staff. NORS Teams may be asked to remove the heart for aortic/pulmonary valves, if consent/ authorisation has been given, following standard guidance on retrieval (INF195).

3.57 Care must be taken to identify and report abnormal anatomy such as aberrant or accessory renal and hepatic arteries.

3.58 The abdominal team will retrieve 2 palpable lymph nodes per allocated organ, blood vessels, and spleen samples to accompany the organs and any additional samples as required. The SN-OD will arrange for the blood samples to accompany each organ.

3.59 Kidneys from donors aged under 5 years will be retrieved and offered *en-bloc* while kidneys from donors aged 5 years and over will be retrieved and transplanted singly wherever possible. *En-bloc* kidney retrieval relates to the removal of both kidneys in continuity with the aorta and inferior vena cava. *En-bloc* kidneys will be offered on a centre, rather than patient basis, to any centre wishing to receive offers of such kidneys. If the recipient centre wishes to implant both kidneys separately, then they will divide the separate the two kidneys on receipt at the recipient centre - splitting a paediatric *bloc* is NOT a requirement of the NORS Team.

3.60 Livers may be split *in-situ* if both recipient liver transplant centres agree and provided that the attending cardiothoracic NORS Team does not object, but must be abandoned if, in the opinion of either the abdominal or the cardiothoracic NORS Team, the donor becomes unstable. Where agreement cannot be reached on liver splitting *in-situ,* the paediatric recipient centre is the index centre where the whole liver will be sent to be split unless both recipient liver transplant centres agree otherwise.

3.61 In the case of any liver retrieval the competent NORS Team Lead Surgeon(s) will contact the RCPOC to communicate about the quality of the respective organ as, frequently in these cases, the recipient operation will start before the arrival of the organ. For all other organs it is sufficient that the competent NORS Team Lead Surgeon(s) notifies the RCPOC immediately if any organ appears sub-optimal or if any unexpected damage or abnormality is encountered which might compromise the function or safe use of that organ. The NORS Team Lead Surgeon is responsible for documenting the conversation in the medical notes as well as for documenting any unusual findings that cause concern.

3.62 On completion of the operation, the NORS Team Lead Surgeon is responsible for producing an accurate operation record in the donor patient notes. This note should include clear documentation of all organs and tissue removed from the body, including which organs have been removed and which have been accepted for transplantation. Documentation of any abnormalities/injuries noted during laparotomy or thoracotomy, the start time of the retrieval operation, and any communication with members of the transplant team(s) is required.

3.63 The NORS Lead Surgeon should also document any conversations with accepting transplant centres and their response to that conversation.

3.64 After signing the notes, the surgeons must clearly write their names and the names of their NORS Centre together with a contact number in case ODT Hub Information Services or Coroner/Procurator Fiscal wishes to contact them.

3.65 Where required, it is the competent NORS Team Lead Surgeon's responsibility to complete MG11 forms (Witness Statements), if requested by the Coroner.

3.66 HTA A form: The SN-OD will legibly record the donor demographics on the HTA Organ Specific forms. Documenting and recording fluid type and batch number is the responsibility of the Organ Preservation Practitioner. The NORS Team Lead Surgeon(s) must ensure that all surgical and anatomical details are legibly recorded and then signed and returned to the SN-OD prior to leaving the premises. If the form is not returned to the SN-OD then ODT Hub Information Services will contact the NORS Team Lead Surgeon(s) for a copy of the form.

3.67 If organ(s) have not been placed with a transplant centre at the end of a retrieval, it is the NORS Abdominal Team's responsibility to take the organ(s) back to their base. The organ(s) should be held in a well-defined and secured environment at their base until ODT Hub Operations informs them that they have been placed. It is then the responsibility of the NORS Team to liaise with the RCPOC, who will arrange for transport of the organs. Unplaced organs which are not going to be used for transplantation or research and which cannot be returned to the donor, should accompany the NORS Team to the NORS Centre. The NORS Team will be responsible for arranging disposal of the organ according to NORS Centre policy and recording on the HTA-B form.

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3.68 If, in a donor attended by a NORS Team, a specific organ is found to be unsuitable for transplantation and is declined by the relevant transplant centres, then the NORS Team may retrieve it for research purposes provided that appropriate consent/authorisation has been obtained. NB: Under HTA rules, if material is being removed from the deceased for the primary purpose of research then a specific HTA licence for the premises where the material is removed must be in place unless the respective Trust is covered by the extended NHSBT Research Licence for specifically NHSBT approved research studies. The Human Tissue Act only applies to England, Wales and Northern Ireland. There is no requirement for an HTA licence to procure organs and tissue for research for hospitals in Scotland.

3.69 NHSBT facilitates research and NORS Teams are required to obtain samples during retrieval for QUOD or projects agreed by RINTAG, where appropriate consent/authorisation has been obtained.

3.70 Retrieval surgeons using banked blood must capture the DIN number on the HTA form for the organ. The DIN number must also be recorded in the operation notes for the donor. Refer to Appendix 7 (Blood utilisation for donor organ retrieval, *ex situ* machine perfusion and preservation technologies)**.**

3.71 The SN-OD and members of the NORS Team will report any significant adverse occurrence during retrieval within 48 hours (SOP3888) by accessing the NHSBT Incident reporting form via https://safe.nhsbt.nhs.uk/IncidentSubmission or via the ODT Clinical website: https://www.odt.nhs.uk/.

3.72 All SAEARs should be reported within **24 hours** of discovery by the license holder. In cases where an urgent notification is required, the establishment must telephone the NHSBT Hub Operations on 01179 757575 immediately upon discovery. The telephone call must be followed up by an online submission of a report form detailing any immediate actions taken. Such urgent notification would be required in cases where there are potential implications for other recipients.

3.73 A Retrieval Team Information (RTI) form (FRM4125) must be completed by the NORS Team and submitted by the NORS Centre for every donor attendance.

Communication of Intra-Operative Findings

Table 1 is not intended to be an exhaustive list of findings but serves as a guide for effective communication before, during and after organ retrieval.

