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# Procedures in Family Practice

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## Placement of Subclavian Lines

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The technique of placement of a central venous line can be easily mastered by careful adherence to details. It is used for pressure monitoring, hyperalimentation, or administration of medications. Complications are few, easily recognized, and simply treated.

The technique of subclavian venipuncture forms a very important place in the armamentarium of any physician. Access to the central venous system may be required for a variety of reasons.

Emergent indications consist of (1) the trauma patient in shock who arrives in the emergency room with collapsed veins or who has had multiple venous cannulations resulting in thrombosed peripheral veins; and (2) the need to measure central venous pressure in shock, or to place a Swan-Ganz line for monitoring fluid balance in the patient with pulmonary or cardiac problems.

Nonemergent indications include (1) hyperalimentation, short or long term; (2) the injection of sclerosing medications, chemotherapeutic or otherwise; and (3) the need for repeated venous samplings. Recently the availability of split needles has popularized the insertion of permanent transvenous pacemakers through a percutaneous subclavian catheterization.

Two major points are important with respect to contraindications of this procedure. The procedure is contraindicated if there are adequate peripheral sites to obtain venous access. There are no real contraindications if one has clearly in mind the risks and indications and has the technical capability to perform the procedure.

### Technique

The patient should be lying on his/her back in a Trendelenburg position of approximately 10 to 15 degrees. The Valsalva maneuver should be used with the head-down position for an extra margin of

safety. The position on the chest wall is indicated by Figure 1A. As one presses beneath the clavicle from medial to lateral, a small depression is noted. This depression is almost always at the junction of the distal third and middle third of the clavicle and represents the point at which subclavius muscle attachment to the clavicle terminates. Keeping in mind these two identifying marks—the junction of the distal third and middle third of the clavicle and the relative absence of subclavius muscle—one should note the appropriate position for insertion. The area should be cleaned with a povidone-iodine (Betadine) scrub from the sternal notch to the acromion above and below the clavicle. The area is then draped with sterile towels. Appropriate local anesthesia (a 25-gauge and 22-gauge needle are used) is performed. One should be careful to anesthetize the periosteal portion of the under-surface of the clavicle and subcutaneous tissue through which the cannulating needle will pass. One percent lidocaine (Xylocaine) without epinephrine is used. A No. 11 blade is used to make a 5- to 7-mm opening in the skin. This allows easy access of both the cannulating needle and the catheter to the subcutaneous tissue. After insertion of the needle through the skin, two extremely important factors help prevent complications. Keeping the barrel of the syringe and the needle parallel to the floor will prevent both pneumothorax and brachial plexus injury (Figure 1B). Raising the barrel from the transverse position will increase the incidence of pneumothorax. With a finger in the suprasternal notch and directing the aspirating needle toward the suprasternal notch, the syringe is inserted in the appropriate spot and the needle passes underneath the clavicle (Figure 1C). Aspiration is initiated as soon as the needle passes the skin. Careful manipulation of the needle tip

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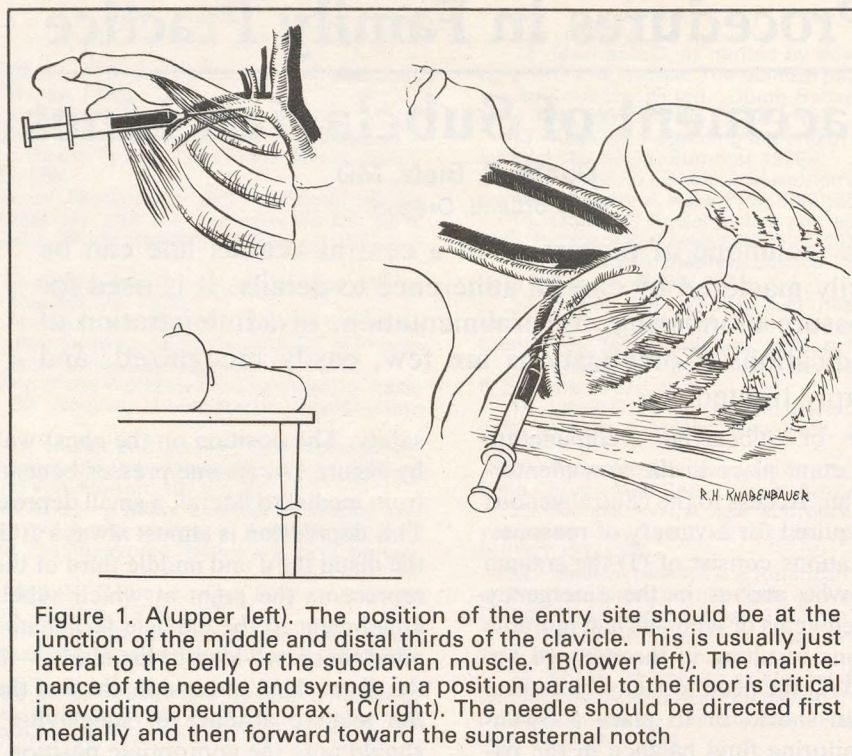


Figure 1. A(upper left). The position of the entry site should be at the junction of the middle and distal thirds of the clavicle. This is usually just lateral to the belly of the subclavian muscle. 1B(lower left). The maintenance of the needle and syringe in a position parallel to the floor is critical in avoiding pneumothorax. 1C(right). The needle should be directed first medially and then forward toward the suprasternal notch

when it encounters the periosteum, the undersurface of the clavicle, or the junction of the clavicle and the first rib will usually result in passage of the needle through the connecting fascia in this region and the vein will be found.

