Funeral Service Academy

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Embalming:

Diseases and Conditions

3 CE Hours

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Final Exam - PREVIEW

Course Name: Embalming: Diseases and Conditions (*3 Contact Hours = .3 CEUs)*

1. Today, the most commonly-used injection apparatus is _____.
   a. Gravity injection
   b. The air pressure machine
   c. The bulb syringe
   d. The embalming machine or centrifugal pump

2. The _____ is an instrument that can be used during the embalming of autopsy cases to inject two regions at the same time.
   a. Stopcock
   b. Y tube
   c. Hydroaspirator
   d. Grooved director

3. _____ are used in embalming fluids to maintain the pH balance of the fluid.
   a. Buffers
   b. Anticoagulants
   c. Humectants
   d. Surfectants

4. Standard cases, although rare, require about a _____ primary dilution factor to achieve a good preservation and sufficiently disinfect the body.
   a. 15-17%
   b. 10-11%
   c. 5-6%
   d. 2-3%

5. If the embalmer is required to raise both arteries and veins from all three major injection sites, this is called a _____.
   a. Split injection and drainage
   b. Six-point injection

c. One-point injection
d. Mistake

6. _____ composed of blood and blood clots, interstitial fluid, lymphatic fluid, and embalming solution, is a crucial part of the arterial embalming.
a. Drainage
b. Purge
c. Solution
d. Disinfection

7. _____ which allows the embalmer more control over the head, is recommended in dealing with jaundice cases.
a. Using cavity fluids as arterial fluids
b. Mild arterial solution
c. Restricted cervical injection
d. Avoiding the use of dye

8. When a diabetes case is presented, the embalmer must keep in mind that there are several conditions that will most likely accompany the disease, including _____.
a. Jaundice
b. Edema
c. Arteriosclerosis
d. An excess of bilirubin

9. _____ is immensely important when embalming an obese body, as the fatty tissue does not take very well to the arterial embalming.
a. Hypodermic embalming
b. Opaque cosmetic
c. Mild arterial solution
d. Dye

10. _____ are very small petechial hemorrhages that are caused from the rupture of tiny blood vessels.
a. Purpura
b. Tardieu spots
c. Hematoma
d. Ecchymosis

CONTINUING EDUCATION
for Funeral Directors

Embalming — Diseases & Conditions

3 CE Hours

Learning Objectives

This course provides a review of standard embalming terminology and procedures, followed by an examination of more complicated scenarios, including purge, obesity/emaciation, diabetes, jaundice, and gangrene. By the end of the course, learners should be familiar with:

- ❑ Embalming Equipment, Instruments, and Supplies
- ❑ Embalming Chemicals: Preservatives, Modifying Agents, Germicides, Dyes, Masking Agents, & Vehicles
- ❑ Arterial Embalming: Pre-Arterial Embalming, During Arterial Embalming, Post-Arterial Embalming
- ❑ Cavity Embalming
- ❑ Advanced Embalming: Jaundice, Edema, Diabetes Mellitus, Gangrene, Pruritus, Decubitus Ulcers, Emaciation, Obesity, Purge, Discolorations
- ❑ Advanced Embalming: Shipping Human Remains

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

Introduction and History

Embalming, as defined by The International Conference of Funeral Service Examining Boards, is the chemical treatment of the dead human body to reduce the presence and growth of microorganisms, to temporarily inhibit organic decomposition, and to restore the dead human body to an acceptable physical appearance.[1]

The history of embalming dates back to the ancient Egyptians, who mummified and preserved their dead for primarily religious reasons: they believed the body needed to remain intact so that the spirit could rejoin it in the afterlife. The Egyptian mummification process began with the removal of the brain, using a metal hook pushed through the ethmoid bone. Evisceration of the organs, except for the kidneys and sometimes the heart, was performed; while we don't know what happened to all the organs, most were next immersed in wine or packed in salts such as natron. The entire body was then submerged in a natron solution, usually for 20 days. On the 20th day, the body was removed from the natron, washed with water, and dried in the sun.[2] The body was then coated with a resin mixture and wrapped, while the preserved organs were put into 4 different canopic jars, representing the 4 children of Horus.

In the United States, the Civil War brought attention to the art of embalming. The movement of troops meant that, for the first time, significant numbers of Americans were dying far away from their homes and families; in order to return the soldiers home to be buried, surgeons employed embalming techniques. The process quickly became widespread – people who wished to pay respects to their loved ones, and retain the memory of how they looked prior to disease, accident, or similar, needed a professional to prepare their bodies for this purpose – and the specialized position of "embalmer" was born. In a poignant example, after his death by assassination, President Abraham Lincoln was embalmed; his body traveled by train from Washington, DC to Springfield, IL, with many stops along the way for a mourning nation to pay their respects.

This was the first time in American history that embalming was available to everyone who wanted it, and it gave rise to the funeral industry as we know it today. At first, the home remained the center of activity surrounding a death; initially, embalming might even be done at the home of the deceased. Wakes and viewings were often done at the decedent's residence, as well, with the actual funeral taking place there, at the church, or at the cemetery. But as death became something people did not want to deal with, more and more of the work was turned over to the undertaker: funerals moved from the family home to the undertaker's home, and eventually funeral establishments, or separate buildings only housing the business of funeral undertaking, became the norm.

Today, even with cremation rates on the rise, embalming is still a service that is chosen by many Americans. In addition to being required for most post-mortem public transportation, embalming is recommended for any pre-cremation or pre-burial viewing of remains – especially for public viewing.

1 The Conference, 2012
2 Mayer, 2012, p. 472

Embalming: Equipment, Instruments, and Supplies

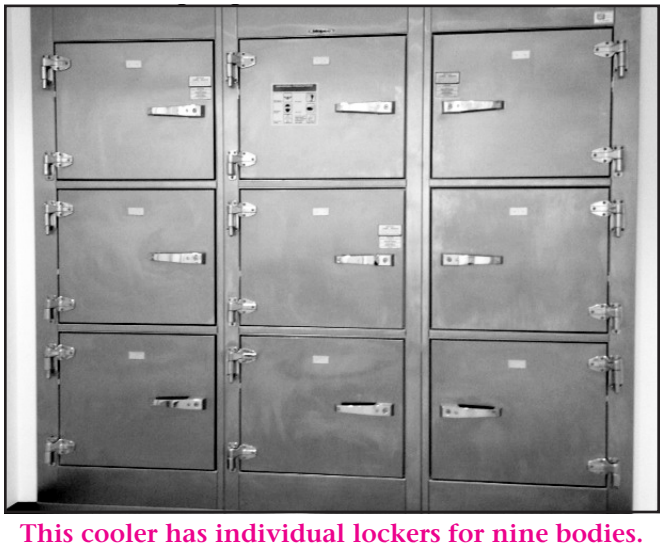
A wide variety of equipment and instruments are used by embalming professionals, along with numerous supplies to help set the features and prevent leakage, among other things.

Equipment

Body boards are used to assist in the movement of bodies. They are thin and can easily be slid under the body to help move the body from one table or cot to another.

Body lifts are another method used to move the body from one place to another. Body lifts can be mounted to the ceiling, or they can be a movable device. They can be hydraulic or electric. Body lifts can move the body from the table to the casket, or the table to the shipping container, or even table to table. If a lift device is available, it should be utilized to avoid injuring the embalmer.

Coolers can drastically range in size and style. Many cooling units are custom made for the space available. The refrigeration temperature should range from 35-45 degrees Fahrenheit. Coolers should have the capacity to be locked, and have a detailed log of each decedent going in and out of the cooler.



This cooler has individual lockers for nine bodies.

The *injection apparatus* is used to inject arterial solution into the body during the embalming process.

Historical methods include the *bulb syringe, gravity injection, combination gravity and bulb syringe, hand pump,* and the *air pressure machine*.

The *bulb syringe* is hand operated and is made of a rubber bulb with hoses attached to either end.

Gravity injection utilizes gravity to create the pressure needed to get the arterial solution into the body.

The *combination gravity and bulb syringe* uses gravity, but also adds the bulb syringe to increase pressure.

The *hand pump* has one hose to create pressure and one hose to create a vacuum.

Finally, the *air pressure machine* is like the hand pump, but is motorized.

Gravity injection is still utilized in some anatomical embalmings,[3] and any of the above methods may be considered for use due to power outage or malfunction in the primary injection apparatus.

Today, the most commonly-used injection apparatus is the *embalming machine* or *centrifugal pump*. Most centrifugal pump embalming machines contain a large tank to hold the embalming solution, and are able to maintain a constant flow with a predetermined pressure. Many machines allow the embalmer to control the pressure and rate of flow: the embalmer sets them prior to injection, and then adjusts them as needed during the embalming process. Some modern machines even automatically set the rate of flow and pressure for the embalmer. (*Pressure and rate of flow will be discussed in more detail on page 11 of this text.*)

High pressure embalming machine manufactured by The Dodge Company.

Tables are used for moving bodies, embalming, dressing, cosmetizing, and storing, among other usages. They can be solid and sturdy tables that are made to stay in one place, or they can be light and mobile to more easily move bodies around. Some tables are adjustable, and some fold in half for easy storage.

3 Barton & Wilcox, 2015

Embalming table set up in the prep room. The foot end is slightly lower than the head end and is over the drain bowl. Notice the draining channel that goes all the way around the table.

Instruments

The instruments used in the prep room come in many sizes and varieties. These instruments can generally be used for many tasks and are usually made of steel and plated with nickel or chrome. They are chemically treated to be heat resistant and durable.

Instruments should be thoroughly disinfected or sterilized after each use. A good cold sterilizing chemical or an autoclave can be used for the sterilization of most instruments. Although disinfecting is not at the same level as sterilization, for standard cases where the decedent did not have a contagious disease, disinfection may be considered sufficient. It should be noted, however, that only proper sterilization can ensure disease-causing microorganisms have been killed. Sterilization is best to prevent spreading microorganisms to other bodies, and to the embalmer.

Slotted handle aneurysm hook

Let's start with the *aneurysm hook*, probably the most recognizable and widely-used of all of the embalming instruments. The aneurysm hook is a handle with a blunt hook on the end. This instrument can be used

exam question...

1. Today, the most commonly-used injection apparatus is _____.

a. Gravity injection
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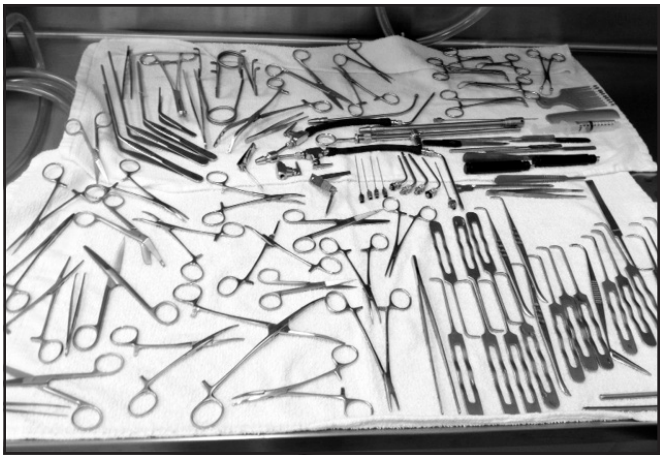


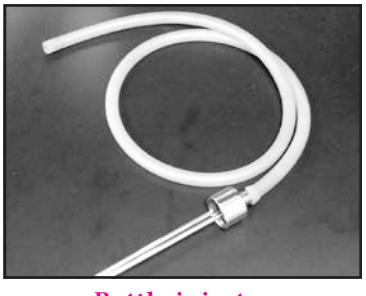
A variety of embalming instruments drying after being sterilized.

for a number of things, but is mostly used for finding and raising vessels. There are many different types of aneurysm hooks. The main difference in styles is the handle: solid, slotted, curved, concave, or corrugated, to name a few.

