Solutions and Dilutions

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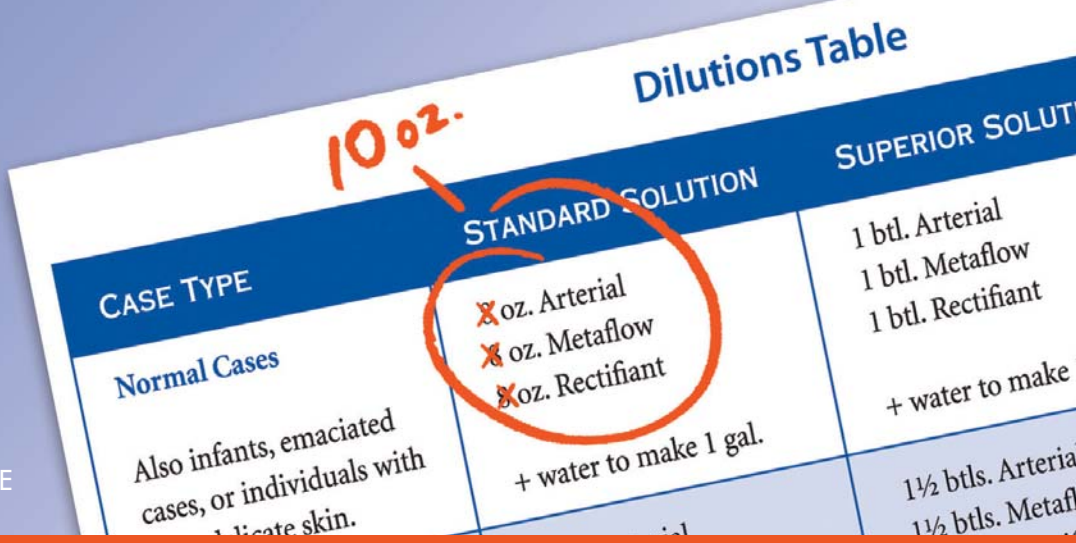

We hear a lot about increases in life expectancy and medical advances increasing even faster. The average life expectancy for the US in 1900 was 47 years of age with only one person in 25 ever reaching the age of 60. The Centers for Disease Control reports that in 2010 the life expectancy was a record-breaking 78.7 years[1]. This sounds very impressive but if you check a study put together by the U.S. National Research Council[2], you'll see that out of 16 affluent nations, the U.S. male life expectancy is 75 (the lowest in the 16 nations studied), and 81 for females, higher only than Denmark in the study. The U.S. may be wealthy but not healthy.

The problem has little to do with the health system but more to do with American habits and risk factors. High calorie diets, drug use, including prescription drugs, not using seat belts, and violent deaths with guns are all factors mentioned in the study. The U.S. spends much more than other nations on health care but we don't live as long as some of our European friends[3]. The effects of prolonging life, and death, are commonly seen in the difficult cases of today. This is an era of medical miracles and advanced chemotherapeutic treatment allow people to live longer, but also can have negative effects on organs and tissue. We all know by now that embalming isn't getting easier!

Even experienced embalmers are changing their ways and procedures and intensifying their solutions to deal with all the difficulties. Most embalming failures are generally due to underestimating or not correctly evaluating the condition of tissue.

Importance of Pre-injections and Co-injections

In Robert Mayer's book, "Embalming – History, Theory, Practice" (Fifth Edition, 2012, Chapter 23) it notes that drugs, chemotherapy, and drug addiction cause damage to the organ systems. Malfunctioning of the systems cause nitrogenous wastes (ammonia) to build up in the tissues, making them moist and spongy. This build-up also neutralizes our preservatives. There is no better way to neutralize formaldehyde than to interact it with ammonia. A large proportion of formaldehyde will be neutralized when it comes in contact with the nitrogenous waste in the body. Old standard solutions won't be sufficient to preserve these cases.

Pre-injections and co-injections are very valuable tools to overcome the negative effects of drug therapy during embalming. Drug therapy decreases the permeability of the cell membrane. The passages of the membrane become clogged and calcified by the presence of antibiotics and chemotherapy drugs. Metaflow dissolves blood clots and circulatory obstructions and also helps to open the pores of the cell membrane. Rectifiant makes water more effective for embalming and decalcifies the cell membrane. It neutralizes the negative effects of drugs on the embalming solution and helps distribute the preservative evenly to the deep tissues. This powerful delivery system of Metaflow and Rectifiant will break into and enter the damaged, calcified cell membrane. This action is what is necessary to deliver the stronger solutions that are needed to preserve the difficult drug affected cases of today, crossing cell membranes to achieve a well-embalmed body.

