



**Embalming:  
Autopsies & Organ/Tissue Donors  
1 CE Hour**

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*APFSP Provider 1107*

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# Funeral Service Academy

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## Final Exam - PREVIEW

**Course Name:** Embalming: Autopsies and Organ/Tissue Donors (*1 Contact Hour = .1 CEUs*)

1. There are several things to be considered when preparing the arterial embalming solution for an autopsied body, including \_\_\_\_\_.
  - a. The size of the deceased
  - b. Refrigeration time
  - c. Any postmortem changes that may have already occurred
  - d. All of the above
  
2. In an autopsied body, the injection should begin \_\_\_\_\_.
  - a. With the lower extremities
  - b. With the upper extremities
  - c. With the head
  - d. Wherever is convenient
  
3. Ideally, in an autopsied body, the \_\_\_\_\_ will be used for injecting the upper extremities.
  - a. Axillary arteries
  - b. Vertebral artery
  - c. Right and left subclavian arteries
  - d. Thoracic artery
  
4. Prior to replacing the viscera bag, the thoracic cavity should be \_\_\_\_\_.
  - a. Rinsed and patted dry
  - b. Sealed with a locking suture to hold skin flaps in place
  - c. Painted with autopsy gel or covered with autopsy paraformaldehyde chemical
  - d. Shaped and tied off
  
5. \_\_\_\_\_ is the most commonly harvested tissue, as it can sustain the longest upon the somatic death, or death of the entire body.
  - a. Skin
  - b. Cornea

- c. Long bones
  - d. Mandible
6. From inside the procurement incision, the \_\_\_\_\_ can be arterially embalmed by injecting down the aorta and up and down the right and/or left femoral arteries with the aorta clamped off.
- a. Head
  - b. Thorax
  - c. Arms
  - d. Abdomen and legs
7. When embalming after eye enucleation, one technique that can be utilized to control swelling of any kind on the head is \_\_\_\_\_.
- a. Rapid rate of flow
  - b. Restricted cervical injection
  - c. High injection pressure
  - d. Weak arterial embalming solution
8. The first method of treating long bone donors, where the incisions are open, is also known as \_\_\_\_\_.
- a. Saturated packing
  - b. Hypodermic injection
  - c. The free-flow method
  - d. Surface packs
9. \_\_\_\_\_ is recovered by two different methods: partial thickness and full thickness.
- a. Donor cornea
  - b. Donor spine
  - c. Donor bone
  - d. Donor skin
10. \_\_\_\_\_ can be recovered using either the internal approach or the external approach.
- a. Long bones
  - b. Ribs
  - c. The temporal bone
  - d. The mandible

# CONTINUING EDUCATION for Funeral Directors & Embalmers

## Embalming — Autopsies & Organ/Tissue Donors

1 CE Hour

### Learning Objectives

This course examines complicated scenarios that may be encountered by embalmers, including autopsies and organ/tissue donors. By the end of the course, learners should be familiar with:

- Embalming Considerations for Autopsies: Lower Extremities, Upper Extremities, Head
- Embalming Considerations for Organ Donors
- Embalming Considerations for Tissue Donors: Cornea Donors, Vertebral Donors, Long Bone Donors, Arm Bone Donors, Skin Donors, Rib Donors,
- Cavity Embalming
- Mandible Donors, Temporal Bone Donors

*NOTE: Links and illustrations provided within the course material are for informational purposes only. No endorsement of processes or products is intended or implied.*

## Autopsies

Autopsies are often seen in the embalming room. They may also be referred to as a necropsy, postmortem examination, or simply a “post.” They are generally performed for a number of reasons, which will be discussed below.

Autopsies do not have to be problematic for the embalmer, but they can be. The main issue with autopsied remains is allowing for the extra time required to do the embalming and repair.

There are two different types of autopsies: hospital autopsies and coroner/medical examiner autopsies. Both types of autopsies have different reasons as to why they might be requested or required.

### Hospital Autopsies

Hospital autopsies – or medical autopsies – are generally performed at the request of the doctor, with permission from the person with authority over the body (the next of kin or an agent of the deceased). The doctor might request an autopsy in the event that he or she cannot make a firm diagnosis, if the death follows unexpected medical complications, if the death occurs during a procedure, when the death occurs suddenly or unexpectedly while in the hospital, when the death occurs during or after childbirth, when the death could be due to an experimental or new drug or procedure/device, when there are concerns of hereditary disease, when there are concerns of a contagious disease, when the death could affect insurance settlements, or when the death occurs in a hospital but the patient came from a nursing home where quality of care is a concern.<sup>1</sup> The next of kin or agent of the deceased may request an autopsy for any reason, as long as they are willing to pay: if an individual requests the autopsy, and not the doctor, that individual is generally responsible for the cost of the autopsy.

