

Ultrasound aided inexperienced operators in central venous line insertion

Gualtieri E, Deppe SA, Sipperly ME, Thompson DR. *Subclavian venous catheterization: greater success rate for less experienced operators using ultrasound guidance. Crit Care Med. 1995 Apr;23:692-7.*

Objective

To compare an ultrasound-guided technique with the conventional landmark technique for subclavian vein catheterization when done by inexperienced physician operators in critically ill patients.

Design

Randomized controlled trial.

Setting

Intensive care unit (ICU) in the United States.

Patients

33 critically ill adult patients required central venous access for central venous pressure assessment; administration of total parenteral nutrition, vasoactive drugs, and large amounts of fluid; or pulmonary artery catheterization. Exclusion criteria were

cardiopulmonary arrest or other emergency situations. 52 catheterizations in 33 patients were recorded.

Intervention

All operators were first- or second-year residents on clinical rotation in the ICU who had placed < 30 central venous catheters and who were supervised by an experienced physician. Catheterizations were allocated to the ultrasound-guided technique ($n = 25$) or to the landmark technique ($n = 27$).

Main Outcome Measures

Catheter placement success rate, complication rate (major: pneumothorax and air embolism; minor: arterial puncture, hematoma, or malposition), number of venipunctures required, and number of insertion kits required.

Main Results

23 catheters (92%) were successfully placed in patients in the ultrasound group compared with 12 (44%) in the landmark group {95% CI for the 48% absolute risk improvement, 24% to 67%; $P < 0.001$; relative risk improvement, 109%; number needed to treat

[NNT], 2; CI, 2 to 4)*. The ultrasound group had 1 minor complication (4%) and the landmark group had 11 (41%) minor complications (CI for the 37% absolute risk reduction, 16% to 56%; $P = 0.002$; relative risk reduction, 90%; NNT, 3; CI, 2 to 6)*. No major complications occurred in either group. Fewer punctures and fewer insertion kits were required in the ultrasound group than in the landmark group (1.4 vs. 2.5 punctures and 1.0 vs. 1.4 insertion kits; $P < 0.001$ for both).

Conclusion

Inexperienced physician operators had a high success rate in placing subclavian vein catheters in critically ill patients using an ultrasound-guided technique.

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*Numbers calculated from data in article.

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Commentary

Percutaneous catheterization of the subclavian vein is a routine hospital procedure that is mastered by most internal medicine residents and trainees of other disciplines. The conventional landmark technique for locating this vein can usually be done safely, but several reports indicate that inexperienced operators tend to have higher complication rates. Gualtieri and colleagues have convincingly shown that trainee use of ultrasound guidance, in conjunction with one-on-one instruction by an experienced teacher, increases the rate of successful cannulation and decreases the risk for complications associated with this procedure. Its added utility in the hands of experienced operators was not addressed.

Ultrasound imaging may have a role as a teaching tool apart from directly guiding the venipuncture itself. Imaging allows visualization of the size, location, and depth of the target vein and its position relative to the corresponding artery. The effects of patient positioning and respiration on the diameter of the vein can be shown. Seeing all of this firsthand gives a perspective on the relevant anatomy and the technique of cannulation that could be carried over to future procedures, including those for which ultrasound imaging is unavailable.

Nevertheless, technical differences exist in subclavian venipuncture by the landmark method compared with the ultrasound-guidance method. These in-

clude the attention paid to bony landmarks, the point of cutaneous puncture, and the angle of the needle's trajectory during cannulation. Thus, an important question that is unanswered by this study is whether training with the ultrasound-guided method actually helps the trainee master the landmark method. It is unlikely that the ultrasound-guided technique will totally supplant the conventional method, and so its overall effect on physician training is uncertain, at least for those trainees who will continue to do this procedure throughout their careers.

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