Teaching Central Line Placement and Other Options for Intravenous Access

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The ability to place an intravenous catheter is essential for family physicians. Percutaneous placement of an intravenous catheter is a standard part of training and practice, but clinical situations may call for more advanced skill. Percutaneous placement of an adequate intravenous catheter may not be feasible, or the clinical factors may make the peripheral access unacceptable. A central venous catheter may be required for specific infusions or for monitoring. In addition, advanced cardiac life-support training will increase the emphasis on central venous catheters.[1] Residents must be knowledgeable about clinical situations requiring intravenous catheterization and become adept at placement techniques. Animal models may be expensive and difficult to obtain, and the amount of clinical experience with intravenous catheter placement obtained during residency varies considerably. For this reason a workshop has been developed to teach basic information and skills for intravenous access.

CENTRAL VENOUS APPROACHES

The subclavian and internal jugular vein can be approached by a variety of routes (Figure 1). Subclavian catheterization by the infraclavicular approach was described in 1952.[2] Since then, further refinements have been made and the potential complications acknowledged.[3–5] In 1965 the supraclavicular approach to the subclavian vein was described.[6] Proponents have argued that the supraclavicular approach is simpler, safer, and more comfortable than the subclavian approach,[7–9] and this approach has been advocated for management of cardiopulmonary arrest and advanced cardiac life-support training.[10] Although both approaches may have similar complication rates, the ability to use both approaches may improve the chance of successful catheter placement.[11] With these approaches a guidewire may be used to aid in intravascular cannulation, as described by Seldinger in 1953.[12] Advantages and variations for subclavian catheterization have been discussed by several authors.[13–15]

Jugular veins have also been used for central venous access. Blitt et al[16] described a method by which central venous catheterization can be achieved with a guidewire using the external jugular vein. Central venous access through the internal jugular vein was described in 1970.[17] There are three basic approaches to the internal jugular vein (Figure 1). Proponents have claimed a lower incidence of complications for internal jugular catheterization than for other central veins,[18] and safety may be increased by the use of a spinal needle over which the larger-gauge needle is passed.[19]

Use of the femoral vein for central venous catheterization has major drawbacks: A high incidence of thrombophlebitis has been reported,[17] and the delivery of drugs below the diaphragm during cardiopulmonary resuscitation is not ideal.[1] Passage of a central venous catheter through the basilic system at the antecubital fossa is a highly valuable approach, but it may be technically difficult and time-consuming, especially during cardiopulmonary resuscitation. When treating a patient undergoing cardiac arrest, cannulation of an antecubital vein should be the site of first choice; but if the resuscitation is not rapidly successful, a central venous catheter should be placed.[1] This central venous catheterization can be accomplished by an approach to the subclavian or internal jugular vein.

The intraosseous route, which was described in 1922 and promoted in the 1940s,[20,21] fell into disuse, but has recently been presented as an acceptable alternative for children aged less than 3 years, and has been shown to be an effective alternative means of "venous" access.[22,23] Although this procedure does not establish a true central venous catheter, it does offer rapid intravenous access in pediatric patients for whom other options may be less attractive.

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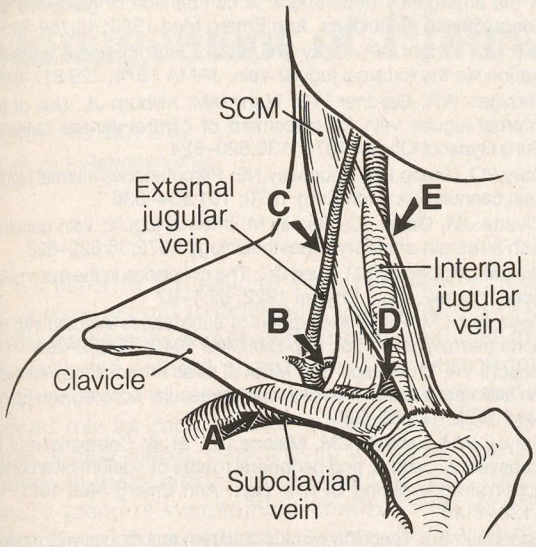

Figure 1. The subclavian vein can be entered through the infraclavicular (A) and supraclavicular (B) approaches. The internal jugular vein can be entered through the posterior (C), central (D), or anterior (E) approaches

METHODS

The workshop begins with a didactic session including basic venous anatomy, cutdown technique, and central venous catheter placement options and techniques. Also covered is intraosseous access for pediatric patients. An outline and appropriate literature are provided and reviewed as a group. After discussion of the advantages and disadvantages of each option, the residents proceed through three practical stations.

At the first station the residents practice the techniques of venous cutdowns on models and use a plastic model of a tibia for intraosseous access.[24]

At the second station the residents place catheters into fluid-filled one-half-inch surgical tubing that has been placed in a model skeleton in the position of the subclavian vein with "vein" and skeleton covered with Microfoam surgical tape.* At this station, they practice using a variety of needles, catheters, and introducers, and practice securing the catheter after placement.

The residents then proceed to the human anatomy laboratory, where a skin flap has been created on one side of a cadaver exposing the subclavian and internal jugular veins. In visualizing and remembering the anatomy, it is helpful to emphasize that the internal jugular and subclavian vein meet deep to the clavicle just caudad to the base of the triangle formed by the two heads of the sternocleidomastoid muscle. After the residents have reviewed this anatomy, the skin flap is put back into position, and the residents attempt to catheterize central veins. After each attempt, the skin flap is lifted so the resident can see the actual structures traversed by the needle. The infraclavicular and supraclavicular approaches to the subclavian vein and approaches to the internal jugular vein are practiced.

Complications of these techniques, including pneumothorax, arterial puncture, hematoma, air embolism, and catheter embolism, are reviewed. The residents then dissect the opposite side, exposing the subclavian and internal jugular veins, to gain further appreciation of this anatomy. When this study of the central veins is completed, the residents place cutdowns in various veins and gain confidence in their abilities.

COMMENT

Evaluation forms were sent to 19 current family medicine residents and to 12 of the recent University of Washington residency graduates. All 13 of 13 responding current residents and 8 of the 9 responding recent graduates recommended that the workshop be repeated yearly; 11 of the 15 responding current residents and 5 of the 8 responding recent graduates felt that the workshop had helped them with the care of patients; 7 of 9 current resident respondents and 4 of 8 responding graduates felt that the workshop had helped them learn more effectively from patient care experience.

From the evaluative comments and faculty observation of the workshops, it was concluded that this method of teaching central venous catheter placement provided an overview of the options available for intravenous access, the basic skills necessary for the placement of these catheters, and the increased confidence in emergency clinical situations.

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* *Microfoam surgical tape, Medical Products Division/3M, St. Paul, Minnesota*

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