### Coroner/Medical Examiner Autopsies

Coroner or medical examiner jurisdiction varies on why they may choose to do an autopsy on a body as a form of investigation. Generally, there are several reasons that would apply in most jurisdictions, including all sudden deaths not caused by a disease or that cannot be properly certified by a physician whom the deceased has recently seen; all deaths occurring in suspicious circumstances; all deaths occurring as a result of violence or trauma; any fetal death, stillbirth, or death of a baby within 24 hours of birth where the mother has not been under the care of a physician; all therapeutic and criminal abortions and spontaneous

<sup>1</sup> Mayer, 2012, p. 327-328

<sup>2</sup> Mayer, 2012, p. 328

abortions beyond 16 weeks’ gestation; all operative and perioperative deaths in which the death is not explainable on the basis of prior disease; any death wherein the body is unidentified or unclaimed; and any death where there is uncertainty as to whether or not it should be reported to the coroner’s office.<sup>2</sup>

## Embalming: Autopsies

The arterial embalming solution for an autopsied body should generally be stronger than a typical arterial embalming solution. However, there are several things to be considered when preparing the solution, including the size of the deceased, the cause of death, the postmortem interval, refrigeration time, and any postmortem changes that may have already occurred. In order to avoid mixing too much of any one type, the embalmer should also keep in mind that the legs, arms, and head can all be injected with a different arterial solution.

Some embalmers prefer to have the body positioned on body bridges or blocks while others prefer the body to be directly on the table. If the embalmer is using body bridges or blocks, he or she should be sure those are positioned prior to moving the body onto the embalming table. Whether or not the embalmer chooses to use body bridges or blocks, the head should be supported and elevated.

The embalmer should make sure all garments and wrappings are off of the body, and disposed of in a safe and sanitary manner as necessary. The body should then be primarily disinfected with a topical disinfectant spray. The embalmer should be sure to apply the topical disinfecting spray to all open wounds, incisions, and orifices. The body should then be washed with germicidal soap – this allows the embalmer to properly evaluate the body, and also helps to protect the embalmer. Once the body is thoroughly washed, it should also be dried. The embalmer can then relieve as much rigor mortis as possible if any is present.

All sutures made during the autopsy should be removed, and the flaps of skin should be laid back on both the thoracic cavity and the cranial cavity. The cavities should be disinfected with disinfecting spray. Remove the calvarium from the cranial cavity and the sternum from the thoracic cavity. The internal

### exam question...

1. There are several things to be considered when preparing the arterial embalming solution for an autopsied body, including \_\_\_\_\_.
  - a. The size of the deceased
  - b. Refrigeration time
  - c. Any postmortem changes that may have already occurred
  - d. All of the above

surfaces of these cavities should now be disinfected; the embalmer may want to put a layer of autopsy gel inside the cranial cavity.

(Note: the embalmer must be alert to the rib bones that are sticking out of the thoracic cavity – these bones can be very sharp, and may injure the unwary embalmer.)

If the viscera has been returned, it should be removed from the thoracic cavity and placed in a viscera bucket or similar – something that can contain the viscera and allow it to be treated. Once the viscera is in the viscera bucket, the embalmer should open the bag containing the viscera. All fluid should be aspirated from the viscera bag. Once the fluid has been removed, either undiluted cavity chemical or autopsy paraformaldehyde compound should be added to the viscera bag. The embalmer should then close the viscera bag and put the viscera bag off to the side to allow it the contents to “embalm” while the body is treated.

The body can be positioned at this time: although it will be manipulated throughout the embalming, it is best to have a set position to start, and return the body to that set position when it is not being manipulated.

It is now time to begin arterial injection. In an autopsied body, injection takes place from within the cavities. The injection should begin with the lower extremities, followed by the upper extremities, and then the head.

### Arterial Injection: Lower Extremities

When injecting the legs, the rate of flow and pressure can be a bit higher than with the upper extremities or the head. The embalmer should be sure to set the rate of flow and pressure as desired, AND test it, prior to arterial injection.

Ideally, the legs will be injected using the right and left common iliac arteries – using these arteries should arterially embalm the entire lower extremity, including the buttocks and anal area.

Start with one leg and locate the arteries – be aware that sometimes the arteries are ligated by the pathologist or autopsy technician. The embalmer should pick a healthy spot (not the place where the artery is severed) and make an incision for the arterial tube. The arterial tube should be inserted facing downward toward the lower extremity. If any cuts are

### exam question...

2. In an autopsied body, the injection should begin \_\_\_\_\_.
- With the lower extremities
  - With the upper extremities
  - With the head
  - Wherever is convenient

visible in the artery, they can be clamped on with a locking forceps (hemostat) at this time.

Turn the embalming machine on and begin arterial injection. If the embalmer notices any squirting or leakage from the artery, the sever can be located and clamped. Blood and embalming solution will drain into the thoracic cavity. An autopsy aspirator should be used on a continuous basis in the cavity during injection of an autopsied body.