If the Lead Abdominal and/or Cardiothoracic Lead Surgeon is concerned about any element of the donor's medical history, findings during theatre and anything else that may impact on the health and safety of the intended recipient then they must discuss with the accepting consultant transplant surgeon.

** It is recommended that best practice is for the Lead Retrieval Surgeon to discuss any concerns directly with the Consultant Transplant Surgeon at accepting Transplant Centres. This conversation may be facilitated by Hub Operations e.g. the SNOD/the Lead Surgeon may request the Hub Operations to contact the Transplant Centre recipient points of contact and request that the Consultant Surgeon calls the Lead NORS Team Lead Surgeon.

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Table 1

Finding	Who informs Who?	Documentation
Lead Surgeon(s) review medical notes and EOS at the donor hospital, any new information or information of concern should be communicated to accepting transplant centres	Lead NORS Surgeon(s) informs Hub Operations who must inform Recipient points of contact at accepting transplant centres Lead surgeon(s) should also inform the SNOD of his/her concerns	Conversation documented in the medical notes SNOD should document on EOS and inform HUB operations
Findings in theatre requiring urgent biopsy: suspicious nodule/possible tumour Intended specimens taken and processed in the donor hospital	SNOD informs Hub Operations that an urgent biopsy is being processed and results will be communicated when available Hub Operations inform all accepting recipient points of contact at accepting transplant centre	SNOD documents on DonorPath
When biopsy results are available, recipient points of contact at accepting centres informed	Benign results – SNOD informs Hub Operations who communicate the result to accepting recipient points of contact Possible malignancy/ confirmed malignancy- Lead Surgeon informs Hub Operations. Hub Operations inform accepting recipient points of contact *Recommendation- it is advised that best practice is for the accepting Consultant Transplant Surgeon and the Lead Surgeon to liaise directly upon receipt of the information.* **This conversation may be arranged by Hub Operations	SNOD documents result on Donor Path and EOS Lead Surgeon documents conversation in the medical notes e.g. who was told what information, and the centre's response

Suspicious area/ nodule identified on an organ/ in the donor hospital at the back-table and a decision is made for the biopsy to be done at the Transplant Centre	Lead surgeon informs the accepting Transplant Consultant at the Transplant Centre. **This conversation may be arranged by Hub Operations If the Cardiothoracic NORS Team has left the OT with organs for transplant the abdominal Lead Surgeon informs the accepting Consultant Transplant Surgeon at the CT Centre The Lead Surgeon informs Hub Operations of this and requests that the accepting transplant units are urgently informed	Lead surgeon documents on the HTA form Lead Surgeon documents conversation in the medical notes e.g. who was told what information and the centre's response Hub Operations will document on NTxD SNOD should document in DonorPath
Poor or inadequate kidney/pancreas/liver perfusion	Lead surgeon informs the SNOD SNOD informs HUB operations Hub Operations inform recipient points of contact	Lead surgeon documents on the HTA form SNOD documents on Donor Path
Unusual or extra ordinary anatomy or injury that might compromise any recipient of an organ from that donor must be reported immediately to ODT Hub Operations	Lead Surgeon informs the SN-OD during the procedure, SN-OD informs Hub Operations, who should then inform recipient point of contact at accepting Transplant Centres After the procedure the Lead Surgeon contacts the recipient surgeon(s) **This conversation may be arranged by Hub Operations	Lead Surgeon documents in the medical notes and on the HTA A form Conversation documented including the response from the accepting transplant surgeons
Organ damage requiring possible repair at the accepting centre	Lead surgeon informs the accepting Transplant Consultant **This conversation may be arranged by HUB operations	Lead surgeon documents on the HTA form Lead Surgeon documents conversation in the medical notes e.g. who was told what information and the centre's response
If there is an unintended breach of the digestive tract during retrieval, this should be documented on the HTA Form	Lead Surgeon informs Hub Operations to convey information to all relevant Transplant Centres **This conversation may be arranged by Hub Operations	Lead Surgeon documents in the medical notes Lead Surgeon documents on the HTA A Form Hub Operations document on NTxD

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4. NORS Centre Requirements

4.1 Each NORS Centre must ensure they have the appropriate workforce in place for the NORS Team:

a) Lead Surgeon – a surgeon who is competent in retrieval, either certified following NHSBT accredited training or by the Grandfather Clause*.
b) Surgical Assistance – a healthcare professional who provides support to the Lead Surgeon.
c) Organ Preservation Practitioner – a theatre practitioner who is capable of performing preservation, perfusion and packing of organs.
d) Scrub Practitioner – a theatre practitioner who provides expert assistance to the surgical team in theatre.

* (*Practising members of a NORS team as at 1st April 2014 are automatically deemed to be 'certified and competent'*)

4.2 Each NORS Centre must have a named NORS Team Clinical Lead; a named NORS Management Lead; and a named NORS Finance Lead. These individuals' contact details must be provided to NHSBT.

4.3 Each NORS Centre must have clear, written, regularly reviewed, version controlled and circulated protocols for the retrieval procedures that they will undertake, including for both DBD and DCD operations**.**

4.4 There should be effective and sustainable workforce planning covering all professional disciplines included in the multidisciplinary NORS Team. All staff should have regular appraisals and agreed professional development plans.

4.5 NORS Centres must provide opportunities for training for all members of the NORS Team to maintain competency levels. There should be explicit consultant involvement in the educational aspects of the retrieval programme, on the job training, and the assessment of competency of trainees by NORS Team Clinical Leads.

4.6 All NORS Centres must hold monthly meetings to audit their own activity and performance, and to identify and rectify deficiencies in donor care, organ integrity, inefficient processes and poor communications.

4.7 Audit meetings should include clinical governance incidents and outcome of retrieved organs, organ damage and dysfunction, punctuality and delays, difficulties encountered in donor hospitals, transport problems and feedback from donor hospitals and SN-ODs.

