UK Lung DCD Retrieval Protocol

Background

In 2010 more than a third of all deceased organ donors in the UK were DCD donors. The lung is eminently suited to DCD retrieval because of its relative tolerance to warm ischaemia and the potential avoidance of some of the deleterious effects of brain stem death. Accepting a possible publication bias, the reported outcomes after lung transplant from DCD donors are at least as good, and possibly better, than for DBD donors.

In some European countries, notably the Netherlands, with high rates of DCD donation, these donors contribute up to a third of all lung transplants. But in the UK, they comprise less than 10% of lung transplants.

Many of the controversies surrounding DCD donation were resolved in the combined ICS and BTS document "Donation after Circulatory Death" sponsored by the Department of Health and NHSBT. But there remain differences, particularly with regard to the retrieval process, and post-mortem lung inflation and ventilation. On the transplant side, there is confusion over acceptance criteria and allocation policies. Retrieval team availability is sometimes patchy and one centre does not have DCD retrieval capability.

This was recognised at CTAG in autumn of 2010, and a working group, consisting of Karen Redmond, John Dunning, Ali Machaal, Jorge Mascaro, and chaired by John Dark, was established. Its remit included defining acceptance criteria and contraindications, proposing an allocation algorithm and developing guidelines for the actual retrieval.

The aim was to construct a working document, congruent with the other publications in the field, which would accelerate use of DCD lungs for transplant. At the same time an audit of DCD lung Tx Activity was carried out by NHSBT, with particular regard to the reasons for non-use.

Acceptance Criteria

All donors <65 who do not have any of the contraindications listed below:

Absolute contraindications to retrieval – agreed for *all* organs

- Active invasive cancer in the last 3 years **excluding** non-melanoma skin cancer and primary brain tumour
- Haematological malignancy – myeloma, lymphoma, leukaemia
- Untreated systemic infection
- Variant CJD
- HIV disease (but not HIV infection)

Absolute contraindications to retrieval for *lung*

- Chest trauma with extensive bilateral lung contusions
- Convincing radiological evidence of bilateral pneumonic consolidation
- Pre-existing structural lung changes (e.g. emphysematous or multiple large bullae)
- Previous complex intra-pleural thoracic surgery or dense adhesions prohibiting safe procurement
- Bronchoscopy (if available) showing inflammation/soiling of the airway, *and* recurrent secretions in the distal airway after adequate toilet
- Sustained peak airway pressure > 30 cmH2O

Note: The decision with regard to EVLP is taken by the implanting centre, not by the offering SN-OD or the retrieving centre. If EVLP is *not* being considered, the following requirements are required:

- Systemic arterial PO2> 40 kPa on 100% FiO2 and 5 cmH2O PEEP, or *equivalent* FiO2:PaO2 within 12 hours
- Bronchoscopy (if available, see below)– no severe inflammation of the airway, or recurrent secretions in the distal airway after adequate toilet.

These criteria are consistent with "Organ Donation after Circulatory Death" and with the DEVELOP-UK protocol.

Information on Referral

"Organ Donation after Circulatory Death" specified that "Donor assessment and recipient identification rely in part on a series of blood tests. It is both acceptable and lawful for samples of blood to be taken from the donor to allow these various tests to be carried out (including FBC, U/E, LFT, blood gases, virology screening, HLA-typing, and blood group) and this should be done as soon as possible to minimise delays. It is vital that all blood samples are correctly and fully labelled, particularly if they are to be sent for analysis in laboratories other than those of the donor hospital"

For lung donation, we consider that the following information additional to that determining suitability is available *on offer*

- Age
- Sex
- Height
- Blood group
- HLA Tissue Type*
- Serological result for HIV, HBV, HCV*
  *or the time this will be available is stated

The following information to determine the likelihood of death occurring:

- primary diagnosis and past medical history
- The use and dose of inotropes
- Presence of a gag reflex
- Presence of a cough reflex
- Respiratory rate when disconnected from the ventilator
- The fraction of inspired oxygen (FiO2)
- Arterial oxygen saturation and pH
- Ventilation mode
- Planned time of withdrawal of treatment
- Planned mode of withdrawal of treatment – ie extubation, reduction of inotropes