Monitor the injection process: look for swelling of the leg or excessive embalming solution inside the cavity. The embalmer should massage the entire lower extremity during injection and watch for signs that the entire leg is getting the embalming solution. If the embalmer notices that fluid is not getting to the extreme portions of the leg, continue firmly massaging, especially along the arterial routes; if not already doing so, the embalmer should also employ the “pulsating” mode on the embalming machine.

There is not a specific time frame or volume of solution for injection of any part of an autopsy. When the embalmer feels the leg has been embalmed as well as it can be through arterial embalming, stop injection. If portions of the lower extremity did not embalm well with arterial embalming, hypodermic injection can be utilized after arterial injection of the entire body is complete.

Follow the same procedure as above for the other lower extremity.

(Note: if the embalmer is unable to utilize the common iliac arteries, the femoral arteries can be raised to embalm the leg. However, the embalmer should then be sure to shoot the fluid up from the femoral artery toward the upper thigh, buttocks and anal area and/or hypodermically inject the upper thigh and buttocks area.)

If both legs are in similar shape, some embalmers choose to inject both at the same time with a Y-tube injection apparatus. This can save time if done correctly in the proper situations, but can cause severe damage – and therefore problems for the embalmer – if done improperly or in the wrong situation. Prior to beginning, the embalmer should take into consideration the cause of death (if traumatic, broken bones, internal damage, etc. may be present), and should carefully monitor both legs while injecting.

### Arterial Injection: Upper Extremities

After the embalmer is finished with the lower extremities, he or she can move on to the injection of the upper extremities.

Ideally, the right and left subclavian arteries will be used for injecting the upper extremities. Injection from these arteries should arterially embalm the shoulders, the upper back, the back of the neck, and the arms. (The

embalmer should be cautious of embalming solution coming out of other arteries, including the vertebral artery and thoracic artery. These arteries usually need to be clamped off when injecting the upper extremities using the subclavian arteries.)

If the subclavian arteries cannot be utilized, the embalmer can raise the axillary arteries. However, the embalmer will need to treat the shoulder area, upper back, and back of the neck using hypodermic injection after the arterial embalming is complete.

If the same arterial embalming solution is being used as with the legs, there is no need to mix a different solution. If a different solution is being used, prepare that at this time.

Just like with the lower extremities, the embalmer should set the rate of flow and pressure, AND test them, prior to injection.

Injection technique for the upper extremities is the same as with the lower extremities. Once the embalmer feels an extremity has been as thoroughly arterially embalmed as possible, stop the injection. Hypodermic injection can be done once the arterial embalming of the entire body is complete.

Follow the same procedure for the other upper extremity.

Just as with the leg, both upper extremities can be embalmed at once with the Y-tube apparatus. However, once again, this is not ideal in every situation.

### **Arterial Injection: Head**

The head should be injected last.

The embalmer should be sure the body is positioned so the shoulders and head are elevated above the rest of the body. The facial tissues, eyes, nasal, and oral cavities should then be disinfected. Next, the embalmer should wash and dry the face and hair. A thick layer of massage cream should be applied to the facial tissues. The throat should then be packed and the features set (if the deceased needs to be shaved, this should be done prior to setting the features).

The right and left common carotid arteries should be used for injection. Often, the arteries are severed inside the neck: if a sever is visible, clamp it off prior to injection; if not, it will become obvious where it

### **exam question...**

3. Ideally, in an autopsied body, the \_\_\_\_\_ will be used for injecting the upper extremities.
- Axillary arteries
  - Vertebral artery
  - Right and left subclavian arteries
  - Thoracic artery

is located after injection begins, and can be clamped off at that time. (The internal carotids will need to be clamped off from inside the cranial cavity so the arterial embalming fluid can circulation through the vascular system in within the head.)

If a new arterial embalming solution needs to be mixed, it should be mixed at this time. As before, the embalmer should set the rate of flow and pressure at this time AND test it: the rate of flow and pressure for the head should probably not be as high as it was for the extremities. It is recommended that the embalmer start out with a pretty low rate of flow, and work from there, so as to not swell the facial tissue.

Once injection has begun, if any vessels are leaking (either from the neck area or from within the cranial cavity) they should be clamped to stop the leakage and allow circulation of fluid. The embalmer can lightly massage the face and ears during injection.

Be very cautious of swelling: always monitor the face while injecting. If swelling is observed, stop injection, mix a stronger fluid, and restart injection with a very low rate of flow. If swelling is noticed again, stop embalming. The tissue can instead be treated with surface packs and restorative treatment.

Once the embalmer feels the facial tissue has been adequately embalmed, stop injecting.

(Note: If there is blood discoloration in the facial tissues, steps can be taken by the embalmer to try to get rid of or lessen the discolorations during arterial embalming. The arterial embalming solution used in these cases should be of moderate strength and contain added dye. The embalmer should inject the arterial embalming solution slowly and massage the discolored area while the injection is taking place: the massage will encourage the flow of arterial solution into these tissues, causing displacement of the blood and resultant discoloration.)

