DCD Heart Retrieval Surgical Protocol -Standard DCD

Use in conjunction with DCD Heart Donation Guide to Donor Selection and Assessment Criteria

https://www.odt.nhs.uk/retrieval/policies-and-nors-reports/

Contents

Requirements needed of the NORS teams:

The following are required for the successful removal of the heart and lungs retrieval in a DCD donor.

A detailed discussion between cardiothoracic and abdominal teams to agree protocol and steps to be taken.

From the cardiothoracic team

- Senior surgeon who is experienced in DCD heart retrieval
- Assistant surgeon
- scrub
- cold perfusion practitioner
- The ex-situ normothermic heart perfusion machine plus perfusion practitioner
- Cell saver

Preparation

- Prepare St Thomas cardioplegia - Add the following medication to 500ml bag of Ringers:

    - 2,500iu of Epoetin Alfa
    - 50mgs GTN
    - 3mls Sodium bicarbonate 8.4% (840mgs in 10ml amp)
    - 10mls cardioplegia concentrate
    - Add heparin 300u/kg

    (Solution to be put back into the ice box but easily accessible for use when donor arrives in theatre)

- Prepare St Thomas cardioplegia for back at implant site – Add the following medication to 1L bag of Ringers:

    - 5000iu of Epoetin Alfa
    - 100mgs GTN
    - 6mls Sodium bicarbonate 8.4% (840mgs in 10ml amp)

- 20mls cardioplegia concentrate

(Solution to be put back into the ice box for use when heart is at implant site

NORS team Mobilisation

- Cardiac NORS team to arrive 2 hours before the planned withdrawal of treatment time
- Abdominal team to arrive 1 hour before withdrawal of treatment time

Set up

It is recommended that the donor is transfused to Hb of >100g/L.
This is to ensure that oxygenation of the heart is not limited by anaemia during machine perfusion. Timing of the transfusion – once the CT NORS team is mobile.

Where possible it is recommended that the donor is moved to the anaesthetic room before the withdrawal of life sustaining treatments.

Height of the donor bed should be the same as the theatre table. This is done by simply marking the height of the donor's bed by tape on the SNOD's trousers and match this with the theatre table height.

The SNOD will prepare units of packed red blood cells (cross matched to donor) to be available.

- 4 units for DCD heart

Preparation of OCS

- Prepare St Thomas cardioplegia - Add the following medication to 500ml bag of Ringers:

    - 2,500iu of Epoetin Alfa
    - 50mgs GTN
    - 3mls Sodium bicarbonate 8.4% (840mgs in 10ml amp)
    - 10mls cardioplegia concentrate
    - Add heparin 300u/kg

    (Solution to be put back into the ice box but easily accessible for use when donor arrives in theatre)

- Prepare St Thomas cardioplegia for back at implant site – Add the following medication to 1L bag of Ringers:

    - 5000iu of Epoetin Alfa
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    - 20mls cardioplegia concentrate

    (Solution to be put back into the ice box for use when heart is at implant site)

DCD HEART Functional Warm ischaemia and Stand Down Criteria

- After withdrawal of treatment, regular contact will be maintained with the SNOD regarding blood pressure and arterial saturations on the donor.
    - Functional warm ischaemia begins when systolic blood pressure falls below 50mmHg.
    - 30 minutes from beginning of functional warm ischaemia until cold cardioplegia is delivered will be tolerated before standing down.
    - Essential for the team diagnosing death to be familiar with the Academy of Medical Royal Colleges Code of Practice for the Diagnosis and Confirmation of Death. View the Code of Practice.
    - If cardiac arrest does not occur within 120 minutes from withdrawal of treatment, consider standing down DCD heart retrieval at this stage, unless death is likely to be imminent.
    - We recommend having a discussion between retrieval and recipient centres after 60 min from withdrawal.

Transfer to operating theatre.

Following verification of death 5 minutes after circulatory arrest, the patient is transferred to the operating table, the SNOD shows the patient's name band to confirm donor identity. This is cross-checked with the donor authorisation/consent form. It is best practice if the physician who has pronounced death attends with the donor to confirm the pronouncement of death in person.

Surgical protocol:

The thoracic and abdominal surgeons will prepare the skin with an alcohol-based skin preparation solution and apply 4 drapes.

