



## **Sim\*Cath**

### **Central Venous Catheter Insertion Tray**

#### **Suggested Exercises**

The use of central venous catheters has been around since 1949 when Duffy reported in the *Annals of Surgery* about the use of polyethylene tubing in the femoral and jugular vein as an alternative to peripheral intravenous lines. In 1952, Aubaniac added the technique of subclavian vein puncture to our armamentarium of large vein access. In the 80's, multilumen catheters were popularized and in the early 90's came the use of ultrasound to assist in the safe visualization of veins. Today, central lines are a ubiquitous component of a busy intensive care, oncologic, renal, and nutrition clinical service. However, as with most invasive medical techniques, complications can occur in the insertion of these devices, some of which can lead to catastrophic consequences. The advent of patient safety initiatives dictates that each practitioner must achieve a minimal level of competency prior to credentialing. In our current environment that mandates patient safety, learners are no longer able to "practice" on patients. To provide a safe learning and practice environment, many models for the practice of central venous line placement have become available and have been used to successfully train future proceduralists in these techniques.

**Sim\*Vivo** is proud to be involved in this training environment and is providing an economical CVC insertion kit that will allow each learner to become familiar with the standard needles, wires, dilators, and catheters that are typically used in central venous catheter insertion procedures. We believe that each learner should be provided with her or his own kit in order to allow a thorough exploration of the device followed by extensive practice in the sequence of insertion.

In order to help each learner in this task, we are providing some exercises that will familiarize you with the standard kits. Some of these exercises seem kind of silly but, when you're trying to put one these lines in a "crashing" patient, you might appreciate some of skills that you acquired during your practice sessions when the "pressure was off." As with all Sim\*Vivo modules, we believe that your initial practice sessions should be supervised by a highly qualified mentor. The purpose of these exercise guides is to provide you some goals for practice that will allow you to become an expert in the use of the equipment.

Before we begin, please note that this equipment is not sterile and cannot be used on humans and animals. The FDA would be pretty upset with us if that occurred. Of equal importance is the fact that this equipment has sharp needles and scalpels that could harm individuals who are not facile in their use. If you take this module to a learning environment where non-medically trained individuals or children are present, please take great care to keep it out of their hands. *Please be safe with the use of this module!*

OK, let's get started ...

In the clinical situation, you will start by defining the indications and contraindications for your procedure, followed by an explanation of the procedure to your patient and the obtaining of the appropriate consents. You will want to make sure that all of your equipment and supplies are available close at hand. The patient must be positioned correctly. The antimicrobial prep procedure must be according to your protocol and draping must be extensive so that none of the equipment and supplies becomes contaminated. You will learn all of this in the simulation lab.

For the purposes of this exercise, we are interested in the actual puncture, wire placement, site dilatation, and catheter insertion. The kit that has been supplied to you is a “bare bones” equivalent of the one that you probably will be using in the clinical setting. This kit does not have the gloves, drapes, skin prep and local anesthesia which will be available when you insert these catheters in patients. However, what you have are the essential components necessary to allow you to become comfortable with the equipment and the procedure.

You can open the kit by pulling the corner of the paper cover. Remove it completely. Be careful not to turn the kit upside down when you do this or you will have all of the components strewn out over the bed and will look a little silly in front of the nurses ... just kidding.

Let's review what is in the kit:

- A five ml syringe and 22 ga needle – this is for the injection of local anesthesia
- A 4 inch 18 ga needle – this will be attached to the 10 ml syringe and be used to puncture the vein. The lumen of this needle is large enough to accept the J-wire that is used for the Seldinger technique
- A 10 ml syringe with a blue plunger – this is the syringe that will be used to aspirate blood when your insertion needle expertly punctures the vein. Note that the blue plunger has a hole in the middle of end. This allows the wire to be placed through the syringe and needle without the necessity of disconnecting the syringe and needle. Pretty cool! And it reduces the chance of bleeding out the needle and air embolus.
- A 0.035 J-wire – note how this is loaded in a circular plastic carrier. The end of the wire is covered with a plastic cap which will be removed prior to its use
- A 6 inch blue dilator. This has a hole in the center through which the wire passes (retrograde). If a vein injury occurs during the performance of this procedure, it is usually caused by the dilator. When used wrong, we call this: *an instrument of the devil!!!*
- A single lumen 14 or 16 gauge central venous catheter. Note the markings on the out side of the catheter. There is a ring every one centimeter from 10 to 20 centimeters from the tip of the catheter. These help you gauge the distance that the catheter is in the vein.
- A securing/suturing ring – this wraps around the catheter and allows you to suture it to the skin so it can't be pulled out later (an act that will cause major misery since you will be asked in the middle of the night to come in and replace it)
- A small scalpel to enlarge the puncture site to facilitate catheter insertion

There you have it. Before you practice on the model or phantom, let's try a few exercises to get you acquainted with the equipment. Most of this has to do with manipulating the wire and the dilator.

