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SECTION 1: INITIAL PHONE CALL AND ALERTS

The CUK emergency call-out team will normally be alerted to the possible death of a member by a phone call. It is anticipated that some advance warning of a member's health would normally have been received, but it may be that the phone call will not be received until the member is near death or, in the worst case, has already died. Whatever the situation, the response will broadly follow the sequence given in this manual, but details will vary according to the individual circumstances of each case.

ENSURE ALL CONTACT AND LOCATION DETAILS ARE CORRECT so that the patient's relatives, hospital/hospice staff, and any others involved can be contacted. Questions to ask include:

- name and contact details of the person calling;
- relationship of caller to the patient;
- what funding is in place (via Alcor or Cryonics Institute, etc.)
- current state of patient's health and prognosis (how soon is death expected?);
- whether a call-out is needed immediately;
- explain the need for rapid cooling on death;
- whether any arrangements have been put in place to obtain rapid verification of death; and
- any other special circumstances.

Notes

CHECK THE PATIENT IS A MEMBER OF CUK AND PHONE THE CRYONICS PROVIDER (Alcor or the Cryonics Institute) TO ENSURE FUNDING STATUS – see contact details in appendix F.

- If there are no arrangements with a cryonics provider, CUK cannot help, as there will be nowhere to send the patient.
- If the person has a cryonics provider but is not a member of CUK, then members may agree to help but both CUK and the members need to be assured that all costs will be covered.

PHONE CUK MEMBERS TO ASSEMBLE A CALL-OUT TEAM - see CUK membership list.

DECIDE WHO WILL BE THE OVERALL CO-ORDINATOR, who will be responsible for ensuring that all necessary arrangements are made. Separate individuals may take responsibility for individual stages, such as phone calls for various arrangements, the actual cool-down and perfusion, liaison on site, final arrangements for final cool-down and transportation, etc., but there should be one overall co-ordinator to ensure nothing has been overlooked.

USE THE CO-ORDINATOR'S CHECK LIST IN APPENDIX A to ensure all items are covered at all stages (optional, depends on co-ordinator's experience).

SECTION 1: INITIAL PHONE CALL AND ALERTS

PHONE THE MAIN FUNERAL DIRECTOR - normally Rowland Brothers or F A Albin and Sons – see contact details in appendix F.

- Inform them of the situation.
- Ask them to arrange for a local embalmer and funeral director to act for them.
- Possibly phone an embalmer separately; normally Geoff Taylor – see contact details in appendix F.
- Arrange for the transport box to be sent to the local or main funeral director's premises, along with the inner box and expanded polystyrene packing. Explain that when dry ice arrives it should be kept in the transport box.
- Arrange where the perfusate is to be delivered, and ensure arrangements are in place to keep the perfusate solutions in a fridge (10%, 30%, solutions) and freezer (70% solution).

LIAISE WITH RELATIVES, HOSPITAL, HOSPICE, ETC., to assess the condition of the patient and minimise problems and/or delays once the call-out team arrives.

- This could be critical in deciding when to mobilise the call-out team.
- It will also be critical in minimising any delays in treatment after death (see below).

MAKE ARRANGEMENTS FOR RAPID VERIFICATION OF DEATH

Rapid treatment after death is vital to preserve the patient in the best possible condition, with minimum ischemic damage and tissue deterioration, especially in the brain.

The procedure will depend on the location of the patient and any prior arrangements he/she has made. This is a complex subject, and a review of possible alternative is given in a separate article. Some possible situations, and how they affect call-out procedures, are discussed below.

The patient at home being tended by an NHS GP and possibly care workers is likely to be the most common situation. Points to note are:

- It is essential to liaise with the GP, explain the patient's wishes and emphasise the urgency of treatment on death.
- If possible, get the GP to agree to CPR (cardio-pulmonary resuscitation), being carried out immediately after death, before verification of death. Explain that this will consist of chest compressions, possibly lung ventilation, and cooling of the neck with ice packs to minimise brain damage. Experience shows that doctors will generally view CPR as reasonable and non-life-threatening, and will agree to this.
- Explain to the GP the need for rapid verification of death. He/she will normally say that this cannot be guaranteed under the NHS but may be willing to provide such a service on a private basis. If not, an agency that supplies on-call doctors may be willing to help – from experience, only Ambition24direct will provide this service. They will require payment in advance, typically around £2,000, but have performed satisfactorily in the past. A quicker, but more expensive, alternative is to employ a live-in nurse who is qualified to verify death (subject to prior agreement of the patient's doctor). Various arrangements may be possible through Fairway Training, a training agency that gives the appropriate courses and supplies trained nurses. Contact details for Ambition24 and Fairway Training are given in appendix F.

For a patient in a nursing home, then rapid verification of death could also be achieved by having one or more of the nursing home nurses qualified to verify death. Some may have qualified nurses already but, if not, they may agree to have one or two of their nurses trained, especially if their costs are covered. Fairway Training can provide such training, which consists of a three-hour course.

For a patient in a hospital, a lot will depend on the co-operation of the medical staff, especially doctors. Liaison with them at the earliest opportunity is vital, so that decisions can be made regarding having private arrangements to verify death, and what they will permit.

MAKE INITIAL ENQUIRIES FOR DRY ICE SUPPLIES

- For suppliers and dry ice requirements see appendix F.
- Make sure you are ordering dry ice - carbon dioxide ice - not "dry ice-packs" which is ordinary ice in sealed bags.

SECTION 2: MOBILISATION

BEFORE SETTING OUT

ENSURE THE AMBULANCE AND ALL EQUIPMENT ARE MADE READY

- Ensure all equipment is loaded into the ambulance:
 - check the ambulance equipment list - appendix B;
 - remember to take meds from the fridge just before departure.
- Put perfusate in freezer or take to wherever perfusion is to be carried out.
- Take transport box to local or main funeral directors, as agreed with them.
- Remember to buy an assortment of batteries for the temperature probe, refractometer, etc. to load it just before departure.

PUT MEDICATIONS BOX INTO THE AMBULANCE.

Remember that some meds are kept in the fridge and must be loaded shortly before departure (do not leave them too late and risk forgetting or last-minute delays).

WHEN APPROPRIATE START THE ICE MACHINE (figure 2.1), which is normally used for initial ice supply. It is kept in Tim's garage. It should be switched on and kept full of ice in preparation for the call-out. Further supplies can be obtained from supermarkets as needed. Operation is straightforward:

- ensure the machine is connected to the water and electricity supplies, and switch on;
- keep a check on the level of the ice, because the machine will switch off automatically if the ice reaches the sensor bar near the top of the hopper; if this happens, clear the ice away from the sensor bar and press the 'reset' button on the front of the machine - after a few minutes, when the sensor bar has warmed up sufficiently, the machine will restart.



Figure 2.1: ice machine

ICE STORAGE - after making or buying, ice is transferred to electric cool boxes. These can be plugged in to the ambulance 12v DIN outlets (see ambulance manual) - some will also work off 240v mains supply.

KEEP FUNERAL DIRECTORS AND EMBALMER INFORMED of the situation.

DRY ICE - CONSIDER WHEN IT SHOULD BE ORDERED FOR DELIVERY TO THE FUNERAL DIRECTOR

- The first batch should be ordered well before death to ensure it is available, even if this risks some wastage.
- Suggested initial order is 100kg, with 50kg for each subsequent day, typically for 3-4 days, but this may be modified depending on the rate of use of dry ice – see section 3 for more details.
- A small supply of dry ice (say 5kg) will be needed at the patient's location.
- Remind funeral director to place the dry ice in the transport box, to reduce sublimation loss and to pre-cool the box.

ON FIRST ARRIVAL

APPRAISE THE SITUATION and consider the best approach for team operation.

- meet up with the team.

LIAISE WITH FAMILY - ensure that CUK will have clear custody of the patient immediately on pronouncement of death.

LIAISE WITH MEDICAL STAFF AND ASK FOR CO-OPERATION:

SECTION 2: MOBILISATION

- stress the need for urgency in pronouncing death, discuss possible arrangements to minimise delays;
- ask for any IV lines to be left in;
- any other help staff may be prepared to give.

LIAISE WITH FUNERAL DIRECTOR AND LOCAL FUNERAL DIRECTOR/EMBALMER when appropriate to ensure facilities and personnel will be available when needed. Discuss procedures with the embalmer - give him a copy of the *Notes for Embalmer* given in appendix E.

FIND A SUITABLE LOCATION TO PARK THE AMBULANCE

- where it can be plugged in to the mains power supply, if possible;
- convenient for transferring the patient to it and working in it.