4.8 Audit meetings should be chaired by the named NORS Team Clinical Lead and attended by as many members of the NORS Team as possible. Members of the local SN-OD teams and CLODs should be invited to attend these meetings.

4.9 Minutes of audit meetings should be recorded, distributed to all members of the NORS team and made available to NHSBT on request.

4.10 All NORS Centres should, when requested, contribute data to national audits and registries. Such data should be accurate, complete and transmitted on time.

4.11 There should be provision of appropriate staff for the collection, storage and transmission of audit and registry data.

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4.12 All NORS Centres are expected to participate in national clinical research projects aimed at improving the quality of retrieved organs when called upon to participate.

4.13 There should be clear accounting for all income to the Trust/NHS Board that is designated for the delivery of retrieval services in accordance with financial governance procedures. This will include finance directly managed by the transplant service and finance that is managed by the financial infrastructure within the Trust/NHS Board.

4.14 The NORS Centre will submit a quarterly financial return of actual and forecasted costs. For those centres that are not under the National Transport Contract, this must include all costs and transport journey details, including donor numbers, journey type and organ type.

4.15 There should be annual Contract Review Meetings to address issues specific to NORS, including but not limited to, financial, activity, audit, clinical governance. The annual meetings are held at the NORS Centre.

4.16 Robust arrangements should be in place for timely and accurate collection of data. Data should be made available to NHSBT under agreed reporting mechanisms.

4.17 There should be clear and accountable leadership of the NORS service at each centre with a NORS Team Clinical Lead notified to NHSBT.

4.18 The NORS Team Clinical Lead is responsible for ensuring that all members of the NORS Team possess the appropriate qualifications, experience and skills to perform the roles and duties assigned to them. The team must include a competent and certified NORS Team Lead Surgeon, competent Organ Preservation Practitioner, and Scrub Practitioner.

4.19 All NORS Team surgeons who were already trained and in post as at 1st April 2014 were automatically deemed to be certified and competent under the 'Grandfather clause'*.

(**Practising members of a NORS team as at 1st April 2014 are automatically deemed to be 'certified and competent.'*).

4.20 All Surgeons or Surgeons-in-Training aspiring competency in organ retrieval to participate eventually in a NORS Team as independent and competent Lead Surgeons need to register with NHSBT ODT as being in training, name their NORS Team and NORS Team Clinical Lead and then provide evidence of their retrievals undertaken; e-learning (as provided by NHSBT for NORS); and attendance at the annual NHSBT Organ Retrieval Masterclass.

4.21 The NORS Team Clinical Lead is responsible for ensuring that the 'trainee' retrieval surgeon is assessed when undertaking a retrieval independently. If the 'trainee' is deemed competent the NORS Team Clinical Lead must complete the necessary documentation to sign off the 'trainee' retrieval surgeon as competent informing NHSBT that will then enter the name of the trainee in the Register of Competent NORS Lead Surgeons.

4.22 The NORS Team Clinical Lead is responsible for providing a list of all Lead Surgeons, within each NORS Centre, to NHSBT together with a declaration that each has been assessed as competent to lead their NORS Team during a retrieval procedure.

4.23 NORS Team Clinical Leads must check, validate and return a prefilled list of NORS Team surgeons (competent and in-training) to NHSBT on a quarterly basis. This should include details of all new surgical members entering the competency training facilitated by NHSBT.

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4.24 Once registered as competent and in order to retain the competent status, NORS Team surgeons are required to have actively participated in a prespecified number of organ retrieval procedures per annum. NHSBT will check the individual record of retrievals undertaken by the Lead Surgeon on an on-going basis to complete the accreditation database.

4.25 Competent NORS Lead Abdominal Surgeons must be capable of accurately assessing and retrieving liver, pancreas and kidneys. Competent NORS Lead Cardiothoracic Surgeons must be capable of accurately assessing and retrieving heart and lungs.

4.26 All members of the NORS Team are expected to participate in continuing professional development by attending appropriate courses and meetings.

4.27 Trainees in higher surgical training programmes should be instructed in all aspects of organ retrieval and maintain a log book of surgical procedures in accordance with SAC guidelines.

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5. Post Retrieval & Receipt at Transplant Centre

5.1 On receipt of a retrieved organ, the transplant surgeon is responsible for checking the integrity and suitability of the retrieved organ, including donor details on the organ specific HTA-A form, the blood group, and microbiology results before implanting it into the recipient.

5.2 In cases where an organ is deemed unsuitable for the allocated recipient the transplant surgeon is advised to discuss the reason with a surgical colleague. If the organ is still deemed to be transplantable the surgeon/recipient co-ordinator should immediately inform ODT Hub Operations to reallocate the organ as per national allocation policies. In cases where the transplant surgeon and their surgical colleague decide the organ is not transplantable ODT Hub Operations should be informed. ODT Hub Operations will then advise on the appropriate course of action as set out in the national allocation policies in relation to further offering for transplantation, offering for research or if the organ should be disposed of.

5.3 Transplant centres have an obligation to urgently report any abnormality such as a suspected or proven malignant tumour which might impact adversely on recipients of other organs. Any such abnormality must be reported immediately to ODT Hub Operations who will then immediately notify other transplant centres.

5.4 Transplant centres must notify NORS Teams of any organ damage or abnormality that was not recognised or recorded on the organ specific HTA-A form during the retrieval process.

5.5 If, post-transplant, positive results from cultures of the transport perfusion fluid are identified, this must be reported to ODT Hub Operations. Results that require reporting to ODT Hub Operations include:

Candida
Staphylococcus aureus
Pseudomonas
Enterobacter
Multi-drug resistant organisms

5.6 If the transplant centre, at back table assessment, note any suspicious nodes/etc. and take a sample for histopathology prior to implant then this must be communicated to ODT Hub Operations immediately (see Table 1 under Section 4).

