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REVA #1: Cadaver Embalming and Preparation for Whole Body Imaging

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We use this protocol and it's working

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Abstract

This protocol describes the process to embalm a human cadaver and prepare the cadaver for a whole-body imaging procedure, such as MRI or CT.

Image Attribution

Dead body icons created by amornrat rungreangfangsai - Flaticon

Image: Flaticon.com

Guidelines

N/A

Materials

1. Vacuum seal bags for mattresses (twin/full or queen-size work, depending on the size of the cadaver, but queen is recommended) ([Link](#))
 - a. Company: Homie, sold on Amazon. Size: Queen/Full/Full-XL. Any brand of mattress-sized (e.g., full to king) vacuum seal bag.
2. Electric vacuum or shop vac for sealing the mattress bags ([Link](#))
 - a. Company: Vacmaster, sold on Amazon. Size: 5-gallon. Model: VOC508S 1101. Wet or dry capabilities.
3. Dissection cart/table ([Link](#))
 - a. Company: Mopec, sold on Fisher Scientific. Name: Hydraulic Dissection Cart. Model: DC850.
4. Opaque pads ([Link](#))
 - a. Company: PIG, sold on Fisher Scientific. Name: absorbent mat pad. Model: MAT231.
5. FerrAlert Target Scanner ([Link](#))
 - a. Any other metal detector that is approved for MRI use can be used.
6. Arterial tube slip hub ([Link](#))
7. 5.5" Arterial fixation forceps with 2 holes ([Link](#))
8. Formaldehyde-phenol embalming fluid
 - a. Custom composition used most commonly: water (69.81%), ethanol (13.85%), propylene glycol (5.05%), phenol (4.88%), formaldehyde (3.90%), methanol (1.74%), isopropyl alcohol (0.77%)
9. Optional: Large (40-55 gallon) opaque trash/biohazard bags ([Link](#))
 - a. Company: Bel-Art, sold on Fisher Scientific. Name: thick biohazard disposal bags, 1.5 mil. Size: 40-55 gallon
10. Optional: Flat sheet ([Link](#))
11. Optional: Backboard ([Link](#))
 - a. Manufacturer: Allied Healthcare Products, sold on Medline. Name: XTRA Emergency Backboards.
12. Optional: Electric hair clippers ([Link](#))



Safety warnings

! This protocol might include items and/or substances that may pose hazards (e.g., chemical, physical, biological, or otherwise) to your health upon use or exposure. Before engaging in the processes described in this protocol, familiarize yourself with and follow the safety data sheets, manufacturer safety recommendations, and local regulations.

Ethics statement

Be sure to seek approval for or an exemption from human subjects research from your local regulatory body(ies) as required by local and/or institutional regulations before initiating studies.

This study was determined to be exempt from IRB oversight by the Case Western Reserve University Institutional Review Board (IRB) because it involved de-identified cadaveric tissue and no protected health information was collected from the donors.

Before start

Prior to beginning, a cadaver must be enrolled in the study according to the established inclusion and exclusion criteria. The post-mortem interval (i.e., time from death until embalming) should be kept to a minimum.

Note

Donors who pass away in institutions (e.g., hospitals, nursing homes, etc.) tend to have the best embalming outcomes, whereas donors who pass away at home, especially unwitnessed, tend to have the worst outcomes. Therefore, the location of death should be considered at the time of enrollment in the study.

Section 1: Embalming

- 1 After a cadaver is enrolled in the study, assign a study number to the cadaver and document the number in the study metadata.
- 2 Remove all clothing and jewelry (including institutional identification bands) from the body. Keep cadaver identification tags with the body.
- 3 Inspect the body for surgical scars and other externally-visible anatomic abnormalities and record any findings.
- 4 Place the cadaver supine on the embalming table.
- 4.1 Optional: Remove cadaver's hair via standard electric hair clippers. 
- 5 If the body has been stored in a cold room, let it sit at  Room temperature for at least 24 hours before embalming to ensure adequate uptake of embalming fluid. 
- 6 Expose and mobilize the artery(ies) to be used for embalming (e.g., femoral, brachial, and/or carotid, in order of preference) using standard dissection instruments.