The following *should* also be available, but with varying detail

- Arterial blood gases, ideally on 100% and PEEP 5 cm H20. Not all ITU's will report this, but the ABG and FIO2 of the last blood gas, within less than 12 hours of retrieval, should be available
- Chest X-ray; within 24 hours of retrieval. Chest X-ray report (on the basis of which some of the contraindications, ie extensive bilateral lower lobe consolidation) should be available
- Bronchoscopy; the consensus document states "Bronchoscopy to assess the potential for lung donation may be appropriate, if it does not cause the patient distress. This needs specific discussion with the patient□s family." Bronchoscopy should be requested as a routine, although there is no obligation for the ITU to carry this out. There is no need for gram staining of tracheal or central airway secretions.

Allocation

Time may be limited, and organs are being lost because of delays in allocation. The consensus document states: "At present most organs are offered to transplant centres sequentially rather than simultaneously. This can result in considerable delays that place an intolerable and unnecessary burden on referring units and donor families.
Simultaneous offering to all relevant centres would reduce these delays significantly, and must be addressed by NHSBT as a matter of urgency".

The simplest routine is to use current Zones (on the basis that all teams can retrieve and assess DCD lungs). The Zonal centre has primacy of use, but a *provisional* offer is made by NHSBT Duty Office to all the other 4 centres *simultaneously*. It was agreed at CTAG that offers will be made according to the regular sequence, at 5 minute intervals. Offering

simultaneously can only be done by fax, which is not satisfactory. If the primary zonal centre does not accept the organs, allocation will go according to the sequence at that time. But all centres will be expected to give a yes or no answer to the provisional offer. We did not discuss the time allowed; this is a detail to be worked out.

If the zonal centre turns down the organ, as long as there is no contraindication, the decision to proceed falls on the accepting centre.

Process of Retrieval

The Donor ITU team

- The retrieval team and the SN-OD are not involved in any way with the management of the donor, so there is a reliance on the donor ITU team.
- Ventilator management should be with a lung-protective regime, 5-6 ml/Kg tidal volume and PEEP of 8cm H2o.
- In an ideal situation, there will have been a bronchoscopy, with report of state of airway mucosa and secretions, recent ABG's and a chest X-ray within 12 hours.
- A nasogastric tube should be placed unless there is likelihood of distress to the donor.
- A suitably experienced clinician will be available throughout the process of withdrawal of treatment, and will be responsible for confirming death promptly when it occurs. This individual may agree to re-intubate the donor after death (if there has been extubation). The donor hospital team should have a robust protocol in this regard.

The situation with regard to re-intubation by the donor hospital team must be ascertained before the Retrieval team leave their base. If the donor hospital team will not reintubate the donor, the retrieval team MUST include someone appropriately skilled.

The Retrieval Team

- Withdrawal of treatment may take place in A&E, ITU, an anaesthetic room or an operating theatre.
- The team should be present in or adjacent to the operating theatre to be used for the retrieval surgery. They should not be in the same room as the donor until 5 minutes after asystole and after certification of death.
- The local arrangements with the SN-OD with regard to withdrawal of treatment, the presence of the family, time to arrival in the operating room and personnel to re-intubate should be confirmed. Potential difficulties with intubation should be identified at this stage.
- The Retrieval surgeon should check the consent, height & weight, X-ray chest, blood group and virology of donor and c*omplete the National Transplant Database Form*
- A discussion should take place with the abdominal retrieval team with regard to how the surgery should be planned. **It must be recognised that the greatest urgency for the abdominal team is cannulation and cooling of the abdominal organs. The focus for the Thoracic team is protection of the airway and inflation of the lungs. The two teams must agree details such as when the chest is opened and when the thoracic team will inspect and cannulate the lungs. The need for rapid cooling of the abdominal organs must be recognised.**
- If possible, discussions should be held with the donor team about the use of the operating theatre anaesthetic machine to deliver continuous PEEP.
- After withdrawal of treatment, maintain regular contact with the SN-OD with regard to the haemodynamics and saturations on the donor. If cardiac arrest does not occur within 120 minutes, the situation should be discussed with the implanting team. A decision may be made to abandon the retrieval at this stage if the donor is stable.
- The point at which systolic blood pressure falls below 50 mmHg, or the saturations fall below 70% should be noted. If more than an hour passes with pressure and

saturation at this level there is concern about warm ischaemia and the retrieval should be abandoned. A warm ischaemia time of more than 30 minutes is an indication for the use of EVLP.

