Long-term Embalming

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When we think about embalming, most of the time we are referring to a process that I will call (for purposes of this article) "mortuary style embalming." The goal of mortuary style embalming is temporary preservation, with the appearance of the deceased being equally important. It is generally accepted that the preservation is short term with no promise of long-term preservation. Many mortuaries have even put that wording into their embalming authorization forms (embalming is temporary preservation). The goal of mortuary style embalming is to provide a lasting memory picture that is pleasant and recognizable.

The second type of embalming that I am going to discuss is called "anatomical embalming." This is the type of embalming commonly done at medical schools and research facilities. The goal of anatomical embalming is long-term preservation with little or no regard given to the appearance of the deceased. The cadavers are held at room temperature from several months to several years. With anatomical embalming, I've preserved cadavers that have been around for 3-4 years with little or no signs of decomposition. In general, anatomical embalming uses chemicals in their raw form (formaldehyde, isopropyl alcohol, propylene glycol). There are also some additional chemicals used in anatomical embalming that you would not use in a mortuary setting, such as carbolic acid (phenol) and high percentage alcohols. These chemicals are needed for anatomical embalming but not desirable for mortuary use.

The process I'm referring to as "long-term embalming" is a combination of these two styles. This technique should be considered when you are presented with a case that will be at your mortuary for several months or longer. For purposes of this article, long term is 2-12 months. I have used this technique on 21 cases and have had good results with each. The 21 cases had delays between 3 and 14 months with the average being 5 months. I wanted to present this process in a way that every embalmer could easily follow. I will also refer to the class of chemicals for easy substitution (humectants, co-injectant, etc). I refer to some specialty fluids and I hope that these are already part of your standard prep room supply. If they are not, I hope that you will give serious consideration to including them.

Embalming Basics

Embalming chemically inhibits or arrests decomposition. *It does not reverse decomposition*, it only retards it. For this reason, it is important that the embalming be done in a timely fashion. The longer we wait to embalm, the more decomposition will occur and less tissue will be available for preservation. The process of decomposition begins

as soon as death occurs and with some complications, like sepsis or organ failure, this breakdown may even begin before physical death occurs.

Washing the Body

The body should be washed thoroughly using an antibacterial soap and be elevated above the table surface with body blocks. By correctly placing the body blocks you can avoid constricting the major arterial vessels to the back and buttocks. A third block should be placed under the heels of the deceased to elevate the lower extremity.

Special care should be taken to thoroughly disinfect the eyes, nose, and mouth. I get good results by washing these orifices with the same antibacterial soap that I use on the body without having to worry about the dehydrating effects of harsher chemicals. I find that flushing the nasal cavity with a light stream of water helps to flush the mucous out. This mucous holds bacteria, which can be a source of odor if not removed. Make sure you're satisfied with the features prior to injecting, as this solution will fixate the tissues quickly. Filling out cheeks or lips after injection will be more difficult than with a standard case.

Head Injection

The first injection will be a bi-lateral injection (sometimes called restricted cervical injection) using the carotid arteries.

Make the following solution:

- 20 ounces Introfiant (arterial)
- 10 ounces of Rectifiant (water corrective)
- 10 ounces of Restorative (humectant)
- 10 ounces of Metaflow (co-injectant)
- Arterial dye is at the discretion of the embalmer.
- No water needs to be added for the head injection.

There should be no need to drain blood during the head injection. By embalming the head first, we've decreased the chance of swelling (but always be cautious and monitor). I inject at a moderate/high pressure and a slow rate of flow, somewhere around 6-8 oz. per minute. You should always be massaging the face/head while injecting. As with every embalming, pay attention to the color and texture of the tissue, as well as the fixation, to confirm distribution. Every case is different but it's not uncommon to have the head completely embalmed and still have half the solution unused. Go with your own judgment and experience. After the head has been embalmed, tie off the ascending arteries.

Body Injection

Before injecting the body we need to open the jugular vein and establish drainage.

Make the following solution:

- 48 ounces Introfiant (arterial)
- 48 ounces of Rectifiant (water corrective)
- 24 ounces of Restorative (humectant)
- 64 ounces of Metaflow (co-injectant)
- Phenol* (4-6 ounces of a phenol-based cauterant)
- Add enough water to make 2 gallons of solution.
- Arterial dye is at the discretion of the embalmer. Keep in mind that the phenol is a bleaching agent and may bleach out some of the color over time.

**You might want to check the warranty on your embalming machine; some manufactures will void the warranty if you use a phenol-based fluid in the machine. The warranty on Dodge Embalming Machines does become void if phenol is used in the machine. Phenol can be omitted from the recipe if unable to use.*

Make the body solution as many times as needed. As with every embalming, the body will dictate how much total solution will be injected. With the carotid arteries already raised it makes sense to use them as the primary injection point for the body. If this were a standard case we could embalm the entire body using only the carotid artery but with long-term embalming it will be necessary to use a six-point injection, using both femoral and axillary arteries. Don't forget to tie off the vessels after injection to keep the vascular pressure. Injecting six points does add extra steps to the embalming process but for long-term preservation it pays dividends.

Hypodermic Injection

For some embalmers the idea of hypodermically injecting for preservation is akin to being lazy, or taking the easy way out. When thinking about "long-term embalming," hypodermic injection is essential. You should always hypo the gluteal region, taking advantage of the already open femoral incision and hypo from within it.