5.7 Transplant centres must participate in organ retrieval audits when called upon to do so.

5.8 Centres should have a clear policy on the storage and disposal of any unused organs, tissues or surplus tissue in compliance with the Human Tissue Act (2004), the Human Tissue (Scotland) Act, 2006 and Human Transplantation (Wales) Act 2013.

5.9 Transplant centres should maintain a record and summary of all offers of donor organs assessed and accepted or declined for transplantation. Transplant centres will undertake a rolling audit of donor offers and notify NHSBT of their reasons for declining individual organs.

5.10 The transplant centre is responsible for arranging transport of retrieved organs from the donor hospital to the transplant centre with the exception of pancreas and kidneys. NHSBT will continue to make transport arrangements for retrieved pancreas and kidneys.

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5.11 The transplant centre should record the time that the organ arrived at the centre and the time that the organ was transferred from cold solution into the operative field (i.e. end of cold ischaemia time).

5.12 The transplant centre must ensure completion of an HTA-B form for each organ intended for transplant in accordance with the Human Tissue Act (2004) and the Human Tissue (Scotland) Act, 2006.

5.13 Transplant centres must record on the HTA-B form any abnormality or damage to organs that they receive. Retrieval damage should be classified as indicated on the form.

5.14 The transplant centre must return the HTA-B forms to ODT Hub Information Services within seven days of receipt of the organ.

5.15 If, due to retrieval damage, the organ fails to function following transplantation, then the transplant centre must notify NHSBT by accessing the NHSBT Incident reporting form via https://safe.nhsbt.nhs.uk/IncidentSubmission or via the ODT Clinical website https://www.odt.nhs.uk/.

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APPENDIX 1

Organ Donation and Transplantation Safety Alert

Interpretation and management of spinal movements in potential brain-stem dead donors

May 2014

Unexpected movements in patients who are brain-stem dead can be distressing for both family members and clinical staff and may generate uncertainty over the validity of a diagnosis of brain-stem death. Misinterpretation of spinal movements in a potential brain-stem dead donor by a member of an organ retrieval team has recently resulted in the loss of cardio-thoracic organs and unnecessarily added to the distress of a grieving family.

Clinical features of spinal movements in brain-stem death

Brain-stem death relieves the spinal cord from descending central control, allowing the emergence of spontaneous and reflex movements from neuronal networks within the spinal cord – so called spinal movements.

Spinal movements are seen in circumstances where brain-stem death has been confirmed by four-vessel cerebral angiography. For this reason, clinicians can be confident that **spinal movements in no way invalidate the diagnosis of brain-stem death.**

Spinal movements often appear after an initial period of complete flaccid paralysis. For this reason, they may be seen for the first time after brain-stem death has been confirmed, for instance during donor optimisation, transfer to theatre or organ retrieval.

Spinal movements may be triggered or exaggerated by hypotension or acid-base disturbances and are often reported during apnoea testing or following the withdrawal of mechanical ventilation in patients not proceeding with organ donation.

Spinal movements can be abolished with anaesthetic muscle relaxants.

Spectrum of spinal movements seen in brain-stem death

- Flexor / extensor plantar responses
- Triple flexion response
- Abdominal reflex
- Cremasteric reflex
- Tonic-neck reflexes
- Isolated jerks of the upper extremities
- Unilateral extension-pronation movements
- Asymmetric ophisthotonic posturing of trunk
- Undulating toe flexion sign
- Myoclonus
- “Lazarus sign”
- Head rotation
- Respiratory-like movements
- Quadriceps contraction
- Eye opening response
- Leg movements mimicking periodic leg movement
- Facial myokymia

MANAGEMENT PROCESS DESCRIPTION MPD1043/8 – Effective: 15/10/18

National Standards for Organ Retrieval from Deceased Donors

Authors – Kathy Zalewska & Rutger Ploeg

Spinal movements are reported to occur in as many as 50% of brain-stem dead patients. Whilst some movements are clearly 'abnormal', others can appear alarmingly purposeful. To view an example of spinal movements go to http://ccforum.com/content/17/4/440/suppl/S1 (head rotation).

Actions

Who: Clinical Leads for Organ Donation
Organ Donation Team Managers
Specialist Nurses - Organ Donation
National Organ Retrieval Service Clinical Leads

What:

Please ensure that

- ⚠ all staff who care for potential brain-stem dead donors are aware of this safety alert
- ⚠ all staff have an adequate knowledge of the aetiology, nature and implications of the spinal movements associated with brain-stem death, and that they clearly understand that such movements do not invalidate its diagnosis
- ⚠ members of retrieval teams are aware that inexperienced staff may be alarmed by spinal movements, and they have a duty to avoid misleading statements that will add to this uncertainty.
- ⚠ members of retrieval teams recognise that brain-stem death is diagnosed by senior medical staff on ICU, and that if they wish to seek clarification on points of detail this should be done respectfully, discretely, and without causing alarm to other team members.
- ⚠ muscle relaxants are given prior to organ retrieval and are continued until the aorta is cross clamped. Suitable drugs and their doses (based upon a 70kg adult) are as follows:
    - rocuronium, 100mg at start of procedure
    - atracrium, 50 mg with 10 mg boluses repeated every 30 minutes
    - vecuronium 10 mg, with 2 mg boluses repeated every 30 minutes

  remembering that neuromuscular blockade should be monitored using a nerve stimulator and that volatile agents may also be used to blunt spinal movements.

References

1. Saposnik G, Basile VS, Young GB. Movements in Brain Death: A Systematic Review. Can. J. Neurol. Sci. 2009; 36: 154-160.
2. Wu Y, Balaguer PO: Spontaneous and reflex head turning in brain death. Critical Care 2013, 17:440.

