Ultrasonographic guidance increased successful insertion of internal jugular vein catheter in the emergency department

Leung J, Duffy M, Finckh A. **Real-time ultrasonographically-guided internal jugular vein catheterization in the emergency department increases success rates and reduces complications: a randomized, prospective study.** Ann Emerg Med. 2006;48:540-7.

Clinical impact ratings: Emergency Med ★★★★★★☆ Hospitalists ★★★★★☆☆ Critical Care ★★★★★☆☆

QUESTION

In patients having insertion of an internal jugular vein catheter in the emergency department (ED), does real-time ultrasonographic guidance increase the success rate more than does the landmark technique?

METHODS

Design: Randomized controlled trial.
Allocation: Concealed.*
Blinding: Unblinded.*
Follow-up period: To successful completion or abandonment of the procedure.
Setting: ED of a tertiary teaching hospital in Sydney, Australia.
Patients: 130 patients ≥ 18 years of age (mean age 55 y, 58% men) who required central venous access in the ED. Trauma patients in whom the cervical spine could not be cleared and patients with uncorrected severe coagulopathy were excluded.
Intervention: Insertion of the internal jugular vein catheter under ultrasonographic guidance using the SonoSite 180 ultrasonographic system (n = 65) or using the landmark technique with a central, anterior, or posterior approach depending on operator preference (n = 65). The operators were ED physicians and registrars; at the start of the trial, 5 operators were considered to be experienced (successful performance of ≥ 25 landmark internal jugular vein catheterizations) and 8 were inexperienced. All operators received a refresher course on the landmark technique and instruction on the use of real-time ultrasonographic guidance.
Outcomes: Successful insertion (in ≤ 3 attempts) of the catheter, success on first attempt, access time, and complications (e.g., hematoma, carotid artery puncture, and pneumothorax).
Patient follow-up: 100% (intention-to-treat analysis).

MAIN RESULTS

The proportion of patients in whom internal jugular vein catheterization was successful both within 3 attempts and on the first attempt was higher in the ultrasonography group than in the landmark group (Table). The mean time from the start of the procedure (not including preparing the ultrasonographic equipment) to achieving a working line was 281 seconds (median 198 s) in the ultrasonography group and 271 seconds (median 180 s) in the landmark group (difference in means 10 s, 95% CI −118 to 98). The complication rate was lower in the ultrasonography group (Table).

CONCLUSION

In patients having insertion of an internal jugular vein catheter in the emergency department, real-time ultrasonographic guidance increased the success rate and reduced complications more than did the landmark technique.

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*See Glossary.

Ultrasonographic guidance vs the landmark technique for insertion of an internal jugular vein catheter in the emergency department†

Outcomes	Ultrasonographic guidance	Landmark technique	RBI (95% CI)	NNT (CI)
Successful insertion	94%	78%	20% (5 to 41)	7 (4 to 27)
Success on first attempt	77%	55%	39% (8 to 82)	5 (3 to 19)
			RRR (CI)	
Complications	4.6%	17%	73% (14 to 92)	9 (5 to 56)

†Abbreviations defined in Glossary; RBI, RRR, NNT, and CI calculated from data in article.

COMMENTARY

Several previous studies have shown that ultrasonographically guided central vein catheter (CVC) insertion has greater initial success and fewer complications than traditional landmark-based insertion. The study by Leung and colleagues differed from other ED studies by limiting the procedure to the internal jugular approach, randomizing with concealed allocation, and using a sample size large enough to show important differences. A weakness of this study was the use of few operators (n = 13) for a large number of procedures (n = 130). Complication rates did not differ between experienced (defined as ≥ 25 previous CVC insertions) and inexperienced operators in either treatment group, although the study lacked power to show small differences. The overall complication rate in the control group was higher (16.9%) than that often seen in the literature, but most complications were hematomas, which often require no further intervention (1).

Applying this evidence in actual practice is difficult because several other issues often dominate ED scenarios. For example, in a sudden emergency, mobilization of an ultrasonography machine may not be possible. Thus, the landmark techniques are still valuable and should be taught. Which anatomical approach should be favored in less urgent settings? A systematic review showed that the subclavian approach has a lower infection rate and a similar overall mechanical complication rate (although fewer arterial punctures) compared with the internal jugular approach and is favored, for example, in the "central line bundle" advocated by the Institute for Healthcare Improvement (2). A history of previous CVCs and such anatomical variations as obesity or cachexia may also influence the choice of CVC insertion route.

In short, the study by Leung and colleagues provides welcome evidence that the use of ultrasonography improves outcomes for CVC placement. Because the previous review (2) compared landmark techniques and included non-ED patients, the current study suggests a new research question: Does the initial internal jugular approach lead to fewer mechanical complications than the subclavian approach in the era of ED ultrasonography?

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References

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