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Techniques and Procedures

THE ULTRASOUND-GUIDED “PERIPHERAL IJ”: INTERNAL JUGULAR VEIN CATHETERIZATION USING A STANDARD INTRAVENOUS CATHETER

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Abstract—Background: Obtaining vascular access is difficult in certain patients. When routine peripheral venous catheterization is not possible, several alternatives may be considered, each with its own strengths and limitations. **Discussion:** We describe a novel technique for establishing vascular access in Emergency Department (ED) patients: the placement of a standard catheter-over-needle device into the internal jugular vein using real-time ultrasound guidance. We present a series of patients for whom this procedure was performed after other attempts at vascular access were unsuccessful. In all cases, the procedure was performed quickly and without complications. **Conclusion:** Although further study of this technique is required, we believe this procedure may be a valuable option for ED patients requiring rapid vascular access. © 2012 Elsevier Inc.

Keywords—ultrasound; ultrasound guidance; vascular access; internal jugular vein; single lumen catheter

INTRODUCTION

Venous access is a vital component of the management of most Emergency Department (ED) patients. When catheter placement in a peripheral vein of the upper or lower extremity is difficult or impossible, alternatives include placement of a catheter in an external jugular (EJ) vein, in a peripheral vein, or a deep upper-arm vein (i.e., bra-

chial or cephalic) using ultrasound guidance, or placement of either a peripherally inserted central venous catheter or a standard central venous catheter (CVC) (1–3). Additionally, in unstable patients who require immediate access, placement of either an intraosseous needle or a catheter in the greater saphenous vein via a cutdown procedure may be considered.

In addition to the above options, a standard catheter-over-needle device may be placed directly into the internal jugular vein using real-time ultrasound guidance. Although this procedure was discussed in a letter to the editorial staff of an Emergency Medicine journal, we are unaware of other publications describing this technique in the literature of any specialty (4). Because our experience has been that this procedure is safe, well tolerated, and rapidly performed, we believe it is a valuable skill for the clinician approaching a patient with difficult vascular access. Below, we describe a series of cases in which this procedure was performed for ED patients in whom other attempts at venous access had been unsuccessful.

DISCUSSION

Study Participants

After obtaining Institutional Review Board approval, we prospectively collected data during a 1-year period on 9 patients who underwent placement of a “peripheral

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Figure 1. Technique for cannulation of right internal jugular vein.

[internal jugular] IJ” (PIJ) catheter. Demographic and clinical data, including type of catheter used and time required to complete the procedure (rounded to the nearest ½ minute) after all supplies were collected, were recorded. In each case, the procedure was performed by one of the authors while on duty in the ED. Two authors were senior Emergency Medicine residents, two were ultrasound fellows, and two were attending physicians with expertise in diagnostic and procedure-guided ultrasound. Follow-up by telephone or in person within 1 week was attempted in all cases.

Technique

The patient is placed in Trendelenburg position with the head turned slightly toward the opposite side of the target vein. Using a high-frequency (10–13 Mhz) linear transducer with a Sonosite Micro-Maxx portable ultrasound machine (Bothell, WA), we then assess the patient’s vasculature, identifying a suitable segment of the IJ vein that appears minimally overlapping with the adjacent carotid artery. Chlorhexidine solution is then used to cleanse the skin and a sterile cover is placed over the transducer. For awake patients, we administer a wheal of subcutaneous lidocaine at the intended site of catheter entry to minimize pain. A small amount of sterile ultrasound gel is then placed on the patient’s skin. Finally, a standard, catheter-over-needle device is advanced into the patient’s IJ vein under direct ultrasound guidance (Figure 1). To confirm placement, venous blood is aspirated and ultrasound is again used to visually confirm the presence of the catheter in the IJ vein. For most patients, we favor a 2½-inch 18-g Introcan® Safety catheter (B Braun, Melsungen, Germany). In unstable patients requiring