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APPENDIX 2

LUNG RETRIEVAL FROM DCD DONORS

Preparation for DCD lung retrieval

1. Lung DCD retrieval requires careful planning and close collaboration between all of those involved in the care of the patient.
2. Prior to treatment withdrawal, the Specialist Nurse – Organ Donation (SN-OD) and the lead surgeons from the abdominal and thoracic NORS Teams should meet with a senior member of the ICU / anaesthetic team in order to
    a. Establish whether treatment withdrawal will include extubation
    b. Identify who will be responsible for re-intubation (where relevant), re-inflation and re-ventilation to facilitate lung retrieval
        i. Ideally this will be a member of the donor hospital ICU / anaesthetic team, who should be available
        ii. If the donor hospital ICU / anaesthetic team are not able to support the various airways interventions, the retrieval team must ensure they are appropriately staffed and equipped to support lung retrieval.
    c. Ensure that all involved have agreed the respective timings of the various airway interventions as defined below.
    d. Ensure that all the necessary equipment to support the various airway interventions is available in the retrieval theatre.
3. **Any uncertainties or disputes with regards to airway interventions must be resolved prior to withdrawal of life sustaining treatments.**

Pathway for DCD lung retrieval

1. The abdominal and cardiothoracic NORS Teams should be ready and prepared in theatre prior to treatment withdrawal
    a. The equipment required to re-intubate the donor and to re-inflate / re-ventilate the lungs should be available in the theatre prior to treatment withdrawal.

2. Life -sustaining treatments are withdrawn by the donor hospital team.
    a. Lung retrieval should be stood down if asystole does not occur within 2 hours of treatment withdrawal

3. Death is diagnosed and confirmed by the donor hospital team after 5 minutes of continuous absence of cardio-respiratory function in accordance with national professional guidance.

4. Upon the arrival of the donor in theatre, the priority of the cardiothoracic NORS Team is the airway and lungs whilst the priority of the abdominal team is perfusion of the abdominal organs as quickly as possible. **The cardiothoracic team should facilitate and support the abdominal team during cannulation and abdominal perfusion.**

5. Re-intubation
    a. If the patient has been extubated as part of treatment withdrawal, the airway should be re-intubated with a cuffed endotracheal tube as soon as possible after death has been confirmed in order to prevent contamination of the airways with gastric contents (the likelihood of which increases considerably during the retrieval laparotomy).
        i. The cuff of the endotracheal tube should be firmly inflated to ensure that airway soiling is prevented.
    b. **The lungs must not be inflated until ten minutes has elapsed since the onset of irreversible asystole.**

6. Inflation of the lungs
   a. **At a point no earlier than 10 minutes after the onset of irreversible asystole**, the lungs should be re-inflated with single vital capacity breath of oxygen enriched air.
      i. If lung re-inflation is performed by a member of the anaesthetic / ICU team, this should be done using an anaesthetic machine and circuit to deliver a single vital capacity breath of 50% oxygen. Initially, the APL valve should be adjusted to maintain airway pressures of 30-40 cm H_2O for 30 seconds to aid lung recruitment. Thereafter, gas flows and the APL valve should be adjusted to maintain steady lung inflation at 5–10 cm H_2O CPAP
      ii. If lung re-inflation is performed by a member of the retrieval team, a self-inflating manual device such as an Ambu Bag® should be used to re-inflate the lungs with a single breath of oxygen-enriched air. Thereafter, the endotracheal tube should be clamped to maintain lung inflation.
   b. Over-inflation should be avoided.
   c. **Cyclical lung ventilation must not be instituted automatically at this stage and can only begin once lung perfusion has commenced (see below).**

7. Cyclical ventilation, either with an anaesthetic machine or by hand-bagging, should start during lung perfusion to aid distribution of perfusate. Cyclical ventilation of the lungs is not allowed **until the retrieval team has started to flush the lungs and vented the left atrium.**
   a. If initiated by a member of the anaesthetic / ICU team, the lungs should be ventilated with 60% oxygen using an anaesthetic ventilator. If possible, a protective ventilatory strategy (pressure-controlled ventilation, 5 – 10 cmH_2O PEEP) should be employed.
   b. If initiated by a member of the retrieval team, the lungs should be ventilated manually with oxygen-enriched air using an Ambu Bag® or similar device.
   c. Over-inflation should be avoided.

8. If the arch vessels are to be clamped, for instance to support normothermic regional perfusion, then lung recruitment and ventilation can begin as soon as the cerebral circulation has been so isolated.

9. Bronchoscopy should be performed as soon practicable and include thorough bronchial toilet.

10. On explanation, the trachea should be clamped with the lungs ¾ inflated. Over inflation must be avoided, particularly if the lungs are being transported by air to the implanting centre.

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Authors – Kathy Zalewska & Rutger Ploeg

APPENDIX 3

Abdominal Perfusion and Preservation Protocol for NORS Teams in the UK

Please refer to Appendix 4 below for Perfusion protocol for abdominal organ retrieval from infant and neonatal donors (DBD and DCD)

Background

Following a meeting of representatives from all of the NORS abdominal centres on 9th October 2012, a national protocol for the use of preservation solutions was agreed. This protocol was reviewed on 17 September 2014. The protocol covers the following:

1. Donor type: DBD or DCD;
2. Organ specific: Liver, pancreas and kidney retrieval;
3. In-situ portal flush of the liver;
4. Back table perfusion of liver, pancreas kidney;
5. Packing for static cold storage and transport;
6. Specific issues were also highlighted: use of streptokinase in DCD, pressurised aortic in-situ perfusion, minimum volumes of solution.
7. Where the document refers to University of Wisconsin (UW) solution, this should be read as "UW or equivalent". "Equivalent" means the fluid used must have the same chemical composition as University of Wisconsin fluid for cold storage solution.

In situ perfusion

1. The aim of in situ perfusion should be to ensure the effluent runs clear.
2. Teams should record the volume of fluid used per donor.