A midline sternotomy is performed with a retractor to spread the sternal tables placed upside down. The abdominal surgeon will open the abdomen simultaneously.

For all heart retrievals:

Initially perform the heart assessment for:

- **coronary disease**
- **visible anomalies**
- **trauma**
- **left ventricular hypertrophy**
- **congenital disease**
- **other causes preventing transplantation**

If none of the above give clear instruction to open and prime the OCS.

The heart assessment can take place while draining blood to prime the OCS.

- Blood collection: Minimum of 1.2L to be collected with a raised table in head down position. It is crucial to ensure that no preservation solution is given until donor blood is drained, and no vasoconstrictor bolus is given at this stage. This should take no more than 60secs.

  There are several variations across units:

  - Insertion of a 2-stage venous cannula connected to a blood collection bag with Heparin 25,000 IU. If this is the case, 25,000 IU of heparin are injected into the right atrium and 25,000 IU of heparin into the pulmonary trunk prior to blood drainage.

  - Insertion of a drainage cannula connected to a sucking device or sterile reservoir. Blood is drained under suction and simultaneously mixed with the Organ Care System (OCS) priming solution containing 60000 IU of heparin.

During donor blood collection the cardiothoracic surgeon will clamp the descending aorta above the diaphragm, as low as possible. The cardiothoracic surgeon will announce this clamp is in place and the time will be recorded on the National DCD Heart Passport.

A clamp is placed across the ascending aorta and a DLP cannula inserted into the ascending aorta for cardioplegia delivery, and the heart excised in the standard fashion for heart retrieval.

Preparation of the DRP-DCD heart prior to Ex-Situ perfusion

- The heart is immediately placed into a basin of ice cold sterile saline solution.
- Dissection made to free the aorta from the pulmonary artery placing and securing the appropriately sized perfusion connector for the Organ Care System (OCS) with the supplied cable tie. Teflon pledgeted aortic stitches are used to further secure the aorta to the OCS so reducing the risk of disconnection during travel to the recipient hospital.
- The heart is placed and de-aired onto the primed OCS.
- Insert and secure LV vent through the left atrium into organ chamber.

Place ventricular pacing wires in case pacing is required at a later stage.

PA cannula (Protocol difference)

Harefield retrieval – PA cannula secured and connected. (SVC and IVC - sutured) and connect blue flow probe – follow Transmedics protocol.

Glasgow/Papworth retrieval – PA cannula NOT connected, allowing free drainage.

OCS perfusion parameters during transport:

Commence OCS perfusion of donor heart aiming for:

- Mean AOP 55-70 mmHg
- Aortic flow of 900-1100 mL/min-
- Coronary flow 650-750 ml/min
- Heart rate 70-90 BPM with V-pacing
- Once heart rhythm and perfusion are stable consider synchronising perfusion depending on discussion with implanting team

Acquire simultaneous AV blood samples. Perfusate targets are:

- Hct >15%
- Calcium 1.0-1.3 mmol/l
- Bicarbonate 22-29 mmol/l

- pH – 7.3-7.45

Video clip to be transferred to implanting centre at 30min reperfusion on the rig.
In order to reduce OCS perfusion time, a direct communication between lead retrieval and lead implanting surgeon should be established en route. Both parties must agree on good organ function, before the recipient preparation begins.

Transport

Ensure to travel with a safety ice box and roadside bag which will include;

- Ice, cardioplegia, giving set + pressure bag, 8 litres of cold saline

Roadside bag – sterile instruments, sterile gloves different size, sterile gowns, 3 packing bags for heart.

Cardioplegia at recipient site (agreed telecom 2.9.20)

Once implanting team are happy to receive the heart,

- The retrieval team have set up to administer cardioplegia
- All 3 teams will administer St. Thomas at retrieval and implant site when retrieving for any 6/7 UK centres
- Harefield will carry both Custodiol and St. Thomas and will have a choice of Custodiol or St. Thomas when retrieving for Harefield

(Refer to St. Thomas preparation on page 3)

Trouble shooting;

- Check placement heart on the rig (twist, impaired drainage)
- Syringe drives
- Flow probes and sensors
- Module position within the rig
- Redo medication preparation

Set up of Transmedics OCS and use of Cell Saver

Papworth have developed an OCS training manual for DCD hearts and an OCS blood collection with cell saver manual. These are available for reference on the NHSBT ODT microsite: Policies and NORS reports - ODT Clinical - NHS Blood and Transplant

OCS perfusion parameters during transport:

In general, it is recommended to maintain the OCS in manual rather than automatic mode.