### **Post-Arterial Injection**

After arterial injection is complete, hypodermic injection can be employed.

Hypodermic injection with an infant trocar or specially designed trocar for hypodermic embalming should be done on any parts of the body that did not arterially embalm well (*excluding* the face: some hypodermic injection may be done on the face with a small hypodermic needle and syringe, but surface packs generally work better for facial tissue). The thick skin in the skin flaps of the thoracic cavity should be hypodermically embalmed, as well.

During this entire process, the viscera has been “embalming” in the viscera bucket or other container. At this time, the embalmer should return to the viscera; if it needs to be aspirated again, the embalmer should do so.



Prior to replacing the viscera bag, the thoracic cavity should be painted with autopsy gel or covered with autopsy paraformaldehyde chemical. The viscera bag can then be returned to the cavity, shaped, and tied off, making sure the majority of the air is out of the bag so the cavity appears natural (it is best to tie the bag with ligature in case it needs to be re-opened). More autopsy paraformaldehyde chemical should be placed over the bag. The sternum rests on top, with more chemical covering it. The three skin flaps should be pulled together over the sternum and attached, either with an instrument such as the grasping forceps, or with a locking suture to hold the flaps in place.

Optionally, each organ can be individually removed from the viscera bag and placed inside the treated thoracic cavity. In this situation, each organ should be treated with either autopsy gel or paraformaldehyde chemical prior to being placed in the cavity; filling may also need to be added to the cavity to give it a natural appearance.

The cranial cavity should also be painted again with autopsy gel, including the calvarium (if the brain was returned, it was probably in the bag with the viscera). Fill the cranial cavity with cotton or other absorbent material. Put the calvarium in place using calvarium clamps or the drill and wire skull closure method. Pull the skin flaps together and use either an instrument such as the grasping forceps or a locking suture to hold the flaps in place.

The embalmer should now suture the incisions.

The “Y” incision can be sutured using the baseball suture, “locking” it after every five inches or so using the locking suture (the locking suture is similar to the baseball suture except the needle is looped through the ligature; the ligature is then pulled tight). Be sure the suture is very tight to help prevent leakage.

The cranial cavity incision can be sutured using the worm (inversion) suture or the baseball suture. Just like with the suturing of the “Y” incision, “lock” the suture after every five inches or so using the locking suture. Again, it is very important that the embalmer make the suture very tight. Incision sealing powder or mortuary putty can also be used to help prevent leakage.

Both incisions, once sutured closed, can be treated with a sealing agent on the surface, and then covered with prep cotton and plastic wrap. If leakage is suspected, plastic garments can be used.

### exam question...

4. Prior to replacing the viscera bag, the thoracic cavity should be \_\_\_\_\_.
- Rinsed and patted dry
  - Sealed with a locking suture to hold skin flaps in place
  - Painted with autopsy gel or covered with autopsy paraformaldehyde chemical
  - Shaped and tied off

## Organ and Tissue Donors

Organ and tissue donation is becoming more and more common with advances in medical technology and research. Those willing to donate their organs and tissue may do so and their loved ones are still able to have a viewing of the body. Organ procurement organizations treat each donor with the utmost respect and dignity, allowing the donor to be viewed.<sup>3</sup>

Organs that can be donated after death are the heart, liver, kidneys, lungs, pancreas, and small intestine.<sup>4</sup> The organs recovered depend on consent and viability of each organ.

Tissue is taken for donation more often than organs due to the sustainability of the tissue after death – tissue tends to “live” longer once the donor is deceased.

Tissue that can be harvested for recovery includes cornea, vertebral column (spine or parts of the spine), long bones (femur, tibia, and/or fibula), skin, mandible, ribs, and temporal bone. Cornea is the most commonly harvested tissue, as it can sustain the longest upon the somatic death, or death of the entire body.

Although embalming an organ and tissue donation case is more difficult and poses many problems, it can be done.

(Note: It is good for any funeral home to have a working relationship with the organ and tissue procurement agency in the area. Knowing the tissue recovery specialists and how they work helps in the embalming process; the embalmer can even offer suggestions to the tissue recovery specialists if a solid working relationship exists.)

## Embalming: Organ Donors

Prior to embalming an organ donor, the embalmer should be sure to consider the cause of death. Often, when a person qualifies to be an organ donor, they died traumatically as with an accident or after a long illness most likely involving a long hospital stay. With any accident or lengthy hospital stay, special embalming techniques must be taken into consideration.