EQUIPMENT AND MEDICATIONS CHECKS AND SET-UP

TEAM PREPARATION:

- discuss the situation, consider who will do what, issue protective clothing;
- consider any problems specific to the location;
- arrange to check equipment and run through procedures with it;

EQUIPMENT PREPARATION - see section 3 for equipment details and photographs

ICE BATH	Check it is set up on the trolley, with stretcher, meds stand and cover – see figure 3.1
ICE	Check it is readily available, with bucket for cold water. Check water source. Check where ice can be bought locally (supermarket) and buy as needed.
STRETCHER, LIFTING SHEET	Check equipment is available to quickly lift the patient immediately on pronouncement of death.
CPS MACHINE (THUMPER)	Set up equipment - connect to gas bottle and test out to check equipment and refresh memory on operation - figures 3.1 to 3.3. Keep manual CPS aid and bag valve mask handy in case needed - figures 3.4, 3.5.
PERFUSATE & WASHOUT SOLUTION	If the perfusate and washout solutions are being kept with the ambulance, transfer the washout solution and the 10% and 30% perfusate to a fridge and the 70% solution (VM1) to a freezer. If necessary, buy a cheap chest freezer. Do not forget to transfer them back into the ambulance before departure to the embalmer.
SMALL ITEMS	Check the following items are ready and somebody is designated to use them: <ul style="list-style-type: none">• CombiTube and insertion tool - figures 3.6, 3.7• FAST intra-osseous infuser, with chest template - figures 3.10, 3.11• temperature probes with readout unit, and anal plug - figure 3.13• rectal plug• tubing, connectors and syringe ports, cannulas, etc., for medications• miscellaneous batteries - check batteries fitted to all equipment that needs them• miscellaneous items (duct tape, scissors, etc.), normally kept in ambulance• body bag and/or sleeping bad (fully openable type) for patient transport

SECTION 2: MOBILISATION

AMBULANCE LOCKERS	Team members should familiarise themselves with the contents of the ambulance lockers so they can quickly locate any additional items that might be needed.
PROCEDURES CHECKS	Designated people should run through operation of equipment to refresh their memories.
EQUIPMENT LOCATION	Avoid leaving equipment around - keep a note of any items removed from the ambulance.
MEDICATIONS PREPARATION	<p>Medications are administered via lines connecting to an intravenous (IV) line left in by medical staff or, if this is not available, the FAST intraosseous infuser inserted into the chest (see section 3).</p> <p>Open the meds box and check through each numbered packet in turn, starting a no. 1 and working in numerical order. Meds can be divided into two kinds:</p> <ul style="list-style-type: none">• meds that are ready to use;<ul style="list-style-type: none">• prepare these by drawing into syringes or, if they are to be administered by drip, simply removing them from the packet;• lay them out on a suitable clean surface, in numerical order, ready for use;• meds that need to be mixed, and have a short life (typically 1-2 days) once mixed;<ul style="list-style-type: none">• delay preparation of these until shortly before death is expected.

Medications vary over time, as improvements are made, and depending on supplier, so the instructions in the meds box should be followed. However, an indication of typical meds, their method of preparation and administration, typical doses and their effect are given in appendix C.

BEFORE DEATH: PATIENT CARE AND VIGILANCE

CUK team members are not expected to look after the patient; this will be carried out by relatives, care workers, hospital staff, etc.. However, the team should ensure that somebody, usually a relative but otherwise a team member, is checking on the patient at all times so that there is minimal delay between death and the start of procedures.

There should be continued liaison with the doctor and any visiting nurses to maintain the best possible co-operation of medical staff.

PRE-DEATH MEDICATION. If possible obtain permission from the doctor to administer pre-death medication; vitamin E, aspirin and possibly a dexamethorphan-based cough suppressant such as Benylin Dry Coughs, as described in Section 3.

WHEN THE PATIENT DIES

PROCEED AS DESCRIBED IN SECTION 3.

SECTION 3: PROCEDURES

This section describes the various procedures for an initial cool-down, perfusion and further cooling to dry ice temperature ready for transportation. It should be remembered, however, that the details of each call-out will be different: the details, order and locations of procedures are likely to vary, and some procedures will be carried out simultaneously.

PRECAUTIONS

1. Wear a face mask, hair cover, latex gloves and protective overalls during all operations to minimise risk of exposure to body fluids, which pose a risk of infection. Protective clothing and equipment should be issued in good time.
2. Take care when using sharp objects such as needles and scalpels - wear puncture-resistant gloves where practicable.
3. Take care during lifting the patient or heavy equipment to avoid risk of back injury.
4. Beware of any trip or slip hazards and dangers to yourself and others when moving equipment.

RECORDING EVENTS

Remember to get somebody to record all relevant information during the cool-down and perfusion procedures. This will include: times of death, transfer to cooling bath, start of perfusion, etc.; details of medications given; temperature and pressure readings; and any other information that might be relevant.

PRE-DEATH MEDICATION

If possible, the following non-prescription medications should be given prior to death, to minimise ischemic damage:

- vitamin E – a typical high-dose vitamin E tablet (say 400iu) twice a day;
- aspirin – say one 300mg tablet two or three times a day;
- a cough suppressant containing dextromethorphan– as recommended dose (e.g. Benlyn Dry Cough: 2.5ml spoonfuls 4 times a day).

ON DEATH

CHECK THAT THE PATIENT IS DEAD (two people to check independently):

- Check for pulse and breathing; at carotid artery in the neck, using a finger oxy/pulse meter, and using a stethoscope.
- Check pupil dilation by shining a torch into the eye - does the pupil contract?
- Be sure to record the checks made and the findings – video if possible, as proof of checks.

START CARDIO-PULMONARY RESUSCITATION (CPR) using the 'thumper' (see below) and limited cooling of the head by placing ice bags against the neck, SUBJECT TO PRIOR AGREEMENT BY THE PATIENT'S DOCTOR. DO NOT REMOVE THE PATIENT FROM THE BED OR ADMINISTER MEDS BEFORE VERIFICATION OF DEATH.

IMMEDIATELY INFORM THE ON-CALL DOCTOR OR NURSE to obtain verification of death as quickly as possible.

INFORM THE EMBALMER AND/OR FUNERAL DIRECTOR, as agreed with them during the initial alert, to ensure that they will be available when needed.

KEEP A CHECK ON BLOOD OXYGEN LEVELS using the finger oxy/pulse meter: an oxygen reading of 98-100 is normal; 90 is poor; 80 is very poor. Note that there will appear to be a pulse once the CPR is started but this does not mean that the patient has been resuscitated unless there are other signs.

SECTION 3: PROCEDURES

ON VERIFICATION OF DEATH - INITIAL COOL-DOWN

INSERT ANAL PLUG just before or just after lifting (optional).

LIFT PATIENT INTO ICE BATH (figure 3.1) as soon as possible after verification of death.

- Split the stretcher into two halves and slide under the patient, then clip them together and lift with one or two people at each end. Alternatively, use a lifting sheet.
- Make sure patient is the right way round (head at the end with a cut-down section for the thumper).
- Surround the patient with ice, paying particular attention to the head, and add cold water to the ice bath.

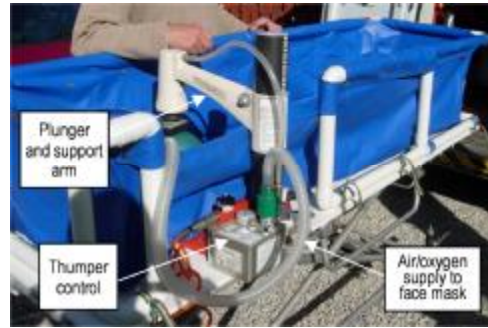


Figure 3.1: ice bath and thumper

MOVE ICE BATH AND PATIENT INTO AMBULANCE - the stage at which this is done will depend on circumstances: in a hospital, or sometimes at home, meds may be administered before moving.

PACK ICE AROUND THE PATIENT, paying particular attention to the head - round 40-50kg of ice is normally sufficient. Also add 10-15 litres of water. The patient should have minimum clothing on as this reduces the cooling effect of the ice.

START (OR CONTINUE) CARDIOPULMONARY SUPPORT (CPS), consisting of:

- chest compressions and ventilation of the lungs, if this can be started within 10 minutes of death; or
- chest compressions only, if there is a delay of more than 10 minutes between death and start of CPS.

Because it is unlikely that chest compressions will begin within 10 minutes of death, lung ventilation will not normally be used.

Chest compressions are normally administered using the CPS machine ("thumper" – figure 3.1) but may be administered by hand if this is not available. The hand method may be used initially while the CPS machine is set up. The hand method is less effective, so the thumper should be used whenever possible. The older thumper may also be used to give lung ventilation but the newer machines give only chest compressions, reflecting the modern trend away from giving lung ventilation during cardio-pulmonary resuscitation (CPR): if lung ventilation is required, the machine will have to be stopped every 15 seconds for two ventilations to be given by hand (see below).

For lung ventilation, using either hand or mechanical methods, a CombiTube should be inserted (see below), but insertion of the tube should not be allowed to delay the start of chest compressions, which are vital to minimise ischemia.

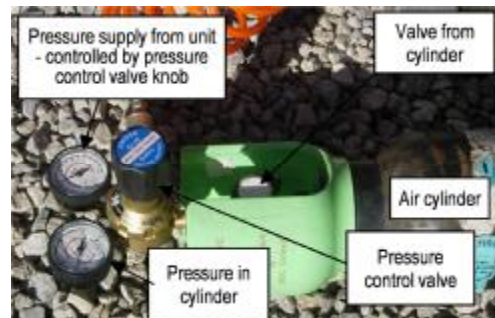


Figure 3.2: air cylinder controls (older model)

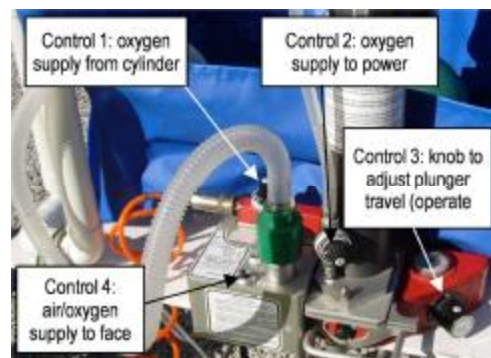


Figure 3.3: thumper controls (older model)

SECTION 3: PROCEDURES

CHEST COMPRESSIONS USING THE THUMPER. CUK has several thumpers, of two different designs, so operation will depend on the model used. Details of operation are kept with the machines and practised during training sessions. With different thumpers, control valves to the gas supply bottles may also differ from those shown here. The basic operation is outlined below.

