



## Extra-Thoracic Subclavian Vein Access: The Tips And Tricks

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### Abstract

*The success of any trans-venous procedure involves the rate limiting step, which is the access. The procedure cannot be performed without the access site. It is the key that opens the success of the procedure. There are many procedures that require extra-thoracic subclavian vein. These procedures may include: central venous pressure monitoring, administration of multiple medications and drips, high volume/flow resuscitation, emergency venous access, inability to obtain peripheral venous access, repetitive blood sampling, administering hyperalimentation, vasopressors, caustic agents, or other concentrated fluids; insertion of transvenous cardiac pacemakers, hemodialysis or plasmapheresis and insertion of pulmonary artery catheters. In this review, we discuss the various techniques of accessing the vein and its tips and tricks..*

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### Keywords

extra-thoracic, subclavian, vein, tips and tricks.

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### Introduction

The subclavian vein is one of the central vein [1]. The others are internal Jugular vein, and the femoral vein where central venous access could be obtained [1,2]. An access is a rate limiting step to the various cardiac and peripheral interventions including cardiac devices implantation. A cardiac or peripheral intervention will not take place without an access [3-5]. The operator must be familiar with skills of various access, hence this review of subclavian venous access with emphasis on the tips and tricks. In the review, the focus was on identifying the anatomical structures pertinent to subclavian vein insertion; describing how the patient should be positioned during insertion of a subclavian line, the complications associated with subclavian line insertion.

### Anatomy of the subclavian vein

The subclavian vein is a continuation of the axillary vein [6]. The axillary vein is a continuation of the Brachial vein. The axillary ends at the lateral border of the first rib. The subclavian vein continues from the lateral margin of the first rib. The extra thoracic segment of the subclavian vein lies on top of the first rib. The extra-thoracic part ends at the medial margin of the first rib [6,7]. The extra thoracic segment continues from the medial margin of the first rib till it joins the internal jugular vein to form the Brachiocephalic vein. The left and right brachiocephalic vein join at

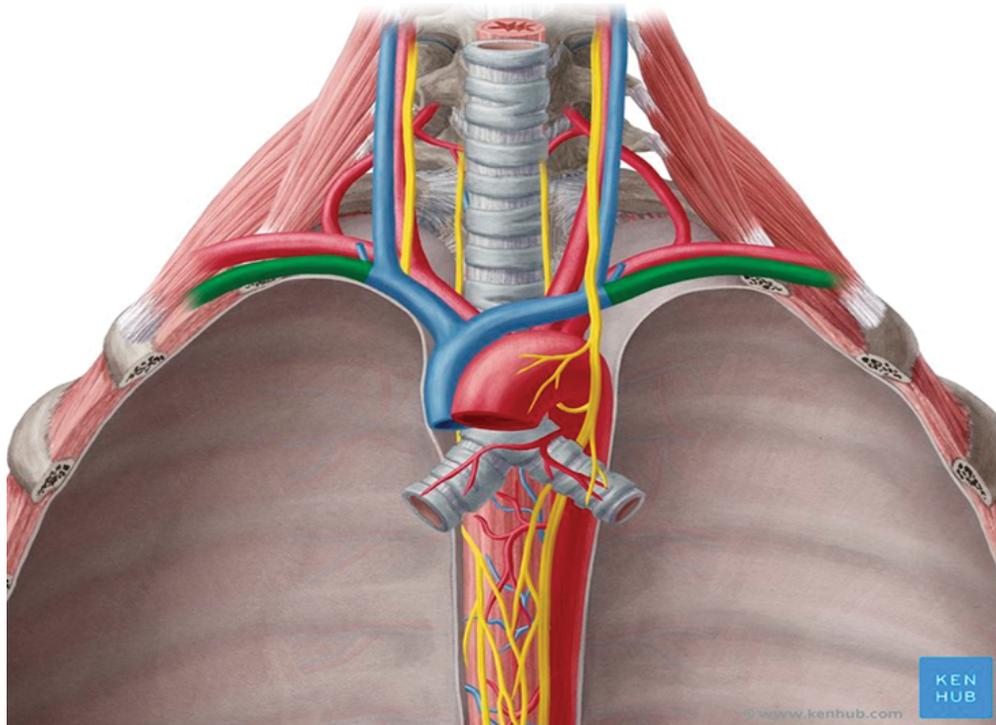
the conference of Pirogoff to form the superior vena cava [6,7]. The brachiocephalic veins also called innominate veins. The left and right brachiocephalic vein joins to form the superior vena cava on the right side of the upper chest. These vessels are a vital component of the human circulatory system, aiding in drainage of deoxygenated blood from the head and upper limbs [6,7].

The subclavian vein follows the subclavian artery and is separated from the artery by the insertion of the anterior scalene [6,7]. The subclavian vein lies anterior to the anterior scalene while the subclavian artery lies posterior to the anterior scalene (and anterior to the middle scalene). The subclavian muscle lies below the clavicle and joins the first rib [6,7].

### Indication for the central venous line

Centrally inserted central venous catheters are primarily placed via the internal jugular vein, subclavian vein, or femoral vein [8]. The central lines are placed for the following reasons: central venous pressure monitoring, administration of multiple medications and drips, high volume/flow resuscitation, emergency venous access, inability to obtain peripheral venous access, repetitive blood sampling, administering hyperalimentation, vasopressors, caustic agents, or other concentrated fluids; insertion of transvenous cardiac pacemakers, hemodialysis or plasmapheresis and insertion of pulmonary artery catheters [8].

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**Figure 1.** The subclavian vein (anterior view). It is colored green with a blue arrow pointing to the left and right subclavian vein [6].