Arm and hand rests are designed to keep the arms and hands in an appropriate position for a viewing after the embalming is complete. (It is not a good idea to use them during the embalming process, as they might restrict your ability to manipulate the arms and hands as needed.) They consist of holders for the arms attached to an adjustable strap that rests across the body.

The *arterial tube* (or *cannula* as it was historically known) is used for injecting arterial solution into the artery. Arterial tubes are made in many different sizes and types. They are also made with different ways of attaching to the embalming machine: the arterial tube can be threaded and screwed into the embalming machine hose directly or used with a stopcock; it can also be a slip-type and attach to the hose directly. The most common version is made for injection into the carotid artery, and is short in length with a larger diameter. It is a good idea to keep a variety of sizes on hand to suit different ages and sizes of people, as well as different arteries in each body.

The *autopsy aspirator* is an aspirating device designed specifically for use during autopsies. The end, which is weighted to allow the embalmer to leave the instrument resting in the open cavity of the autopsied body, has many openings to reduce the likelihood of a clog.



Bottle injector

The *bottle injector* is used for injecting cavity fluid into the body's cavities during the cavity embalming process. A 16 ounce bottle of cavity fluid is attached to the injection apparatus, while the trocar is attached to the hose end of the instrument.

A *cavity fluid injector* attaches to the cavity fluid bottle and to the trocar. Cavity fluid enters the body through the trocar once the cavity fluid injector – and the bottle of cavity fluid to which it is attached – are inverted to allow the fluid to flow freely.

The *drain tube* is an instrument used to help get the blood out of the body during the embalming process. It is inserted into a vein toward the heart. The drain tube expands the vein, holding it open, to permit easier blood flow. The rod in the tube can be used to break up clots and sludge in the blood to improve drainage; it can also temporarily stop drainage to allow the vascular pressure to build up. A hose can be attached to the drain tube to increase control over the drainage – this also lessens the embalmer's chance of exposure to bodily fluids. Drain tubes are made in different sizes to account for the varying sizes of veins.

(Spring) *forceps* are used for grasping and holding tissue. Forceps can have straight, curved, or angular limbs, and smooth, serrated, or rat-toothed tips. They come in a variety of sizes. Along with grasping and holding tissue, forceps can be used to assist with drainage by inserting the tips into the vein.

A *grooved director* is an instrument used to help get a drain tube or other drainage device into the vein to allow for drainage.

Headrests are used to keep the head and neck slightly elevated above the rest of the body in an ideal viewing position. Headrests can also be used for arm rests, feet rests… they can support the body in any way necessary, both during the embalming process or as a positioning device in the casket.

The *hemostat*, or locking forceps, can be used similarly to the spring forceps, but have a mechanism that allows them to lock. This feature makes the hemostat ideal for clamping leaking vessels, or holding tissue together or in place. A variation on the hemostat, known as fixation forceps, can be used to hold the arterial tube in place.

A *hydroaspirator* utilizes water for the aspiration process. The device creates a vacuum with the water for suction. It generally has a vacuum breaker to prevent materials aspirated from the body from entering the water supply.

The *hypovalve trocar* is a trocar that is not used for aspiration, but for hypodermic injection.

Ligature is used for many different things in the prep room, including suturing incisions, closing the mouth, ligating vessels, and adjusting clothing, among other things. Ligature comes in different weights, and is made both with and without wax.

The *nasal aspirator* can be attached to the hose of the

aspirator and then inserted into the nostril and down the back of the throat to aspirate any fluid or purge that may be present.

A *needle injector* is an instrument used to secure the jaw. It is used to inject a needle or barb with a wire into each the mandible and maxilla. The wires of each are then securely attached to make sure the jaw stays in a closed position. There are various designs in both manual and electric needle injectors.

Scissors, an instrument used for cutting, come in a variety of sizes and different tip styles in the prep room. Arterial scissors, for example, which are used to open the vessels, are small and very sharp. Bandage or clothing scissors, on the other hand, have a blunt end designed to be used against the surface of the body when cutting through bandages or clothing so as to not damage the skin.

A *scalpel* is used to make incisions in the skin. The blade should be very sharp to create a neat incision. Some scalpels are for one time use only, and the entire instrument is designed to be disposable; others feature a permanent handle paired with disposable blades.

Shoulder blocks, or *body blocks*, are used to raise the shoulders, hips, and heels off the table. This helps with continuous disinfection during the embalming process, and allows for cleaning, disinfecting, and massaging the underside of the deceased. It's important that the rests contact bony areas of the body, such as those mentioned above, so as not to disrupt the flow of embalming solution entering the body or blood exiting the body.

A *separator* is used to separate vessels from the rest of the body, or raise them above the incision after they have been located.

A *stopcock* can be attached to the embalming tank hose and then to the arterial tube. The stopcock helps the embalmer control the flow of embalming solution.

Suture needles are used for closing incisions. There are several varieties of suture needles, including *half-curved, double-curved, 3/8" circle,* and *Loopuypt*. Each comes in many sizes and can be used for a number of different functions, depending on the needs and preferences of the embalmer.

The *trocar* is used for aspirating, and subsequently for injecting cavity fluid into the aspirated cavities. It is long and hollow and has a sharp tip to puncture the abdomen. The trocar is made in different diameters and lengths, and its tip is detachable to allow for changing it out once it is too dull.

The *trocar button applicator* is an instrument used to insert the trocar button into the puncture from the trocar.

The *Y tube* is an instrument that can be used during the embalming of autopsy cases to inject two regions at the same time; for example, both legs or both arms could be injected at once (while some embalmers use the Y tube to inject both sides of the heads at the same time, I do not recommend this usage). Y tubes with 4, and even 6, tubes have been designed to further speed up the process of autopsy embalmings.

Supplies

Calvarium clamps are small devices used to attach the calvarium to the cranium following a cranial autopsy.

Eyecaps are inserted under the eyelid, both to help keep the eyelid closed and to help retain the shape of the eye. They are made of plastic with little grippers to help with closure.

A *mouth former* is used to replace the teeth if the deceased does not have enough real teeth or dentures.

Needle injector barbs are sharp wire objects inserted into both the mandible and maxilla with the needle injector to secure the jaw.

Trocar buttons are used to close the puncture caused by the trocar. They are made of plastic, and threaded so that they can be screwed into the puncture with the trocar button applicator. Trocar buttons can also be used to close other small punctures, like those caused by medical devices.

Personal protective equipment, or PPE, is a necessity. PPE should cover the embalmer from head to toe with no exposed skin. It consists of disposable gloves, surgical mask, surgical cap or hood, a face shield, a water-resistant gown, and closed-toe, non-slip footwear with non-slip shoe or boot covers over them. Once the embalmer is ready to leave the embalming room, all personal protective equipment must be removed for disposal (or, if reusable, decontamination).

Embalming student in necessary personal protective equipment (PPE).

exam question...

2. The _____ is an instrument that can be used during the embalming of autopsy cases to inject two regions at the same time.

a. Stopcock
b. Y tube
c. Hydroaspirator
d. Grooved director

Plastic garments are used to prevent leakage. This leakage can be caused by many different things, including health conditions, tissue donation, and autopsies. Plastic garments come as *sleeves, jackets, stockings, pants, coveralls, unionalls,* and *capris* among others. External embalming powders and gels or deodorants can also be added to help control any persisting leakage and the odors that go with it.

Prep cotton is a thin cotton sheeting used in the embalming room for any number of things: for example, it can be used to help with mouth closures, seal incisions, and surface packs, to name a few.

Embalming: Chemicals

Before we begin discussing the embalming process, let's review embalming chemicals. Embalming chemicals are generally separated into 5 different groups: arterial fluid, cavity fluid, supplemental fluid, accessory chemicals, and special purpose fluids.

Arterial fluid, also known as embalming fluid, vascular fluid, or preservative fluid, is packaged in a concentrated form and diluted with water and/or supplemental fluids in the embalming machine tank prior to embalming. The mixture in the embalming machine tank is known as the *arterial solution*.

Cavity fluid is packaged and used in the concentrated from. Cavity fluid is injected into the body's cavities following aspiration. It can also be used as a topical treatment in the form of a *cavity pack,* or injected into less-embalmed tissue as a hypodermic treatment.

Supplemental fluid does not contain a preservative chemical. These fluids can be used as pre-injections – injected by themselves for various reasons prior to the arterial fluid – or they can be used as co-injections, mixed in the *arterial solution* with the arterial fluid.

Accessory chemicals are chemicals that are not used in the vascular embalming process, but are used in addition to the vascular embalming. These chemicals are generally applied to the surface of the body.

Special purpose fluids are chemicals for special conditions the deceased may have, such as jaundice, edema, and severe decomposition.

The chemical components that make up embalming chemicals include preservatives, modifying agents, germicides, dyes, masking agents, and vehicles. There are numerous chemicals that fit into each of these categories.

Preservatives are chemicals we use to preserve the body. These are the chemicals that actually do the "embalming," or change the properties of the proteins in the body. Proteins are naturally very decomposable. Preservatives change the state of the protein to delay decomposition. (*Formaldehyde* is probably the most used and widely-known preservative for embalming; however, other chemicals also have preservative qualities and can be used in combination with formaldehyde or in place of formaldehyde.)

Alcohol has become more common in embalming fluids with the popularity of green burials on the rise. Alcohol preserves and disinfects tissue similarly to phenol, discussed below. Alcohol may also be present along with other chemicals in embalming fluid.

Aldehydes, such as *acetaldehyde, methylglyoxal,* and *benzaldehyde*, have potential to be used as preservatives, and some are even included with other chemicals in embalming fluids. (To be considered an aldehyde, a chemical must have denaturing and cross-linking properties allowing it to produce a firm tissue.[4])

Dialdehydes, which are chemical compounds containing two aldehyde groups in the same molecule, can also be found in embalming fluids. The most common dialdehyde relating to embalming is *glyoxal*, which is available commercially as a yellow, aqueous solution. The solution also contains ethylene glycol, formic acid, formaldehyde, and glycolic acid. Because it can cause a yellowish tint of the tissue, glyoxal is generally used only in cavity fluids.

Formaldehyde is a colorless gas at room temperature. It has a very strong and often irritating odor. Some people are very sensitive to formaldehyde, and even exposure to very low levels can cause discomfort.

4 Embalming: History, Theory, and Practice, 5th ed. (2012), pg. 130

Formaldehyde has disinfecting qualities: it destroys putrefactive organisms when carried by a proper vehicle permitting it to penetrate these organisms.[5] But it is not only used as a preservative in the embalming process – it is found everywhere. It is in many everyday items like nail polish and products in found in the home. It is also created in certain processes, like some cooking and weather conditions.

Formaldehyde is water soluble: formalin, the commercial source of formaldehyde, is an aqueous solution of the gas dissolved in water. It is 37% formaldehyde gas by mass and 40% formaldehyde gas by volume.

It is generally believed that the index of an arterial fluid is the percent of formaldehyde gas by volume, like the 40% in formalin. However, associations and schools have agreed that index is more accurately defined as follows: an embalming fluid will be said to have formaldehyde index, N, when 100mL of fluid, at normal room temperature, contain N grams of formaldehyde gas.[6] As an example, a 25-index product contains 25g of formaldehyde gas per 100mL of concentrated fluid. Therefore, the index of an arterial chemical refers only to the amount of absolute formaldehyde gas present, and not other aldehyde concentrations. If you see an arterial fluid with an index, it assuredly contains formaldehyde. Arterial fluids with other chemicals used as the preservative should not contain an index as it is defined.

There are both advantages and disadvantages to formaldehyde and its widespread use in embalming chemicals. Disadvantages include formaldehyde's odor, which, as mentioned above, can be irritating to the embalmer. In addition, many consider formaldehyde a suspected carcinogen, though formal studies have been largely inconclusive. Other disadvantages that can crop up during the embalming process include the gray coloring of the tissue formaldehyde can create when mixed with blood left in the body, dehydrating tissue, and permanently fixating discolorations and making them hard to conceal. Finally, formaldehyde has a short shelf life.