- The thumper should already have been connected to the gas supply during initial preparation.
- Place the thumper under the patient's chest and position the thumper head over the sternum.
- Adjust the height as detailed on the instructions for the particular model used.
- Turn on the gas supply and adjust the pressure as needed:
 - for the old thumper, set the outlet valve (figure 3.2) to about 4 bars (60 psi);
 - with newer models, the valve automatically sets the pressure.
- Adjust the thumper controls to start compressions, **TAKING CARE TO AVOID EXCESSIVE PLUNGER MOVEMENT TO AVOID DAMAGING THE STERNUM.**
- Lung ventilation, if required, may be given using the older thumper or, for newer models, using hand ventilation – see the notes on ventilation, below.

CHEST COMPRESSIONS USING THE MANUAL METHOD. The effectiveness of the hand method may be improved by use of a cardiopump (a manual CPS aid), shown in figure 3.4. The person using the cardiopump should be changed frequently, as this is a strenuous procedure.

- Locate the correct pressure point: at the centre of the chest, over the base of the sternum. To locate the base of the sternum, place two fingers on the sternum and work down until you come to the V-shape.
- Use the CPS manual aid (figure 3.4) (or, if not available, place the palm of your hand, with the other hand on top), elbows locked, whilst leaning over the patient. Push down briskly, depressing the sternum 4-5cm (1½-2") at about 100 times per minute.
- Change the person using the cardiopump should be changed frequently as this is a tiring operation.



Figure 3.4: cardiopump

LUNG VENTILATION. Ventilation, if given, may be administered via a face mask but it is preferable to use a CombiTube, inserted into the throat (described later). The older thumper can be set to automatically switch between chest compressions and lung ventilation. Otherwise, ventilation is carried out using a bag valve (figure 3.5).

- Ensure the air passage is free, with the head back to hyper-extend the neck and, if possible, a CombiTube inserted in the throat (see below).
- If a CombiTube has been inserted then the bag valve (or older thumper air pipe) is attached to it, as shown in the figure; otherwise, a face mask is used.
- With the bag valve, alternate between 15 secs (~30 compressions) and 2 lung ventilations.



Figure 3.5: bag valve used with CombiTube

INSERT THE COMBITUBE INTO THE THROAT. This may need to be done earlier if lung ventilation is to be carried out (see above).

- Tip the head backwards, open the mouth and gently insert the tube down the throat until printed lines on the tube lie between the teeth. Take care not to accidentally push the tongue back and cause a blockage - if necessary, pull the tongue forwards. If difficulty is experienced inserting the tube, use a special hand tool to aid



Figure 3.6: tool to aid insertion of CombiTube

SECTION 3: PROCEDURES

insertion - see figure 3.6.

- If there are continued problems in inserting the tube, abandon the attempt, especially if ventilation of the lungs is not to be carried out, as it is imperative that there are no delays in the cool-down procedure.
- Once in position, the tube needs to be sealed into the airways by inflating the two bladder seals on the tubes (figure 3.7). This is done by injecting air into them using syringes provided - figure 3.8. Inject the correct amount of air by following instructions and using syringes provided, to ensure a seal but avoid over-inflating which risks bursting the seal bladders.
- On insertion, the tube may enter either the oesophagus or the trachea, as shown in figure 3.9. Insertion into the oesophagus is more usual, and preferable but, either way, it allows antacid to be administered to the stomach, via the oesophagus, and (if required) air to be administered to the lungs, via the trachea, as shown in the figure.
- Use the bag valve to check which tube goes to the stomach and which to the lungs.

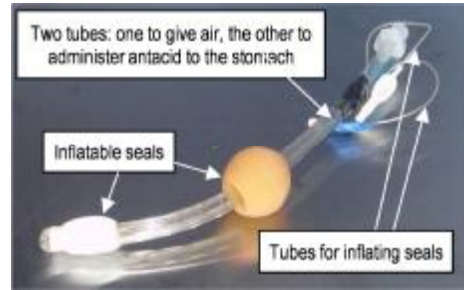
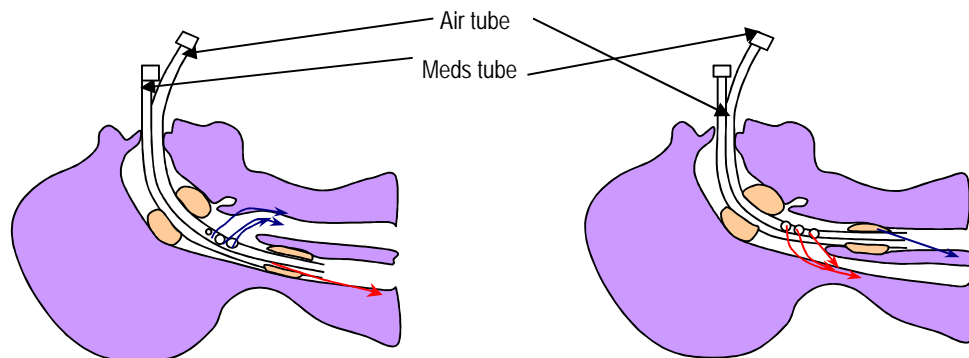


Figure 3.7: CombiTube



Figure 3.8: inflating the seal in the CombiTube



(a) oesophageal placement (80%)

(b) tracheal placement (20%)

Figure 3.9: CombiTube placement

ADMINISTER MEDICATIONS, via the FAST inter-osseous infuser system inserted into the sternum, or possibly via an intravenous (IV) line.

- Appendix C gives typical medications, with their dosages, functions, and any special storage requirements. However, you should follow the list given in the meds case and on containers for the most up-to-date information.
- Medications should already have been prepared for use as described in section 2.
- To use the FAST infuser, plunge it into the chest bone. The correct location is obtained using a template that is stuck to the chest bone as indicated in figure 3.10, and the infuser is then plunged in as shown in figure 3.11.

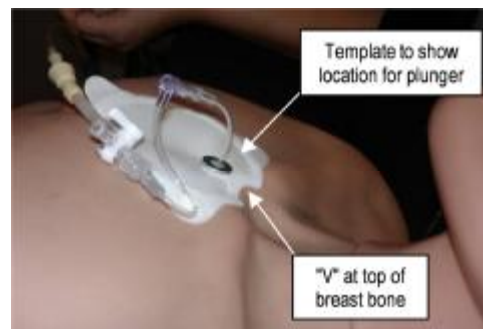


Figure 3.10: template to properly locate FAST infuser

SECTION 3: PROCEDURES

- Medications are administered by connecting multiple lines to the IV or FAST infuser and injecting them into the lines from syringes (via syringe ports) or, for high volume medications, from hanging bags connected via tap connectors and hung on a stand. Figure 3.12 shows a free-standing drip stand but it is more usual to use one that fits on the ice bath.
- In addition, antacid is administered orally, via the CombiTube, as soon as convenient. Check the CombiTube insertion to determine which tube to use for the antacid - be sure it goes into the stomach, not the lungs.

IF INSERTION INTO THE STERNUM IS DIFFICULT the infuser could be inserted into the top of the femur (the upper leg bone) where it joins the hip bone – at the hip, just forward of the buttock.

INSERT TEMPERATURE PROBE INTO EAR and connect to the readout unit (figure 3.13). (This step may be delayed until the start of perfusion, to save time.)

TAKE PATIENT IN AMBULANCE TO AGREED FUNERAL DIRECTOR'S OR EMBALMER'S PREMISES.

- MAKE SURE THE PERFUSATE AND WASHOUT (SALINE) SOLUTIONS ARE TRANSFERRED TO THE AMBULANCE BEFORE SETTING OFF, if they are not already with the embalmer.

PERFUSION

Patient preparation

TRANSFER THE PATIENT TO THE EMBALMER'S TABLE.

- Ensure there is a bucket beneath the table drain to collect fluid waste.

EXPLAIN TO THE EMBALMER WHAT IS REQUIRED. The procedure followed is normally the Standard Method given in appendix E, *Notes for Embalmer*, a copy of which may be given to the embalmer. This appendix also gives diagrams and alternative procedures, which may be considered if the embalmer feels confident enough to perform them. In summary, for the Standard Method:

- Insert cannulas into the two common carotid arteries, directed towards the head, and connected to the washout/perfusion kit tubing via a Y-connector;
- Insert cannulas into the two inner jugular veins, directed towards the head, and connected to tubing so that they drain either on to the table or into a container below it.
- Insert temperature probe into the ear, if not done already, and tape or staple in place, for connection up to readout unit.

PROTECT THE INCISIONS FROM CONTACT WITH THE LIQUID IN THE ICE BATH.