Even experienced embalmers are changing their ways and procedures and intensifying their solutions to deal with all the difficulties. Most embalming failures are generally due to underestimating or not correctly evaluating the condition of tissue. There was a time when eight ounces of a 24 index arterial chemical per gallon of solution would be enough preservative to treat the average or "normal" case. Since then, the average case has all but disappeared.

Older dilution tables begin with using minimums of eight ounces of arterial preservative per gallon solution. Today many recommend starting with 10 to 12 ounces of preservative per gallon and using higher indexes. This solution would be altered to make stronger as needed during the embalming depending on the case. It is not unusual for a remains to have two or three different types of tissue composition. This type of problem can be solved by treating each part of the body according to the condition of the tissue. One obvious sign to look for would be the fluid content or fluid retention in the tissue.

There are times when fluid content of tissue is higher than normal causing spongy tissue. The elderly and debilitated will lose muscle tissue, decreasing protein levels, and this spongy tissue

almost looks normal in size but because the muscle is deteriorated, it is very difficult to firm and preserve. Sometimes size and body weight remain semi-normal but tissue condition changes from muscle (protein) to spongy tissue with higher fluid content. Of course, edema is excess fluid in the tissue and some parts of a remains can have severe edema while others may look emaciated. Patients experiencing organ breakdown will commonly have swollen arms or legs. The circulation can be blocked in the right leg causing the leg to have extreme edema. A normal solution won't be adequate to dry and preserve this leg.

Perhaps you've had a family member hospitalized and during your visit you noticed an uneven swelling of tissue. An uncle of mine had muscle loss and, with the drug therapy he had undergone, his tissues became spongy, holding more fluid without appearing distended. If he napped for a while and laid the side of his head on the pillow, he'd wake up and have the pillow side swollen with fluid that gravitated and settled to that side of his head. When death occurs with such cases, the embalmer is faced with remains that consist of multiple types of tissue moisture that will call for various treatment and solution strengths to adequately treat the various body tissue to insure preservation. This type of condition may call for a stronger solution being injected to one side of the head where the fluid and moisture is collected.

Post embalming BLISTERING: This condition is becoming more and more common. It goes back to, once again, underestimating the fluid content or condition of tissue. When evaluating tissue, we must not only look at it but we need to feel it. You don't need to have severe edema or distension of moisture in the tissue to cause blistering. We can avoid post-embalming blisters but only if we are aware of the potential negative condition. The use of stronger solutions to individual body parts that need it, and adding Edemaco, can wall-off moisture, and prevent leakage, odor and decomposition. With edematous cases, and even those cases where moisture doesn't look severe but the tissues are moist and spongy, the fluid content will always settle or gravitate to the dependent body parts.

With casketed remains, blisters occur on sidewalls, buttocks, and the back of the legs or arms. If you suspected possible blistering during your final tissue evaluation, you most likely used protective plastic garments wherever needed. It is important to also place a drying preservative compound inside the plastic to absorb any dehydrating liquids and to absorb any liquids from blistering or lesions. I prefer to use VP (Viscerock Plus) inside of the plastics. This product will not only absorb all liquids but it will also penetrate and embalm moist tissue.

If no preservative absorbent is used to treat the liquids in the plastic garments, condensation and fluid build-up will begin to accelerate decomposition and the fluid will find its way outside of the plastic garments and cause leakage and odor problems. Leakage and odors may also be labeled mental anguish that can trigger some unnecessary legal actions. We can prevent the majority of blistering but when it does occur, we need to treat it and stop it. In the end, all cases must be made leak-proof.

Another condition that seems to be reappearing with a vengeance is tissue gas. This condition is caused by the Clostridium perfringens spore found in the gastrointestinal system. Weakened immune systems allow these organisms to thrive. It is not uncommon to make a removal of a remains that died in the morning and the removal is made, let's say, early afternoon and to find the abdomen to have a trace of green and distension. A green abdomen would be one of the first signs of decomposition or even tissue gas. A preventative measure would be to add 16 ounces of Dis-Spray to each gallon of strengthened arterial solution to deactivate the Clostridium spore.