In general, if redirection needs to occur, it will be superior. As the vein is entered, the syringe will fill with blood. A free flow of blood is important in order to allow easy insertion of the cannula. Placement of a straight clamp at the skin-needle junction will help fix the needle more securely on the chest wall so that position is not lost while removing the syringe and inserting the cannula. Having already positioned the patient with the Valsalva maneuver, and placing the finger on the end of the needle immediately on removal of the syringe until the catheter can be placed are important steps to prevent air embolism. As the catheter reaches the needle tip, some resistance will be encountered. If, with minimal additional gentle pressure, the cannula does not go forward into the vein, some rotation of the needle may be necessary to allow it to pass easily. Under no circumstances should the catheter be withdrawn without removal of the needle at the same time.

As the cannula is inserted, the needle is with-

drawn from it, and the appropriate attachments are made so that blood can be readily aspirated and intravenous solution connected. There are a variety of indications that assure a correct position, such as the easy aspiration of blood with the syringe, or the "flashback" of blood in the catheter tubing.

On occasion one will be startled when upon removal of the syringe the blood, instead of gently dripping from the end of the needle, comes in a systolic spurt. It is apparent then that one has punctured the subclavian artery, and although it may be noted by bright red, arterial blood in the syringe, in patients in shock this occasionally will not be apparent. The needle should be removed and another attempt may be made on the same side after four to five minutes of pressure.

After cannulation, one should be very concerned about maintaining position of this catheter; consequently, fixation of the catheter becomes extremely important. Utilizing 2.0 or 3.0 nylon suture the catheter to the skin with a tied loop of suture material around the fixation devices at the needle hub. A drop of antibiotic ointment is placed at the skin-catheter junction, and appropriate sterile dressing is placed to exclude air from the inser-

tion site. Following the positioning, most physicians obtain chest x-ray films to determine the appropriate position of the catheter tip. This also confirms the absence of pneumothorax. Appropriate extension tubes may be attached to the catheter and to the intravenous tubing to allow plenty of length, additional hubs for injection sites, and a stopcock for placement of a central venous pressure monitor.

In order to prevent infection in the area of the catheter, a rigid procedure of dressing changes with sterile technique is necessary. The cleansing of the skin with acetone and Betadine, with replacement of occlusive dressing following Betadine ointment, should be performed regularly every two or three days. Table 1 summarizes the principal technical steps of this procedure.

### Complications

Complications do occur with this procedure as with any other invasive procedure, and one should recognize these and understand the techniques necessary to avoid them.

Pneumothorax is the most important, relatively frequent complication. It occurs more often in a person with chronic obstructive pulmonary disease and a thin chest wall in which an apex of the lung rises above the first rib. It may occur when the needle is raised from a position parallel to the floor after insertion. Aspiration is maintained immediately after penetrating the skin. If bubbles are aspirated, the needle should be promptly removed, as the changes of any significant pneumothorax are small. Physical examination following successful or unsuccessful insertion should be combined with a chest x-ray film to confirm position of the catheter and confirm the absence of pneumothorax.

Hydrothorax can occur if the vein is not cannulated, but the catheter is inserted into the pleural space. The assurance of appropriate position is usually accomplished by a "flashback" or by confirmatory chest x-ray film.

Hemothorax may occur if laceration of the vein or artery occurs during the course of insertion and appropriate pressure is not applied after removal of the needle.

Catheter embolization, shearing off of the plastic cannula against the needle, can occur but will be avoided if the catheter is never retracted within the needle sheath. If it is necessary to withdraw

**Table 1. Procedural Steps**

1. Position of patient—Trendelenburg
2. Prep—drape
3. Anesthesia
4. Needle location for insertion
5. Needle position
6. Needle direction
7. Aspiration
8. Fix needle with clamp
9. Valsalva—remove syringe—finger on needle
10. Insert cannula
11. Remove needle—connect line and attachment
12. Fix to skin—2.0 suture
13. Antibiotic ointment
14. Dressing
15. Chest x-ray films for position and possible complications

the catheter, it should be withdrawn together with the needle and the procedure initiated again.

Perforation of a vein or wall of the heart by the tip of the catheter can occur, but is most unusual, as the catheters presently used are pliable enough to avoid this problem. In addition, venous thrombosis may occur after long-term usage of the catheter.

Multiple small pulmonary emboli no doubt occur in the presence of a catheter left in place for any length of time. A fibrous sheath on subclavian lines has been demonstrated by Peters.<sup>1</sup> These sheaths are sheared off when the catheter is removed and pulmonary emboli occur. To date, these emboli have not been clinically significant.

Air embolism can occur, but is prevented by an appropriate head-down position or by use of a Valsalva maneuver during the moments of venous puncture and insertion of the catheter. Careful attention to the technique as described can result in very few complications.

### Reference

1. Peters W: The development of fibrin sheath on indwelling catheters. *Surg Gynecol Obstet* 137:43, 1973

### Further Reading

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