DBD	**Aorta (type/volume)**	**Portal vein (type/volume)**
Liver, pancreas and kidney	UW solution 50 – 70 ml/kg	Nil or UW 1 litre
Liver and kidney	UW or Soltran solution 50 – 70 ml/kg	UW 1 litre when Soltran is used
Kidney	UW or Soltran solution 50 – 70 ml/kg	N/A
DCD III		
Liver, pancreas and kidney	UW solution alone (heparinised) 50 – 70 ml/kg or 1 litre flush with heparinised low viscosity solution followed by UW solution 50 - 70 ml/kg	UW 1 litre
Liver and Kidney	UW solution alone (heparinised) 50 – 70 ml/kg or 1 litre flush with heparinised low viscosity solution followed by UW solution 50 – 70 ml/kg	UW 1 litre

Kidney	UW solution alone (heparinised) 50 – 70 ml/kg or 1 litre flush with heparinised low viscosity solution followed by UW solution or Soltran solution alone (heparinised) 50 – 70 ml/kg	N/A

Important: the use of Soltran solution only for aortic in-situ perfusion was agreed for liver and kidney DBD retrievals, with the proviso that portal vein perfusion with UW solution is also undertaken (either in-situ or during the back table).

There was discussion around the merits of flushing the aorta and the organs in the context of DCD with 1 litre of low viscosity solution, such as Soltran solution. It was noted that while there is currently no clear evidence for a benefit, teams who prefer this regimen can continue to do so.

Back table perfusion

Back table perfusion may not be required if in situ examination demonstrates that the organs are well-perfused. However, portal perfusion must take place, either in situ or on the back table.

DBD	**HA (type/vol)**	**Portal (type/vol)**	**CBD (type/vol)**	**Pancreas (type/vol)**	**Kidney (type/vol)**
Liver	UW 200-500 ml	UW 500-1000 ml	UW 250 ml		
Pancreas				Nil unless indicated (UW)	
Kidney					UW or Soltran 200-300 ml or until clear
DCD III					
Liver	UW 200-500 ml	UW 500-1000 ml	UW 250 ml		
Pancreas				Nil unless indicated (UW)	
Kidney					UW or Soltran 200-300 ml or until clear

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Packing for static cold storage and transport

Packing	Liver (type/vol)	Kidney (type/vol)	Pancreas (type/vol)
DBD	UW until submerged (approx 2 L)	UW or Soltran (approx 250 ml)	UW (approx 500 ml)
DCD	UW until submerged (approx 2 L)	UW or Soltran (approx 250 ml)	UW (approx 500 ml)

Other discussion points and specific issues:

1. The administration of streptokinase in an initial flush is not acceptable in the retrieval of liver or pancreas, as it must be delivered at normal body temperature, and concern was expressed about the delay in cold perfusion. The evidence base for its use in liver and pancreas retrievals is non-existent.
2. The group supported the administration of heparin in the aortic flush.
3. The use of pressurisation of fluids was debated, with the recommendation that a pressure of max 200 mmHg be exerted, which has previously been shown to correspond to an intra-aortic pressure of around 40 mmHg.
4. The addition of additives, such as benzyl penicillin, insulin and dexamethasone, to the preservation solution UW is not recommended any more. The addition of fresh glutathione is optional, although no clinical evidence is available for a benefit.
5. When UW solution is obtained from Bridge to Life (Belzer UW Solution) or from ORS (SPS-1) no filter is needed.
6. Auxiliary blood vessels retrieved for use as conduits should be stored in UW solution in separate pots plus two bags to ensure sterile conditions where possible to facilitate transport to the transplanting centres. If the vessels are to be stored after the transplant, then antibiotics may be added to the pots at the recipient centre according to current centre practice.
7. It was agreed that all organs should be stored in **THREE** bags except for the liver that will be stored in a bowl plus two bags to ensure sterile conditions.
8. All organs should be stored as follows:
    a. Each organ is submerged in sufficient cold preservation solution in the first bag.
    b. The second bag is filled with at least 250 ml cold saline (without any ice).
    c. A small amount of fluid (sufficient to ensure there is no air in the bag) shall be placed between the second and third bags.
    d. Important: each bag is firmly tied after adequate de-airing.
    e. The bagged organs are then placed in the transport box and covered with non-sterile melting ice.
9. The liver should be placed in a sterile bowl (if the liver is too large to fit in the bowl, the bowl should not be used) and submerged in preservation solution. The bowl with the liver is then packed as described above.
10. For all livers which are to be split, and in all paediatric donors, all perfusion must be with UW solution, and must include in situ portal vein perfusion.

11. It was noted that following the initial in-situ flush first liver and then pancreas should be retrieved followed by immediate additional back table flush and packing. Ideally, another team member could retrieve the kidneys at the same time to reduce 'warm ischaemic' time.
12. In the tables the 'generic' names for the preservation solution are used as according to tender processes brand names may vary.

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APPENDIX 4

Perfusion protocol for abdominal organ retrieval from infant donors (DBD and DCD)

Donor Criteria

- All paediatric donors weighing 15 kilograms or less
- DBD and DCD
- Abdominal Organ Retrieval

Heparin / Perfusion Fluids

DBD donors: administer Heparin at 100IU/Kg 5 minutes prior to cross - clamp

DCD donors: add Heparin to the flush solution (Hartmann's or Ringers Lactate) and preservation solution (University of Wisconsin) at a concentration of 10,000 IU /L

Ideal perfusion temperature for University of Wisconsin cold storage solution should be between 2-4^{0}C.

Perfusion

- Cannulate through the right or left common iliac artery. Be mindful of the ureter.
- Initial flush through aorta with Hartmann's solution (Maximum 500mls) at **room temperature** under gravity holding the infusion bag at 100 cm above the donor. **Do not apply additional external pressure.**
- Vent in the chest whenever possible, otherwise in the pelvis.
- After infusion of Hartmann's solution continue with the aortic flush using cold UW cold storage solution. Perfuse 50-70 ml/Kg until organs are flushed, sufficiently cold and ready to be removed.
- In DCD: in view of the constraints with warm ischaemia time, **in-situ portal vein perfusion is not recommended**. This can often cause injury to major vasculature in such small donors. Proceed with in-situ portal flush if it is felt safe to do so, portal flush can be done more effectively on the back table before packing the organs.
- In DBD: in-situ portal flush can be done if it's safe to do so, or if the consultant transplant surgeon request in situ portal flush after previously considering the experience of the retrieving surgeon

Back Table

- Flush liver through portal vein, hepatic artery and common bile duct using UW solution.
- Kidneys can prove difficult to flush on the back table, avoid injury whilst attempting to perform back table flushing. If necessary, they can be re-flushed after completion of back table dissection.
- Pack all organs submerged in UW solution.