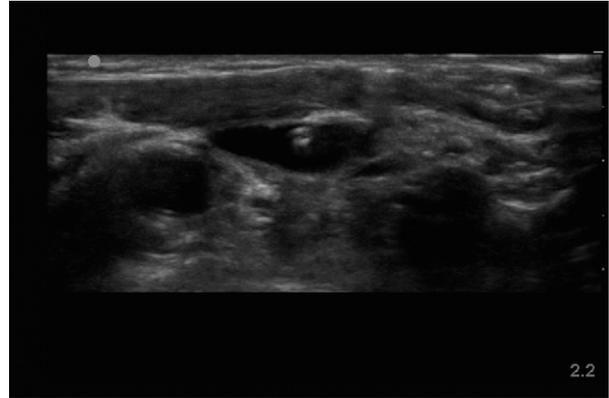


Figure 2. Sonogram of catheter tip in vein lumen.

rapid infusion of fluids, larger-diameter catheters may be used. For ultrasound guidance, we prefer an out-of-plane technique for catheter placement (Figure 2) and an in-plane technique for confirmation (Figure 3). The catheter is secured to the skin with a bio-occlusive dressing and plastic tape. Sterile surgical gloves are used throughout.

RESULTS

Table 1 provides a summary of the clinical data for each patient. In all cases, attempts at peripheral venous access by ED nursing staff had failed, along with attempts at catheter placement in an EJ vein, brachial or cephalic deep arm vein (using ultrasound guidance), or peripheral vein (with or without ultrasound guidance) by a physician. The procedure was not performed for stable patients who were likely to require longer-term central access for central venous pressure monitoring or infusions of multiple

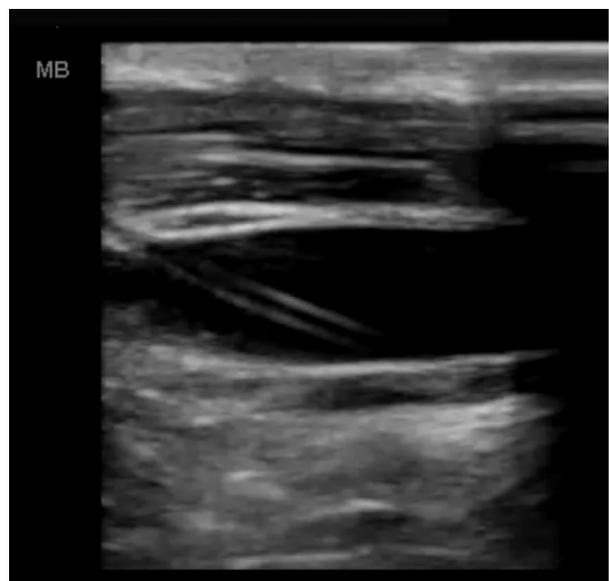


Figure 3. Sonogram of catheter in correct position within vein.

Table 1. Summary of Clinical Data for Each Patient

Age (Years)	Sex	Comorbidities	Summary of ED Course	Disposition	Catheter & Site	Time (min)
58	F	CHF, SVT cocaine abuse	BIBA for SVT with hypotension; Converted to sinus rhythm after receiving adenosine via PIJ	Home; PIJ removed at discharge	2½ in 18 g, RIJ	2.5
26	M	IDU	Diagnosed with R leg cellulitis with associated deep vein thrombosis; Received fluids, antibiotics and analgesics via PIJ	Admit; PIJ removed after PICC placed as inpatient	2½ in 18 g, RIJ	4.5
60	F	CHF, COPD, HTN	BIBA for hypotension and hypoglycemia; Treated in ED with dextrose, fluids and antibiotics; Required intubation; Sedatives, paralytics and other medications given via PIJ; After stabilization, CVC and arterial lines placed for definitive access	Admit to ICU; PIJ removed after CVC placed in ED	2 in, 14 g, LIJ	3.5
51	M	COPD, DM	Evaluated for dyspnea; Treated with intravenous steroids for COPD and received contrast for PE-protocol chest CT via PIJ, results negative	Home; PIJ removed at discharge	2½ in, 18 g, RIJ	7
33	F	DM, CRI, IDU	Treated for diabetic ketoacidosis and hypotension; Received fluids, insulin, and potassium via PIJ	Admit; PIJ removed after CVC placed in ED	2 in, 14 g, RIJ	5.5
59	F	MS, seizure disorder	BIBA for status epilepticus; Received lorazepam and phenytoin via PIJ	Nursing Home; PIJ removed at discharge	2½ in, 18 g, RIJ	3
61	M	IDU	Treated for large gluteal abscess; Received fluids, antibiotics, analgesics and medications for procedural sedation via PIJ	Home; PIJ removed at discharge	2½ in, 18 g, LIJ	5.5
38	F	Obesity	Treated for severe allergic reaction with diphenhydramine, famotidine, steroids, and saline via PIJ	Home; PIJ removed at discharge	2½ in, 18 g, RIJ	4
44	F	IDU	BIBA for depressed mental status; Received naloxone, saline, and antibiotics via PIJ; Admitted for pneumonia	Admit; PIJ removed after peripheral i.v. placed in ED	2½ in, 18 g, RIJ	2.5