### exam question...

5. \_\_\_\_\_ is the most commonly harvested tissue, as it can sustain the longest upon the somatic death, or death of the entire body.
- Skin
  - Cornea
  - Long bones
  - Mandible

<sup>3</sup> American Transplant Foundation website

<sup>4</sup> American Transplant Foundation website

When an embalmer embalms an organ donor, the embalmer must decide if he or she is going to raise vessels at common injection sites from outside the body and keep the procurement incision closed, or if he or she is going to open the procurement incision and embalm from within the cavity.

If the embalmer knows what organs were procured, this might help in the decision-making process: for example, if all possible organs were procured, it may be best to embalm by opening the incision and accessing the vessels from within.

### Opening the Procurement Incision

Should the embalmer choose to embalm by opening the procurement incision, he or she will likely find one of four procurement incisions.

- A midline incision that runs from the base of the neck to a point superior to the umbilicus for a heart, lung, or heart and lung procurement.
- A midline incision that runs from the base of the sternum to the pubic bone for liver, kidney, pancreas, and/or small bowel recovery.
- A “T” incision that transverses the abdomen along the inferior margin of the ribcage, and a midline incision from the base of the sternum to the pubic bone for liver, kidney, pancreas, and/or bowel recovery.
- A midline incision that runs from the base of the neck to the pubic bone if a full recover was done.<sup>5</sup>

From inside the procurement incision, the abdomen and legs can be arterially embalmed by injecting down the aorta and up and down the right and/or left femoral arteries with the aorta clamped off. To arterially embalm the thorax, head, and arms, inject up the aorta; in addition, the embalmer can use restricted cervical injection and inject the head with the right and left common carotid arteries, and the right or left axillary arteries.

Since the body cavity will be empty, the embalmer will need to use a filling in the chest and abdominal cavity to provide a natural form and act as an absorbent. A drying or hardening compound is also recommended to treat the cavity. Painting the inside of the cavity

### exam question...

6. From inside the procurement incision, the \_\_\_\_\_ can be arterially embalmed by injecting down the aorta and up and down the right and/or left femoral arteries with the aorta clamped off.
- a. Head
  - b. Thorax
  - c. Arms
  - d. Abdomen and legs

with autopsy gel prior to filling, much like with an autopsy, is another option.

### Keeping the Procurement Incision Closed

To arterially embalm an organ donor while keeping the procurement incision closed, the embalmer must raise arteries and veins at commonly used injection and drainage sites. The embalmer should anticipate the need to use two or (most likely) more injection sites, depending on the extent of vascular disruption caused by the organ procurement.

(Note: If leakage occurs in the cavities and distention is severe, the embalmer will need to open the procurement incision to aspirate the fluid. The cavity will then need to be treated, filled with something to give it natural shape and appearance, and then the incision will need to be closed.)

### Embalming: Tissue Donors

As mentioned above, the human cornea is the most commonly transplanted tissue today. Recovering the cornea can be done in one of two ways: the entire eye can be removed – or *enucleated* – or just the cornea can be removed from the donor.

### Eye Enucleation

Eye enucleation is when the entire eyeball is removed from the donor. When embalming a donor who has had the eye enucleated, the embalmer must be cautious of swelling and/or distension in and around the orbital cavity. In addition, the embalmer must also watch for ecchymosis and small lacerations around the orbital cavity.

Prior to arterial embalming, the embalmer should be certain to apply massage cream around the eye and extend out onto the facial tissue to protect facial skin areas from chemical burns during the arterial embalming process. The packing placed in the eye by the procurement team should be removed from the eye. New cotton should be saturated with autopsy gel and put loosely into the orbital cavity. The embalmer should be sure the material is not packed too tightly into the orbit: having the cotton loosely packed will allow some leakage but will help prevent swelling. The embalmer should then put cotton in the eye to recreate the normal appearance of the closed eye.

(Note: It is recommended that the embalmer avoid preembalming and excessive manipulation of the eyelids prior to and during the embalming.)

During the arterial embalming, the embalmer should avoid rapid rates of flow and high injection pressure, and take precautions to help control swelling and

<sup>5</sup> Mayer, 2012, p. 348-349

distention. One technique that can be utilized to control swelling of any kind on the head is restricted cervical injection. With this method of injection, the embalmer has complete control over how much arterial embalming solution enters the head, at what pressure it enters, and at what rate of flow it enters. The embalmer should also use a slightly stronger arterial embalming solution for the injection of the head.

Over the course of the arterial embalming, arterial solution, blood, or other fluid may drain from the eye: the embalmer should allow it to do so. If the embalmer notices swelling starting to occur in the eye area, he or she should strengthen the arterial embalming solution: if only a minimal amount is going to be able to be injected, it should be stringent enough to preserve the tissue. If swelling becomes excessive, stop injection entirely. If more preservation is necessary, surface embalming should be employed.