In response to these and other concerns, chemical companies have developed alternative chemical solutions which do not use formaldehyde – such as *glutaraldehyde*, discussed below – but they have never been widely adopted. Many embalmers still agree that the advantages of formaldehyde use tend to outweigh the disadvantages: formaldehyde is very inexpensive compared to many other chemicals, and only a small amount is needed to act on a large amount of protein. It also creates rapid fixation for positioning and setting the features of the body during the embalming process, and deodorizes during putrefaction.

Glutaraldehyde is used for a number of things commercially, including embalming, as well as disinfecting embalming instruments and equipment. For use in embalming, glutaraldehyde is commercially manufactured as a 2.5% stable aqueous solution with a mild odor and faint color. Glutaraldehyde changes the nature of the protein and makes it unattractive to bacteria trying to feed off of decaying tissue; in addition, it also does not dehydrate the tissue as much as formaldehyde does. However, even with these respectable properties, and despite several formaldehyde-free chemicals on the market that incorporate it, it has not become as widely-used as formaldehyde. Many embalmers feel that, when glutaraldehyde is used, the tissue does not seem to attain comparable firmness: although it is certainly disinfected, and somewhat firm, it still seems flimsy in comparison to the firmness of a body embalmed with a formaldehyde solution.

Paraformaldehyde is a polymer of formaldehyde containing anywhere from about 85 to 99% formaldehyde. It is in a solid form and is generally created by evaporation and distillation to a point of solidification. Since this preservative is in a solid form – typically a powder or rock – it is not used for arterial embalming, but instead for such things as preserving viscera or the cavity during an autopsy embalming.

Phenol is a chemical classified as a preservative and as a germicidal. It is also known as carbolic acid. While the early embalming fluids primarily contained phenol, today it is primarily found only in cavity fluids because of the grayish color it tends to turn the tissue when used as an arterial fluid. Phenol is still often used as one of the primary ingredients in anatomical embalmings.[7] It is also used in bleaching chemical formulas to help lighten any skin discolorations: these chemical formulations are often loaded into a hypodermic syringe and injected; embalmers may also use them to saturate prep cotton and apply them as a surface pack.

As a side note, embalmers should take extra precautions to not come into contact with phenol, as it is corrosive to tissue. For example, some embalmers put phenol-containing products in a spray bottle for easy application: this is not a good idea since the uncontrolled nature of the spray increases the likelihood that phenol could come into accidental contact with skin and eyes.

Finally, although some hard varieties are prohibited in embalming chemicals, *salts* have been used in embalming products from the beginning. Some of today's commonly-used salts include some salts of aluminum, potassium acetate, and sodium nitrate.

5 Mayer, 2012, p. 129
6 Mayer, 2012, p. 129
7 Barton & Wilcox, 2015

Each preservative works in a similar way to achieve the same ultimate goal. The embalming process is targeted at denaturing the proteins of the body, rendering them unattractive to the body's bacteria that, as part of normal decay, are looking to feed off of them. The preservatives "fix" the proteins to delay decay, and simultaneously disinfect the body.

There are several modifying agents that can be mixed into the arterial embalming solution to assist in the process. The addition of these chemicals improves the solution: preservatives used alone would not yield the same results without modifying agents.

Some modifying agents are included in the actual embalming fluid, while others are manufactured separately and later mixed into the arterial embalming solution with the preservative fluid. Modifying agents include *anticoagulants, buffers, humectants,* and *surfactants*.

Anticoagulants are used in the embalming solution to help keep blood in a liquid state. After death, once circulation stops, blood has a tendency to thicken and clot up, accumulating in the capillary beds. Any clots that form will have to be forced out with pressure during the arterial embalming process. Anticoagulant chemicals help prevent this thickening and clotting, making it easier to move blood through and out of the vascular system. (Since they are also used to reduce the hardness of water, anticoagulants are also sometimes called water conditioners or water softeners. They help to mitigate the clotting and thickening of the blood in this role as well, as hard water promotes that clotting.) Anticoagulants are generally manufactured separately from the embalming fluid. Chemicals included in these formulations include *boric acid, borax, sodium salts, magnesium sulfate, sodium chloride, sodium sulfate,* and *sodium phosphate*.

Buffers are used in embalming fluids to maintain the pH balance of the fluid. The body's pH levels fluctuate after death: as rigor mortis sets in upon the dead body, the body's acid levels rise; after rigor mortis has taken its course and left the body, its pH level becomes very basic. Throughout this process, buffers help balance these levels to achieve the desired effect of the preservative chemicals. Chemicals that can act as buffers in the embalming fluid include *sodium borate, boric acid, sodium carbonate,* and *magnesium carbonate*.

exam question...

3. _____ are used in embalming fluids to maintain the pH balance of the fluid.

a. Buffers
b. Anticoagulants
c. Humectants
d. Surfectants

Humectants help keep the tissue of the body hydrated during the arterial embalming process, preserving its pliability (or improving its pliability, in the case of bodies that are already dehydrated prior to the beginning of the embalming, for example. Humectants can be manufactured in the embalming fluid with the preservative, or they can be manufactured separately and added to the arterial embalming solution in the embalming machine tank. Humectants are typically made with such chemicals as *glycerin, sorbitol, ethylene glycol, propylene glycol, lanolin, silicon*, and some *vegetable gums*.

Surfactants, or wetting agents, are generally manufactured with the embalming fluid. They act in a number of ways to assist in the embalming process by lowering the surface tension of the arterial embalming solution. Once the surface tension is reduced, liquid more easily moves out of the capillary beds, allowing the blood to flow through, and eventually exit, the vascular system; the arterial embalming solution can thus more thoroughly saturate the many cells of the body. Surfactants also allow the fluid to filter through the capillary walls in a uniform manner, making it possible to include coloring agents in arterial embalming solutions without attaining a blotchy appearance. Chemicals that act as surfactants in embalming fluids include *soap, alkyl sulfonates, oils,* and *quaternary ammonia compounds*.

Since sanitizing the body is one of the most important parts of the embalming process, germicides are a key ingredient in embalming fluids. Germicides are included in the formulation for not only arterial embalming fluids, but also in cavity fluids, coinjection fluids, and chemicals used for surface disinfection. Germicides kill, or render incapable of reproduction, disease-causing microorganisms.[8] Chemicals that act as germicides in embalming fluid are often also the preservative chemical, such as *formaldehyde* and *phenol*. *Quaternary ammonium compounds* are often found in cavity fluids and act as a germicide.

Dyes, or coloring agents, are used to create an internal cosmetic effect as part of the arterial embalming process. Dyes that stain the tissue in the process of creating that cosmetic effect are referred to as active dyes. Dyes that do not color the tissue, but just color the fluid in the bottle, are called inactive dyes. Dyes generally come in different shades and varying degrees of reds and browns, in order to create the most natural color. While both natural and synthetic coloring agents are used to achieve these reds and browns, synthetic coloring agents – such as *eosin, erythrosine, ponceau,* and *amaranth* – are more commonly used today because they are more economical. Dyes can be manufactured directly with the fluid, but can also be manufactured separately and added to the arterial embalming solution. (Please note: dyes, like other embalming chemicals, are often

8 Mayer, 2012, p. 133

manufactured in a 16 ounce bottle. While the entire bottle is commonly used in the case of other embalming chemicals, only a small portion of dye is needed in each tank of arterial embalming solution.)

Masking agents, also known as perfuming agents or deodorants, are used to mask harsh chemical smells – although some chemical odors, such as formaldehyde, are hard to conceal, there is often an attempt; other chemicals have an easier odor to cover – and sometimes to create a pleasant smell on top of the masking. Some perfuming agents used in embalming chemicals include spices, fruits, mints, and oils. These agents are manufactured in the formulation for each chemical and do not need to be added separately to the mixture of arterial embalming solution.

A vehicle is needed to circulate the preservative fluids through the vascular system. The vehicle must be a solvent or mixture of solvents that keeps the chemicals in a stable and active state while they are being distributed throughout the body by way of the vascular system. Water is the most common vehicle used in arterial embalming; however, more and more embalmers are finding it necessary to use low water or waterless embalmings as more cases considered difficult are presented. In these cases, the co-injection chemicals act as the vehicle.

Embalming: Minimum Standards & Chemical Selection

Minimum standards for embalming were originally established at the turn of the 20th century, when formaldehyde became the most widely-used embalming fluid, to set a guideline for how much formaldehyde was needed to adequately disinfect the body's tissues. The standard until the early 1970's was 1.0% to 1.5% solution strength for an effective embalming. It was revised in the early 1970's to be at least a 2% formaldehyde-based arterial solution. In the future, these standards will change again as the industry moves away from formaldehyde chemicals.[9]

More informally, it also used to be said that a good rule of thumb was about 1 gallon of fluid per 50 pounds of body weight. More recently, some chemical companies and embalmers have suggested less fluid per 50 lbs: for example, the Dodge Chemical Company recommends 2 gallons of solution for a 150 pound body; for each additional 50 pounds of body weight, another ½ gallon of solution is recommended.[10] Whatever your preferred starting point, there are so many factors involved today – including a number of adverse health conditions which can affect the arterial solution (discussed in more detail beginning on page 10 below) – that it will almost always need to be adjusted as the condition of each body is taken into account.

With the minimum standards as mentioned above in mind, as well as an analysis of the body, we are able to select what chemicals to use for each embalming. The biggest mistake an embalmer can make is to use the exact same solution formula for each body, no matter what conditions present.[11]

Many chemical companies provide suggested solution formulas that apply to specific situations. These can be a great starting point as you're deciding which chemicals to use. For example, Dodge offers the following chart as a guide in the embalming room:[12]

Every embalming chemical company has similar usage guidelines. For more information on the usage guidelines of each individual chemical company, contact the company directly.

Using Dodge Injection Chemicals

Case Type	Standard Solution	Superior Solution	Waterless
NORMAL CASES Also infants, emaciated cases, or individuals with thin, delicate skin.	8 oz. Arterial 8 oz. Metaflow 8 oz. Rectifiant + water to make 1 gal.	1 btl. Arterial 1 btl. Metaflow 1 btl. Rectifiant + water to make 1 gal.	1 btl. Arterial 1 btl. Restorative 2-3 btls. Metaflow 2-3 btls. Rectifiant NO water
MODERATELY DIFFICULT Some chemotherapy, autopsied, jaundiced, some putrefaction.	12 oz. Arterial 12 oz. Metaflow 12 oz. Rectifiant + water to make 1 gal.	1½ btls. Arterial 1½ btls. Metaflow 1½ btls. Rectifiant + water to make 1 gal.	2 btls. Arterial 1 btl. Restorative 2½ btls. Metaflow 2½ btls. Rectifiant NO water
VERY DIFFICULT Advanced putrefaction, gas gangrene, skin slip, heavy chemotherapy.	16 oz. Arterial 16 oz. Metaflow 16 oz. Rectifiant + water to make 1 gal.	2 btls. Arterial 2 btls. Metaflow 2 btls. Rectifiant + water to make 1 gal.	3 btls. Arterial 1 btl. Restorative 2-3 btls. Metaflow 2-3 btls. Rectifiant NO water

9 Mayer, 2012, p. 126-127 10 The Dodge Company 11 Mayer, 2012, p. 33 12 The Dodge Company

Arterial Embalming

Arterial embalming, also known as vascular embalming, is a major part of the embalming process (the other major part of the process is cavity embalming, which will be discussed later). It is defined as the use of the blood vascular system of the body for temporary preservation, disinfection, and restoration, and is usually accomplished through injection of embalming solutions into the arteries and drainage from the veins.[13]

There are many things that must be done with each body, as will be discussed, for a successful arterial embalming to take place. A step-by-step suggested order of embalming is provided below, but every embalmer approaches the arterial embalming process differently. So long as no step of the process is omitted, the order in which they are accomplished is less important.