ED = Emergency Department; CHF = congestive heart failure; SVT = supraventricular tachycardia; PIJ = peripheral internal jugular; BIBA = "brought in by ambulance"; RIJ = right internal jugular; IDU = injection drug use; COPD = chronic obstructive pulmonary disease; HTN = hypertension; CVC = central venous catheter; PICC = peripherally inserted central catheter; LIJ = left internal jugular; DM = diabetes mellitus; PE = pulmonary embolism; CT = computed tomography; CRI = chronic renal insufficiency; MS = multiple sclerosis.

medications. In these cases, a CVC was placed straight-away. In several cases, a PIJ catheter was placed emergently and then removed after the patient's condition had stabilized and definitive access achieved.

The procedure was performed successfully and without complication in all cases. After all supplies were gathered, the procedure was completed within a range of 2.5–7 min. Two patients were lost to follow-up. Of the remaining patients, none reported fevers, chills, neck pain, or stiffness, nor swelling or pain at the site of catheter entry.

Implications for Clinical Practice

Point-of-care ultrasound allows the IJ vein to be visualized and cannulated as if it were a peripheral vein. As the cases above illustrate, a PIJ line may be used to treat unstable patients requiring emergent treatment with fluids and medications as well as more stable patients who require venous access for their care, but for whom options other than central access have been exhausted. Our experience suggests that this line is rapidly performed, well tolerated, and safe for patients.

Why not just place a central venous catheter in cases like these? The major advantage is the rapidity with which this procedure can be performed. Nearly all cases in our series were completed in fewer than 6 min, far less than what would be expected for the placement of a CVC. Because fewer supplies are required, we expect that actual time savings in most clinical environments would be even more substantial. Further, because the catheters used include a passive safety device that has been shown to protect against needlestick injury (a needle guard that auto-deploys and shields the needle tip), this procedure may be safer for the clinician than standard CVC placement, especially when working quickly to provide care for an unstable patient (5). Finally, because the catheter remains in the IJ vein and does not come close to the central circulation or to the heart itself, the patient is spared the risks of guidewire-induced dysrhythmias, catheter malposition, and other potential dangers inherent in CVC placement.

Despite these benefits, several points deserve mention. First, we consider this line to be a temporary solution and do not recommend that it serve as definitive access, especially in an unmonitored setting. Our practice is to secure these catheters with plastic tape and a bio-occlusive dressing. Especially when a larger-diameter catheter is used, careful attention should be paid to prevent it from becoming damaged, dislodged, or unattached from plastic tubing.

Second, regarding the risk of spontaneous migration out of or through the vein lumen (i.e., "infiltration"), we have had no known failures to date. Our experience suggests that when proper intraluminal position is confirmed by direct ultrasound visualization, this line is as reliable, or more reliable, than a well-placed peripheral catheter.