Figure 3.11: FAST intraosseous infuser



Figure 3.12: meds stand and drip lines

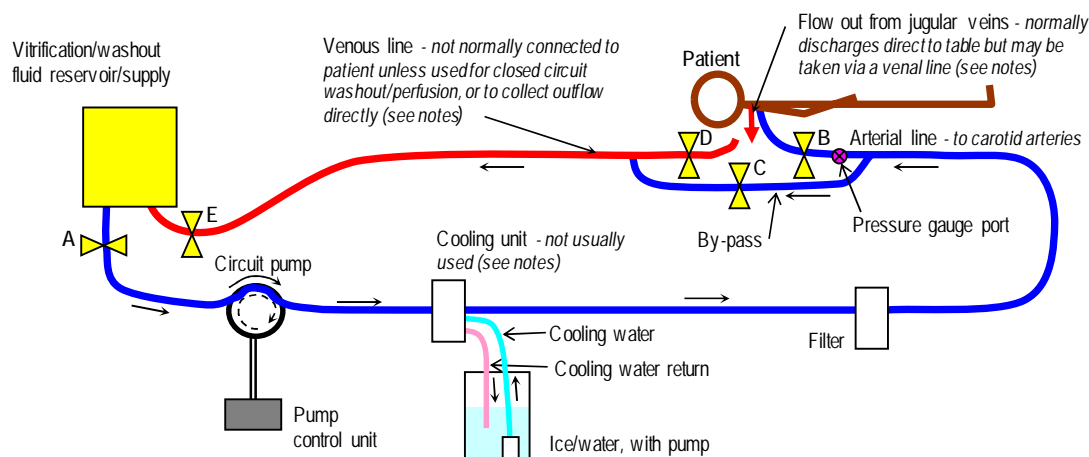


Figure 3.13: temperature probes and readout unit

SECTION 3: PROCEDURES

Equipment and set-up

SET UP THE WASHOUT/PERFUSION KIT ON the floor next to the patient - the main features are shown in figures 3.14 and 3.15, below.



Clamps to direct flow as appropriate:

- A, E - closed when setting up equipment, then released for initial de-airing and for washout/perfusion.
- B - closed when setting up equipment and during de-airing - released only during washout-perfusion.
- C - released during de-airing and testing, closed during washout/perfusion.
- D - kept permanently clamped unless the venal line is used.

Figure 3.14: circuit diagram for washout kit

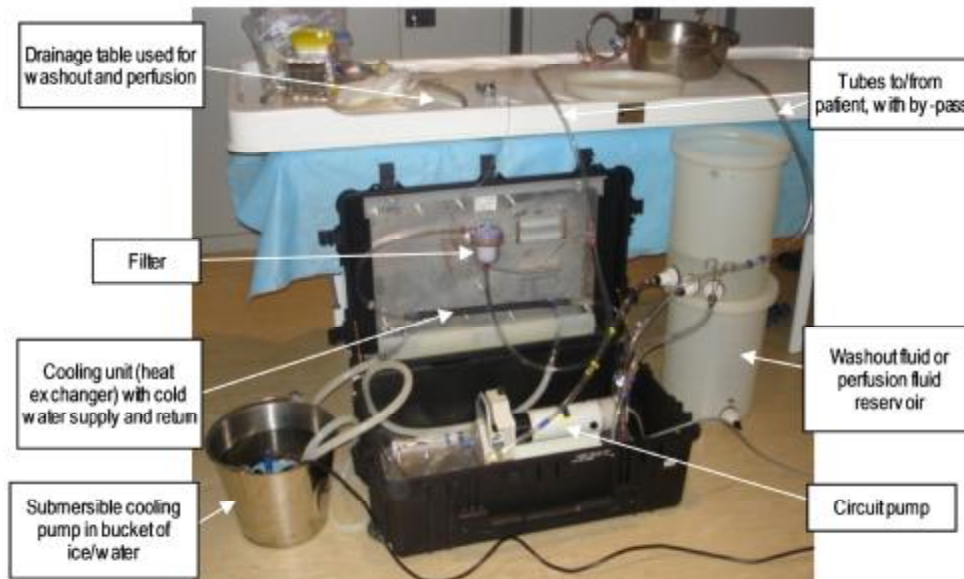


Figure 3.15: general arrangement (set up for training session)

CIRCUIT PUMP AND CONTROL UNIT. Connect the controller to the circuit pump (using the appropriate lead). Ensure the on/off switch on the controller (see figure 3.16) is set to "off" and connect the controller to the mains via the power lead, with an extension lead if necessary. The unit can be operated via a remote controller which, if used, should be connected to it before switching on.

SECTION 3: PROCEDURES

CAUTION: ensure you connect up the circuit pump to the pump controller BEFORE switching on the controller: switching on the controller first may damage the electronics.

HOSES. Connect as shown in figures 3.14 and 3.15.

CIRCUIT PUMP. Locate the softer length of tubing that goes into the pump and insert it as shown in figure 3.17. Make sure it is in the right way round for the circuit flow to be correct - if unsure, check the circuit against the circuit diagram (figure 3.14) and run the pump briefly to see which way the rollers rotate. Clamp down the rollers using the clamp handle, making sure the tubing is seated correctly.

Switch on the controller and press the stop/start button on the top to check the operation of the circuit pump. Press the stop/start button again to switch off the pump.

SENSORS. A pressure gauge (figure 3.18) should be installed in the circuit at the point shown in figure 3.14, to check that the pressure of fluid entering the patient is not too high or too low (normally about 120mm mercury). Note that the gauge will still work even though fluid does not fully enter the inlet tube attached to the base.

If the outflow from the patient is channelled via tubing, a thermometer may also be attached to the venous (outflow) tubing

COOLING PUMP. This is a submersible pump - see figure 3.15.

Note that the cooling pump will not normally be required since the perfusate used will normally have been kept in a fridge (10% and 30% solutions) and freezer (70% solution – VM1) and is likely to be cold when used; in which case, the effect of running ice-cold water through the cooling unit would be to heat up the perfusate, not cool it. Similarly, the washout solution, if kept in a fridge, should be cold. It would be used, however, if the perfusate or washout solution were not pre-cooled.

If the pump is to be used, then:

- place the pump in a bucket and connect the outflow tubing from the pump to the heat exchanger inlet pipe;
- connect the return tubing (with a diffuser on the end) to the outlet pipe of the heat exchanger, and place the diffuser end in the bucket;
- add sufficient water to cover the pump, then switch it on for a few seconds to test it, checking that water is flowing through the circuit - no flow may be caused by an air block in the pump which can be removed by tilting or jolting it;
- when the unit is ready to use, take the diffuser out of the bucket, fill with ice and reset the diffuser on top of the ice.



Figure 3.16: circuit pump control unit

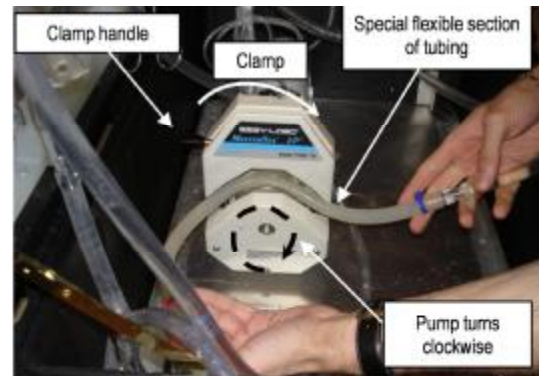


Figure 3.17: inserting flexible tubing into circuit pump



Figure 3.18: pressure gauge

SECTION 3: PROCEDURES

Note that the cooling water to the heat exchanger should be connected so that the cooling water flows in the opposite direction to that of the perfusate or washout solution passing through the unit. (Desirable but not vital.)

Equipment priming and connection to the patient

CLEANSE THE TUBING AND RESERVOIRS USING MILTON SOLUTION:

- pour water into the reservoir until it comfortably covers the outlet pipes (about 3L), then add Milton solution to the strength specified on the bottle, mixing it and wiping it over the sides of the reservoir;
- set the clamps to run the system in closed circuit mode, with clamps at open pipes B and C (figure 3.14)
- run the pump at moderate speed for about 10 minutes, ensuring the water flows through all pipes;
- drain the system.

PURGE THE PERFUSION KIT LINES OF BUBBLES before connecting to the patient:

- pour washout (saline) solution into the reservoir until it comfortably covers the outlet pipes (about 3L);
- Run the pump, increasing the flow rate until it is sufficient to rid the pipes of bubbles. Wiggle or tap the tubing to remove any difficult bubbles. Take special care to remove bubbles from the filter and (if used) the heat exchanger.

CONNECT TO THE PATIENT

- The arterial line (B in figure 3.14) is connected to the two head cannulas in the carotid arteries, using a Y-connector. This must be done carefully, with cannulas primed with saline solution, to avoid trapping air bubbles in the system: the embalmer may assist with this procedure.
- Clamps B and D (figure 3.14) are still in place at this point.

START THE COOLANT PUMP, IF USED - not normally used; see notes above.

Perfusion procedure (current CUK protocol: open circuit perfusion of head only)

ENSURE SOMEBODY IS MONITORING TEMPERATURE PROBES AND RECORDING EVENTS.

BEGIN PERFUSION

- a) START THE CIRCUIT PUMP, RUNNING IT SLOWLY – showing a flow rate of 2L/min or less.
- b) UNCLAMP THE ARTERIAL LINE (clamp B, figure 3.14).
 - **Caution:** do not allow clamps B and C to be in place at the same time, as this will completely block flow around the system, putting excessive pressure on components.
- c) CLAMP THE BY-PASS (clamp C). Washout solution is now being pumped into the patient.
- d) SLOWLY INCREASE THE PUMP SPEED whilst checking to ensure that the line into the patient does not exceed a pressure of 120-140mm Hg or a flow rate of 5 litres per minute.
 - **Note** that the rate of flow shown on the pump control unit is nominal: actual flow will vary according to the resistance in the circuit; flow decreasing as resistance increases, until there may be no flow even though the pump is working. Therefore, the actual flow rate can be determined only by noting the rate at which fluid falls in the reservoir.
- e) KEEP A CHECK ON THE LEVEL OF FLUID IN THE RESERVOIR and top up with more fluid as needed. Take care to avoid bubbles in the fluid - never allow the fluid level to fall below the outlet level and add fluid carefully when topping up.
- f) ADD 10% PERFUSATE TO THE CONTAINER, a little at a time, adding more as the fluid level falls close to the outlet pipe level, but again making sure that it does not fall too far and admit air into the pipes. **By letting the level fall to near the outlet level and adding small amounts at a time, the perfusate concentration will be gradually increased**

SECTION 3: PROCEDURES

throughout the perfusion process: this is vital for good perfusion. Normally use about 5-7L.