Most tissue gas cases are discovered the day following the embalming. Hopefully you've realized it before the family arrives for the service. It's not a good way to start your day when you check on the remains in chapel A that is scheduled for a 10 a.m. service and you discover the right eye is swollen up to a size larger than a golf ball. If so, you'd need to deactivate the tissue gas fast and remove the swelling by channeling, swabbing and treating the eye and surrounding tissue with Basic Dryene.

Tissue gas has an attraction to the brain. If tissue gas is present in the body, most likely it will spread to the brain and the first sign is generally swollen eyes. There is a foramen (or opening) where the optic artery and nerve pass through the cranium which allows the gas to pass through from the brain to the eyes causing them to swell and protrude.

Sometimes a minor separation of connective tissue under the eyelids will be needed to access and swab the inner tissue with Basic Dryene or a phenol-based product. Hypodermic treatment may be necessary to insure the spore is deactivated. If you channel the gas out but it returns, the bug is still alive and active so more hypoing will be needed.

If you are familiar with what to do and have the courage to step up and do it, this procedure could save the day and keep the casket open. If you're not familiar with what to do, it may be a very unpleasant experience for the family and funeral home. If one can recognize the potential for gas developing, steps can and should be taken to prevent these embalming failures. Further information about preventing and treating tissue gas can be found in the *Dodge Magazine* article, "Tissue Gas Alert." (Fall 2010)

All cases should be evaluated after injecting each gallon. You will inject more, of course, but it's a good idea to check after the first gallon and make adjustments as needed. We should begin to see some results besides color change. Making a solution stronger or adding buffers and humectants can be done during these tissue checks. Feeling or

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touching tissue is a must. Protein in the muscle tissue will begin to react to the preservative. Utilizing restricted drainage will insure fluid distribution to the deep tissues.

Normal case: What is normal anyway? This type of case has all but disappeared. Maybe we should say a case that appears to be normal. The tissue appears to be normal, or at least not edematous, emaciated, or spongy. This type of case isn't common but occasionally they will surface. We won't find out the effect of our preservatives until injecting at least one gallon of solution.

After practicing some restrictive drainage during the injection we should begin to see true results with actual tissue changes and not just surface skin color. Again, delivering the preservative to the deep tissue is what insures a good embalming. Bodies containing low protein levels and abnormal excess of nitrogenous waste or with spongy tissue will demand stronger solutions with co-injections that neutralize the negative effects on the calcified cell membrane and allow for even distribution of our preservative to the deep tissue. There are no better pre-injection and co-injection chemicals than Metaflow and Rectifiant.

The days of pre-mixing fluid and not making necessary adjustments throughout the embalming are over. The use of Metaflow and Rectifiant and utilizing restricted drainage are all parts of delivering our preservatives to the deep cell level and insuring trouble-free embalming.

Let's take a look at some guidelines for some common cases. Following is a dilution table for all Dodge Arterial chemicals. The index of the chemical would be adjusted by the embalmer as needed.

Charts or solution suggestions are merely guidelines to help the embalmer decide dilutions after he or she makes the analysis of the case at hand. Injecting one gallon and following up with an examination of tissue condition will dictate our changes in our dilution game plan. Changes in the strength of the solution can be made if necessary. This common adjustment may be the most important part of embalming the difficult cases of today. The days of pre-mixing fluid and not making necessary adjustments throughout the embalming are over. The use of Metaflow and Rectifiant and utilizing restricted drainage are all parts of delivering our preservatives to the deep cell level and insuring trouble-free embalming.

Embalming success is not sold in a bottle of chemical. Success is in the hands of the embalmer who is able to use the chemical, make adjustments, and implicate techniques to insure complete distribution of the chemical being used. These basic embalming adjustments of changing dilutions, raising arteries, and using restricted drainage are more important today than ever.

Dilutions Table

Case Type	Standard Solution	Superior Solution	Waterless
Normal Cases Also infants, emaciated cases, or individuals with thin, delicate skin.	10 oz. Arterial 10 oz. Metaflow 10 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

Jack is Dodge's busiest embalming educator and lecturer. Along with working for Dodge as a sales representative in northern Illinois, he is an Embalming Lab Instructor at Worsham College.
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References:

[1]Centers for Disease Control and Prevention, 2010 Life Expectancy study

[2]New Scientist Magazine, January 2013, Issue No. 2900 - National Research Council Study

[3]The Atlantic Magazine, Derek Thompson, "10 Ways to Visualize How Americans Spend Money on Health Care," March 19, 2012