

OVERVIEW

This guide walks through preparing a RediStik modular ECMO training model for use, priming it, running a simulated cannulation, and caring for the model afterward so it lasts for repeated training sessions. This guide covers use of a 500-301 series neck module, paired with either a 501-201 rigid clear heart module, or a 500-201 series chest module. The procedure is specifically written to cover cannulation with a dual lumen ECMO cannula, but the assembly and priming process is the same if simulating any other CVC.

COMPONENTS REFERENCED

- Neck model with jugular vein and carotid artery
- Clear rigid heart with internal chambers

OR

Chest model with internal heart structures (right ventricle, tricuspid valve, right atrium, inferior vena cava, simulated hepatic veins and abdominal aorta)

- Two model bases with rotational locking mechanisms
- Valved manifold (attaches at the proximal end)
- Y-shaped manifold with clear tubing (attaches at the distal end)
- 1000 mL IV bag
- Collapsible IV tower with base
- Included lubricant (soap) for larger or rougher-surfaced devices
- A 22-gauge needle or similar, useful for venting trapped air during priming

NOTE: Replacement parts available at www.sawbones.com

INITIAL ASSEMBLY

1. Use forceps and ultrasound gel or non-foaming soap to pull jugular and carotid vessels through the neck tissue. Leave at least 1½" on the distal end.
2. Align the jugular vein with the larger barb on the heart or chest. Stretch the tubing over the barb by pinching one side of the jugular vein, and pulling it wide to get it started. Then use friction to work it up and around until it's fully seated at the shoulder of the barb. A little isopropyl alcohol or water on the barb can help it slide on.

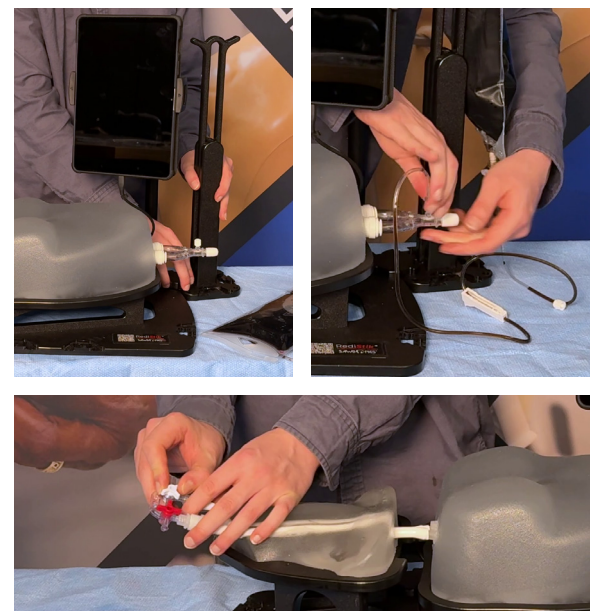


3. Repeat the same process for the carotid artery, working it up the barb until fully seated at the barb shoulder.
4. Lock the two model bases together: align the cog-shaped outline (the bases are numbered to help with orientation), insert the rotational lock, and rotate it clockwise until it's tight. The bases should act as one solid piece.
5. Pinch the jugular vein and carotid artery at the heart barb and pull each tight by tugging on the proximal ends to remove any kinking within the tissue — the pinch is just to confirm they won't slip off the barb while you're working.
6. Take the barbed valve manifold (with all pieces already attached) and connect to the proximal end of the vessels installed in the neck. The carotid artery and jugular vein should both be installed the same way they were connected to the barbs on the chest.
7. Install the Y-shaped manifold, luer port upwards, in the push-disconnects at the distal end of the chest or heart model— give it a firm push to make sure it's fully seated, ~1" of tubing should be inserted into the connector.
8. The model is now assembled and ready to be primed.

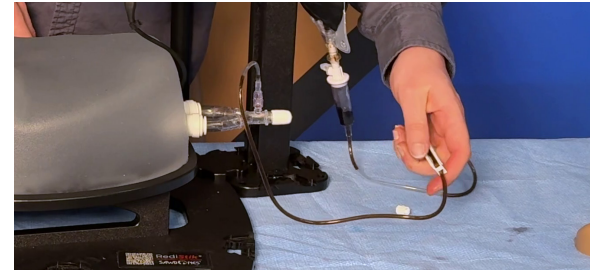


PRIMING THE MODEL

1. Set up the collapsible IV tower: pull it out to the frontal convex side, slide it up, and lock it in place at its maximum height. This will help prime the model, but it can be adjusted later for desired flash and bleeding.
2. Connect the base of the IV tower to any desired position on the model bases. Note that the base has an opposite concave side and a convex side, with two straight sides in between — pay attention to orientation, and match the curve to the curve of the model base as necessary.
3. Connect the line from the filled IV bag to the distal manifold, by removing the cap on the top. The roller clamp should still be closed at this time.
4. Ensure the proximal manifold has one valve open to atmosphere, and the other open in a loop — this lets air escape as fluid moves through the system.