Once the embalming is complete, the embalmer should remove the cotton from the eye and orbital cavity. The entire face should be washed at this time, as the eyes should not get wet again after setting them. The orbital cavity and eye area should be dried completely. The embalmer should place a small amount of either incision sealing powder or mortuary putty in the base of the orbit – since incision sealing powder will swell in contact with water, the embalmer should take extra precaution to not get the eye area wet. The orbital cavity should be packed with cotton. An eye cap can be inserted over the filler and the eyelid pulled over. The embalmer should be sure the eye has a natural shape and appearance before gluing the eyelids closed.

### **Cornea Removal**

If only the cornea is removed from the donor, the preparation work is greatly reduced. The embalmer should embalm the body as usual, using whatever injection method, rate of flow and injection pressure he or she feels necessary. The embalmer may also want to fill the eye globe with cotton saturated with autopsy gel or undiluted cavity fluid during the arterial embalming. Watch for swelling and distention. If leakage occurs, the embalmer should allow it during the arterial embalming process.

### **exam question...**

7. When embalming after eye enucleation, one technique that can be utilized to control swelling of any kind on the head is \_\_\_\_\_.
- a. Rapid rate of flow
  - b. Restricted cervical injection
  - c. High injection pressure
  - d. Weak arterial embalming solution

After the arterial embalming is complete, the eyes should be set as usual. If the embalmer feels the eye needs to be aspirated of fluids to prevent leakage, it can be done at this point; the embalmer then may fill the eye globe with mortuary putty or incision sealer. (Again, be sure not to get the eye wet after filling the eye globe with incision sealer as it will swell when it comes into contact with water.) An eyecap can then be placed over the eyeball to support the eyelids and create a natural contour and form to the eye. Finally, the eyelids can be glued closed.

### **Vertebral Donors**

The vertebral donor will have sections of the spinal column – or possibly the entire spinal column – removed.

With each vertebral donor, the procurement agency should place some sort of prosthetic device to replace the spine or portion of the spine recovered. However, the embalmer should keep in mind that the body will be less rigid even with the prosthetic device replacing the spine. This will make the body harder to move from the embalming table to the casket, for example.

After the spine or sections of the spine have been recovered, viscera will be put back into position – the embalmer should anticipate that accidental damage or disruptions will occur. Once the procurement is complete, the incision may be closed.

The procurement of the spine can be done in a number of ways. If there is already an incision from organ donation or from an autopsy, the spine can be accessed through this incision. The spine could also be harvested from an anterior incision if there is no organ procurement or autopsy. Finally, the harvest can take place through a posterior incision.

If the spine is recovered through an autopsy or organ recovery incision, the arterial embalming procedure will not drastically change from what would be done for an organ donor or autopsy case. However, the embalmer should carefully inspect the donor's back to be sure there are no punctures from the recovery that may cause leakage.

If the spine is recovered via an anterior midline incision (an incision that runs from the xiphoid process to the pubic bone), the embalmer should anticipate that the aorta will be cut in both the thoracic and abdominal cavities, and that a renal vein will also be cut. The embalmer can open the incision and arterially inject the case using the ends of the transected vessels. Watch for signs of leakage into the cavities. After injecting from inside the incision, if more preservation is needed, the embalmer may need to raise additional vessels outside of the procurement incision and/or use supplemental embalming procedures like hypodermic embalming and/or surface packs.

If the spine is recovered via a posterior midline incision (beginning at the level of the scapula, ending at about the level of the sacrum), and proper skill and care are utilized, the procedure will not cut or damage the vascular structures that are necessary for arterial embalming. Since the vascular system was not disrupted, the embalmer should be able to perform the arterial embalming as usual, bearing in mind that there could – and most likely will be – leakage from the closed procurement incision. (Note: when sealing the incision, the embalmer would ideally have assistance from a second embalmer, since it is on the posterior side of the body.)

No matter where it is, in sealing the incision, the embalmer should use an incision sealing powder or mortuary putty inside the incision (if the incision is opened), then sealant on the outside of the incision, and finally prep cotton and plastic wrap on top of the sealant. As an additional precaution to prevent leakage, plastic coveralls or unionalls should be utilized – in fact, these plastic garments are generally required by the tissue procurement agency.

### FINAL CONSIDERATIONS:

The vertebral column is rarely the only tissue recovered. The embalmer must keep in mind that if additional tissue is recovered, additional measures must be taken during the embalming process.

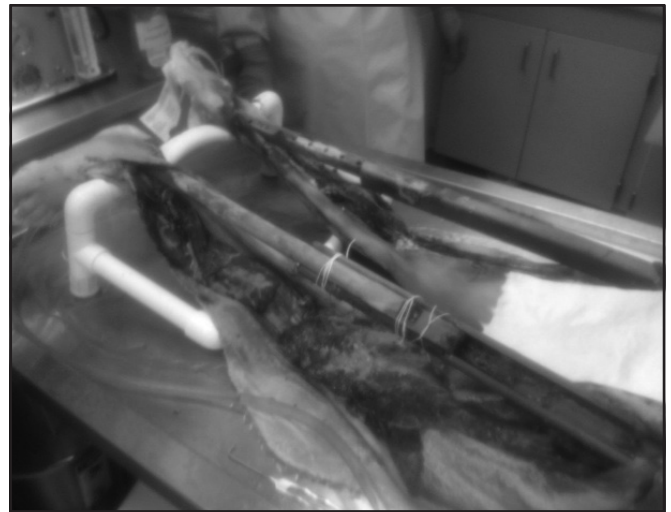
### Long Bone Donors

Long bone donation, probably the most intense of all tissue recovery, is becoming more and more common. Generally, if all bones are recovered, there will be no internal tissue in the lower extremities from mid-thigh to mid-foot – only skin will remain.

