EDITORIAL VIEW

Ultrasound-guided peripheral venous access: Is it the standard of care?

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ABSTRACT

Venous access or cannulation is the most common invasive procedure being performed in the hospitals. It may appear very simple and straight forward routine, but every one of us has encountered a situation when, due to any one or multiple causes, we feel it almost impossible to gain access. It is here that ultrasound comes into play. Although original cost and lack of training have limited its acceptance for wide spread use in all departments of a hospital, the advantages offered by it, will soon overcome the obstacles and will become the standard of care as far as peripheral or central venous access is concerned. This editorial highlights the difficulties and the scope of this new tool in ER, ICU and OR.

Key words: Ultrasound; Catheterization, Peripheral; Catheterization, Central Venous; Standard of Care; Quality of Health Care

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Gaining peripheral venous access is perhaps the most commonly performed procedure in the emergency department (ED), operating room, and ICU. In critically ill patients, difficulties in obtaining venous access may occur in up to one-quarter of patients.[1-3] Various factors including obesity, prolonged hospitalizations, multiple previous attempts, prematurity, and other co-morbid conditions (shock, dehydration) can increase difficulties with peripheral vascular access. In emergent and critical situations, obtaining access to the vascular system represents the second most critical technical component of acute care and stabilization following airway management. In emergent situations, when peripheral venous access cannot be easily and quickly obtained within 90 seconds in the pediatric-aged patient, resuscitation guidelines mandate the use of the intraosseous (IO) route.[4-7] While commonplace in the practice of pediatric ICU care, the IO route has now gained acceptance intraoperatively and its use in the adult population is growing.[8-10] These latter applications have been facilitated by the development of new devices, needles, and access sites including the humerus.

In non-emergent situations, other options are available to facilitate peripheral venous access including ultrasound.[11,12] When considering any of these devices, the goal remains the same: to facilitate the procedure, limit the pain and trauma inflicted on the patient, and decrease the time required by the provider. Although ultrasound imaging is generally considered state of the art, if not standard of care, for obtaining central venous access, its use has not been universally accepted for challenging peripheral venous cannulation.[13] This may be the result of lack of training in its use in locations outside of the ICU or the operating room as well as simple lack of familiarity with its potential applications in such scenarios.

As clearly illustrated by the dedication of an issue of *Anaesthesia, Pain, and Intensive Care* to the subject, there is growing realization of the utility of the technique. This practice has been facilitated by advancements in the design of ultrasound

equipment leading to improvements in both the quality of the image and the portability of the equipment. Additionally, ongoing education has resulted in the spread of this technology out of the operating room and ICU to those involved in the care of patients on the inpatient ward and beyond. When placed in experienced hands, the literature has clearly demonstrated the utility of this technique for difficult venous cannulation has been demonstrated in both the adult and pediatric patients.[14-18]

Although ultrasound was first used for central venous access, its application has expanded to include peripheral venous cannulation. The reports in the literature parallel the author's clinical practice for peripheral venous cannulation as we use ultrasound when superficial identification of appropriate veins is not possible or when traditional attempts have failed. We have also found that ultrasound facilitates the placement of larger bore cannulas for resuscitation or the administration of blood products during the perioperative period. The ability to quickly gain vascular access may also lead to decreased time spent thereby freeing physicians to perform other tasks or care for other patients. Time saved after anesthetic induction and prior to the start of a surgical procedure as the patient is "lined up" may translate to valuable minutes of operating room time that is now available for other purposes.

What obstacles remain to the wide-spread application of the technique? Practice is needed to become facile with the ultrasound machine, its working parameters, and the hand-eye coordination needed to image and cannulate with separate hands.

Figure 1: Standard anesthesia cart at Nationwide Children's Hospital (Columbus, Ohio, United States). Two sizes of intraosseous needles are kept in the top, left-hand drawer of every anesthesia cart

Education is necessary regarding the anatomy of the deep vascular structures, the techniques for cannulation, and the catheters available. Cost constraints must be considered as we look to the purchase of additional ultrasound machines as their use and demand increases. Although one cannot vehemently state that the technology is the standard of care, it is certainly a useful adjunct to our current practice, and one that I wholeheartedly embrace and use on a weekly basis in my busy clinical practice. Regardless of our experience and success with ultrasound, in the emergent situation, the IO route remains the standard of care for access to the vascular system. As illustrated by the photograph of our standard anesthesia cart, these devices must be readily available in every operating room (figure 1).