Pre-Arterial Embalming

Multiple factors must be taken into consideration when deciding on the arterial solution strength, or the strength of the embalming solution. For example, the embalmer must evaluate the body, recognizing any diseases or conditions present, and identifying how each would affect the embalming process: some diseases or conditions might require a higher preservative content, while others might interact negatively with preservatives.

Standard cases, although rare, require about a 2-3% primary dilution factor to achieve a good preservation and sufficiently disinfect the body. The strength of solution can be adjusted from here. For difficult cases, such as long term refrigeration, severe edema, decomposition, and disease conditions among others (discussed in more detail beginning on page 20 below), a higher primary dilution factor is necessary. If the embalmer is ever unsure of the diseases or conditions affecting the deceased, or suspects a particular case may be difficult, it is best to go with a higher primary dilution factor. It is better to have a well-preserved and disinfected body rather than an under-embalmed and not sufficiently disinfected body.

After selecting the fluid and determining the solution strength, the embalmer can mix the chemicals together in the embalming machine to create the arterial embalming solution. Many embalming machines have a "mix" function; if not, external mixing with a stirrer may be needed.

Prior to moving the decedent to the embalming table, the embalmer should make sure that the table is clean and ready to be used. Some tables allow the embalmer to set the placement of the body blocks prior to moving the body over, which makes positioning them much less difficult. If not, the body blocks can still be placed once the body is on the table.

Getting the body set up on the table varies in difficulty depending on the equipment available and number of people present. When the body is on a cot or another table, it can be carefully pulled onto the embalming table – by one person if necessary, though if two or more people are available to move the body, this method is much easier. When pulling, it is best to grip bony areas, like the hip and the shoulder – *never* grab on and pull a spot on the body with exposed skin – and remember to do your best to support the head while the body is in motion. The embalmer may also use a body board to slide the body more easily. If the decedent is larger in size or the embalmer has injuries that prevent moving and lifting, a body lift can be utilized to move the body from one location to another.

Once the body is on the table, any clothing or sheeting with the body should be removed, and the body should be positioned on the table. As part of positioning, there are several things that need to be done.

The body blocks can be placed at this time if they were not already on the table. (Although not every embalmer uses body blocks, they have their advantages. Elevating the shoulders on the body blocks can assist in drainage. Elevating the buttocks along with the shoulders will help keep the body and table clean during continuous disinfection, allowing the water to flow under the body. Elevation also helps the body dry later, allowing air to pass underneath it.)

Also at this time, rigor mortis can be relieved (although it should be noted that some embalmers choose not to relieve rigor). Of course, this is a somewhat continuous process, but it begins here in order to get the body in the correct position on the table – or possibly just prior to positioning, when removing the clothing. In relieving the rigor, flex the head back and forth and in small circles and rotate the neck from side to side. Flex and extend the arms several times, and then rotate the shoulders. Fingers should be moved around. The legs should be moved up and down, and the knees extended, as well as the feet rotated at the ankle. The embalmer should be cautious, however, not to apply excessive force when relieving the rigor. Capillaries can be torn and lead to swelling during the arterial embalming.

exam question...

4. Standard cases, although rare, require about a _____ primary dilution factor to achieve a good preservation and sufficiently disinfect the body.
a. 15-17%
b. 10-11%
c. 5-6%
d. 2-3%

13 Mayer, 2012, p. 33

The head should be placed in the head block up off of the table. The head block is designed to have several levels; the embalmer should decide on the correct level for each body. For viewing purposes, the head should be tilted 15 degrees to the right, or looking at the decedent's right big toe. The head may need to be moved at times during the embalming process. This should be done cautiously. The head should always be placed back to the correct spot.

The hands should be rested gently on the abdomen of the decedent, with one hand on top of the other. It does not matter which hand goes on top. If there is severe bruising on one hand from an intravenous catheter or other device, the opposite hand can be on top. If both hands are bruised, or if neither hand is bruised, most embalmers choose to put the left hand on top to show the wedding ring. There are many reasons the embalmer may have difficulty getting the arms to go into the proper position, including abdominal swelling, obesity, and broken or dislocated bones, among others. The arm and hand straps can be used at this point to help with positioning. As with the head, the arms may need to be moved during the embalming process to help with drainage, massage, cleaning, and other situations: for example, to assist in clearing out the nail beds, the arms are dropped down to the side at times. This is fine, but the embalmer should be sure to return the arms to the proper placement whenever possible.

Next, *primary disinfection* should be employed. During primary disinfection of the body, the embalmer should use a disinfecting spray to topically disinfect orifices, open wounds, and anything else the embalmer feels is necessary. It should be noted, however, that the entire surface of the body does not need to be primarily disinfected.

Some medical devices, such as urinary catheters, tracheotomy tubes, and feeding or airway tubes, should be dealt with during the primary disinfection process. (There are many other devices that are best removed after the arterial embalming process. They will be discussed in detail on page 17 and 18.)

Urinary catheters should be removed during the primary disinfection and analysis of the body. They can be removed by releasing the pressure in the bulb located in the bladder: cutting a small slit with scissors in the external part of the catheter will collapse the balloon. Gently slide the collapsed balloon out of the bladder. Disinfect the area.

Tracheotomy tubes are another medical device that should be removed prior to embalming. Gently pull the tube out and disinfect the area. The hole can be packed with prep cotton saturated with a cauterizing chemical: leave this cotton in during the arterial embalming; once the arterial embalming is complete, and prior to beginning the cavity embalming, remove the saturated cotton and pack the hole with prep cotton and sealing powder or putty. Then use a purse string suture or N suture to close the tracheotomy opening (sutures will be reviewed on page 16 and 17).

Feeding or airway tubes that enter the mouth or nose can cause major issues with setting features and the general appearance of the deceased if they are left in during the embalming. They should be removed during this time, as well, if not sooner: if the embalmer is on the removal of the deceased from the place of death and notices them, for example, they can be removed immediately upon arrival at the funeral home, even if the body is not going to be embalmed right away. After loosening any straps that may be holding the device in place, gently pull the tube out. Be sure to thoroughly disinfect the area.

After the primary disinfection is complete, the *continuous disinfection* can begin. Continuous disinfection uses continuously running water on the table to keep both the table and the body clean during the embalming. The water hose can be attached to the table using a device constructed to do so (often magnetic or a suction cup); this attachment frees the hands of the embalmer while still allowing for continuous disinfection. The site of the drainage will impact the placement of the hose: if drainage is from the jugular vein, for instance, the embalmer may choose to attach the hose to the table near that drainage site to keep the blood flowing down the table.

While most embalmers have developed a preference as to rate of flow and pressure, these levels should always be finalized by evaluating the decedent. (As a reminder: the *rate of flow* is the amount of embalming solution that enters the body in a given period and is measured in ounces per minute.[14] The *pressure* is the force required to distribute the embalming solution throughout the body.[15]) Too much fluid flowing into the artery at once will cause swelling – for this reason, the rate of flow should be kept moderately low. The pressure is what will help with diffusion of the arterial solution, and can be moderately high: in fact, as embalming machines have evolved, the potential pressure available for embalming has increased. Many embalmers have found this higher pressure to be beneficial, and choose to use it to achieve the best results. The embalmer should always check these levels prior to inserting the arterial tube into the artery: although there are gages on the machine that indicate such, it is best to also use the eyeball test.

For the arterial embalming, at least one artery and one vein should be raised.

Prior to raising the artery, some embalmers first choose to set the features; however, many

14 Mayer, 2012, p. 95
15 Mayer, 2012, p. 95

embalmers raise the artery first so that they can freely manipulate the head while doing so. Setting the head all the way down on the table will elevate the carotid artery, which may make it easier to locate – but if the features are already set, it is not a good idea to lift the head out of the head block.

The artery should be a major artery, such as the carotid artery or the femoral artery. Many embalmers choose to raise the accompanying vein in order to do what is referred to as a *one-point injection* at a single site (a one-point injection is an embalming where only one artery at one site needs to be open). Other embalmers choose to raise a vein at a different site than the artery: this is called *split injection and drainage*. Embalmers may also choose to raise more than one artery, or a *multi-point injection:* this can provide a more complete embalming, or be used in special embalming cases (when raising more than one artery can be necessary to achieve even a satisfactory embalming). If the embalmer is required to raise both arteries and veins from all three major injection sites, this is called a *six-point injection*.

Raising the axillary artery.

Please note: even though the vein is superficial to the artery in the case of the jugular vein and carotid artery, as with some others, the artery should be raised prior to the vein. The artery is the single most important part of the arterial embalming. Without an artery, arterial embalming is not possible. If, while raising it, the embalmer nicks the delicate vein and causes it to leak blood, the artery is much more difficult to find – an embalmer with less experience may not be able to find it at all.

exam question...

5. If the embalmer is required to raise both arteries and veins from all three major injection sites, this is called a _____.

a. Split injection and drainage
b. Six-point injection
c. One-point injection
d. Mistake

Once an artery and a vein are found and raised, a small incision is made from the center of the artery outward, and the arterial tube is inserted to allow embalming solution to enter the vascular system. A similar incision is made in the vein to allow for drainage of the blood from the body. A drainage device, such as a drain tube or forceps, may be inserted into the vein to assist with drainage. If a drainage device is being used, the embalmer should insert that into the vein prior to inserting the arterial tube into the artery so the arterial tube is not in the way of a smooth insertion into the vein. The arterial tube should always be pointed toward to area of the body in which you want embalmed. (In the case of the carotid artery, the arterial tube should be inserted toward the body. If the head needs additional fluid later, the arterial tube can be pointed toward the head.) With the jugular vein, the drainage device should be inserted toward the heart. All drainage devices should be directed toward the heart. (It should also be noted that drainage devices should not be forced into the vein – this could break or tear the vein. Even if the device is not fully inserted into the vein, it will still assist with drainage.) The arterial tube can be secured to the artery with the arterial hemostat or with ligature. Likewise, if the drainage device is a drain tube, it can be secured to the vein with ligature.

As previously mentioned, some embalmers prefer to set the features before raising the artery; either way, setting the features should be done prior to starting the arterial embalming. (Remember, formaldehyde can fixate rather quickly – we want the eyes and mouth set, and the body positioned, before any fixation occurs.) While feature setting does not necessarily have a particular order, shaving the decedent (if needed) towards the beginning of the process is recommended, as it is often easier before the other features are set and the mandible is secured.

The eyes should be thoroughly disinfected and closed. To achieve a desired natural eye closure appearance, the top eyelid should meet the bottom eyelid approximately ¾ of the way to the bottom.

Shaving the deceased before setting features can make the process easier.

Eyecaps should be used to help keep the shape of the eye and to help keep the eyelid closed; the eyecap can be coated with massage cream or petroleum jelly to help prevent the eyes from dehydrating. The selected lubricant can also be placed in the inner canthus of the eye for the same reason. The eyelids should not be glued shut at this time, except possibly for rare and severe cases. If the eyes are sunken, tissue builder – or even just water – can be injected into the eye with a hypodermic syringe. If the eye tissue has been removed for procurement, additional treatment will be needed to be done to properly close the eye.

If only the cornea has been removed, fluid may be aspirated to avoid leakage. During the arterial embalming, the eye globe can be filled with a thick cotton, saturated with either autopsy gel or undiluted cavity fluid. Once the embalming is complete, the face is washed, and the eye and the area around it are dry, the eye orbit can be filled with either mortuary putty or incision sealer (you do not want to expose either to moisture, however, so this step should always take place after the arterial embalming). An eyecap can then be placed over the eyeball to create the natural contour and shape. It is generally best to glue the eye shut.

