

Options for Lung Retrieval from DCD donors when Abdominal Normothermic Regional Perfusion (NRP) is Utilised

Background

The use of NRP in abdominal DCD organ retrieval has been relatively limited until now, with much of the experience being gained by Edinburgh. It is already performed locally in Cambridge (at Addenbrookes) and very occasionally in Birmingham and Oxford. However, funding may shortly come available to allow a roll-out to 5 additional English retrieval centres. There is some evidence of a higher abdominal organ yield from DCD donors with NRP, so it's wider utilisation, at least for evaluation, is likely.

There are clearly challenges to removal of the lungs from such donors without jeopardizing either lung preservation or successful abdominal perfusion.

The first step in any DCD lung retrieval is re-intubation and protection of the airway, followed by re-inflation. There is good evidence that an hour of warm inflation can be tolerated if the pre-mortem agonal phase is short. However, in the initial discussions with the Edinburgh team they wanted to be able to do NRP for longer, typically two hours. As a result we developed the approach of early removal of the lungs.

The Current, CTAG Approved, Technique

This has been very successful, with good lung function and no significant blood loss during abdominal NRP. The essence of the approach is that the lungs are inflated whilst the abdominal team establish cannulation for NRP. As soon as the chest is opened, the low thoracic aorta is clamped, and NRP commenced, with no chance of brain perfusion.

The lungs are cold flushed and removed in a fairly standard fashion. During removal, haemostasis should be rigorously achieved within the chest, completely isolating the abdominal perfusion from any chance of leak into the now empty thoracic space. If the rules are followed and the thoracic team know what is required of them, the approach is very successful.

This technique was published (Dual Temperature Multi-Organ Recovery From a Maastricht Category III Donor After Circulatory Death. Oniscu GC, Siddique A, Dark JH Am J Transplant 2014; 14:21881-86), and proposed to CTAG. Following the meeting in April 2013, the UK DCD Lung Retrieval Protocol was adapted to include this technical change (highlighted in attached Protocol).

Recent Difficulties

There have been a number of incidents where there was significant haemorrhage into the chest during and after the lung removal, which has required either considerable transfusion or early termination of NRP. It is felt that either the thoracic surgeons were inexperienced or had not appreciated the technical change in the national protocol. As a result of those incidents, it has been suggested that we examine other options.

Rationale for Delayed Lung Removal

In patients on conventional cardiopulmonary bypass, there is perfusion of the lung via the bronchial arteries, predominantly from the descending thoracic aorta. This is aided by the fact that in general the left side of the heart is vented, so that there is low left atrial pressure and no obstruction to outflow of bronchial perfusion.

It has been suggested that if rather than the low thoracic aorta being clamped, this is done instead at the level of the distal arch, so allowing bronchial perfusion. It is also suggested that a vent is placed in the left atrium to ensure no obstruction to pulmonary vein outflow. The NRP perfusion circuit has a reservoir, so placement of a vent should be straightforward, and entrainment of air not a problem.

This system would therefore allow the lungs to stay in situ until the abdominal organ retrieval, and obviate difficulties of haemostasis in the chest. A detailed technical protocol could easily be developed.

For Discussion ahead of CTAG

The approach which was agreed in April 2013 is successful, with good lung function, and satisfactory abdominal perfusion. But there are increasing numbers of Incidents reported both formally, or known to NHSBT, where lung retrieval teams have ignored the agreed approach, with severe haemorrhage resulting.

Retrieval team leads are asked whether CTAG should reinforce the technique previously agreed, or explore an alternative, delayed lung retrieval and incorporation of the bronchial supply in the NRP. The latter would probably work, but does include some unknowns, and would require a detailed technical protocol to be devised. It places more of an emphasis on reliable placement of the aortic clamp, and also left atrial venting.

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