


The Expanding Role of Ultrasound Vascular Access Procedures in Prehospital Emergency Medical Services

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Conflicts of interest/funding: The author has no conflicts or financial interests related to this publication to disclose. No grants, funding (public or private), or financial support were received for this work.

Keywords: arterial catheterization; Emergency Medical Services; prehospital emergency; REBOA; ultrasound guidance; vascular access

Abbreviations:

EMS: Emergency Medical Services
REBOA: Resuscitative Endovascular Balloon Occlusion of the Aorta
US: ultrasound

Received: January 29, 2022

Revised: February 6, 2022

Accepted: February 12, 2022

doi:[10.1017/S1049023X22000589](https://doi.org/10.1017/S1049023X22000589)

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Imbriaco G. The expanding role of ultrasound vascular access procedures in prehospital Emergency Medical Services. *Prehosp Disaster Med.* 2022;37(3):424–425.

Dear Editor,

In recent years, the use of ultrasound (US) guidance for vascular access procedures in the critical care setting has increased significantly, with proven benefits for both patients and clinicians, and it's now considered the standard of care practice.¹ The undeniable clinical role of point-of-care US and the availability of compact, multi-probe portable US machines (dedicated to extended focused assessment with sonography for trauma/E-FAST or cardiac assessment) has led the way for further application to guide vascular accesses procedures by prehospital Emergency Medical Services (EMS).² Despite the concerns that US for vascular accesses could be seen as a time-consuming procedure,³ it is beneficial to highlight its important clinical advantages, most notably the increased success rates, including patients with clinical signs of shock.

The range of life-saving techniques presently available to EMS providers can strongly benefit from the addition of US guidance, either with central or peripheral venous or arterial cannulation. Ultrasound provides a safe and reliable tool for intravascular device insertion in a large “grey area” of patients, ranging from a simple blind-inserted peripheral access to a rapid intraosseous needle. With the rise in patients with difficult intravenous access, the use of US has been a game changer.⁴

Radial artery access is gathering an increased attention in the EMS field.⁵ The on-going COVID-19 pandemic brought out the opportunity for arterial punctures in the prehospital context, necessary for blood gas sampling and subsequent analysis through point-of-care testing systems, improving the quality of treatment provided to critical patients.⁶ Arterial catheters offer additional value to provide effective continuous monitoring of unstable patients during ground or air transports from rural or remote areas as well as inter-hospital transports.

A further application during medical emergencies is represented by femoral artery catheterization with sheath introducers; these intravascular devices and the use of US for a successful insertion are closely connected. A small-bore arterial sheath introducer (4Fr) can be inserted in the prehospital environment in hemorrhagic hypotensive patients, permitting effective pressure monitoring and timely evaluation to the clinical responses with fluid resuscitation or inotropic therapies. Once in the emergency department, the small-bore sheath introducer allows quick access for blood specimen collection and arterial blood gas analysis, and may be exchanged to a larger introducer through a guidewire, which may be used in hospital for invasive procedures (eg, splenic artery embolization in blunt trauma) or other endovascular procedures.

Large bore sheath introducers (7–8Fr) are required for the femoral artery insertion of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) catheters; REBOA was introduced as a hemorrhage control technique in severe trauma and consists of an intra-aortic temporary balloon occlusion aimed at reducing bleeding.⁷ The increased blood flow resulting from the REBOA has expanded its original indications for non-traumatic cardiac arrest, obtaining better cerebral and coronary perfusion during cardiopulmonary resuscitation maneuvers.⁸

The current application of US-guided vascular procedures by EMS providers may benefit the prehospital treatment of critically ill patients. In consideration of the



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Figure 1. (a) High-Fidelity Simulation Training of REBOA Insertion by a Helicopter Emergency Medical Crew; (b) US Needle Puncture; (c) Guidewire Insertion; and (d) 7Fr Sheath Introducer Positioned in the Right Femoral Artery. Abbreviations: REBOA, Resuscitative Endovascular Balloon Occlusion of the Aorta; US, ultrasound.

over-mentioned techniques and devices, US vascular access competencies should be included in the core curriculum of EMS providers. Dedicated training paths in the clinical context and in simulation scenarios (Figure 1) should be developed to achieve optimal team performance, reducing insertion times, and improving patient outcomes.

Acknowledgements

The author would like to thank Aimone Giugni, MD, and Alessandro Monesi, RN, CCRN, for granting the pictures of the simulation training of REBOA insertion by a helicopter Emergency Medical service crew, and CRIBO Academy (Bologna, Italy) for the use of the high-fidelity simulation center.

References

- Guy A, Bryson A, Wheeler S, McLean N, Kanji HD. A blended prehospital ultrasound curriculum for critical care paramedics. *Air Med J.* 2019;38(6): 426–430.
- Amaral CB, Ralston DC, Becker TK. Prehospital point-of-care ultrasound: a transformative technology. *SAGE Open Med.* 2020;8:205031212093270.
- Kitch BB, Beck EH. “Vascular access.” In: Cone DC, Brice JH, Delbridge TR, et al, (eds). *Emergency Medical Services: Clinical Practice and Systems Oversight.* 3rd ed. Hoboken, New Jersey, USA: Wiley; 2021: 83–89.
- van Loon F, van Hooff L, de Boer H, et al. The modified A-DIVA scale as a predictive tool for prospective identification of adult patients at risk of a difficult intravenous access: a multicenter validation study. *J Clin Med.* 2019;8(2):144.
- Standifird C, Wassermann M, Lauria MJ. Initiation of invasive arterial pressure monitoring by critical care transport crews. *Air Med J.* 2022;41(2):248–251.
- Zwisler ST, Zinck Y, Bering CB, Zinck A, Nybo M, Mikkelsen S. Diagnostic value of prehospital arterial blood gas measurements - a randomized controlled trial. *Scand J Trauma Resusc Emerg Med.* 2019;27(1):1–9.
- Castellini G, Gianola S, Biffi A, et al. Resuscitative endovascular balloon occlusion of the aorta (REBOA) in patients with major trauma and uncontrolled hemorrhagic shock: a systematic review with meta-analysis. *World J Emerg Surg.* 2021;16(1):1–12.
- Mazzoli CA, Chiarini V, Coniglio C, et al. Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in non-traumatic cardiac arrest: a narrative review of known and potential physiological effects. *J Clin Med.* 2022;11(3):742.