



Green Solutions Group, LLC

Safest Choice...by Design



GreenMBalm™ Protocol Surgical Training Fluid

Embalming Process

The following protocol for a non-toxic surgical training embalming is designed for an optimal result using the GreenMBalm™ Surgical Training Fluid to ensure saturation of the tissues. Embalming a surgical training donor is a 3-step process as described herein.

Prior to beginning the embalming process, ensure the cadaver is taken from the cooler and allowed to thaw to room temperature. Selection of the donor is critical. It is recommended the donor weight not exceed 150 pounds. Ideally, the donor should have a BMI under 27 with no pathologies that would limit distribution and diffusion of the fluid, and no damage to the anatomical structures for surgical training. This step is important as cadavers prepared using Green Solutions Group (GSG) STF can be repurposed for additional surgical training sessions versus a one-session training from using a fresh frozen cadaver.

Step 1

The first step in preparing a surgical training cadaver is to clear coagulated blood from the vascular system. Use GreenMBalm™ non-toxic Pre-Injection Fluid (PIF) to flush coagulated blood from the vascular system. This is accomplished by mixing one (1) 16 oz. bottle of PIF with one gallon of water. It is recommended to use a total of three (3) 16 oz. bottles with three gallons of water as the pre-injection flush. When proceeding with this procedure, a single-point injection method is preferred by injecting 2 of the 3-gallons of PIF into the carotid artery at 40 PSI and about 15-20 oz/min (600 ml/min) and the fluid enters into the circulatory system and the system is closed, the vein should not be opened for drainage, no other vessel should be isolated nor cannulated. Adjust flow as needed in order to see proper vascular distention in the superficial vasculature (through the skin). It is recommended to let the PIF remain in the closed system for approximately 45 minutes.

Step 2

The second step in the process is to preserve the human brain. Drill a small hole in the superior sagittal sinus and use a drill bit that is rated for metal, and clear hair and tissue from the drilling area to ensure that the bit does not get tangled while you are working. Upon completion of drilling the hole, use a hypodermic needle and inject approximately 48 cc's of GreenMBalm™ long-term anatomical preservation fluid directly into the brain. This will preserve the brain for long-term use.

Another method to preserve the brain is to introduce a canula into the opening and injecting the brain using the embalming machine. Set the pressure to about 10 PSI and flow to about 5oz/min. Inject, remove the canula, allow fluid to drain out of the hole, and continue to do this until there is no longer blood in the returning fluid. In this method, you will use approximately 8-16 oz of GreenMBalm™ long-term anatomical preservation fluid. Close the drill hole with a trocar button to allow the brain to profuse with the fluid or elevate the donor's head to allow gravity to keep the fluid inside of the

cranium. After the cadaver is finished being used for surgical training, the brain can be extracted from the cranial case and be used for pro-section.

Step 3

The third step is to allow for as much of the PIF and blood to drain from the cadaver prior to embalming. This is accomplished by opening the closed system and introducing pressure from the embalming machine to flush the PIF from the cadaver. While injecting the final gallon of PIF, open the jugular vein to encourage draining of as much blood as possible. Once the final gallon is injected, allow the donor to sit until the drainage has stopped, re-close the system by ligating or clamping the jugular vein. Proceed with the embalming process by injecting 4-gallons of GSG's ready to use STF fluid. The viscosity of the STF is such that it will penetrate the tissues much faster than standard embalming but will not give the same "tell-tale" signs of completion that you get with formaldehyde. Rather than looking for firming of tissues, look for fullness of tissues. The size of the body will increase throughout injection, leading to a feeling of fullness in the tissues. This will be the main indicator that you are getting proper distribution and diffusion of the STF.

Upon completion of the embalming process, allow the donor to sit for 1-2 weeks, if possible before using it for surgical training. The longer the donor is allowed to cure, the better the preservation will be. The results you will see will be different than standard formaldehyde embalmed donors. You will see a considerable increase in the pliability of the tissues, as well as retained tissue coloration. Seeing red muscles, and properly colored organs does not mean they are not preserved. It is simply one of the benefits of the STF solution. This embalming process uses only non-toxic chemicals to preserve surgical training cadavers.

GSG also created a method whereby the circulatory system is charged, and a proprietary solution is introduced to the system that simulates blood, making the surgical experience even more realistic. In order to accomplish this, once embalming has been completed, keep the embalming cannulas secured in the carotid artery (or artery of your choice). You will want to re-open the jugular vein and insert a drainage tube. The drain tube should be connected to a drainage hose, which should empty into a 5-gallon carboy, which can be used for waste removal after the session. Mix 3-gallons of GSG's recharge fluid into the electric embalming machine. Set the pressure to about 20 PSI and set flow to med-low or about 15-20 oz/min (600 ml/min) (you may increase flow to proper vascular distention) and then set flow to the pulse setting. Keep drain tube closed until the vasculature has distended and open drain tube to allow the

release of some vascular pressure as needed. You may keep the machine going or turn it on only during the procedures.

This protocol is not achievable when the body has been embalmed with a formaldehyde and phenol solution, as the blood will harden, leaving vascular blockage and the vasculature dehydrates, making re-vascularization very difficult. This protocol is conducted optimally in conjunction with preservation with GreenMBalm™, as the vasculature remains elastic, and the proprietary formula hinders coagulation and vascular blockages.