Note

Paediatric kidneys do not flush well with cold UW solution, hence the initial use of Hartmann's solution at room temperature.

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APPENDIX 5

Donor Heart Perfusion & Preservation Protocol for NORS Teams in the UK

1. Systemically anticoagulate donors with 30,000 units of IV heparin
2. Venting of the IVC (chest or abdomen) as agreed between the NORS teams present
3. Donor heart preservation solution:
    a. Sterile Concentrate for Cardioplegia Infusion (SCfCI, Martindale Pharma®) should be used for all national shared donor hearts
    b. This will be diluted by adding 20ml of SCfCI to 1 litre of Ringers solution
4. Volume:
    a. Donor weight 30-70 Kg: administer 1 litre of reconstituted SCfCI solution
    b. Donor weight >70 Kg: administer 1.5 L of reconstituted SCfCI solution
    c. At the request of the **recipient** transplant surgeon, it is permissible to change the above doses dependent on logistics and/or donor physiology
5. Delivery pressure: 60-90 mmHg
6. Storage of donor heart for transport:
    a. Inner bag: cold Saline 2 L
    b. 2nd bag: cold Saline 2 L
    c. Outer bag: cold Saline 2 L

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APPENDIX 6

Donor Lung Perfusion & Preservation Protocol for NORS Teams in the UK

1. Systemically anticoagulate donors with 30,000 units of IV heparin
2. Donor lung preservation solution: Perfadex® Plus
3. Volume: 50 - 75ml/Kg (see table below)

Donor Wt (Kg)	Antegrade Vol (L)	Retrograde Vol (L)	Total Vol (L)	Number of 1L bags required
21-40	**1.0**	**1.0**	**2.0 (50-95 ml/kg)**	**2**
41-60	**2.0**	**1.0**	**3.0 (50-73 ml/kg)**	**3**
61-80	**3.0**	**1.0**	**4.0 (50-67 ml/kg)**	**4**
81-100	**4.0**	**1.0**	**5.0 (50-62 ml/kg)**	**5**
101-120	**5.0**	**1.0**	**6.0 (50-59 ml/kg)**	**6**
121-140	**6.0**	**1.0**	**7.0 (50-58 ml/kg)**	**7**

4. Temperature for both DBD and DCD donor lungs:
    a. first 1L at room temperature
    b. the rest of fluids cold

5. Prostacycline (Flolan):
    a. For DBD donors, systemic heparinisation by the anaesthetists and then 10ml of Flolan injected slowly into pulmonary artery prior to cross clamping.
    b. For DCD donors, heparin injected into the pulmonary artery by retrieval surgeon directly followed by 10ml of Flolan.

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6. Technique:
    a. Insert a straight 24F cannula in pulmonary artery
    b. Place lung perfusion fluid bags 25cm above the donor or use delivery pressure of 25 mmHg
    c. Preservation solution is delivered in two phases:
        i. Antegrade for all bags except for the final 1L
        ii. The final 1L bag is administered retrograde - the antegrade cannula is removed from the PA and placed into each pulmonary vein in turn
        iii. Prior to the retrograde flush, the heart is excised and the pulmonary trunk transected just proximal to its bifurcation
        iv. The retrograde phase consists of delivering 250 mls of Perfadex® Plus into each pulmonary vein in turn. This is done by pinching the cannula between the fingers so as to prevent the fluid from leaking back into the left atrium.

7. Lung inflation:
    a. FiO_2 = 0.5
    b. Airway pressure = 15–20 cmH2O

8. Storage of donor lungs for transportation:
    a. Inner bag: cold Saline 2 L
    b. 2nd bag: cold Saline 2 L
    c. Outer bag: cold Saline 2 L

PREPARATION OF PERFADEX

1. Store at 2-25° C

2. DO NOT add any drugs or buffering agents to the Perfadex bags until it is finally confirmed that lungs are being retrieved

3. Once the Perfadex® Plus container is opened and additives have been added the solution must be kept cold and used within 24 hours

4. **No THAM or Calcium is required (Perfadex® Plus is pre-supplemented with THAM and calcium)**

5. The first 1.0L Perfadex® Plus bag should contain:
    a. Prostacyclin 500 mcg
    b. GTN 25 mg diluted in 50 mL of supplied diluent

6. Drugs should be added to the bags individually, giving each bag a good shake to mix

7. Once additives are used or the container is opened the contents should be chilled and used within 24 hours.

8. Ensure that the Perfadex® Plus bag is not in direct contact with ice.

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	Bag 1	Bag 2	Bag 3	Bag 4	Bag 5	Bag 6	Bag 7
Temperature	**Room**	**Cold**	**Cold**	**Cold**	**Cold**	**Cold**	**Cold**
Prostacyclin	**Yes**	**-**	**-**	**-**	**-**	**-**	**-**
GTN	**Yes**	**-**	**-**	**-**	**-**	**-**	**-**

APPENDIX 7

Blood utilisation for donor organ retrieval, *ex situ* machine perfusion and preservation technologies

Definitions:

1. **Direct procurement and machine perfusion (DPMP) of heart/lung** – DCD heart/lung retrieval is undertaken rapidly, and the organs placed on portable perfusion technology(ies) using donor blood. Abdominal procurement is undertaken as standard with cold perfusion.
2. **Thoraco-abdominal NRP (TANRP)** – NRP of thoracic and abdominal compartments, restarting the heart *in situ* prior to procurement. This is similar to a DBD donor procurement.
3. **NRP** – abdominal normothermic regional perfusion
4. **Donor blood** – this refers to the donor's own circulating blood.
5. **Bank blood** – blood that is cross-matched to the donor (for technologies used at the donor centre) or recipient (for technologies used at the recipient centre).