If the entire eyeball has been enucleated – completely removed – more preparation is required. Swelling or distension in and around the orbital cavity is the most common problem associated with eye enucleation. Ecchymosis – bruising – or small lacerations in the eye area are also a possibility. To prepare the enucleated eye prior to arterial embalming, apply massage cream around the eye – this will help protect the skin as the eye drains during the arterial embalming. Remove all packing placed by the procurement agency from the eye. Saturate pieces of cotton with autopsy gel and loosely fill the orbital cavity. Be sure the material is not packed too tightly to allow for some drainage during the arterial embalming. Fill the eye with sufficient cotton to recreate the normal appearance of a closed eye.

To help control swelling, restricted cervical injection is recommended – this allows the embalmer to control the arterial solution entering the head. It is also recommended that a stronger than normal arterial solution is injected, little to no manipulation is administered to the eye prior to or during arterial embalming, and rapid rates of flow and high injection pressures are not used on the head. Also, be sure to let the eye drain during the arterial embalming process. If swelling becomes excessive, stop injection and use surface embalming if necessary.

After arterial injection, remove all cotton from the eye and dry out the orbit. Place a small amount of incision sealer in the base of the orbit. Again, be sure the area is completely dry and will not become externally wet again prior to placing the absorbent material. Pack the orbital cavity with cotton or more mortuary putty. Place an eyecap over the filler and position the eyelid in a natural closed position. Glue the eyelids closed as usual.

For the mouth closure, there are several things that must be done before the mandible is secured. If the jaw seems to already be tightly closed due to rigor mortis, it is important for the embalmer to work the rigor mortis out by opening and closing the jaw numerous times. Rigor mortis will leave the body after a certain time period and the jaw will no longer be tight, and a secure mandible needs to be ensured. Once the embalmer is able to open the jaw by breaking up the rigor mortis, the mouth and teeth should be properly disinfected. If the decedent has dentures, they should be removed and properly disinfected prior to being replaced. The nasal cavity should also be disinfected at this time if it has not already been done. If there is excessive moisture or purge (discussed in more detail on page 23) present, the nasal aspirator can be used to aspirate the nose, mouth, and throat. The embalmer may also choose to pack the throat after finishing with the aspiration: this is especially important in autopsy cases.

Once the disinfection is complete, the mandible can be secured. This is commonly accomplished with either a *needle injector* or with a *suture method*. There are two lesser-used methods that should also be mentioned: the *dental tie* and the *drill* and *wire*.

The *needle injector* can be used on many bodies and requires less time. In this method, a needle injector barb – a very sharp pin or needle with a wire attached – is driven into both the mandible and maxilla with the needle injector. Once a barb is injected into both the mandible and maxilla, the wires are attached together to create a natural closure. Although the bone may be more solid at the nasal spine, it is not necessarily the best place to insert the needle injector barbs: the embalmer may rather choose to inject the barbs to the left side of the nasal spine just a bit, in order to avoid a projection from the wire or barbs.

Inserting needle injector barbs into the gums of the deceased in order to secure the mandible.

Some bodies, especially those with dentures, tend to have soft bones from atrophy or disease. This makes them a poor candidate for the needle injector method, and instead, a *suture method* should be employed. (It should be mentioned, too, that a suture method is arguably more secure – many embalmers choose to suture the mandible closed on all of the bodies they embalm.) There are two suture methods: the *muscular suture* and the *mandibular suture*.

The *muscular suture* uses the musculature of the chin to secure the mandible to the maxilla. From inside the mouth, use an aneurysm hook to separate the upper lip from the maxilla. Run a threaded needle up along the bone near where the upper lip connects to the maxilla, making sure to leave a good tail on the ligature side left in the mouth. Slide the needle close to the bone and out through the right nostril. Next, as close to the same hole as possible, pass the needle through the septum of the nose, keeping the needle as close to the bone as possible. (It is important to try to keep the same or very close holes and stay close to the bone to avoid a "stitch" appearing in the nostril. This can be visible during viewing if the person has a large enough nostril.) Insert the needle into the left nostril, again trying to stay as close to the same hole as possible and as close to the bone as possible. Bring the needle back down along the maxilla bone and into the mouth. The next step is to place the dentures, mouth former, or cotton to help shape the mouth. After that has been accomplished, again using the aneurysm hook, pull the lower lip away from the mandible. At the point where the lower lip meets the bone, insert the needle into the muscle on the right side. Running along the bone, make a wide stitch and exit the needle on the left side. With the two ends of the ligature, pull to tighten the jaw to the desired point, and then tie the two ends together. DO NOT tie into a knot, but instead tie into a bow, as if you were tying your shoes. (A pucker on the chin where the muscle was sutured might be visible, which is why the needle should be kept as close to the bone as possible.)

Arguably the most secure method of mouth closure, the *mandibular suture* is very similar to the muscular suture; in fact, the first several steps are the same. A threaded needle is run up along the bone near where the upper lip connects to the maxilla, sliding the needle as close to the bone as possible. Pass the needle through the septum and into the left nostril. From the left nostril, take the needle back down along the maxilla bone and into the mouth. Place the dentures, mouth former, or cotton as needed. Next, insert the needle at the center of the mouth at the base of the tongue behind the teeth where the floor of the mouth joins the gum. Push the needle downward, and it should come out at the point where the base of the chin joins the submandibular area. Push the needle back up through the same hole at the base of the chin. Run the needle upward just in front of the center of the mandible where the lip attaches to the gum. Take the ends of the ligature and run it back and forth a few times in order to get the ligature through the soft tissue in the chin and resting against the mandible. Finally, tighten as needed, and tie the ends together to secure the jaw. If there is a small hole from the needle at the base of the chin, a small amount of wax can be used to conceal it.

In the case of a fractured jaw, the lesser-used *dental tie* and *drill and wire* methods may be preferred. For an embalmer to use the *dental tie* method, the deceased must have natural teeth on both the top and bottom. In this method, a piece of thread/dental floss or a very thin ligature is tied around one tooth and the top of the mouth, and one tooth on the bottom of the mouth; the two pieces of dental floss or ligature are then tied together. Incisor teeth are most commonly chosen, but any of the teeth toward the front of the mouth can be used. Several dental ties may be needed to best align the fractured jaw for mouth closure. With the *drill and wire* method, a small hold is drilled through both the mandible and the maxilla. Thin wire is then passed through each hole and linked together to secure the jaw (ligature can also be used if wire is not available.) However, to employ this method, the embalmer must have a drill in the embalming room designated for use on deceased bodies only.

During Arterial Embalming

After the body is positioned, the features are set, and instruments are in the right place, the embalming machine is turned on and the actual arterial embalming process can begin. The embalmer must make sure everything is flowing properly and there is no leakage around the injection site. Desired blood drainage should also be monitored. The embalmer must watch for swelling in the abdomen, which could indicate fluid leaking out of the vascular system. For at least a few minutes, the embalmer should pay special attention to how the body is taking the embalming. During this time, he or she may be able to determine if the body is receiving fluid and blood is draining, or if another artery will need to be located, raised, and injected.

The actual embalming takes place at a cellular level. The arterial embalming solution flows through the vascular system from the arteries into the capillaries. Once in the capillaries, the solution leaves the vascular system and goes into the tissue and cells. The solution goes from the concentrated space in the artery to the much greater space in the tissue. This process is known as "diffusion," defined as the movement of embalming solution from the intravascular to the extravascular space.[16] Once the fluid is out into the tissue, the fluid actually embalms each individual cell by changing

16 Mayer, 2012, p. 257

the state of the protein. Some of the fluid passes into the vascular system to help push the blood out of the body, as well, and becomes part of the drainage.

Drainage, composed of blood and blood clots, interstitial fluid, lymphatic fluid, and embalming solution,[17] is a crucial part of the arterial embalming: although drainage itself does not actually embalm the body, the embalming will be more thorough if drainage takes place. There are several purposes of drainage. Blood remaining in the body can lead to discolorations. Blood also rapidly decomposes after death, leading to additional discoloration, odor, and the possible formation of gas. Removing the blood also help remove microbes present in the blood. And finally, removing the blood creates more room for the arterial solution. The center of drainage in a dead human body is the right atrium of the heart.[18] The drainage starts out dark and consisting mostly of blood and body fluids; as the embalming progresses, the drainage becomes lighter and contains some embalming solution. In some bodies there may be little to no drainage for various reasons, including prior decomposition of blood, extensive loss of blood from traumatic hemorrhaging, and internal or alternate drainage routes. If the blood drains into the abdominal cavity, aspiration of the blood should relieve any swelling. If the blood is draining through an alternate route such through the intestinal tract or through pathological lesions in the skin, just let the blood drain out as you inject. As long as there is distribution and diffusion along with no swelling, the lack of drainage should not be a concern.

There are only a few methods of drainage: *alternate, concurrent*, and *intermittent*. *Alternate drainage* is when the arterial solution is injected for a time, after which the injection of solution is stopped and drainage is employed. This increases the time of preparation somewhat significantly, and can cause distention in the tissue. *Concurrent drainage* is when the injection of arterial solution and venous drainage occur at the same time. It may be difficult to obtain any vascular pressure with this method because drainage is open the entire time; it might, however, help with bodies containing excessive moisture. *Intermittent drainage* is when the injection of arterial solution continues throughout the entire arterial embalming process, but the drainage is open for a time, and then closed for a time. This creates vascular pressure, which helps with drainage, and also helps the body retain fluids.

Once the embalmer is satisfied with how the arterial embalming is going, a number of other things can be accomplished simultaneously.

The body should be thoroughly and continuously washed with a germicidal soap. Ideally, warm water would be used for the best wash. However, sometimes warm water is not available. Likewise, some embalmers choose to use cold water: because of all of the PPE they wear, working with large amounts of warm water can cause them to become uncomfortably warm. Regardless, the body should be cleansed of all blood, dirt, cosmetic, ink, and anything else that can be removed.

Particular attention should be paid to the face, head, and hands, since these areas are most visible during viewing. The embalmer must clean under the fingernails, using an instrument to remove dirt and other matter. Prior to getting the hair wet, brush out any braids or mats, then wash the hair with germicidal soap or a commercial shampoo. Conditioner or hair rinse can be used, not only on long hair, but on all hair, to help with deodorizing. If there is scaling on the skin, particularly on the face and hands, a solvent such as dry shampoo can be used; likewise, scaling on the scalp can be controlled with dry wash.

More rigor mortis may need to be gently relieved while washing the body. In addition, the embalmer may also massage to better facilitate distribution and diffusion of the arterial embalming solution, as well as get the blood flowing and draining out of the body – this is especially helpful in cases where the remains have been refrigerated. However, the embalmer must be careful not to massage with too much force, which could cause capillary breakage and lead to swelling.

Massaging the hands to get the embalming fluid flowing into the hand, and the blood flowing out. It is very important to clear darkened nail beds. Massage helps with this.

exam question...

6. _____, composed of blood and blood clots, interstitial fluid, lymphatic fluid, and embalming solution, is a crucial part of the arterial embalming.

a. Drainage
b. Purge
c. Solution
d. Disinfection

17 Mayer, 2012, p. 248
18 Mayer, 2012, p. 250

Post-Arterial Embalming

As the arterial embalming solution begins to dwindle in the embalming machine, the embalmer should again analyze the body to determine what else needs to be done. Did the body get thoroughly embalmed? Is there anything else that needs additional embalming? If more embalming is needed, additional arteries may need to be raised in the areas needing embalming. The arteries can then be injected until the embalmer is satisfied with the areas. Another option to more thoroughly embalm a body or to provide additional embalming to areas that may not have been embalmed very well is hypodermic embalming, discussed on page 19.

Once the embalmer is completely satisfied with the embalming after arterial and supplemental embalmings, the embalmer can proceed with the cavity embalming. Cavity embalming will be discussed on pages 18 and 19.

Wrapping up the arterial embalming includes several things. The vessels used for the arterial embalming can now be tied off. Some embalmers choose to do this prior to cavity embalming, but it can be more practical to wait: if disruption from the cavity embalming causes leakage at the incision sites, it is best to treat this prior to sealing the incisions.