- g) CONTINUE WITH 30% PERFUSATE, ADDING IT TO THE CONTAINER A LITTLE AT A TIME, again adding more as the level falls close to the outlet pipes, and making sure that it does not fall too far and let air into the pipes. Normally use about 10L.
- h) CONTINUE WITH 70% PERFUSATE (VM1), adding it to the container in the same way. Continue until all the perfusate is used (30L) or until there is no further flow.
 - The refractive index of the outflow can be monitored with a refractometer to determine the effectiveness of the perfusion.
- i) WHEN PERFUSION HAS BEEN COMPLETED:
 - stop the pump and unclamp the by-pass line;
 - make sure the cannulas are clamped and tied down before cutting or disconnecting the lines to them;
 - ask the embalmer to tie off all blood vessels or clamp the cannulas, as appropriate, and to dress the incisions with waterproof dressing to avoid bleeding, air entry or infection;
 - bag up the tubing to avoid spillage of perfusate, and pack up the perfusion kit.

DRY ICE COOLING AND PREPARATION FOR TRANSPORT

The procedure following completion of perfusion will depend on the location of the transport box:

- if it is at the place where perfusion was carried out, the patient will be transferred directly to the transport box; but
- if it is elsewhere (typically at the funeral directors' premises), the patient will first be transferred back into the ice bath and taken to where the transport box is located.

Transferring the patient back to the ice bath

As stated above, this applies only if the ice bath is located elsewhere: ignore this section if the transport box is located where perfusion is carried out.

CLEAN OUT ANY CONTAMINATED WATER in the ice bath and refresh. Add ice if needed.

PLACE THE PATIENT'S HEAD IN THE ICE BOX (figure 3.19) AND SURROUND IT WITH CRUSHED DRY ICE (carbon dioxide ice) - with packing around the neck to keep out ice bath fluid, and insulation around the sides, if available. Put a thin cloth around the head to keep the dry ice from direct contact with it.



Figure 3.19: head cooling box

TRANSPORT TO THE TRANSPORT BOX LOCATION – normally the funeral directors' premises; Rowland Brothers or F A Albin and Sons.

Transferring the patient into the transport box and preparing for transport

Ideally, the transport box should have been prepared by the funeral director, with the inner box inside it and dry ice in place, to pre-cool it. If not, carry out the following steps:

- PLACE THE INNER BOX INTO THE TRANSPORT BOX (Figure 3.20). The inner box should be placed on a sheet of 25mm-thick expanded polystyrene.
- PLACE DRY ICE IN THE TRANSPORT BOX, surrounding the inner box. About 100kg of dry ice is sufficient initially.



Figure 3.20: transport container and inner box

SECTION 3: PROCEDURES

TRANSFER THE PATIENT TO THE INNER BOX. The patient should be as dry as possible to prevent ice forming on the skin. Also, patient should be placed in a body bag or, if unavailable, another suitable covering to protect the skin.

ENSURE THERE IS A TEMPERATURE PROBE IN THE PATIENT (usually the ear), connected to the readout unit. The readout unit can then be left on top of the transport box, with lids loosely in place.

- Set the readout unit to record readings at least every hour, but take manual values frequently, as a back-up.

PLACE THE LIDS LOOSELY ON BOTH BOXES, ensuring the wires to the temperature probe are not snagged or damaged.

- KEEP THE LIDS ON THE BOXES when not checking or filling with dry ice.

At least one standby team member will need to remain behind to do this checking work and ensure that a supply of dry ice is ordered and delivered as needed, and placed in the box on delivery.

CHECK THE DRY ICE AND TEMPERATURE PROBE SEVERAL TIMES A DAY - initially hourly, then at extended intervals over the following days. The initial 100kg of dry ice will need to be topped up, typically at about 50kg per day. The patient needs to be cooled to -70°C before shipping; a process that will take 3-5 days so about 250-300kg will be needed in total. ENSURE TIMELY DELIVERIES OF DRY ICE.

- Dry ice can also be placed in the inner box, alongside the patient or between the legs and especially around the head (not touching the skin).
- Experience shows that regular repacking of the dry ice, to make sure it is in contact with the inner box, significantly increases the rate of cooling.

LINE THE INNER BOX WITH EXPANDED POLYSTYRENE SHEETS before shipping. Typically 25mm- or 50mm-thick sheets are used. This will add insulation and can be used to pack the inner box against the transport box to prevent movement. The polystyrene should be against the sides of the transport box, with the dry ice against the inner box.

JUST BEFORE SHIPMENT, CARRY OUT FINAL CHECKS:

- Remove the temperature probe readout unit unless prior approval has been given by airport security – check with the funeral director (Rowlands, Albin).
- No dry ice must be left in the inner box, which must be sealed with silicone sealant or similar;
 - the sealant will not stick to the cold metal of the inner box – just lay a bead of silicone around the lip and lower the lid carefully to ensure a seal;
 - the inner box lid is then screwed on – note that it is difficult to line up the lid for the first screw so you will need a small screwdriver or awl to poke through to find the hole.
- Remove or add dry ice so that there is 45kg around the sides and ends of the container, making up any space with expanded polystyrene insulation.
- Adjust the clamps on the outer box lid so they are just tight enough to stay closed – push down on the lid to ensure they stay closed.
 - Note that the transport box lid will probably have warped: this is due to temperature differential between the inner and outer surfaces, and is normal – it will not affect the effectiveness of the box once the lid is clamped.
- Fix cable ties through the padlock loops on the clamps.
- Customs seals need to be added to each clamp by the funeral director; these consist of ribbons that are threaded through the padlock loop then taken over on to the lid where they are sealed by a stamped sealing wax.
- The outside of the shipper must be dry to clear the airport authority, so wipe off any condensation that has built up during cool-down.
- Printed shipping details, supplied by the funeral director, must be stuck on several sides of the transport container.

APPENDIX A: CO-ORDINATOR'S CHECK LIST

INITIAL PHONE CALL AND ALERTS

RECEIVE INITIAL PHONE CALL

- Are all contact details, etc., recorded?

PHONE ALCOR OR CRYONICS INSTITUTE

- Verify membership and funding status.

PHONE CUK MEMBERS TO FORM A CALL-OUT TEAM

- Who will be team co-ordinator?

PHONE FUNERAL DIRECTOR AND EMBALMER

- Arrange for transport and inner boxes to be taken to local or main funeral director or embalmer.
- Arrange where washout and perfusate solutions are to go; also arrange for cooling in fridge/freezer.

LIAISE WITH RELATIVES, HOSPITAL, ETC., to ensure necessary arrangements are in place.

CHECK/MAKE ARRANGEMENTS FOR RAPID VERIFICATION OF DEATH

- Agree with doctor what treatment can be given after death but before verification of death.
- Also ask whether vitamin E, aspirin, and/or cough medicine can be given before death.

MAKE INITIAL ENQUIRIES FOR DRY ICE SUPPLIES

- See appendix F for contacts and order details.

WILL NEED TO DECIDE WHEN TO MOBILISE TEAM

- immediately, or just keep team on alert?

Notes

MOBILISATION: BEFORE SETTING OUT

CHECK THE AMBULANCE EQUIPMENT LIST to ensure all equipment is assembled - appendix B.

- Buy an assortment of batteries

ENSURE MEDICATIONS BOX IS IN THE AMBULANCE

- remember to include meds kept in the fridge.

RUN ICE-MAKING MACHINE if time. Store in cool boxes.

CHECK THAT WASHOUT/PERFUSATE SOLUTIONS ARE IN FRIDGE, FREEZER, as appropriate.

CONSIDER ORDERING DRY ICE

- check with the embalmer/funeral director that deliveries will be stored in the transport box.

APPENDIX A: CO-ORDINATOR'S CHECK LIST

MOBILISATION: ON STANDBY AT THE PATIENT'S LOCATION

INITIAL APPRAISAL on arrival - team meets up.

LIAISE WITH:

- FAMILY- ensure CUK will get custody of patient
- MEDICAL STAFF, especially the doctor
 - give *Notes to hospital staff*, appendix D, if appropriate.
 - discuss need for rapid pronouncement of death.
- FUNERAL DIRECTOR/EMBALMER – keep apprised, ensure perfusate, dry ice, etc. are stored properly.

FIND A SUITABLE LOCATION TO PARK AMBULANCE:

- availability of power to keep charging from mains.

TEAM PREPARATION – brief, issue protective clothing.