Changes to flow and pacing have an immediate effect whereas changing the infusions of epinephrine or maintenance fluid may take minutes to take effect.

Commence OCS perfusion of donor heart aiming for:

• AOP: 55-70 mmHg

• Aortic flow: 800-1100 mL/min

• Heart rate: 70-90 BPM with V-pacing

Aim CF: 650-750 ml/min

• Once heart rhythm and perfusion are stable consider synchronising perfusion depending on discussion with implanting team.

Acquire simultaneous AV blood samples. Perfusate targets are:

• Hct: >15%

• Calcium: 1.0-1.3 mmol/l

• Bicarbonate: 22-29 mmol/l

• pH: 7.30-7.45

Parameters to consider prior to final decision.

- AOP 55-75 mmHg with Maintenance fluid <30 ml/Hr
- Aortic flow 800-1100 ml/min
- HR
- Total lactate trend decreasing over time
- Lactate consumption profile i.e. $Lac_{Art} > Lac_{Ven.}$
- Contractility
- Prescence of superficial petechia and/or oedema
- FWIT < 30min i.e. Time from SBP<50mmHg to start of *in situ* cold perfusion
- OCS perfusion time + all the above + predicted preparation of implant (for example; if OCS > 4hours and redo surgery with predicted additional 2-2.30 hours OCS perfusion) need to assess all the above real time
- If in doubt, call on-call retrieval consultant surgeon at Royal Papworth Hospital for advice

Recipient Centre Guidance

- Recipient team should assemble at the hospital once asystole has occurred.
- It takes at least one hour on the OCS to have an initial assessment of the heart.
- The DCD Team should leave the donor hospital with the OCS machine to travel to the recipient centre within 60 minutes of the heart being placed on the OCS machine.

Appendix 1: Safety Checklist for Direct Retrieval of the Heart

SAFETY CHECKLIST FOR DIRECT RETRIEVAL OF THE HEART/ HEART AND LUNGS AND *IN SITU* NORMOTHERMIC REGIONAL PERFUSION OF THE ABDOMINAL ORGANS

TO BE COMPLETED AT HANDOVER	***CTH SURGEON***	***ABDO SURGEON***
1 Protocol reviewed prior to WLST	☐	☐
2 Debrief completed prior to WLST	☐	☐
3 CTh team equipment ready	☐	
(Cell saver, Clamps, OCS, Fluids for perfusion)		
4 Abdominal team equipment ready		☐
Leading surgeon; Full name and signature		

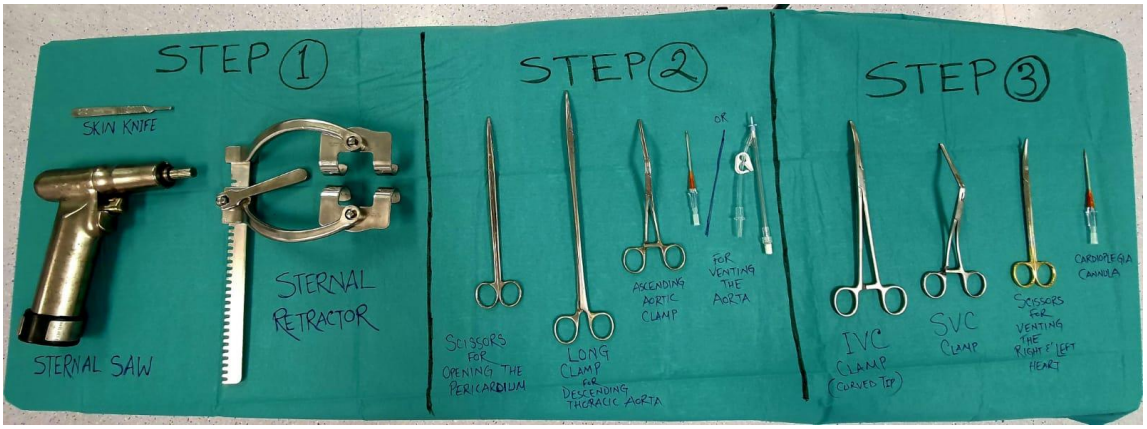
TO BE COMPLETED PRIOR TO START ABDOMINAL NRP

(Time to be noted and signed by Abdominal team Perfusionist)

1 Descending Aorta x clamp time

Appendix 2: Scrub trolley set up.