Once each artery and vein used have been tied off, the incision(s) can be packed and stitched up. A sealant should be used in the incision whether leakage is anticipated or not. Embalming chemical companies make numerous types of sealants, including putty and powder form. Once sealant is placed in the incision, prep cotton can be packed in, along with more sealant on top. Finally, the incision can be sutured closed. The embalmer may choose to partially begin the suture prior to packing the incision.

There are several sutures that can be utilized to close the incisions. The most widely used suture is the *baseball stitch*. It is quick and easy, as well as secure. It can be made with large stitches, or to make it more secure, it can be made with smaller stitches, which makes it nearly airtight. This stitch begins from inside the incision. Bring the suture needle up through the skin at a point at the base of the incision, directly in the center. From there, entering again from inside the incision, begin going side to side, inside and out, inside and out, until the end of the incision is reached.

Other stitches include the *individual suture*, the *single intradermal suture*, the *double intradermal suture*, the *worm suture,* the *lock stitch*, and the *whip stitch*.

The *individual suture*, also known as the *bridge suture,* is a temporary suture. It is most commonly used to align tissue in order to get a better suture with a more secure stitch. It is basically just a single stitch tied in a knot in order to hold tissue in place for a short period of time. This stitch is good for restorative art purposes during embalming to fixate tissue in place for later treatment, as well as aligning tissue of the Y incision or the head incision of an autopsy.

The *single intradermal suture* is also known as the *hidden stitch*, due to its usage on areas of the skin that may be visible during viewing. To perform this stitch, start from the outside of the suture at the base of the incision. Be sure to leave a tail of ligature thread on the outside of the incision at the point where the needle was inserted. From there, on one side of the incision, make a small stitch in the dermis of the skin (the dermis is the layer of fibrous connective tissue between the epidermis and the subcutaneous tissue).[19] The stitch will be completely in the dermis. After the small stitch is made, go directly to the other side of the incision and make a small stitch in the dermis on that side of the incision – make sure to leave the ligature loose in between each stitch. Next, go back to the other side of the incision for another small stitch, and back to the other side, and so forth, until the entire incision has been covered. At the end of the incision, take the needle from the inside of the incision out, at the opposite end from which the incision was started, in a like manner. To complete the stitch, take both tails of the suture and pull out. This will tighten the stitch and bring the skin together to close the incision. Once tightened, cut off the tails of the ligature thread close to the skin. Please note: while this suture can be packed to help prevent any leakage, the single intradermal suture is not a very secure stitch and should not be used in areas where extensive leakage is suspected. When packing, prior to beginning the suture, place prep cotton and absorbing chemical in the incisions. Repeat if there is space or if required.

The *double intradermal suture* is also a stitch that should not be visible. In that way it is similar to the single intradermal suture. However, the double intradermal suture is more secure due to the fact that it is permanently affixed at each end, unlike the single intradermal. This stitch uses two needles threaded at opposite ends of the same ligature thread. Stitch each needle through the dermis at opposite sides of the incision. Do so until the incision is completely sutured. After tightening the ligature thread, knot the two ends together inside the incision. Thread both ends of the ligature, now knotted together, into one needle. Insert the needle under the skin to a point about ½ inch past the base of the incision. Cut the ends close to the skin. The excess ligature thread is now hidden. Again, if packing of the incision is needed, it should be done prior to beginning the incision.

The *worm suture,* also known as the *inversion suture*, is best used to turn under excess tissue, such as jagged edges, or even just a regular carotid incision. This suture is not visible and can be waxed if need be. It is similar to the single intradermal suture, except that the

19 Hart & Loeffler, 2012, p. 296

incisions are made close to the edges of the incision, and not in the incision. The stitches should be made as close to the edge of the incision as possible. Each stitch should be drawn tight as it is sewn and kept snug. As with the other stitches, the incision should be packed prior to beginning the suture if needed.

The *lock stitch,* also known as the *interlocking suture*, is a tight and secure stitch that creates a ridge on the surface where the suture is made. At one end of the incision, begin the suture by taking the needle through the tissue on both sides of the incision from the outside. Lock each individual stitch by taking the needle through the loop on the thread. Keep making single locking stitches until the incision is completely closed.

The *whip stitch,* or the *continuous stitch,* is best for closing long incisions. This suture can be very quick and easy with large stitches, but becomes more secure with smaller stitches. It is often used by autopsy technicians to close an autopsy for transport. It is also commonly used to close long incisions after long bone tissue removal or other long incisions from organ and tissue harvesting. The whip stitch is accomplished by taking the needle through both sides of the incision. Start on the outside of the tissue on one side of the incision and go directly through and out the tissue on the other side of the incision. Go back over the top of the incision and repeat the process, always starting from the same side of the incision. Move down the incision a little each time until the incision is closed. End the suture with a locking stitch.

Two additional stitches should be mentioned here: the *purse string suture* and the *N suture*. Either stitch can be used to close many small openings, including those made by the trocar during aspiration or hypodermic injection, bullet wounds, openings made by medical devices, and many others. Both sutures are quick, easy, and secure.

For the *N suture,* insert the threaded needle below the circular opening, making sure to leave a sufficient tail end. Stitch toward the other side on the bottom of the opening under the skin. Exit the needle. Bring the needle over the opening diagonally and insert above the opening. Stitch under the skin toward the other side of the top of the opening and pull the needle up through the tissue. Remove the needle from the ligature thread. Pull the two tail ends together and tie in a secure knot.

The *purse string suture* is started with a threaded needle at the base of the opening from outside the skin. Stitch under the skin to one side about a quarter of the way around the opening, staying fairly close to the edge. Exit the needle through the tissue. Be sure to leave a tail on the end. Next, stitch under the skin to a point at the top of the opening, exiting the needle through the tissue each time. Make another stitch under the skin to the other side of the opening. One more stitch is needed under the skin to get back to the base of the opening. Remove the needle and draw the two ends of the ligature up together, closing the opening, and tie tightly in a knot.

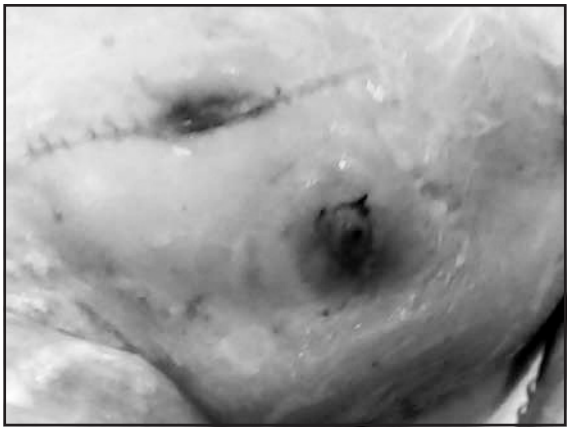
Once the incisions used for the arterial embalming are closed, any additional medical devices (other than those referenced above, on page 11) should be removed. Some embalmers choose to remove these devices prior to the arterial embalming; however, it would greatly benefit the embalmer to wait until after the embalming is complete. Removing devices prior to arterial embalming can cause bleeding, swelling, damage to the vascular system, and leakage into the body's cavities causing distention, along with numerous other problems.

All kinds of medical devices can be seen on decedents that come into the embalming room: while many are removed prior to their leaving the facility in which they died, many medical devices are left in or on the deceased. Some commonly-encountered medical devices include intravenous catheters (including peripheral inserted central catheters or PICC), abdominal feeding tubes, colostomies, and pacemakers. Once any device is removed, the opening should be properly disinfected. If there is a large open wound, it may need to be treated topically with surface embalming such as a cavity pack or autopsy gel. Such wounds may also need to be packed and stitched up to prevent leakage. Any new or recent surgical wounds or sites where a medical device was removed prior to the deceased leaving the facility in which they died should be treated in the same manner. In addition, staples may need to be removed from surgical wounds.

Intravenous catheters can be removed easily enough by gently removing the needle or tube. If there is slight fluid leakage coming from the small hole, a small amount of adhesive can be placed in the hole. This is not always necessary as the firming action of the solution will often prevent any leakage from such a small puncture.

Abdominal feeding tubes are inserted into the stomach wall. Gently remove the tube and completely disinfect the area. A piece of prep cotton saturated with cavity fluid or a cauterizing agent should be inserted into the opening made by the tube. A purse string suture or N suture should be used to close the opening.

A colostomy is when an opening is made in the colon through the abdominal wall and a bag is attached to the stoma (or the exposed part of the colon). The bag must be removed and treated with disinfectant prior to being disposed of in the hazardous waste container. Disinfect the area thoroughly with prep cotton and a cauterizing agent or cavity fluid. With gently pressure on the stoma,



Opening in the abdominal wall from a colostomy bag. Also a surgical incision with staples.

force the piece of bowel back into the abdominal cavity. A slightly twisting motion may be needed to get it loosened from the abdomen. Use the purse string suture or N suture to close the opening in the abdominal wall.

A pacemaker does not necessarily need to be removed. If the body is being buried, the pacemaker should not be removed unless permission is granted by the family. However, if the body is to be cremated after viewing, the pacemaker must be removed. Permission was granted for removal of the pacemaker in the cremation authorization. To remove the pacemaker, an incision is made over the device. Open the pocket and remove the device.

If the embalmer noticed purge (discussed in more detail on page 23) during the arterial embalming, aspiration may need to be performed again in the nose and mouth. Re-pack these areas as needed. All orifices should be packed at this time, including the ears, nose, throat, anus, and vagina (if applicable). Packing should be done with prep cotton saturated with a cauterizing chemical or cavity fluid. Special plugs are made for anal and vaginal closing, so either the plug or the saturated prep cotton can be used.

Features may need to be reset at this time, depending on how much the body was moved during the embalming process. The eyes and lips can be glued at this point, too, but it may be best to wait until the restorative art is ready to be performed.

The body should be thoroughly washed one last time to begin the *terminal disinfection*. The embalmer should pay special attention to removing any blood and body fluids: in particular, if the hair was saturated with blood, it should be rewashed at this time. The body should then be completely dried with cotton towels, and the hair should be dried and combed. (Conventional wisdom suggests that if you are unsure of the style of a woman's hair, you should comb it back; however, that is not necessarily true. If the decedent has bangs, it is best to comb them forward a bit; if not, comb the hair and then loosen it so it is not just resting straight down on the scalp. This makes the hair more manageable for the hair stylist later on.) The eyes, lips, and hands should receive special attention as they will still need manipulation during the restorative treatment, and are important for the viewing: massage cream should be applied to keep them moist and supple as the body firms up.

Terminal disinfection continues with the instruments and the equipment in the embalming room. Everything should be wiped down with disinfectant, regardless of whether or not it was used. The instruments should be rinsed with warm water to remove any debris and dried blood, and then placed in the cold sterilizing chemical, or in the autoclave for sterilization.

Terminal disinfection also applies to the embalmer. The embalmer should remove all PPE and dispose of disposable items. Reusable items should be placed the proper receptacle for laundering.

Finally, the embalmer should complete the *embalming report*. Everything done during the embalming process should be noted in the report; all chemicals used should also be recorded. If the embalmer does something that is not considered the standard of care, an explanation should be given as to why. This will help protect the embalmer and the funeral home should any litigation be brought against them.

