Editorial

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Matthew Ostroff¹ and Nancy Moureau^{2,3}

A systematic approach for ultrasound

guided venous and arterial puncture

The 3 Stations of the Needle:

Abstract

Point-of-care ultrasound-guided (POCUS) venous and arterial access involves accurately guiding a needle from the skin surface through subcutaneous tissue to the target vessel. The success of this procedure relies heavily on the operator's ability to locate and direct the needle tip, which can lead to multiple puncture attempts and iatrogenic complications. A literature review revealed a lack of comprehensive protocols addressing the sonographic details necessary for effective needle identification and vessel cannulation. This paper presents a systematic approach, the "3 Stations of the Needle" protocol, which includes: (1) identifying the needle after initial skin puncture within the subcutaneous tissue; (2) navigating the needle to the vessel's outer wall; and (3) advancing the needle tip into the vessel lumen. This protocol offers a practical educational method for an ultrasound mastery learning program, enhancing needle identification, guidance, safety, and procedural success in venous and arterial cannulation.

Keywords

Arterial catheterization, central venous catheterization, needle visualization, patient safety, peripheral vein catheterization, ultrasound guidance

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Introduction

Over the past two decades, the use of point-of-care ultrasound (POCUS) for vascular access has significantly improved the safety and efficacy of one of the most commonly performed invasive procedures in healthcare. Initially, POCUS was employed to enhance central venous access, effectively reducing the risk of iatrogenic complications (e.g. nerve damage, hematomas, inadvertent arterial punctures, pseudoaneurysms, and pneumothorax or hemothorax) linked to traditional blind anatomical needle techniques. This advancement in patient safety rapidly became the standard of care, supported and endorsed by various professional organizations.^{1–6} Today, evidence continues to grow, supporting the use of POCUS for venous and arterial cannulation.^{7,8}

While ultrasound has significantly reduced morbidity and mortality associated with large-caliber vascular access, its application to smaller-caliber peripheral venous and arterial vessels remains challenging across all patient populations. Procedures guided by needle POCUS can be complex due to the anatomical variations of both superficial and deep vessels. This complexity often leads to complications such as failed attempts, hematomas, pseudoaneurysms, nerve damage, inadequate catheter placement, and subsequent infiltration and extravasation.^{9,10} It is well established that multiple factors influence fine motor procedural success.

Locating and guiding the needle tip into a vein or artery using ultrasound is crucial for accessing challenging patients. Standardized training approaches that effectively measure and document competency and success are essential to ensure patient safety during these procedures. The Infusion Nurses Society (INS) Standards of Practice, the

Corresponding author:

Matthew Ostroff, St. Joseph's Regional Medical Center, 703 Main Street, Paterson, NJ 07503, USA. Email: ostroffm@sjhmc.org

 ¹St. Joseph's Regional Medical Center, Paterson, NJ, USA
²PICC Excellence, Inc. Hartwell, GA, USA
³Griffith University, Brisbane, Queensland, Australia