Let's start with the wire. Remove the guard. What you will see is the end of the wire in the form of a “J”. This shape can be straightened when it is put in a straight tube (like the needle or the

wire carrier) and immediately assumes the J-shape when it is released. The J-curve keeps the catheter from doing any mischief (like puncturing the superior vena cava and causing the patient to bleed to death ... just kidding) as it traverses the large veins and heart. Hold the wire carrier in your dominant hand. You will see that there is a flat area in the guard an inch or so back from the end. The wire runs right over this. With your thumb on this area, move the wire back and forth several times. OK ... that's not too hard! Let's try a few exercises. Check off the boxes when you have completed them:

Hold the carrier in your dominant hand. Using your thumb, bring the end of the wire back into the carrier so that only about 1 mm of the wire is exposed. Now, advance the wire about 20 cm as if you were advancing it into the vein. Repeat 5 times	<input type="checkbox"/>
Perform the above exercise with your non-dominant hand. Repeat 5 times. (Nobody said it was going to be easy.)	<input type="checkbox"/>

Now, let's practice putting the wire through the needle. Assemble the insertion needle and 10 ml syringe. Prepare your wire by pulling it back into the carrier with only 1 mm exposed beyond the conical end. Hold the hub of the needle with your non-dominant hand and twist off the syringe. Pretend that there is blood squirting at you and put your non-dominant index finger over the end of the needle hub. In your dominant hand, grasp the wire carrier and insert the cone into the needle hub (don't forget to remove your index finger first!), and advance the wire about 20 cm. Pull the wire back into the carrier.

Repeat the above exercise 5 times.	<input type="checkbox"/>
Switch hands: dominant hand on the needle hub and non-dominant hand on the wire carrier. Repeat 5 times.	<input type="checkbox"/>

There is another way to do this ... but you will have to check the kits in your hospital to see if blue-plunger syringes are available. This time, do not twist the syringe off the needle hub ... just leave them together. Again, prepare the wire carrier, by pulling the wire back until only 1 mm is exposed. Hold the syringe and needle in the non-dominant hand and advance the wire into the back of the syringe (that little hole in the middle of the blue plunger). Advance the wire about 30 cm. It will eventually come out the end of the needle.

Repeat the above exercise 5 times.	<input type="checkbox"/>
Switch hands: dominant hand on the syringe and non-dominant hand on the wire carrier. Repeat 5 times.	<input type="checkbox"/>

You've mastered the hard part ... just a few more things to practice. Remove the wire from the carrier. Hold the wire in your non-dominant hand and the blue dilator in your dominant hand. Put the non-J end of the wire through the forward end of the dilator and advance the wire into the dilator until it appears at the hub. Hold onto the wire and advance the dilator over the wire while twisting it with your fingers. As you practice this, remember that, at about this time, the patient will have some blood coming around the wire insertion site and there will be some PVC's and the nurse will be wondering why you aren't done yet ... for some reason this simple task of threading the wire into the dilator is always more difficult than it seems.

Repeat the above exercise 5 times.	<input type="checkbox"/>
Switch hands: dominant hand on the wire and non-dominant	

hand on the dilator. Repeat 5 times.	<input type="checkbox"/>
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Finally, the last exercise before going to the insertion models. Keep the wire out of the carrier. Grasp the distal end of the catheter and thread it over the wire. You will now advance the wire retrograde through the catheter (do not advance the catheter over the wire – that just won't work clinically). When the wire protrudes out of the hub of the catheter, grasp it and hold on tight. Now, advance the catheter over the wire (and presumably into the vein).

Repeat the above exercise 5 times.	<input type="checkbox"/>
Switch hands: dominant hand on the needle hub and non-dominant hand on the wire carrier. Repeat 5 times.	<input type="checkbox"/>

Put the wire back into the carrier by reloading it backwards through the conical end. The cap can be placed over the J-tip. Replace all the equipment into their slots in the plastic carrier.

Now, it's off to the insertion models ... have fun!



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**Sim\*Tie** – a complete module with all of the supplies to learn one-handed and two-handed surgical knots. Learn to tie in accessible and inaccessible areas.

**Sim\*Suture** – an inexpensive, complete module to learn simple, vertical mattress, and subcuticular sutures for skin closure. Contains suture board, instruments, suture, and guidebook.

**Bulk\*Suture** – high quality, inexpensive suture material sold in bulk. Available sizes include 3-0 nylon and silk with needles for closure training and long 2-0 silk with needles for extracorporeal laparoscopic knot-tying training.