Cavity Embalming

Cavity embalming is the other major part of the embalming process. Cavity embalming is the direct treatment, other than vascular injection, of the contents of the body cavities and the lumina of the hollow viscera, and is usually accomplished through aspiration and injection of cavity fluid.[20]

Some embalmers choose to do the cavity embalming immediately following the arterial embalming, while some embalmers choose to wait several hours or even until the next day to do the cavity embalming. Either way is considered acceptable, but sometimes one might be a better idea than the other. For example, if swelling in the abdomen or neck occurred during the arterial embalming process, it is best to do the cavity embalming right after arterial embalming in order to subside the swelling. If not, when the cavity embalming is finally employed and the swelling goes down, it may create wrinkling in the tissue; also, if the arms and hands are resting on a swollen abdomen for a long period of time and set up, they may appear to be levitating over the abdomen once the swelling goes down. On the other hand, delaying the cavity embalming may allow the arterial solution

20 Mayer, 2012, p. 33

to better embalm the tissues of the body prior to cavity embalming by allowing vascular pressure to build up and help with the diffusion of the arterial embalming fluid. (Either way, as mentioned earlier, many embalmers choose not to suture the incisions where vessels were raised for arterial embalming until after the cavity embalming is complete.)

The first step involved in the cavity embalming is *aspiration*. Aspiration is a process in which the contents of the hollow organs, along with any liquids or gases that may have accumulated in the body cavities, are suctioned out with the trocar.[21] The trocar, as described on page 5 of this text, is hooked up to the aspirating device available at the funeral home. This could be a hydroaspirator, as described on page 4, or an electric aspirator, which is similar but uses electricity instead of water to create the suction action. The aspirator should be turned on and tested before entering the body. Once the embalmer is sure the aspirator is aspirating properly, the trocar is inserted into the body approximately 2 inches above and 2 inches to the left of the belly button (umbilicus).

Although there is no specific order of aspirating, there are several cavities that should be done as part of each cavity embalming. The *thorax* includes the lungs and the heart. The *abdomen* contains the small intestine and large intestine, consisting of the duodenum, jejunum, ileum, cecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum, and anus. It also includes the gallbladder, liver, pancreas, spleen, kidneys, and stomach. The *pelvis* is different in males and females. In male bodies, there is the urinary bladder, the prostate gland, and the seminal vesicles. Female bodies contain the urinary bladder, the uterus, ovaries, and uterine tubes.

Each organ must be punctured and subsequently aspirated. There are two methods used to help the embalmer locate and aspirate these organs: the n*ine region method* and the *quadrant method*. The *nine region method* divides the thorax, abdomen, and pelvis together (the trunk of the body) into nine regions. If the embalmer is sure to hit all nine regions, a thorough aspiration can be achieved. The other method, the *quadrant method,* divides the trunk of the body into four quadrants. There are more organs in each quadrant with this method. But again, if the embalmer is sure to thoroughly aspirate each quadrant, a thorough aspiration can be achieved.

It is also important to note that the body is three-dimensional. Organs do not all exist on the same plane in the body. Simply aspirating at one level and not going below or above that level will not create a comprehensive cavity embalming. For a great visual of the three-dimensional anatomy of the human body, check out the Zygote Body website (www.zygotebody.com).

The second step involved in the cavity embalming is the injection of a cavity chemical into the body cavities that were just aspirated. The trocar is no longer attached to the aspirator, but is instead attached to the bottle injector apparatus, as discussed on page 4 of this text. Prior to attaching the trocar to the bottle injector, it must first be rinsed and flushed to make sure there is no tissue clogging the instrument. Once the trocar is attached to the hose of the bottle injector, the 16 ounce bottle of cavity fluid is connected to the other end of the bottle injector. When the trocar and the bottle are both in place on the bottle injector, the trocar is inserted into the body through the same puncture as for the aspiration. Once the trocar is in the body, the bottle injector is inverted and held high, at the level of the embalmer's head or higher: the higher the bottle is held, the faster the fluid goes into the cavity. The bottle injector also has a thumb valve that allows the embalmer to control the flow to some degree. The embalmer should try to inject cavity fluid into each of the organs. At least 2-3 16 ounce bottles are needed for an average body. Larger bodies may require even more.

Once the embalmer is confident that the cavities have been sufficiently embalmed, the cavity embalming is complete. A trocar button can be inserted into the puncture made by the trocar, and screwed in tight with the trocar button applicator, both of which were described on page 5 of this text. If a trocar button is not available, or at the preference of the embalmer, a purse string suture or N suture, both described on page 17, may be used to close the puncture from the trocar. Both closures are easily opened if re-aspiration is needed.

It should be noted that there are two additional types of embalming: *hypodermic embalming* and *surface embalming*. These embalming methods are not utilized on every body, but are available as needed. They are often referred to as *supplemental embalming treatments*. *Hypodermic embalming* is the injection of embalming chemicals directly into the tissues of the dead human body through the use of a syringe and needle for smaller areas, or a trocar for larger areas.[22] *Surface embalming* is preservation of the body tissues by direct contact with embalming chemicals such as preservative gels or surface packs of absorbent materials saturated with preservative chemicals and directly placed in contact with the body tissue.[23]

21 Mayer, 2012, p. 34
22 Mayer, 2012, p. 33
23 Mayer, 2012, pg. 33

Advanced Embalming: Dealing with Complicated Cases

Jaundice

Jaundice is a yellowing condition of the skin, eyes, and internal organs caused by an excess of bilirubin. Bilirubin is a breakdown product of hemoglobin and is bright yellow in color. The excess of bilirubin causing the jaundice happens when the liver is unable to remove all of the bilirubin from the blood and excrete it in bile.[24]

The yellowing of the skin causes problems during embalming, when the skin often turns from yellowish to greenish. This is caused by the conversion of bilirubin to biliverdin, which is green in color. Although many believe the heavy formaldehyde content in the typical embalming fluid is what causes the greening of the skin, that is not necessarily the case: a strong acidic environment actually causes the greening of the skin. The embalmer, in jaundice cases (as with most cases), will need to use experience and instinct in order to end up with a viewable, well-preserved body.

There are several methods that have been considered effective for embalming jaundice cases: *using special jaundice fluids* or a *preinjection prior to embalming,* along with other less effective and less-used methods.

Special jaundice fluids are manufactured by most embalming fluid companies. These fluids are specially designed to interact with the excessive bilirubin without causing a strong conversion to biliverdin. Although these fluids generally cause less discoloration, they do not typically contain very strong preservatives. Each manufacturer of special jaundice fluid will usually also provide recommended fluid solutions to use for jaundice cases. These formulas should be followed accurately to achieve the best preservation of the body – with the exception that additional dye, even if not suggested in the formula, can be added.

A *preinjection prior to embalming* is another option in embalming a jaundice case. The idea is to flush out much of the discoloration. Dye can also be added to the preinjection solution to counterstain the tissue. Once the preinjection has thoroughly flushed much of the blood out of the body, a regular arterial solution can be used to embalm the body. The regular arterial solution used should be sufficiently strong enough to preserve the body.

Other methods that tend to be less effective include the use of a *mild arterial solution* and the use of *cavity fluids as arterial fluid*. *Mild arterial solution,* while potentially lessening the likelihood of this occurrence, may still convert the bilirubin to biliverdin and turn the deceased green. On top of that, the body will not be very well preserved, which pose another complete set of problems. Using *cavity fluids as arterial fluid* is always risky. Although some cavity fluids are designed to also be used for arterial fluids specifically for jaundice cases, the embalmer must make absolutely sure of such before beginning the embalming. The benefit of using the cavity chemical is the bleaching quality of the chemical on the discoloration. Dye should be added to cavity fluid if it used, as most cavity fluid does not contain active dye.

There are several things to keep in mind when embalming a jaundice case. Most importantly, as with all embalming, the main objective is to achieve a desired preservation. Clearing the discoloration is also important, but keep in mind that if all else fails, it can be covered with opaque cosmetic. If the body is not very well preserved, decomposition cannot be as easily covered.

As we all know, the head is regarded as the most visual part of the deceased, which means we must concentrate on how the head looks. For this reason, restricted cervical injection, which allows the embalmer more control over the head, is recommended in dealing with jaundice cases. The embalmer may choose to start by injecting downward toward the body and leaving the head alone. This allows the embalmer to test the embalming solution mixed in the embalming machine tank. If the embalmer notices a nice color taking place in hands, for example, he or she may consider using this same embalming solution for the head. However, if the embalmer notices a green discoloration immediately, or no change in the tissue after a time, he or she may consider a different embalming solution and/or more dye in the embalming solution for the head. Alternately, the embalmer may also choose to embalm the head first using special jaundice fluids, and then inject the rest of the body with a stronger solution in order to preserve the body.

Finally, it is important to keep in mind that there are often other problems that accompany jaundice. One such problem is the abundance of nitrogenous waste in the body, like urea nitrogen and ammonia. Severe liver failure often results in an accumulation of ammonia, and severe kidney failure will produce an accumulation of urea nitrogen in the blood.[25] The presence of this

exam question...

7. _____, which allows the embalmer more control over the head, is recommended in dealing with jaundice cases.

a. Using cavity fluids as arterial fluids
b. Mild arterial solution
c. Restricted cervical injection
d. Avoiding the use of dye

24 Hart & Loeffler, 2012, p. 217-218
25 Hart & Loeffler, 2012, p. 218

nitrogenous waste will require a higher preservative demand in order to achieve a well-embalmed body – and, as we discussed above, working with an embalming solution with a higher preservative content is harder when the body is jaundiced.

Another issue to consider with jaundice cases is the fact that the liver is the main site of the metabolism of drugs in the body. As we know, more and more people are taking more and more medications in an effort to keep people alive longer. If the deceased was in severe liver failure, drugs that may have been given to the deceased are probably still strong in the blood stream. This, too, can cause problems with the embalming, possibly requiring a higher preservative demand, as well.

Edema

Edema, the leakage of fluid into the tissue causing swelling,[26] has long been a problem for embalmers – and today, as more and more life-saving and life-lengthening measures are used, we see edema more and more often. An embalmer can be almost certain that a decedent who has been in the hospital for even just a few days with an IV drip will have edema. An extended hospital stay can all but guarantee edema: in addition to the IV drip of hydrating fluids, a wide array of medications are also delivered by IV.

Recognizing that a decedent has edema while making a chemical selection will help the embalmer create a higher-preservative solution. When embalming a decedent with edema, no matter if it is generalized or localized to a specific area, the embalmer must consider the secondary dilution of the embalming fluid: the wateriness of the edema will cause the solution to become weaker. A body is generally composed of about 60% water; with generalized edema, a 10% increase of fluid in the body is considered typical. Given the increase in fluid, it makes sense to use the body's water content instead of adding additional water to the arterial embalming solution. A waterless or near-waterless solution is recommended to achieve the best preservation.[27]

Edema can be further treated after arterial embalming with hypodermic injection. Severe edema may require use of plastic garments to control leakage, and embalming powder can be added inside the plastic garments to further control leakage and odor.

Diabetes mellitus

Diabetes mellitus is a disease in which there is a persistent state of hyperglycemia and loss of glucose homeostasis.[28] Although there are two types of diabetes mellitus, both present similar challenges to the embalmer. As with other difficult cases, a high index solution is recommended; it may even benefit the embalmer to use a completely waterless solution. Furthermore, when embalming a decedent with diabetes, fluid distribution, blood drainage, and preservation may all be difficult.[29] Additional treatments might need to be utilized with diabetes cases, depending on which specific conditions are present.

When a diabetes case is presented, the embalmer must keep in mind that there are several conditions that will most likely accompany the disease. These conditions include *acidosis, arteriosclerosis, dehydration, gangrene, pruritus,* and *decubitus ulcers,* and *emaciation*. *Acidosis* is the increase of acidity in the blood; the presence of this excess acid will require a higher preservative demand. *Arteriosclerosis,* or the narrowing of the arteries caused by calcification, causes poor circulation during life and will affect and limit the fluid distribution during the arterial embalming. Diabetics tend to exhibit *dehydration* due to excessive urination and changed osmotic balance during life; since the embalming is actually dehydrating the body even more, special attention should be given to making sure the body has enough moisture. *Gangrene, pruritus, decubitus ulcers,* and *emaciation* are also common, and will be discussed in their own sections below.

Discolored tissue in the lower extremity indicating poor circulation, like that caused by diabetes.

exam question...