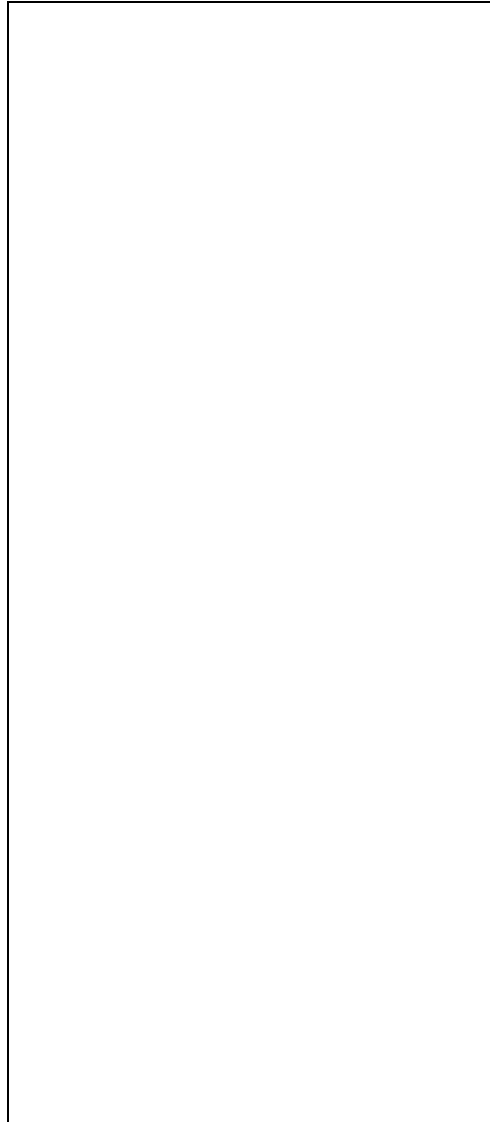
EQUIPMENT PREPARATION and practice run-through:

- ice bath with lifting sheet stretcher and meds stand
- ice and cold water, with bucket
- CPS machine (thumper) with gas bottles and hose
 - also cardiopump and bag valve
- keep perfusate, etc., cooled if brought with ambulance
- CombiTube and ventilation pump connector
- FAST intra-osseous meds infuser
- temperature probe (for ear) with readout unit
- rectal plug

MEDICATIONS PREPARATION - see list and instructions inside meds box and on containers:

- lay out meds - draw into syringes where appropriate;
- decide when short-life meds are to be prepared (close to expected time of death).

KEEP A CHECK ON THE PATIENT AT ALL TIMES to ensure the team knows immediately when death occurs.



PROCEDURES: JUST PRIOR TO DEATH AND ON DEATH

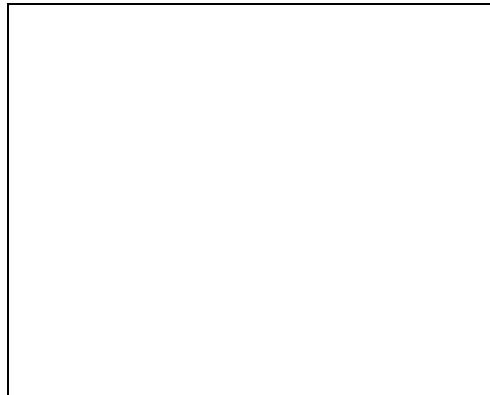
TEAM SHOULD WEAR PROTECTIVE CLOTHING.

TRY TO ARRANGE FOR THE PATIENT TO BE GIVEN PRE-DEATH MEDICATIONS subject to the doctor's and relative's agreement.

ON DEATH, CHECK FOR SIGNS OF LIFE – RECORD ALL CHECKS MADE (video if possible).

GIVE CPR (subject to doctor's agreement) until verification of death.

ON VERIFICATION OF DEATH, BEGIN COOL-DOWN.



APPENDIX A: CO-ORDINATOR'S CHECK LIST

PROCEDURES: ON VERIFICATION OF DEATH – INITIAL COOL-DOWN

MOVE PATIENT TO ICE BATH

- Use stretcher or lifting sheet.
- Add ice and water

START CPS

- Ventilate lungs if it can be done within 10 min of death (initially using a face mask, if necessary).

ADMINISTER MEDICATIONS

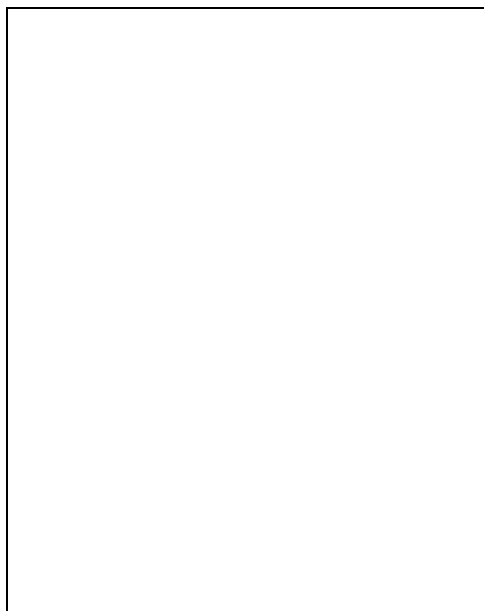
INSERT COMBI TUBE INTO THROAT and give antacid.

INSERT TEMPERATURE PROBE INTO EAR and start automatic and manual recording.

KEEP EMBALMER INFORMED.

TRANSPORT TO EMBALMER FOR PERFUSION

- ensure all equipment, perfusate, etc., in ambulance.
- warn the embalmer when to expect the patient.



PROCEDURES: PERFUSION

- EMBALMER TO PREPARE PATIENT FOR PERFUSION
- transfer to the embalmer's table
- explain to the embalmer what is required
 - directions in appendix E
- remove CombiTube

SET UP PERFUSION KIT

- Check system, clean out with Milton solution
- Empty then de-air tubing using washout solution
- Start the coolant pump, if used (not normally).

CONNECT PERFUSION LINES TO PATIENT

- Final equipment priming

PERFUSION

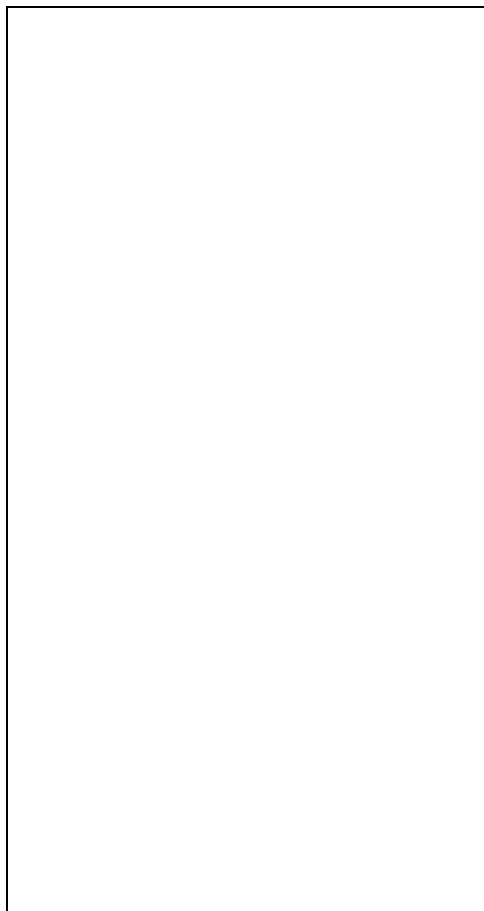
- Proceed with washout solution, then 10%, 30%, 70% perfusate.
- Start pump slowly. – max pressure 120-140mm Hg
- On completion, embalmer to tie off vessels, etc.

COOL-DOWN IN TRANSPORT BOX

- If in a different location, transport patient in ice bath with head box, head surrounded by dry ice.
- Put in body bag, place in inner box, surround with dry ice.

COOLING AND TRANSPORT ARRANGEMENTS

Liaise with funeral director over transport arrangements.
Keep a check on dry ice levels - shift ice around daily;
- add ice as needed.



APPENDIX B: EQUIPMENT CHECKS

The items listed below are normally kept in Tim's garage except where shown otherwise, in square brackets.

	MAIN ITEMS	ACCESSORIES
General equipment	Generators: 240v->110v for ambulance <input type="checkbox"/>	Lead for ambulance generator <input type="checkbox"/>
	240v->12v for cool boxes, etc. <input type="checkbox"/>	General electrical extension leads <input type="checkbox"/>
	Protective overalls (various sizes) <input type="checkbox"/>	Goggles/glasses, masks <input type="checkbox"/>
		Gloves (rubber and heavy duty) <input type="checkbox"/>
		Shoe covers <input type="checkbox"/>
		Scrubs, drapes <input type="checkbox"/>
	Buckets (2) and bowl <i>[house]</i> <input type="checkbox"/>	
	Electric cool boxes (3) <input type="checkbox"/>	Leads <input type="checkbox"/>
	Miscellaneous small items <input type="checkbox"/>	Batteries AAA AA C D 9v 9v 3v-CR2032 <input type="checkbox"/>
		Scissors, knives, tube cutter <input type="checkbox"/>
	Cleaning materials: sterilising fluid, disinfectant, cloths <input type="checkbox"/>	
	Miscellaneous straps, ties, tie gun, duct tape <input type="checkbox"/>	
	Spare fuses, various <input type="checkbox"/>	
	Pens, markers, clipboard <input type="checkbox"/>	
	Manuals, various <input type="checkbox"/>	
	First aid kit <input type="checkbox"/>	
	Ice <i>[from ice machine in garage]</i> <input type="checkbox"/>	Ice scoop <i>[in ice machine, in garage]</i> <input type="checkbox"/>
	<i>Top ups from supermarket - need typically about 100kg overall</i>	
Equipment for initial cool-down	Vital signs monitor <input type="checkbox"/>	
	Stretcher <input type="checkbox"/>	
	Trolley and ice bath, with drip stand <input type="checkbox"/>	Freestanding drip stand <input type="checkbox"/>
		Bags for ice and waste, sharps box <input type="checkbox"/>
		Lifting sheets <input type="checkbox"/>
		Rectal plug <input type="checkbox"/>
	CPS machine ('thumper') <input type="checkbox"/>	Air/oxygen cylinders with regulator valves <input type="checkbox"/>
		Tubing to connect cylinders to thumper <input type="checkbox"/>
		Spanner, tags for gas bottles <input type="checkbox"/>
		Manual CPS aid <input type="checkbox"/>
	CombiTube and insertion aid tool <input type="checkbox"/>	Small and large syringes <input type="checkbox"/>
		Bag valve <input type="checkbox"/>
	Medications box (Pelican case) <i>[house]</i> <input type="checkbox"/>	Medications in fridge <i>[house]</i> - don't forget! <input type="checkbox"/>
	Spare medications <i>[house]</i> <input type="checkbox"/>	Assorted syringes, needles, syringe filters <input type="checkbox"/>
		Assorted tubing, connectors, clamps <input type="checkbox"/>
	FAST infuser with target patch + tubing <input type="checkbox"/>	