Bone tissue that can be recovered includes the femur and the tibia. For the procurement of this tissue, an incision is made along the anterior surface of each leg from the top of the hip to the mid-foot. With this procurement, there is large-scale disruption to the vascular system.

There are two different treatment methods, depending on whether the incisions are open or closed.

The first method, where the incisions are open, is also known as *saturated packing*. The embalmer should begin by opening any procurement sutures. Next, the embalmer should pack the legs with an absorbent material such as cotton. The legs are then resutured, beginning at the foot on each leg; as the embalmer sutures, he or she should saturate the packing material with an undiluted cavity fluid or very strong arterial fluid to create an internal preservative compress. (Note: Either the baseball or the worm suture work well. The suture should be locked about every five inches.) Hypodermic injection of the large muscles in the upper



**Long bones of the legs have been taken for donation and replaced with wooden dowels. Sutures have been removed, and the legs are being prepared for the saturated packing method of preservation.**

thigh – with a strong preservative solution using an infant trocar – follows. Autopsy gel can then be applied to the skin of each leg, and plastic garments should be placed on the legs to prevent any leakage from the incisions.

The second method, where the procurement incisions are left closed as long as they are tight, is also known as the *free-flow method*. (Note: If the sutures are loose – or because the embalmer chooses to do so – the incisions can be opened, the entire leg repacked with absorbent material, and the incisions then resutured as above.) The embalmer should raise either the right and left external iliac arteries or the right and left femoral arteries. The arterial tubes (cannulas) should be inserted and directed down the legs in each vessel. The arterial embalming solution injected into the legs should be very strong, and the embalmer should inject at least a half-gallon per leg. The tissue of the leg may distend slightly – this is normal and to be expected. After injection, allow the arterial embalming solution to thoroughly saturate the tissues of the legs while embalming the rest of the body as usual. Once the arterial embalming is complete, puncture the lower leg, insert a drain tube or trocar, and force as much of the solution as possible from the leg. The absorbent packing material inside the leg, saturated with any remaining embalming chemical, will create an internal compress. The incision should then be treated with

### exam question...

8. The first method of treating long bone donors, where the incisions are open, is also known as \_\_\_\_\_.
- a. Saturated packing
  - b. Hypodermic injection
  - c. The free-flow method
  - d. Surface packs



Again, leg bones removed and replaced with wooden dowels. Sutures have been removed to prepare for saturated packing.

sealant, prep cotton, and plastic wrap, and autopsy gel can be applied to the skin area. Plastic garments are recommended to ensure there will not be any leakage.

### Arm Bone Donors

As with the long bone donors, the arm bone recovery is quite intense: a large incision is made all the way down the arm in order to recover the bones in the arm.

Frequently-harvested arm bone tissue includes the humerus, radius, and ulna bones.

The same two methods can be used to treat arm bone donors as long bone donors: the free-flow method where the sutures are left intact, or the saturated packing method where the sutures are removed and the incision is open. Just as with long bone donors, incisions should be treated and plastic garments used to ensure there is no leakage.



Bones of the arm taken for donation. Sutures have been removed and the arms are being prepared for the saturated packing method of preservation.



Again, bones from the arm have been removed and sutures open to prepare for saturated packing.

### Skin Donors

Donor skin can be recovered from the back, buttocks, thighs, lower legs, and chest.

It is recovered by two different methods: partial thickness and full thickness. With partial thickness, an instrument called a dermatome is used to peel or shave very thin layers of the skin. With full thickness, the skin and connective tissue structures down to the muscle layer are removed using a scalpel; the vascular layer is also removed with full thickness recovery.

Skin procurement can present challenges for the embalmer. For example, there may be leakage from the areas where skin was procured; these areas will then need to dry. Keeping the body elevated on body bridges or blocks will permit air to come into contact with all the affected areas on the body, including the backside, and promote drying of the tissues. In another consideration, since skin tissue is usually recovered from the back, the body will have been turned and rested on its abdomen during the recovery: this may cause a blood discoloration of the facial tissues. For facial discolorations, the embalmer should utilize the same method as previously discussed with autopsy cases. Be sure to use the restricted cervical injection method for the head by raising both the right and left carotid arteries. This will allow the embalmer complete control over the amount, the rate of flow, and the pressure of fluid injected into the head. Drainage may be necessary from both jugular veins, as well.