Background

- The approach to DCD retrieval is evolving, with an increased utilisation of abdominal normothermic regional perfusion (NRP), or extended thoraco-abdominal NRP to include heart and lung retrieval. NRP recirculates the donor blood to establish the extra-corporeal circuit and throughout the duration of perfusion, prior to cross-clamping and cold perfusion.
- At the same time there has been an increased utilisation of novel *ex situ* preservation and perfusion technologies for heart, lung, liver and kidneys donated for transplantation in the UK.
- Some of these approaches utilise a normothermic approach and therefore require access to blood to prime the circuit and perfuse the organ, immediately after retrieval at the donor centre.

It is, therefore, important to avoid any potential competing interests for access to donor blood and establish the need for banked blood products availability at the donor hospital for all new perfusion technologies.

Working principles

- The retrieval process and technique should not be compromised by the use of the *ex situ* technologies (for example if abdominal NRP is utilised, donor blood should not be taken for *ex situ* technologies until completion of NRP).
- *Ex situ* perfusion should utilise bank blood or use donor blood only after circulatory arrest and NRP have finished.
- This document should be used by the SN-OD and retrieval teams to ensure a smooth process at the donor hospital

The indicative amount of blood required during **donor surgery (table 1)** and **organ specific *ex situ* machine perfusion/preservation technology (table 2)** is illustrated below:

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Donor and retrieval technique	Blood requirement	ABO and Rh type
DBD	None	
DCD with abdominal NRP (no CT component)	4 units RBC	Donor typed
TANRP DCD	4 units RBC	Donor typed
DPMP heart/lung with abdominal NRP	4 (for DPMP) + 4 (for NRP) = 8 units RBC	Donor typed
DPMP DCD	None	

Table 1. Indicative amount of blood required, source and ABO/Rh type for the donor procedure according to the type of planned organ procurement technique.

Organ	Retrieval type	Blood requirement	ABO and Rh type
Heart	DBD With *ex situ* perfusion	Donor blood taken immediately prior to cross clamp or 4 units RBC*	Donor typed
Heart	DCD TANRP with *ex situ* perfusion	Donor blood taken at end of NRP phase immediately prior to cold perfusion; or 4 units RBC*	Donor typed
Heart	DCD DPMP with *ex situ* perfusion	Donor blood taken immediately prior to cold perfusion or 4 units RBC*	Donor typed
Heart	DCD DPMP of heart with *ex situ* perfusion and abdominal NRP	8 units RBC*	Donor typed
Lung	DBD with *ex situ* perfusion	Donor blood taken immediately prior to cross clamp or 4 units RBC*	Donor typed
Lung	DCD TANRP with *ex situ* perfusion	Donor blood taken immediately prior to cold perfusion for the heart, (end of NRP phase) 4 units RBC for the lungs* (4 units for lung +4 units for heart if donor blood not used)	Donor typed
Lung	DCD DPMP *ex situ* perfusion	Donor blood taken immediately prior to cold perfusion or 4 units RBC*	Donor typed
Lung	DPMP lung with abdominal NRP	4 + 4 = 8 units RBC*	Donor typed
Liver	DBD All DCDs	4-6 units RBC[#]	Donor typed (if liver placed on machine at donor hospital) Donor and recipient compatible (if liver placed on machine at recipient hospital)
Kidney	DBD All DCDs	1-unit RBC	Donor and recipient compatible

* Organ priorities may apply if more than one *ex situ* technology is to be used for organs from the same donor / [#] - depending on the *ex situ* machine used

Table 2. Indicative amount of blood required, source and type for *ex situ* perfusion and preservation technologies.

- The use of bank blood should comply with all current regulations for testing and safety and the Donor Identifier Number (DIN) for each unit of blood should be clearly recorded in the paperwork accompanying the organ (HTA A form) as well as the donor notes (where appropriate).
- Bank blood used for *ex situ* machine perfusion should be Rhesus matched to the donor. This is to avoid Rhesus positive blood perfusing a Rhesus negative organ that gets transplanted into a Rhesus negative female recipient and so sensitises the recipient to Rhesus antigens with consequences with respect to future pregnancies.
- If the type of the retrieval procedure allows for the use of donor blood and if several *ex situ* technologies are to be used for different organs, it is likely that the donor blood volume will be insufficient to accommodate the use of all these devices. In these cases, a suggested organ priority strategy is proposed below.
- It is likely that during NRP DCD retrieval, bank blood will be administered to the donor. Bank blood should be used for all *ex situ* perfusion of organs retrieved before completion of NRP. At the completion of NRP, donor blood use will be prioritised according to Figure 1.

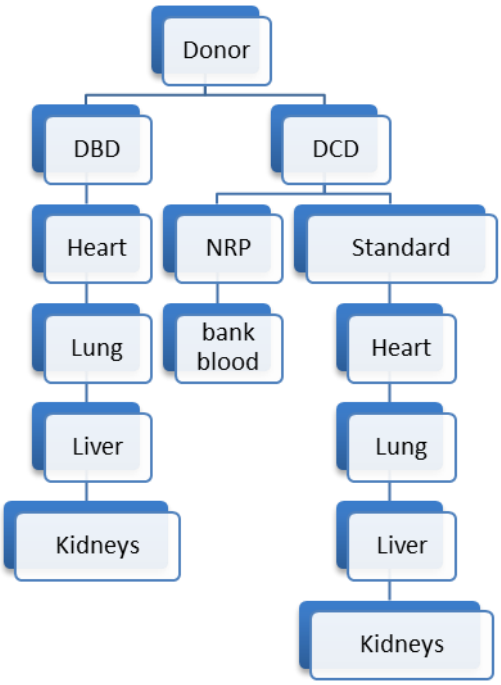

Figure 1. Suggested organ priority for allocation of donor blood when the type and technique of organ retrieval allows it and several technologies are to be used.

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