Scrub trolley set up:

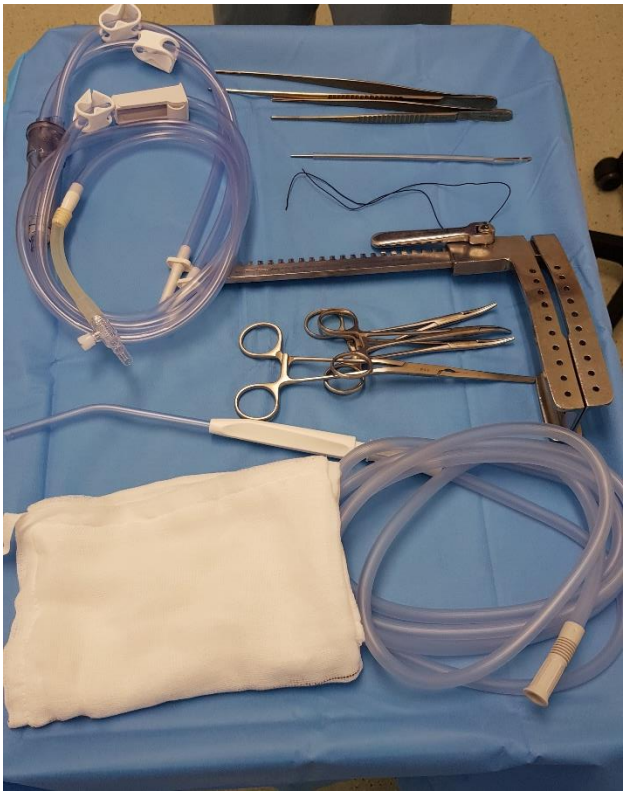


The above figure demonstrates the scrub trolley discipline, which correlates with the surgical steps, and this can be very helpful in the DCD with A-NRP retrieval specially at the very beginning of the process till the start of the antegrade cardio and pneumoplegia. This is not only helpful but also comfortable for the surgeons and the scrub to work in harmony and to prevent unwanted events as well as to maintain sterility in a hasty procedure.

Some teams would prefer a second trolley is prepared for the assistant and will be on the left of the donor.

The trolley contains: SEE PHOTO

- Two suckers, Cell saver and wall sucker (Cell saver marked by a black tie to distinguish from wall sucker and not be used once cardioplegia started)
- Clamp for the SVC
- Two Dunhill clips
- One Abdo pack
- Heparin syringe
- Two forceps
- Chest retractor
- Cardioplegia and pneumoplegia lines



Appendix 3: Cardiothoracic Synchrony between surgeons

Cardiothoracic Synchrony between the Surgeons

SURGEON 1	SURGEON 2
• Skin Incision • Sternotomy	Handle the suckers and the plegia lines
	• Placing the Sternal retractor Not fully opened in order not to stretch the pericardium
• Opening of the pericardium • Opening of the Left pleura • Retracting the Left lung to expose the descending thoracic aorta	
• Inject heparin in right atrium	Inject heparin in PA
	• Clamping the Descending Thoracic Aorta with a long clamp
• Incising right atrial appendage and collection blood for OCS	
• Ascending Aortic clamp • Insertion of venting needle distal to the clamp	
	• Securing the venting needle/cannula
• Rule out CAD	
• Venting the Right (Clamping the IVC in the pericardium and Flush cutting) and Left Heart (through LAA or LSPV) • Inserting with wide bore cannula (medicut) **and holding it in place** proximal to the ascending aortic clamp to deliver antegrade cardioplegia	• SVC clamp caudal to Azygos away from SA node
	• Connecting the cardioplegia line to the cannula

	Surface cooling with cold saline
• At the completion of the cardioplegia, careful procurement of the heart (after securing the Azygos and ensuring adequate SVC length)	• Helping the Surgeon 1
• Heart out and preparing it for OCS in the back table	
	• Securing bleeding points and ensuring haemostasis for a smooth A-NRP run