### exam question...

9. \_\_\_\_\_ is recovered by two different methods: partial thickness and full thickness.
- Donor cornea
  - Donor spine
  - Donor bone
  - Donor skin

When embalming the body of a partial thickness donor, in general, the embalmer can proceed as usual. It is possible that fluid and blood will leak through the areas where skin has been removed; be sure the body is up on body bridges or blocks, and if time permits, let it sit post-embalming to allow leakage and drying of the areas where the skin has been removed (the drying will actually help to seal the affected areas). After sufficient time has gone by to allow for drying, the affected areas can be treated. Begin with an inspection of any areas where skin was removed (this will require that the body be turned on the side to include the backside as well), and further dry them if necessary. A cauterizing agent or preservative gel should be applied to the areas; they then should be covered with prep cotton. Next, cover the areas with plastic wrap or plastic sheeting. Finally, the body should be placed in an appropriate plastic garment such as a unionall; embalming powder or hardening (autopsy) compound can be placed inside the plastic garment.

When embalming the full thickness skin donor, treatment can largely follow similar steps as those outlined above for partial thickness donors. Prior to the arterial embalming of the body, place a large surface pack on the recovered area to treat the tissue while the body is being embalmed (since the vascular layer has been removed, there should be very little leakage from the area). When the embalming is complete, remove the surface pack and prop the body up on body bridges or blocks; if time permits, allow the body to sit and the tissues to dry as much as possible. Follow the same steps as above to treat the tissue after drying.

Note: Ideally, the embalmer would have a second person assisting in this process, as a fair amount of turning the body may be required. If the embalmer is by himself or herself, it is still possible to treat the recovered area during the embalming: prior to placing the body on the table, place the plastic and then the saturated cotton surface pack on the table. The body can be placed on the surface pack and then embalmed as usual.<sup>6</sup>

## Rib Donors

Ribs are generally recovered through the same procurement incision as the organ recovery: the skin is peeled back and every other rib is recovered.

Some intercostal arteries may be disrupted as a result of the procedure, but this may not present a problem for the embalmer; the biggest issue will likely be leakage from the procurement incision.

<sup>6</sup> Adams, 2011, p. 6

<sup>7</sup> Massachusetts Eye and Ear Infirmary, 2016.

<sup>8</sup> Massachusetts Eye and Ear Infirmary, 2016.

## Mandible Donors

Although mandible recovery is not very common, it is still important for the embalmer to be aware of the possibility of such, and how to treat it.

No matter how the mandible is removed from the body, there will be major significant embalming and restorative consequences. The arterial system supplying the facial surface will be disrupted, and the facial artery will be cut and/or broken in the process of the mandible recovery.

Besides the obvious restorative work that would need to be done if the body were to be viewed, the head will be difficult to embalm. If the embalmer is able to recover the severed facial artery and it can be utilized, the head can be injected that way. If not, the face may need to be hypodermically injected and topically embalmed with surface packs.

Most cases of mandible recovery are done on cases where the body will not be viewed.

## Temporal Bone Donors

Temporal bone recovery is also not very common.

The temporal bone can be recovered using either the internal approach or the external approach. The internal approach, or intracranial method, is generally done if a cranial autopsy has already been performed. Four linear bone cuts are made and the temporal bone is grasped and loosened by gently rocking. The attached muscular, ligamentous, and fibrous tissue must be cut to get the bone out.<sup>7</sup> The external approach, or the extracranial method, is done when there is no autopsy or brain removal. An incision is made in the postauricular fold and the external auditory canal is transected. A special instrument is used to remove the temporal bone. The ear canal is then sutured shut and the defect in the skull is tightly packed with gauze.<sup>8</sup>

During embalming, the leakage from the arteries can be controlled with hemostats or by tightly packing cotton into the area where the temporal bone has been removed and applying hand pressure. After the embalming, mortuary putty or incision sealing powder can be placed in the area from which the bone was removed; Plaster of Paris can also be used by the embalmer as a filler, and plenty of cotton filler can be placed in the cranial cavity prior to suturing the scalp. These measures will help prevent leakage from

### exam question...

10. \_\_\_\_\_ can be recovered using either the internal approach or the external approach.
- Long bones
  - Ribs
  - The temporal bone
  - The mandible

the incision. It is also a good idea for the embalmer to pack the external auditory meatus with cotton and some mortuary putty or incision sealing powder, to prevent leakage from the external ear.

If the ear has been partially excised during recovery of the bone from the external approach, the temporal area should be packed with a phenol-based cauterizing agent. The embalmer should then leave this material in place for a while (overnight if possible, or for several hours), then replace it with dry cotton and mortuary putty or incision sealing powder. The ear can then be reattached with glue or restorative sutures.

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