APPENDIX B: EQUIPMENT CHECKS

	MAIN ITEMS	ACCESSORIES
Perfusion equipment	Washout/perfusion kit - main case <input style="width: 40px;" type="checkbox"/>	Roller pump (+ spare) <input style="width: 40px;" type="checkbox"/>
		Roller pump controller <input style="width: 40px;" type="checkbox"/>
		Spare tubing, clamps, connectors, etc. <input style="width: 40px;" type="checkbox"/>
		Cannulas, various sizes <input style="width: 40px;" type="checkbox"/>
		Pressure gauge for inflow, with tubing <input style="width: 40px;" type="checkbox"/>
	Temperature probes and data logger <input style="width: 40px;" type="checkbox"/>	
	Headbox (to cool head with dry ice) <input style="width: 40px;" type="checkbox"/>	
	Dry ice keeper (insulated box) <input style="width: 40px;" type="checkbox"/>	
	Submersible cooling pump <input style="width: 40px;" type="checkbox"/>	Connecting tubing <input style="width: 40px;" type="checkbox"/>
	Washout solution (saline solution) <i>[house]</i> <input style="width: 40px;" type="checkbox"/>	Reservoir with outlets for tubing <input style="width: 40px;" type="checkbox"/>
	Perfusion solutions (10%, 30%, 70%) <i>[house]</i> <input style="width: 40px;" type="checkbox"/>	Sterile water <i>[house]</i> <input style="width: 40px;" type="checkbox"/>
	Freezer <i>[Ansty & Dist. Fun. Dir.*]</i>	
Transport	Transport box <i>[Ansty & Dist. Fun. Dir.*]</i> <input style="width: 40px;" type="checkbox"/>	Inner box <i>[garage]</i> <input style="width: 40px;" type="checkbox"/>
		Body bags <input style="width: 40px;" type="checkbox"/>

* The transport box and insulation, along with a freezer for cooling the 70% (VM1) perfusate, are both kept at the premises of Ansty and District Funeral Directors, Talbot House, Leicester Road, Leicester, LE7 7AT. Phone 01162 340 548 (Arran, Gareth, Vicky). They may also be able to supply a very competent embalmer, Rachel Shiply – see appendix F, *Key contacts*.

APPENDIX C: CRYONICS MEDICATION - SUMMARY OF PURPOSE AND ADMINISTRATION

The list below gives typical medications administered during the initial cool-down. This is intended only to give an indication of the range of medications given and their purpose. Medications will change from time to time, as development occurs: the definitive list of medications and the methods of administering them are given in a list in the medications case and on the individual medications.

Note that medications are listed in order of importance, so that, if not all meds can be given, preference should be given to those near the top of the each list.

PRE-DEATH MEDICATIONS – GIVEN ORALLY, SUBJECT TO THE AGREEMENT OF THE PATIENT’S DOCTOR		
P1.	Vitamin E 400iu twice a day	The most beneficial of all pre-treatment anti-oxidants at reducing ischemic damage.
P2.	Aspirin 300mg twice a day	Reduces blood clots, muscle relaxant.
P3.	Dextromethorphan (e.g. Benlyn Dry Coughs) As given on bottle	Reduces brain ischemia.
P4.	Possibly Nimopodine	L-type calcium channel blocker – has been shown to significantly improve recovery rates from ischemic damage. Must be provided on prescription – unlikely as NHS do not recommend it for older people.

LOW VOLUME MEDICATIONS – DRAWN INTO SYRINGES AND ADMINISTERED VIA INFUSER OR IV PORT		
1.	Diprivan (Propofol) 200mg	Reduces cerebral metabolic activity. (Prevents temporary return of consciousness, which could occur as a result of the CPS procedure.)
2.	Sodium citrate 1-2g (1000-2000mg)	Anti-coagulant (with a longer shelf life than heparin), and mixing agent. Stored in refrigerator.
3.	Streptokinase (Streptase) 250,000 units	Thrombolytic agent (Dissolves clots) Given only if administered within 1 hour of death and if no cerebral haemorrhage.
4.	Sodium Heparin 100,000 units	Anti-coagulant - prevents blood clotting.
5.	Aspirin (Acetyl salicylic acid) 300mg	Reduces blood clots, muscle relaxant. Powder: needs dissolving.
6.	Vasopressin (ADH-antidiuretic hormone) 200 units	Constricts main blood vessels, helping to maintain blood pressure.
7.	Epinephrine(Adrenaline) 30mg	Regulates blood vessel diameters to enhance selective blood circulation.
8.	SMT 400mg	Anti-ischemic agent. (reduces damage due to lack of blood flow) Stored in refrigerator. Powder: needs dissolving.
9.	Niacinamide 500mg	Anti-ischemic agent. (reduces damage due to lack of blood flow) Kept frozen. Powder: needs dissolving.
10.	L-kynurenine sulphate	A neuroprotector: protects nerve cells against the effects of ischemia. Stored in refrigerator. Powder: needs dissolving.
11.	Ketorolac	Anti-inflammatory
12.	Gentamicin	Antibiotic - used to treat bacterial infections.

HIGH VOLUME MEDICATIONS – BAGS/BOTTLES HUNG UP AND ADMINISTERED VIA INFUSER OR IV PORT		
H1.	Vital-Oxy (0.7mL per kg weight)	Proprietary anti-ischemic drug used to suppress inflammation and limit free radical production. Stored in refrigerator.
H2.	Hetastarch 250mL	Volume expander.
H3.	THAM 100mL	Used as a buffer solution during CPR to correct metabolic acidosis.
H4.	Mannitol 100g	Inhibits cell swelling, decreasing cerebral oedema and preventing bursting of red blood cells. Effective for only about one hour.

HIGH VOLUME MEDICATION –ADMINISTERED ORALLY VIA COMBI TUBE		
H5.	Antacid (Maalox) 250mL	Reduces stomach acidity, preventing erosion/bleeding of stomach wall.

APPENDIX D: NOTES FOR HOSPITAL STAFF

Name of patient

The above-named patient has contracted with *the Cryonics Institute / the Alcor Life Extension Foundation** to be cryonically suspended in the event of his/her death. Arrangements have also been made by the patient with Cryonics-UK and *Rowland Brothers / F. A. Albin and Sons** to arrange for his/her remains to be suitably treated and sent to the above cryonics provider. It is the patient's wish that the following be done IMMEDIATELY after clinical death.

*Delete as appropriate

Cool patient by topical application of ice or other coolant, with special attention to the head. If the ice is directly from the freezer, it should be used lightly or with a towel between the ice and patient to avoid surface freezing

Administer heparin (intravenously if possible).
Use 100,000 units.

Maintain heart and lung function by cardiopulmonary support (CPS) if possible, after verification of death.

Call Cryonics UK, of which the patient is a member, who are a self-help group that works in collaboration with the Cryonics Institute and the Alcor Foundation. Contact numbers are:

Tim Gibson	01142 766 488 (Home)	07905 371 495 (Mobile)
Graham Hipkiss	0115 849 2179 (Home)	07752 251564 (Mobile)
Victoria Stephens	01287 669201 (home)	
Mike Carter	029 2069 2818 (home)	07985 963 864 (mobile)
Alan Sinclair	01273 587 660 (Home)	07717 820 715 (Mobile)

Should further contact numbers be required (this would be extremely rare), the following may be called:

F. A. Albin and Sons:	Funeral Directors	020 7237 3637
Rowland Brothers Int.:	Funeral Directors	020 8684 1667
Cryonics Institute (USA)	Cryonics Provider	001 586 791 5961 (Main number)
Alcor Life Extension Foundation (USA)	Cryonics Provider	001 800 367 2228 (24 hour line)

Release the patient with minimum delay to Cryonics UK or the appropriate funeral director (normally Rowland Brothers International or Albin and Sons) or such local funeral director appointed by either of these to act for them).

Please leave in place any access or drainage tubes such as IV, NG, Foley and/or tracheotomy tube or oxygen line.

PLEASE DO NOT AUTOPSY OR FREEZE.

APPENDIX E: NOTES FOR EMBALMER

AIM OF THE PROCEDURE

The aim is to replace the blood in the head with a perfusate solution which permeates the tissue and protects against the formation of ice crystals during freezing.

PROCEDURE - STANDARD METHOD

- INSERT CANNULAS INTO THE TWO COMMON CAROTID ARTERIES (one either side of the neck) - see figure E1;
 - directed towards the head, taped in place;
 - connected to the washout/perfusion kit tubing via a Y-connector.
- INSERT CANNULAS INTO THE TWO INNER JUGULAR VEINS (one either side of the neck) - see figure E2;
 - directed towards the head, taped in place;
 - connected to lengths of tubing so that they drain either on to the table or into a container below the table;
- INSERT TEMPERATURE PROBE INTO THE EAR, if not done already, and tape or staple in place, ready for connection to readout unit.