REFERENCES

1. Fields JM, Piela NE, Au AK, Ku BS. Risk factors associated with difficult venous access in adult ED patients. Am J Emerg Med 2014;32(10):1179-82.[PubMed] doi: 10.1016/j.ajem.2014.07.008.
2. Sebbane M, Claret PG, Lefebvre S, Mercier G, Rubenovitch J, Jreige R, et al. Predicting peripheral venous access difficulty in the emergency department using body mass index and a clinical evaluation of venous accessibility. J Emerg Med 2013;44(2):299-305. [PubMed] doi: 10.1016/j.jemermed.2012.07.051
3. Lininger RA. Pediatric peripheral i.v. insertion success rates. Pediatr Nurs 2003;29:351-4.
4. Joshi G, Tobias JD. The use of intraosseous infusions in the operating room. J Clin Anesth 2008;20(6):469-73. [PubMed] doi: 10.1016/j.jclinane.2008.04.014.
5. Tobias JD, Ross AK. Intraosseous infusions: A review for the anesthesiologist with a focus on pediatric use. Anesth Analg 2010;110(2):391-401. [PubMed] doi: 10.1213/ANE.0b013e3181c03c7f.
6. Neuhaus D, Weiss M, Engelhardt T, Henze G, Giest J, Strauss J, et al. Semi-elective intraosseous infusion after failed intravenous access in pediatric anesthesia. Paediatr Anaesth 2010;20(2):168-71. [PubMed] doi: 10.1111/j.1460-9592.2009.03244.x.
7. Neuhaus D. Intraosseous infusion in elective and emergency pediatric anesthesia: when should we use it? Curr Opin Anaesthesiol 2014;27(3):282-7. [PubMed] doi: 10.1097/ACO.0000000000000069.
8. Lee PM, Lee C, Rattner P, Wu X, Gershengorn H, Acquah S. Intraosseous versus central venous catheter utilization and performance during inpatient medical emergencies. Crit Care Med 2015;43(6):1233-8. [PubMed] doi: 10.1097/CCM.0000000000000942.
9. Kurowski A, Timler D, Evrin T, Szarpak Ł. Comparison of 3 different intraosseous access devices for adult during resuscitation. Randomized crossover manikin study. Am J Emerg Med 2014;32(12):1490-3. [PubMed] doi: 10.1016/j.ajem.2014.09.007

10. Lewis P, Wright C. Saving the critically injured trauma patient: a retrospective analysis of 1000 uses of intraosseous access. Emerg Med J 2015;32(6):463-7. [PubMed][Free full text] doi: 10.1136/emermed-2014-203588.
11. Vyskocil JJ, Kruse JA, Wilson RF. Techniques for vascular access when venous entry is impossible: route depends on urgency and the agent to be administered. J Crit Illn 1993;8(4):539-45. [PubMed]
12. Jöhr M, Berger TM. Venous access in children: state of the art. Curr Opin Anaesthesiol 2015;28:314-20. [PubMed] doi: 10.1097/ACO.0000000000000181.
13. Tobias JD, Martin DP, Bhalla T. Ultrasound for central venous, arterial, and peripheral venous cannulation in the pediatric population. Pediatr Anesth Crit Care J 2014;2:93-101. [Free full text]
14. Costantino TG, Parikh AK, Satz WA, et al. Ultrasonography-guided peripheral intravenous access versus traditional approaches in patients with difficult intravenous access. Ann Emerg Med 2005;46:456-61. [PubMed]
15. Costantino TG, Kirtz JF, Satz WA. Ultrasound-guided peripheral venous access vs the external jugular vein as the initial approach to the patient with difficult vascular access. J Emerg Med 2010 ;39(4):462-7. [PubMed] doi: 10.1016/j.jemermed.2009.02.004.
16. Bair AE, Rose JS, Vance CW, Andrada-Brown E, Kuppermann N. Ultrasound-assisted peripheral venous access in young children: A randomized controlled trial and pilot feasibility study. West J Emerg Med 2008;9(4):219-24. [PubMed] [Free full text]
17. Schnadower D, Lin S, Perera P, Smerling A, Dayan P. A pilot study of ultrasound analysis before pediatric peripheral vein cannulation attempt. Acad Emerg Med 2007;14(5):483-5. [PubMed]
18. Doniger SJ, Ishimine P, Fox JC, Kanegaye JT. Randomized controlled trial of ultrasound-guided peripheral intravenous catheter placement versus traditional techniques in difficult-access pediatric patients. Pediatr Emerg Care 2009;25:154-9.[PubMed] doi: 10.1097/PEC.0b013e31819a8946.

★★★★★

My most unforgettable experience

Prolonged CPR in a neonate with successful outcome

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This is most unforgettable experience in my career, which was like "if God is with you, you can win against any kind of odds!"

A female child was delivered in a small village by a trained *dayan*(midwife). Dayan was a wise and experienced health worker and she told the relatives that there was something wrong with neonate and they should carry the child to higher medical facility! They took the child to nearby district where child was diagnosed to have tracheoesophageal fistula (TEF). So, the neonate was referred to pediatric surgeon. Child was in the hands of pediatric surgeon within 24 hours, though she happened to come from a remote village situated 350 km away from my city. We have seen many neonates being diagnosed of TEF on the 3rd day after birth even in some of the bigger hospitals.

The baby was brought to operating room for surgery. Surgery went smoothly. At the time of closure, surgeon infiltrated the wound with bupivacaine for postoperative analgesia. Instantaneously after infiltration, the baby went into cardiac arrest. We made the child supine and started CPR. After a very long 5 minutes, there was some trace noted on monitor but it was a ventricular tachycardia (VT) rhythm. I asked for defibrillator, which was found to be in a nonworking condition! We called help from a nearby hospital and continued chest compression. After 20 minutes, we managed to get another defibrillator. At the same time, we noticed a sinus rhythm on the monitor. The child survived. It was a memorable moment of great joy for all of the staff.

Postop period was uneventful and she was discharged from the hospital on 6th day. There was no neurological deficit by God's grace in the follow-up!

Lesson learnt: Never give up in cardiac arrest. CPR….CPR….CPR! and you *can* save your patient!