### Seldinger techniques [9,10]

The Seldinger technique is the commonly used method for access in intervention. It could be

- Classical Seldinger technique
- Modified Seldinger technique

In classical Seldinger technique, the puncture is through and through ie anterior and posterior wall of the vessel and gently withdraw the needle back into the vessel lumen and then pass the guide wire [9,10]. In the modified Seldinger technique, only the anterior wall of the wall of the vessel is punctured into the lumen and the guide wire is passed. In the venous access, the Seldinger technique can be used in the following locations

- Internal and external jugular vein
- Subclavian vein
- Common Femoral vein
- Peripheral intravenous line placement or ultrasound guided IV into a deeper vein
- Popliteal vein
- Greater/lesser saphenous vein
- Translumbar IVC
- Transhepatic IVC or portal vein

It is also commonly a technique used in placement of an arterial line in the radial or femoral artery. The correct implementation of the Seldinger technique has resulted into far less of complications [9,10].

### Techniques for extra-subclavian vein access [8]

The extra-thoracic subclavian vein access could be obtained with various techniques. These include: [8-10]

- Ultra sound guided

-Fluoroscopic guided

-Venogram guided

-Blind method using anatomic land marks

-Wire [0.014 or 0.18 wire] assisted

-combination of the above methods

### Ultrasound Guided

This method will guide you not to go beyond the plural line. It visualizes the vein and the artery in transverse and longitudinal views [8]. It is safe, simple and easy and it eliminates complications as much as possible. It is also an effective option for gaining access to the axillary vein during implantation of cardiovascular implantable electronic devices [8]. During the procedure, when your needle is going down the tissue, make sure the tip of the needle is captured by the ultrasound beam. If you do not see the tip, withdraw it back and start again.

### Fluoroscopy Guided

It is expected that the vein runs on top of the first rib bellow the clavicle [8]. To know the first rib, on the fluoroscopy over the medial two-third of the clavicle. When it is identified, advance your needle vertically or near vertical until you reach the first rib, create a vacuum and gently withdraw, you will see a tinge of blood then enter the syringe [8]. Take out the syringe and advance your wire. Make sure you locate the clavicle and advance the needle to the point it first rib is form a straight line just behind the clavicle.

### Venogram/Venography

This method can be combined with fluoroscopic, it involves the injection of contrast agent in the vein of the hand and on fluoroscopic or cine to obtain the flow through the axillary and subclavian vein [8,9]. It identifies the course of the axillary and subclavian veins. It makes the puncture and access to the vein easy.

## Blind method using anatomic land marks [conventional method] [11]

This is the first and oldest method to access the extra-thoracic subclavian vein. It is commonly used in sub-Saharan. The reason for this may be that ultrasound are not readily available in most operating room in the region, fluoroscopic method still need to be learned by the operators and monogram method involved use of contrast and time some time. Blind method using anatomic land marks has been replaced in Europe and North America with the fluoroscopic and the venogram methods. For one to use this method, the operator must be good in anatomy. The best way to do blind method is to get access before you create pocket. This help to overcome the problem of persistent left superior venacava and other abnormality of the vein [11].

Inject lidocaine deep into the tissue to numb all areas going towards the clavicle that the needle will go through. Place one index finger at the sternum and the thumb on the medial two third of the clavicle, and advance the needle through into the tissue until it hit the clavicle, then gently withdraw back to navigate it below the clavicle, creating a vacuum and advance till venous blood enter the syringe.

When it is identified, put sterile in the syringe, advance the needle to hit the clavicle then withdraw it a little backward, put a little pressure horizontally so that it will navigate itself below the clavicle. The key thing to note in blind method with use of land marks include the needle should go horizontally and hit the clavicle and navigate behind it gently to access the vein [11].

Combination of the methods above are usually in use today.

The brightness of the blood and the force that comes out once you take off the syringe should be carefully monitored if you puncture the artery. Note that if an artery is unintentionally punctured, pull back the needle and redirect it inferior to access the vein. If my mistake the peel way sheath is advanced into artery, please, do not remove it until help arrived on your way by the presence of the vascular surgeon.

## Complications of Central Venous Access

Central venous access is not without complication. There are many complications associated with is procedure. But these complications vary, depending on the technique use, experience of the operators and the number of attempts made during the access puncture. Some of the common complications include the following: hemorrhage, pneumothorax, arrhythmias, hematoma, and thrombosis, arterial cannulation/injury, catheter or wire shearing or loss, air embolism, bloodstream infections, failed insertion attempts, lacerations of great vessels, catheter or guide wire colonization.

## Tips and tricks of extra-thoracic subclavian vein [8]

1. Landmarks: Know your anatomic land marks and how to use them. The left hand is used to palpate for external landmarks. The index finger is then placed in the sternal notch, and the thumb is placed at the angle of the clavicle, approximately two-thirds of the way lateral from the sternal notch.
2. Use of micro puncture needles: this saves one from

having bleeding.

3. Master each technique and know it very well. Do not jump to new techniques without learning the one you are familiar with. Always be familiar with each technique and learn it very well.
4. The use of ultrasound, manometry, or pressure-waveform analysis measurement. It should be stated that blood color or absence of pulsatile flow is not a sensitive indicator to confirm that the catheter or thin wall needle resides inside the vein. After confirmation of venous placement, wire threading is allowed to take place. If there is any uncertainty that the catheter or wire resides inside the vein, confirmation is required using ultrasound, Trans esophageal echocardiography, continuous Electrocardiography, or fluoroscopy. After venous residence of the wire has been confirmed, insertion of a dilator or large bore catheter may then proceed [8].

## Conclusion

The knowledge of various techniques and good clinical skills would enhance success of this procedure.

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