SPECIAL CARE REQUIREMENTS

Please observe the following precautions.

- Sterilise the skin with an iodine swab before making incisions.
- Protect the neck area from contact with fluid on the table.
- When connecting cannulas and tubing, it is essential that no air be allowed to enter the system.
- On completion of perfusion, tie off all blood vessels and close the incision with waterproof dressing to prevent leakage or entry of infection.

ALTERNATIVE PROCEDURES

Two alternative procedures, with their advantages and limitations, are described in sheet 2. These will not normally be carried out, but you may wish to discuss them with our team if you feel confident to perform them.

Background information

The common carotid arteries split into the external carotid arteries, which supply blood to structures external to the skull, and the internal carotid arteries, which supply blood to structures internal to the skull, including the brain, pituitary gland, eyeball, nose and ear (see figure E1). Extensions of the internal carotid arteries form an arrangement of blood vessels at the base of the brain known as the cerebral arterial circle, or the Circle of Willis, from which arteries supply blood to most of the brain. The purpose of the cerebral arterial circle is to equalise blood pressure to the brain and to provide alternative routes to the brain, should arteries become damaged.

However, the Circle of Willis is not complete in all people, raising concerns that, in these cases, perfusion may not reach all parts of the brain, although this is not certain. To allow for this possibility, it has been suggested that perfusion should take place through the vertebral arteries (figure E2) as well as the carotid arteries. Two methods may be used to accomplish this.

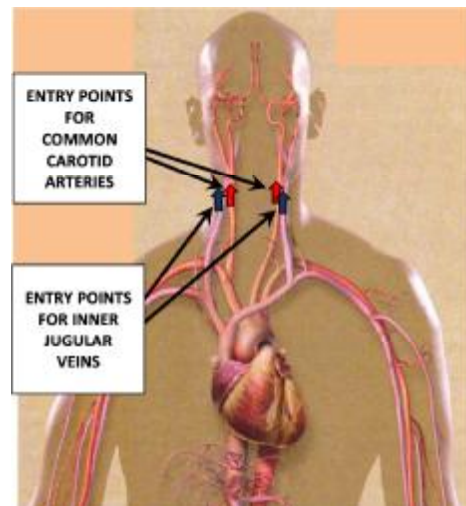


Figure E1: entry points in carotid arteries and jugular veins

APPENDIX E: NOTES FOR EMBALMER

Alternative method 1: inserting cannulas in the vertebral arteries

This procedure follows that of the standard procedure given above, with cannulas being placed in the common carotid arteries, but, additionally, the two vertebral arteries (figure E2) are exposed and cannulas are inserted into them.

Whilst this procedure sounds straightforward, it is in practice not an easy task, as the vertebral arteries are small and difficult to locate.

Alternative method 2: perfusing through the ascending aorta

This requires opening the chest and inserting a cannula (directed towards the head) into the ascending aorta - figure E3. In addition, the following arteries need to be clamped off, as shown:

- the left and right subclavian arteries must be clamped just beyond where the vertebral arteries branch off, to prevent perfusate flowing to the arms and torso;
- the descending aorta will need to be clamped to avoid perfusing the lower part of the body.

Drainage is via the jugular veins as described for the standard method.

BENEFITS AND DISADVANTAGES OF THE DIFFERENT METHODS

In both methods, the advantage of perfusing additionally through the vertebral arteries is questionable, since they are very small, which severely restricts perfusate flow.

The standard method is the least complicated, and all embalmers should be able to locate the carotid arteries and jugular veins, and insert cannulas into them. Both alternative methods require some experience and practice, and embalmers may not feel confident to carry out the procedures properly, possibly resulting in incorrect procedures and a worse perfusion than with the standard method.

Set against the problems of the alternative methods is the advantage of possibly better perfusion in people whose brains do not have a complete Circle of Willis. However, there is doubt about the effectiveness of these methods, in practice, because tests suggest that the narrowness of the vertebral arteries will severely restrict the flow of perfusate.

RECOMMENDATIONS

The Cryonics Institute recommend that, in view of the difficulties of the alternative methods, and the doubts about their advantages, then for CUK, perfusion through the common carotid arteries be adopted as the standard method. However, one of the alternative methods could be used if the embalmer were willing to do this and confident that he/she could do so correctly.

If alternative 1 is used, the line to the carotid arteries could be clamped off for a time to encourage flow through the vertebral arteries, but first lowering the pump speed to avoid a sudden pressure increase as the carotid line is clamped.

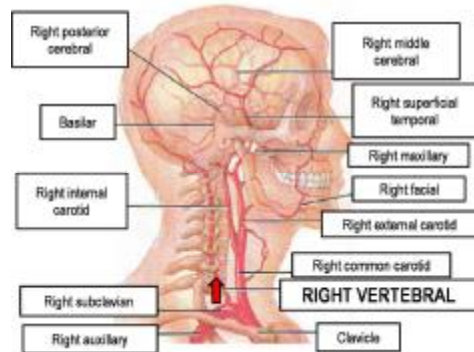


Figure E2: extra insertion points for alternative 1

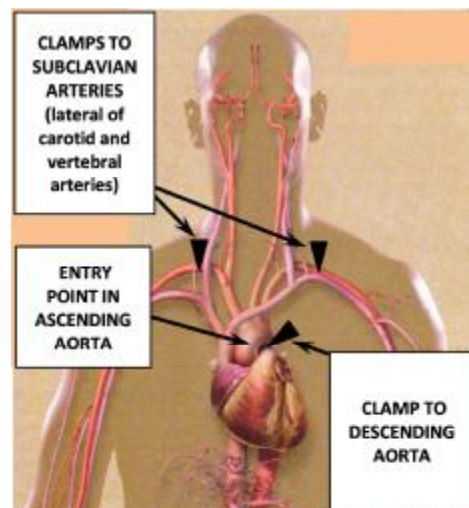


Figure E3: insertion point and clamps for alternative 2

APPENDIX F: KEY CONTACTS

Initial caller: note down number, plus back-up number

Cryonics- UK contacts

Tim Gibson	01142 766 488 (Home)	07905 371 495 (Mobile)
Graham Hipkiss	0115 849 2179 (Home)	07752 251564 (Mobile)
Victoria Stephens	01287 669201 (home)	
Mike Carter	029 2069 2818 (home)	07985 963 864 (mobile)
Alan Sinclair	01273 587 660 (Home)	07717 820 715 (Mobile)

Keys for CUK equipment and ambulance

Keys will be needed for the garage and house at C-UK's HQ, and the ambulance. Details can be obtained from any of the CUK team listed above. For security reasons, details are not given here.

Funeral directors

For CI:	F. A. Albin and Sons Arthur Stanley House 52 Culling Road London SE16 2TN	020 7237 3637 (24 hrs) (020 7237 6366) HeadOffice@Albins.co.uk (Jonathan Fletcher)
For Alcor:	Rowland Brothers Int. 299-305 Whitehorse Road West Croydon CR0 2HR	020 8684 1667 (24 hrs) (Gary Bruce: 07557 430 380) Info@rowlandbrothers.co.uk

<i>Location of CUK's transport box and freezer</i>	Ansty and District Funeral Directors	01162 340 548
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Embalmers

Geoff Taylor (operates nationally)	01273 693 772 07831 312 914
Rachel Shipley (in Leicester but may travel)	07767 416 542

Cryonics providers

Cryonics Institute (USA)	Main number: 001 586 791 5961 Emergency pager: 001 313 990 5916 Fax: 001 586 792 7062 <i>Eastern Standard Time is 5 to 6 hours behind UK time.</i>
Alcor (USA)	Main number: 001 480 905 1906 (business hours) Emergency number: 001 800 367 2228 (24 hour line) Fax: 001 480 922 9027 USA Toll Free line: 001 877 462 5267 <i>Business hours Mon-Fri 9am-5pm - note that Mountain Standard Time is 7 to 8 hours behind UK time.</i>

On-call doctor supply agency

Ambition24	0871 8733 300 or 0871 8733 344 ask for Marius or Aidrian aidrian.peters@a24group.com
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Agency to train or supply nurses to verify death

Fairways Suits 1 & 2, Ground Floor, 4 Mitre Court, Litchfield Road, Training Sutton Coldfield, West Midlands, B74 2LZ. 0845 450 3971 Eddie O'Neil or Mary Joy (trainer)

Dry ice suppliers:

<i>Ice Immediate</i> (24 hours, nationwide) (no address)	Tel: 0800 169 3991
<i>BOC Ltd.</i> (normal working hours only), Bawtry Road, Brinsworth, Rotherham, S60 5NT.	Tel: 01709 828 900
<i>Dry Ice UK</i> (24 hours) Pegasus Square, Innovation Way, Grimsby, DN37 9TT.	Tel: 01472 345 476
<i>24 Hour Ice</i> (24 hours) (no address but supplies only London, Hampshire, Berkshire)	Tel: 07899 982 155

Typical orders: initially 100kg, delivered to funeral director's premises and placed in transport box before arrival of patient (plus 5kg to be available immediately following perfusion if perfusion and cool-down are to be carried out at different locations); then typically 50kg on each subsequent day until the patient reaches -70°C (normally 3-4 days), making 250-300kg in all.

Note that dry ice comes in three forms; 10kg blocks, 1kg slices, and pellets. Order the 1kg slices or, if unavailable, pellets: blocks are too big to be conveniently usable. Typical cost £3.50/kg, plus containers.

Do not confuse dry ice - carbon dioxide ice - with "dry ice-packs" which are ordinary ice in sealed bags.