Note

If using the carotid artery for embalming, take extra care to avoid damaging or disturbing the vagus nerve when opening the carotid sheath and mobilizing the carotid artery.
- 7 Cut a small opening in the exposed artery using scissors or a scalpel ensuring that it does not transect more than 3/4ths of the vessel diameter.
- 8 Insert arterial tube slip hub into the opened artery, clamp arterial fixation forceps around the artery and hub, and inject formaldehyde-phenol embalming fluid cephalad until appropriate tissue color loss and turgor is achieved.
- 9 Remove the hub, reinsert it facing caudad and repeat the injection process until desired result is achieved.

10

Note

Typical embalming volume is approximately 1 gallon per 50 pounds of body weight.

- 11 After embalming is finished in a vessel, use waxed embalmer's twine to tie off the artery above and below the cut site.
- 12 Repeat the embalming process in the same artery on the contralateral side and additional vessels as needed or desired.
- 13 Allow the embalmed cadaver to cure at  Room temperature for 24-72 hours and check the cadaver for loss of joint mobility and signs of inadequate embalming (i.e., soft skin, mobile joints, or retained color) throughout that period. Apply supplemental embalming, including via hypodermic needle, as needed.
- 14 If storing the cadaver in cold storage, ensure adequate embalming has been achieved after curing and before placing the body in the cold room for storage.



Section 2: Cadaver Preparation for Imaging

- 15 Place the cadaver on the dissection cart.
- 16 To prepare for MRI: Use the FerrAlert Target Scanner (or other appropriate metal detector) to check the body for metal. If metal is detected, attempt to determine what type of metal is present and remove it if possible (e.g., subcutaneously implanted pulse generator for a pacemaker).
 - 16.1 If not possible to remove the metal, discuss the feasibility of MR scanning with the Magnetic Resonance Imaging (MRI) technologist or other appropriate MR safety expert.
 - 16.2 Large metallic implants such as implanted cardiac devices can lead to significant image artifacts and should be avoided.
 - 16.3 MR compatibility status of the device must be determined before proceeding.

- 17 Remove all objects from the outside of the cadaver, including clothing, jewelry, subcutaneous implants, hospital/hospice identification wristbands, and cadaver identification tags.

Note

Be sure to keep cadaver identification tags with the body by affixing it to the dissection cart via duct tape or other acceptable adhesive material.

- 18 Optional: Place a sheet (plastic or flat bed sheet) and/or backboard on the dissection cart that will be used to transport the body to the whole-body scanner to allow for easier transfer of the cadaver to the whole body scanning table. *
- 19 Place the vacuum seal bag on the dissection cart that will be used to transport the body to the whole-body scanner, and open the vacuum seal bag to facilitate moving the cadaver into the bag.
- 20 Line up the dissection cart with the table on which the cadaver is resting. Lock the wheels of both carts/tables.
- 21 Transfer the body to the inside of the vacuum seal bag on the dissection cart. Ensure the body is in a supine position and as straight as possible (e.g., limbs in anatomical position, head not hyperextended or turned to one side or the other).
- 22 Place opaque pads on top of the cadaver's face and genitals. *
- 22.1 Opaque pads can be used to cover any part of the cadaver that is not desired to be visible during the scan, due to the transparency of the vacuum seal bags.
- 23 Close the double zip seal of the vacuum bag, removing as much air from the bag as possible when sealing the bag.
- 24 Use the shop vac, or any other available vacuum, and an appropriately sized hose nozzle to remove all air from the inside of the bag.
- 24.1 The bag should tightly follow the contour of the body (similar to vacuum-sealed food). Since the valve in the bag is a 1-way valve, it helps to place a finger or instrument between the two (2) plastic layers of the valve to help keep it open while using the vacuum to remove the air. Once any liquid in the bag begins approaching the 1-way valve, stop vacuuming and quickly close the seal to stop/prevent air entry.



- 25 Optional: If desired, place the vacuum-sealed body inside two (2) opaque trash bags to obscure the view of the cadaver and to provide extra protection from leakage of fluids. 
- 25.1 Two (2) red biohazard bags can be used, one (1) applied from the head and one (1) from the feet of the cadaver to cover the whole body.
- 26 If an MRI or CT is to take place within 48 hours, keep the body at  Room temperature .

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