Third, consideration must be given to the possibility of eliminating a potential site for future CVC placement. In general, if a patient with an existing PIJ catheter requires central access, we favor using an alternative site. If none is available, the PIJ catheter could be removed and, assuming there are no signs of hematoma or thrombosis within the vein, the same site could be used. We would not recommend changing a PIJ to a CVC over a guidewire ("re-wiring"), as this practice is likely to carry a high risk of infection.

Fourth, as with the placement of a CVC in the IJ vein, the risk of complications such as carotid artery puncture, hematoma, and pneumothorax are likely to exist with this procedure. Because sonography is used throughout, we feel that in the hands of clinicians already familiar with ultrasound-guided IJ vein CVC placement, the incidence of arterial puncture or intrathoracic penetration would be low. Real-time ultrasound guidance has been shown to decrease the risk of complications when placing IJ vein CVCs (6,7). Similarly, the requisite use of ultrasound with this procedure is likely to provide a comparable measure of safety. Our practice is not only to directly visualize catheter entry into the vein's lumen, but to subsequently confirm proper placement with direct visualization, a practice similar to visualizing the presence of a guidewire in the IJ vein when placing a CVC, a method recently shown to be a reliable method of confirming proper placement (8).

Finally, the risk of bloodstream infection associated with this procedure is an important concern. We recommend the steps outlined in the description above to minimize the possibility of contamination, and to date, we have had no known catheter-related infections associated with this procedure at our institution. Are these steps adequate? Because strict sterile technique is now recommended during the placement of all CVCs, it could be argued that full-body draping, sterile gown, and surgical mask should be used (9). But is this procedure a "central line?" Anatomically speaking, it is not. Similar to a standard venous catheter placed in an EJ vein (which, like the IJ vein, drains directly to the subclavian vein), the catheter tip is positioned far superior to the junction of the superior vena cava and right atrium. EJ vein catheters are generally considered safe to place after simple skin prep with alcohol or chlorhexidine, and thus, we expect that the more rigorous sterile technique used for this procedure should adequately protect patients. Further, the temporary nature of this line may offer additional protection from catheter-related infection.

CONCLUSION

We report a novel technique for cannulating the IJ vein with a standard intravenous catheter under direct ultrasound guidance. This procedure may benefit both critically

ill patients who require immediate vascular access for life-saving fluids and medications, and stable patients in whom other techniques have been unsuccessful. Although further study is necessary to assess the performance of the PIJ, our clinical experience suggests this procedure is well tolerated and safe, and we believe it will prove to be a valuable skill for the modern Emergency Physician.

REFERENCES

1. Brannam L, Blaivas M, Lyon M, Flake M. Emergency nurses' utilization of ultrasound guidance for placement of peripheral intravenous lines in difficult-access patients. *Acad Emerg Med* 2004;11:1361–3.
2. Stein J, George B, River G, Hebig A, McDermott D. Ultrasonographically guided peripheral intravenous cannulation in emergency department patients with difficult intravenous access: a randomized trial. *Ann Emerg Med* 2009;54:33–40.
3. Keyes LE, Frazee BW, Snoey ER, Simon BC, Christy D. Ultrasound-guided brachial and basilic vein cannulation in emergency department patients with difficult intravenous access. *Ann Emerg Med* 1999;34:711–4.
4. Moayed S. Ultrasound-guided venous access with a single lumen catheter into the internal jugular vein. *J Emerg Med* 2009;37:419.
5. Mendelson M, Chen L, Solomon R. Study of Introcan® Safety IV catheter for the prevention of percutaneous injuries in healthcare workers. Abstract presented at Society for Healthcare Epidemiology of America (SHEA) Annual Meeting; 2003.
6. Karakitsos D, Labropoulos N, De Groot E, et al. Real-time ultrasound-guided catheterisation of the internal jugular vein: a prospective comparison with the landmark technique in critical care patients. *Crit Care* 2006;10:R162.
7. 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.
8. Stone MB, Nagdev A, Murphy MC, Sisson CA. Ultrasound detection of guidewire position during central venous catheterization. *Am J Emerg Med* 2010;28:82–4.
9. O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. *MMWR Recomm Rep* 2002; 51:1–29.