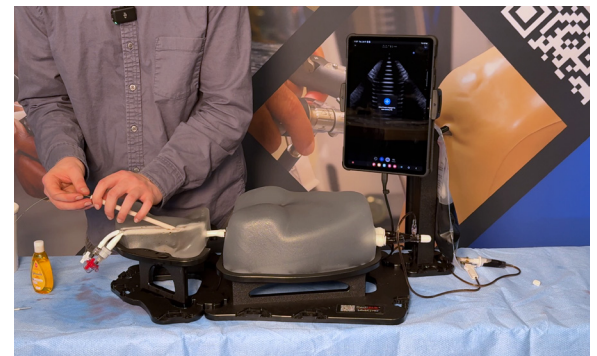
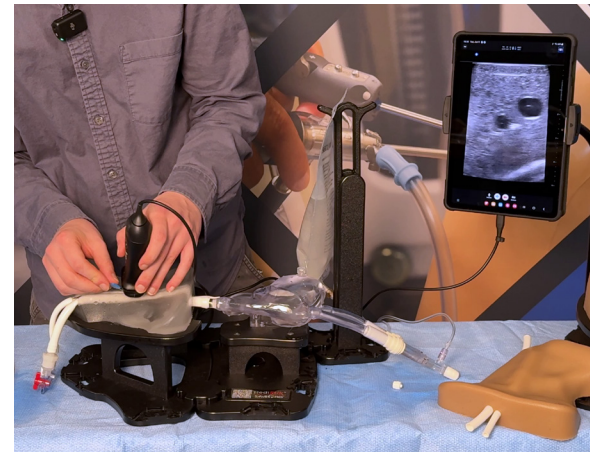


5. Open the 1000 mL IV bag roller clamp and let flow to begin through the model. This can take a little time; lifting the bag from the tower gives extra head pressure if you want it to prime faster, but it will take time for the heart anatomy to fill it's internal volume regardless.
6. Tilt the model to ensure the proximal end is the highest point of the system, and trapped bubbles move their way up through the jugular vein and carotid artery. Disconnect the IV tower if necessary to prevent collapse at the chosen position. An extra set of hands is recommended for this step, especially if using the chest model.
7. If using the clear rigid heart, or a clear chest, you'll be able to visually see fluid fill the system. This can help you with determining the correct angles to hold the model at. If using an opaque chest, it is more difficult; follow the angles shown in the pictures.
8. If using a model you can see into, watch the internal heart cavities fill. Wait until fluid starts to leak from the proximal manifold, close the valve to make a loop and lower the IV bag.
9. A large air bubble in the ventricle, identified under ultrasound or visual inspection in a clear model, is expected and normal. Tilting the model properly can help reduce this, but there are built in methods to aspirate.
10. For both models, leave the IV bag elevated and open, to ensure pressurized fluid will push out the air.
11. If using the rigid heart, simply unscrew the luer cap over the right ventricle, and let all the air vent until fluid starts to leak before replacing the cap.
12. If using the ultrasoundable chest, locate the dimple on the bottom of the left pectoral. This is placed directly over the left ventricle, the location air collects within the model. A flashlight can also help reveal the bubble in clear models.
13. Insert a long, thin needle (22 gauge) with a syringe at that dimple, going in perfectly vertical, deep enough to reach the ventricle.
14. Draw fluid into the syringe as you back the needle out of the model. You should be able to remove air, without creating a vacuum in the syringe chamber. Once the needle is fully removed from the model, discard collected fluid.
15. Repeat the two steps above until the syringe is only pulling water, rather than air; and you can no longer scan or see a bubble within the chest.