8. When a diabetes case is presented, the embalmer must keep in mind that there are several conditions that will most likely accompany the disease, including _____.
a. Jaundice
b. Edema
c. Arteriosclerosis
d. An excess of bilirubin

26 Hart & Loeffler, 2012, p. 40
27 Black, 2015, p. 9
28 Hart & Loeffler, 2012, p. 390
29 Newbern, 2011, p. 8

Gangrene

Gangrene, a tough condition often associated with diabetes, is a coagulation necrosis with superimposed decomposition by saprophytic bacteria.[30] This decomposition is similar to postmortem decomposition, except that just a portion of the body is dead and decomposing. In living bodies, gangrene can lead to amputations of decomposed tissue; if gangrene is present in the deceased, it must be dealt with.

If the gangrene turns out to be gas gangrene, this causes even more problems for the embalmer. The gas gangrene is caused by a bacterium known as *Clostridium perfringens*. Although this organism is natural flora in the intestinal tract of the human body, it is problematic anywhere outside the intestinal tract. If it gets into the blood stream, it can rapidly spread throughout the body. This bacterium produces gas and necrotizing toxins, which can spread rapidly to normal tissue. In a living body, this causes more gangrene and decomposition, and in dead tissue, it can lead to the very scary tissue gas.

Treatment of gangrene should be thorough. The gangrenous limb should be hypodermically injected with a strong preservative chemical. Once the limb has been thoroughly injected, topical embalming should be performed with either a surface pack of cotton saturated with cavity fluid or a cauterizing chemical, or autopsy gel. After the area is treated, and before dressing the body, it is best to utilize a plastic garment to contain the limb.

Pruritus

Pruritus, or an extreme itching of the skin caused by irritation or rashes during life, could lead to bruises, discolorations, leaks, and blisters. After embalming is complete, any bruising and discolorations in an area visible during viewing of the body can be treated. If they are very light but still need attention, light cosmetic can be used to cover them. If they are too dark to cover with light cosmetic, a bleaching agent can be injected under the skin with a needle and syringe, or a surface pack saturated with a bleaching agent can be applied directly to the surface of the skin overnight (be sure to cover the surface pack with plastic to avoid exposure to the fumes). Leaks and blisters should be treated with a cauterizing chemical. If severe enough, plastic garments can be used along with embalming powder sprinkled inside after they are treated.

Decubitus ulcers

Decubitus ulcers, or bedsores, are deep ulcers resulting from pressure on the skin.[31] While common among diabetics, decubitus ulcers can occur on any person, particularly those who are bed-ridden or bound to a wheelchair. They are caused when a person is not bathed frequently and/or not moved from position to position often enough.

During the embalming process, decubitus ulcers should be specially treated. The ulcers should be properly disinfected during the primary disinfection. Hypodermic injection should be done around the ulcer if it is considerably large, and then topical embalming procedures should be utilized, such as a cavity pack, autopsy gel, or a cauterizing agent. Plastic garments should also be used prior to dressing the body to prevent leakage. Embalming powder in the plastic garments provides extra odor control and preservation.

Emaciation

Emaciation, or abnormal thinness, can be caused by diseases like diabetes, but it can also result from such conditions as dementia, failure to thrive, and malnutrition, just to name a few. The extreme thinness of the deceased creates a skeletal look on the entire body, but the sunken facial features tend to be the most problematic for the embalmer: emaciation makes it harder to make the facial features appear natural, and sometimes causes difficulty in setting the features as well. Sites like the temples, lips, cheeks, and eyes often can be injected with tissue builder. Prep cotton can also be utilized in some cases.

Obesity

Obesity, or the accumulation and storage of excessive fat in the body, is a growing problem: 34.9% of adults in the United States are considered obese, having a BMI (body mass index) equal to or greater than 30.[32] Obesity-related conditions include, but are not limited to, heart disease, stroke, type 2 diabetes, and certain types of cancers.[33] With the growing number of overweight Americans, it is no wonder there has been an increase in overweight cases in the funeral home. Obesity can pose many problems in embalming just focusing on the disease conditions alone; add in the extra adipose tissue and the difficulty in preserving it, and obese cases make for a difficult day in the embalming room.

Handling the body is the first hurdle in the process: moving the body onto the embalming table is a challenge in itself. Once the body is on the embalming table, the pre-embalming steps can begin; be certain to plan for additional time and effort as the process moves forward, due to the sheer size of the body.

Determining what disease conditions the deceased

30 Hart & Loeffler, 2012, p. 37
31 Hart & Loeffler, 2012, p. 441
32 Ogden, Carroll, Kit, & Flegal, 2014, p. 806
33 National Institute of Health, 1998, p. vii

may present is the next hurdle with an obese body. Since the embalmer generally does not know the cause of death upon beginning the embalming process, it is best to view an obese body as a "difficult" case: the embalmer should consider a higher formaldehyde demand when figuring the primary dilution factor and mixing the chemicals, and may also consider using a low water or waterless embalming.

Hypodermic embalming is also immensely important when embalming an obese body. The fatty tissue does not take very well to the arterial embalming. Especially with morbidly obese individuals, the fatty tissue of the stomach area, legs, and arms should be hypodermically injected with embalming solution or undiluted cavity fluid. In addition, surface embalming with surface packs may need to be utilized for chafed areas and other open sores caused by the excess amount of skin and weight rubbing together. Plastic garments may also need to be used to prevent leakage coming from fluid seeping through the pores, as well as the oil from the fatty tissue seeping through.

Purge

Purge, defined as the postmortem evacuation of any substance from any external orifice of the body as a result of pressure,[34] is caused by a number of things. It can occur at any time after death, including after the embalming is complete.

Purge can come from the lungs, brain, anus, or stomach. The location of the purge usually dictates what it looks like. Purge coming from the stomach is brown and coarse, and is often described as looking similar to coffee grounds. It comes out of the mouth and nose. Lung purge also comes out of the mouth and nose and is a bit frothy with a red tint. Anal purge comes from the anus and is generally fecal matter, possibly with blood mixed in. Applying pressure to the lower abdomen area will help relieve the body of this purge; running water can then be used to release any solid from the skin and wash it away down the table. Purge coming from the brain, generally as a result of some sort of fracture or trauma to the skull, is a white semisolid that comes out of the ears and nose. (It should also be noted here that purge containing embalming fluid can come from the mouth and nose during the embalming process.)

exam question...

9. _____ is immensely important when embalming an obese body, as the fatty tissue does not take very well to the arterial embalming.

a. Hypodermic embalming
b. Opaque cosmetic
c. Mild arterial solution
d. Dye

Prior to embalming, purge coming from the stomach can burn the skin and cause discolorations; if it is noticed, it should be cleaned up and treated immediately. If purge of any kind occurs during the arterial and cavity embalming, it is best to just let it be: it can easily be washed away with the running water of continuous disinfection, which will avoid any burning on the skin. However, the embalmer should pay special attention to where the purge is coming from, and be sure to keep an eye on those areas after the embalming is complete: additional treatment, such as nasal aspiration or reaspiration of the cavities, may need to be done.

Discolorations

Discolorations can be present on a dead body for a number of reasons. Some discolorations are antemortem, meaning they happen prior to death, but remain on the body after death; other discolorations are postmortem, meaning they occurred after death. There are localized discolorations where the discoloration is contained in a small area, like a black eye; there are also generalized discolorations where the discoloration is over a large portion of, or sometimes the entire, body (we have already discussed one generalized discoloration, jaundice, on pages 20-21 of this text).

In particular, embalmers should be aware of *blood discolorations,* which can be *intravascular* or *extravascular.* Intravascular discolorations, which can generally be remedied during the arterial embalming process with massaging, include *hypostasis,* the discoloration caused by *carbon monoxide poisoning, capillary congestion,* and *livor mortis*.

Hypostatis of the blood, or the settle of blood to dependent areas of the body, is an antemortem blood discoloration and is a blue-black in color.

Carbon monoxide poisoning results in a cherry red coloring.

Capillary congestion can cause a dark red color in dependent areas such as the back and buttocks.

Livor mortis, the result of hypostasis, is a postmortem discoloration and results from capillary congestion once the blood stops circulating.

Extravascular discolorations, on the other hand, cannot be removed with arterial embalming, so other methods must be employed to try to rid the body of these discolorations: for example, they can possibly be lightened with surface embalming, or by hypodermically injecting bleach into the discolored tissue. Extravascular blood discolorations include *ecchymosis, purpura, petechia,* and *hematoma,* as well as *postmortem stain* and *Tardieu spots*.

34 Mayer, 2012, p. 437

Ecchymosis is a large bruise that is caused prior to death when blood escapes the vascular system. It can be treated with surface packs of prep cotton saturated with cavity fluid or a cauterizing agent, or a bleaching agent can be injected directly into the bruise and worked around with the embalmer's gloved finger.

A *purpura* is a flat hemorrhage beneath the skin surface that causes a discoloration. It can be treated in the same way as ecchymosis.

Petechia are small pinpoint skin hemorrhages that are best treated with surface packs.

Hematoma are swollen blood-filled areas within the skin that can be treated in the same way as ecchymosis or hemorrhages.

Postmortem stain is caused when blood exits the vascular system after death. This generally occurs when the body has been lying in place for a time after death: the areas of the body receiving pressure are where the stain appears. For example, if the body is face down upon death and remains that way for some time, the postmortem stain may appear on the front-side of the body, especially the face. Postmortem stain is hard to alleviate, but is treated in the same way as previously mentioned extravascular discolorations.

Tardieu spots are very small petechial hemorrhages that are caused from the rupture of tiny blood vessels. They tend to appear around the eyes after deaths due to asphyxiation or other slow deaths. These are best treated with surface packs.

Abdominal discolorations

exam question...

10. _____ are very small petechial hemorrhages that are caused from the rupture of tiny blood vessels.

a. Purpura
b. Tardieu spots
c. Hematoma
d. Ecchymosis

Advanced Embalming: Shipping Human Remains

Shipping human remains via common carrier is not usual; however, it can always pose problems with the body. When shipping via common carrier, the body must either be embalmed or packed in dry ice. (It should be noted that if the body is being shipped to a foreign county, the specific country's requirements for acceptance of the human remains must be consulted.)

Shipping can be done with casketed remains, where the body is already in the casket, or it can be accomplished with remains that have not yet been casketed. If casketed remains are being shipped, an *air tray* is used to contain the casket: a shipping container of sorts where the bottom is made of wood, and the top and side enclosures are made of sturdy cardboard. If just the body is being shipped without a casket, a *combination case* must be used: a transfer container which is similar to an air tray, but is a particleboard box with a cardboard cover that is used in place of the casket.

No matter how the remains are being shipped, there are several things that must be done to ensure safe transport of the embalmed body to the receiving funeral home. The body should be thoroughly cleansed and dried with all orifices appropriately packed. The body should then be placed in plastic garments and at least partially dressed, even if just in a hospital gown or clean sheet. Some funeral directors choose to completely dress the body: in these situations, extra care should be taken to avoid leakage on the clothing of the deceased (if the body is simply dressed in a hospital gown or clean sheet, the clothing can be shipped along with the body and avoid any leakage that might occur).

Before placing the body in either the casket or the combination unit, place a plastic shroud underneath the body, again to help with leakage either into the casket lining or seeping from the combination unit. If the body is in a casket, it is best to line the entire inside of the casket with plastic: it can be removed or tucked under the body upon its arrival at its destination. It is likewise best to turn the pillow over, just in case. Also, place a layer of cotton around the head and face to soak up any purge.

If the body is casketed, place the bed of the casket in a very low, if not the lowest, position. If in a combination unit, secure the body to the container so the body will not slide. Include a copy of the *embalming report*, the *burial-transit permit*, and a *copy of the death certificate* (if available). Be thorough in your embalming report before, during, and after the embalming, and be sure to notify the receiving funeral home if you foresee any problems or if there are any unusual conditions.

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