After cardiac arrest:

- The time of death must be noted.
- On arrival in the operating theatre, the donor should be reintubated with a cuffed endo-tracheal tube; this may be preceded by a rigid bronchoscopy, depending on the skills available. Intra-abdominal manipulation may cause aspiration, so early protection of the airway is important.
- Thorough airway toilet should be performed as soon as possible.
- Once reintubated, atelectatic lung may be recruited with a *single* breath, perhaps 30-40mmHg pressure for 40 seconds, ideally using the anaesthetic machine.
- CPAP should be maintained at 5 cm H2O and continuous O2, once again ideally with the theatre anaesthetic machine.
- **Cyclical ventilation must not be used at this stage.** Once the chest is open, and spontaneous cardiac contraction is impossible, further *single* recruitment manoeuvres may be required, at the direction of the retrieval surgeon.
- The time of lung inflation should be noted. Warm ischaemia is lessened at this stage, but many teams feel that early flushing of the lungs is still important, so the chest is rapidly opened. The lungs are examined for collapse, consolidation, mass lesions and pleural adhesions. If there is a suspicion of airways disease, the degree of collapse when the lungs are disconnected should be noted.
- The pulmonary artery is cannulated (and the right ventricle may be opened to remove clot).
- Antegrade perfusion is started with 1 litre of warm (room temperature) perfadex. The left atrium is widely opened and clot washed out of the pulmonary veins.
- At this stage, distribution of perfusate is aided by gentle cyclical ventilation of the lungs.
- When the antegrade perfusion is complete, the pulmonary veins are gently cannulated for retrograde perfusion, 200-500 ml down each one, until the effluent from the PA is clear.
- The lungs are best removed collapsed. When only the trachea is intact, the lungs are cautiously reinflated prior to storage. If EVLP is to be used, ensure there is at least 10cm of trachea.
- After removal, the lungs are again examined. Information about the degree of inflation, the “collapse” test, any areas of consolidation or masses, clot in the pulmonary artery, the uniformity of flushing and any palpable oedema will be required by the implanting team. **This must be communicated in a timely manner; the decision to proceed to direct transplant, to EVLP, or to abandon the retrieval is based on this.**
- The lungs are packed as for a standard retrieval, with the routine blood specimens and paperwork.

Note: It has been agreed that the lungs will not be reinflated until 10 minutes has elapsed since the time of death, to avoid any chance of auto-resuscitation. Similarly, cyclical ventilation will not be used until the left atrium is open and there is no longer any chance of cardiac activity.

Normothermic Regional Perfusion (NRP)

A number of liver teams have introduced perfusion of the abdominal organs with oxygenated blood, using an ECMO-like circuit, in category III and IV DCD donors. This approach may reduce liver ischaemia, and give an opportunity for pre-retrieval viability testing. Clamping of the descending aorta to prevent any possibility of re-starting brain perfusion is an absolute requirement.

If an abdominal team wishes to use NRP in a DCD donor who is also a potential lung donor, they must first discuss the details with the cardiothoracic team. Rapid laparotomy coincides with protection of the airway as in a standard retrieval.

The abdominal team will cannulate the abdominal aorta and IVC and the cardiothoracic team will then clamp the lower thoracic aorta and then immediately proceed to flush the lungs in situ. Limited topical cooling should be used. The intra-pericardial IVC should be clamped at an early stage to reduce the chance of entraining air into the perfusion circuit. Whilst abdominal perfusion continues, the thoracic team removes the lungs, for retrograde perfusion on the back table.

The cardiothoracic team must then secure complete haemostasis in the chest (bearing in mind that the donor is by now systemically heparinised) and **must not stand down until both teams are satisfied that there is no significant bleeding into the chest.**

John Dark 15/02/2013