The laws of nature dictate that fluid will follow the path of least resistance. This also holds true when applied to arterial embalming. With the entire weight of the body on the gluteus, it is often not well-embalmed. By hypodermically injecting (even over injecting) the buttocks, we are actually helping the entire body achieve better preservation. When hypodermically injecting the buttocks you increase the vascular pressure of the entire body, not just the gluteus. There are benefits to hypodermically injecting via the femoral incision. It offers easy access to several regions of the body (buttock, groin, thigh). You also get the benefit of multiple hypo-preserved regions without making more holes. If the feet have not received an adequate amount of vascular distribution, be sure to hypodermically inject the feet (via the toes). To hypodermically inject the feet consider using a 6" 20-gauge needle. Inject the toes first, then push the needle deeper and treat the foot as needed.

If the hands require treatment I follow a slightly different protocol. I raise the radial or ulnar arteries and attempt to inject the hands arterially first. If arterial injection does not preserve, you can hypo the hands and fingers via the same incisions. For this hypodermic treatment I use a 10", 13-15 gauge needle. By using a 10" needle you should be able to reach the fingertips on even the longest of hands from the radial or ulnar incision. If you're careful it's possible to guide the needle under the skin and across the palm into each digit separately. I guide the needle into the tip, then slowly inject

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and pull the needle back towards the base of the finger in a controlled motion. After all of the fingers have been injected, you can treat the palm in the same manner. Since we are using the radial or ulnar incisions for hypodermic treatment there are fewer leakage points to worry about.

Aspiration

When embalming a body long-term, don't be in a rush to aspirate. By simply putting it off for several days (or weeks) you will give yourself a better chance of achieving adequate preservation. If we think about it, it makes sense. You should not be in a rush to destroy the vascular pressure you achieved with the long-term embalming. Besides, if were talking about a body that won't be going anywhere for several months, what's the rush? I became familiar with this concept when I started to embalm cadavers. With anatomical embalming the process generally takes several days. I can't tell you how many times I've left after the initial injection unimpressed with the results only to come back the next day to see the embalming fluid had spread throughout the entire body. There were times when it was so pronounced that I thought my associates had already done the second injection before I arrived. In reality the only difference was allowing the vascular pressure to equilibrate the fluid.

After aspirating I would encourage using a quality cavity fluid. For long-term cases my first choice is always Basic Dryene. I know it's not marketed as a cavity fluid but I can't say enough good things about phenol and its ability to dry and neutralize our gut flora. I've also used Dri Cav with excellent results as well.

Storing Long-term Embalming

Once the body has been well-embalmed you've put a stop to decomposition. Congratulations! Your new enemies are going to be dehydration and mold/fungus. By storing properly you can overcome these two obstacles as well. One of the natural functions of skin is to release moisture (16 ounces per day in the living). If you've ever seen a mummy, you've seen how extreme dehydration can get. Arterially we've helped hydration by adding a humectant to our solution. Now we need to store the body in such a way as to minimize dehydration.

Try storing the case in a heavy-duty body bag that is as close to airtight as possible. When positioning the body for long-term storage it is not necessary to use body blocks. Actually, using body blocks could cause the unsupported parts of the body to start to sag and deform over time. There is no need to refrigerate the body. In fact, storing a body in refrigeration will speed up the dehydration process (I know this goes against common opinions within the industry). I also drape a sheet of plastic over the case within the body bag to lessen the chance of dehydration. Put a liberal amount of massage cream on the neck, face, and hands. Don't forget to brush massage cream into the hairline and ears as well. You should put a coat of sealer on top of all suture points. Depending on the viscosity of your sealer you may need to put several coats to give the exposed tissues a protective layer.

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Mold and fungus are big concerns when dealing with bodies that will be held a long time. Inside of the body bag you should sprinkle a liberal coat of Action Powder. I usually put about a ½ cup of it on the bottom of the bag prior to putting the case in. I also sprinkle some of the powder on the body (not the face) after being placed inside the bag. Rub at least a ¼ cup of powder onto each foot (make sure you get in between the toes). If done correctly, you should have crystallized powder coating the feet. It should keep mold and fungus from growing out of control when storing the body.

Fungus is a common occurrence for the living. In the living we call it tinea pedis or onychomycosis (athlete's foot or toenail fungus). The problem arises in death because the fungus is still alive and feeding on the nails and skin. Unchecked it can cover the entire foot and spread to the rest of the body.

Make sure to check the body once a week for the duration of the storage. If the body releases excess fluids into the bag you should aspirate it out. I don't cover the body with a sheet or hospital gown when storing long term. Any cloth that comes into contact with the body has the potential to wick out moisture. Instead I cover the body with a plastic sheet inside of the body bag. I also mist the body down with a humectant (Restorative-undiluted) as the final step. Dodge's new Anatomical Wetting Solution (AWS) can be used in the same manner as the undiluted Restorative and will inhibit mold growth. If you keep the body well covered you should not have to mist it very often. Make sure to check feet during your weekly inspections, as that is the primary location for mold and fungus to start.

Final thoughts…

- As time goes on you will need to supplement the treatments. If the face absorbs the massage cream, apply more. If you find soft spots, hypo with additional embalming fluids.

- Prior to viewing, remove the body from the body bag and wash thoroughly to remove any chemical odor.

This article is a guide only. That being said, I will be the first to agree that there are many variations that would work equally as well and possibly even better. Feel free to have a difference of opinion.

Steven Labrash, CFSP, works at the University of Hawaii as the Director of the Willed Body Program. Steven's passion has always been preservation and as an anatomical embalmer and plastinator he enjoys the opportunity to improve the science of preservation. Steven is a faculty member with the John A. Burns School of Medicine in a tenure track position as a Junior Specialist Professor. Steven is a member of the American Association of Clinical Anatomist (AACA) and the International Society for Plastination (ISP).