RUNNING A SIMULATED ECMO PROCEDURE WITH DUAL LUMEN CANNULA

1. Apply ultrasound gel to your insertion area on the neck, as well as the ultrasound chest if it's in use. The tissue skin is low enough friction that a small amount of water can also work in place of ultrasound gel.
2. Identify relevant anatomy in the neck, as well as the internal anatomy of the chest if using.
3. Use the probe to follow the jugular vein and carotid artery down the neck to plan the needle insertion point.
4. Track the needle tip under ultrasound as it advances above the jugular vein, then puncture the vessel. You should see flashback, with the amount depending on how high the IV bag is set — lower the bag if you want less bleed-back.
5. Introduce the guidewire through the needle and track its tip with the probe all the way through the neck, following it visually if using the rigid heart, or under ultrasound if using the chest. If the wire enters the ventricle instead of the inferior vena cava withdraw the wire and reposition — this is a normal part of simulation practice.
6. Continue advancing the wire down the IVC to the required positioning. In the chest, simulated hepatic veins branch off here, so make sure the wire doesn't get caught in one of them.
7. Once the wire is correctly threaded, insert the dilator (or cannula). The tissue accepts a cannula up to 24 French. The tissue doesn't require dilation prior to cannulation, but it should be done as a training exercise.
8. Though clinically using a blade to make an incision is routine, with this model any cuts void the warranty and shortens the tissue's usable lifespan. The self-healing properties of Resonance™ tissue rely on punctures rather than incisions. If using a particularly large or rough device, lubricant is strongly preferred.
9. Track the cannula under ultrasound, then visually inspect the cannula as it advances into the heart, and position it as needed for the simulation you're running.
10. If using an ECMO circuit in conjunction with the simulator, you can use ultrasound to see the tricuspid leaflets move under induced flow, or Doppler to check flow through the chambers and vessels.
11. When finished, remove the cannula (or dilator) and the wire rather than leaving them inserted in the tissue to better preserve the model for future use. The severity of needle tracks is directly proportional to the length of time the tissue is dilated for.



CARE & MAINTENANCE AFTER EACH USE

1. Remove the catheter as soon as you're finished with the simulation — leaving it in place for extended periods can permanently deform the tissue.
2. Inspect the insertion site. You should see only very small remnants of the needle track (a 24 French dilator, for example, leaves minimal marking), and it should not be actively bleeding. Consider replacing tissue or vessels if necessary.
3. Vessels are expected to last 5-10 uses and the tissue 20 with large devices and aggressive technique.
4. Suture the insertion site if desired for training.
5. Drain and flush the model.
6. Clean any applied gels or dressings from the surface.
7. Leave the model dry if waiting for its next use, or deconstruct it to your facility's routine.
8. Performing the setup steps in reverse order is sufficient.
9. Ensure the locking rings on the push-disconnects at the distal end of the chest are pushed in to remove the distal manifold.

STORAGE INSTRUCTIONS

- Clean any gels, dressings or other materials on the tissue surface.
- Fully drain and flush the model before storing it, especially if any chemicals were used during the session.
- Lower the IV tower and disconnect all bases.
- Store the model flat or in a supported position that avoids putting tension or bending stress on the tissue, vessels, heart, and manifold connections.
- Keep it in a cool, dry place out of direct sunlight.
- Protect the tissue and heart from punctures, compression or abrasion; consider storing in a case, bag, or padded container if one was provided.
- Keep track of approximate use counts for the tissue and vessels so you can anticipate when they'll need replacing (see lifespan note above).

REPLACEMENT PARTS (WWW.SAWBONES.COM)



500-301-30

Ultrasound Internal Jugular and Carotid Cannulation Module, Clear Tone



500-301-32

Ultrasound Internal Jugular and Carotid Cannulation Module, Medium Tone



500-201-30

Ultrasound Right Heart Chamber and Valve Visualization Module, Clear Tone



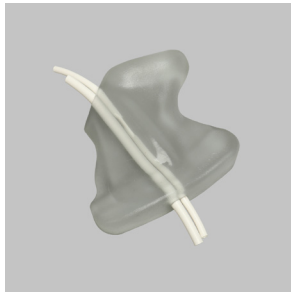
500-201-32

Ultrasound Right Heart Chamber and Valve Visualization Module, Medium Tone



501-301

Clear Heart Visualization Module



525-301-30

Ultrasound Internal Jugular and Carotid Cannulation Replacement, Clear Tone



525-301-32

Ultrasound Internal Jugular and Carotid Cannulation Replacement, Medium Tone



599-50-3

Ultrasound Internal Jugular Vessel Replacement



599-50-4

Ultrasound Carotid Vessel Replacement