ASSOCIATION FOR VASCULAR ACCESS

POSITION PAPER

The Use of Visualization Technology for the Insertion of Peripheral Intravenous Catheters

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Position Paper

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Introduction / Summary

It is estimated that over 350 million peripheral intravenous catheters (PIVC) are inserted in the United States annually, making PIVC insertion the most commonly performed invasive procedure for patients.[1,2,3] PIV catheters are often inserted for infusion of fluids, medications, administration of blood products, and the withdrawal of blood.[4]

Vascular access device selection is a collaborative effort with the healthcare team taking into consideration the patient's history, condition, and infusion needs.[4]

Venous vasculature is assessed through inspection, palpation, and visualization technology. The typical approach to prepare the vessel for PIVC insertion is the use of a tourniquet to enlarge the vessel, visual inspection, dangling the extremity, irritating the vessel (i.e., tapping), and heat.[5] Vein visualization technology is designed to assess for vessel health and to detect the vessel pathway identifying key anatomical structures (such as valves) to support ease and accuracy of PIVC insertion.[6] Evidence indicates that the use of vein visualization technology may improve first stick success, improve vessel identification, decrease procedure time, decrease procedural pain, and improve overall cost.[6,7,8,9]

First stick success is dependent on the combination of visualization technology, clinician experience, skill, and training.[8] Common vascular visualization technologies for the insertion of peripheral intravenous catheters include:

- Transillumination – Light technology placed underneath or around the intended PIVC insertion site and often used to visualize veins in neonates and infants, especially the hands and feet.[8] Transillumination technology improves visualization and first stick success.[6] Approved transillumination vein visualization devices do not emit heat, making it safe for contact with the skin.[6]
- Infrared (IR) or Near-Infrared (NIR) Light vein visualization technology – Provides direct illumination and visualization of the venipuncture site. IR/NIR technology analyzes the skin and projects the received image back on the skin, making the veins appear as black lines, creating a map to guide vessel identification and cannulation.[8] IR and NIR technology may improve procedure time, first success cannulation, procedure cost, and overall dwell time.[6,10-15]
- Ultrasound – Allows for visualization of vessels, arteries, nerves, and surrounding structures. When using ultrasound, the vessel size, depth and anatomical structure are visible (including valves and bifurcations).[7] Ultrasound allows for real-time visualization of needle access into the vessel and is recommended by multiple organizations,

associations, and standards.[16-21] When used appropriately, ultrasound guidance for vascular access has been shown to improve first attempt success rates while reducing inadvertent injury, the number of needle passes, and infection rates.[7,16-21] It may also improve patient comfort and satisfaction.[7] In current guidance documents, the use of ultrasound for PIVC insertion is recommended in "difficult" patients.[4,19,21,22] Considering the evidence of improved first stick success with ultrasound, the risk-to-benefit and the cost-to-benefit, the positive aspects of ultrasound use outweigh the negative.[21]

Background / Problem

Education on vascular access and the insertion of PIVC is typically not provided in formal clinical training (e.g., nursing school). Recent surveys revealed that 57% of nurses reported not being taught in nursing school, 71% reported receiving on-the-job training, and 11% were taught using the "see one, do one" approach.[23] With PIVC insertion being the most common clinical procedure and the evidence demonstrating high failure rates, there is opportunity to improve training, skill level, and guidance associated with the use of visualization technology.[23, 24]

Difficult IV access patients are often those presenting with prematurity, obesity, chronic illness, hypovolemia, vasculopathy or intravenous (IV) drug use.[19] Repeated attempts to insert PIVCs can cause vessel depletion. This often leads to the escalation of more invasive devices, such as central venous catheters. Repeated failed attempts at PIVC catheterization can cause pain, distress, bruising or nerve injury to the patient.[6,24] IV insertion failure also impacts healthcare system efficiency and total cost of care.

Failed PIVC insertion can often lead to a second victim, the clinician attempting insertion. After PIVC insertion failure, the inserter may feel frustration, anxiety, loss of confidence and there may be a loss of trust between the clinician and the patient/family.[6,25]

The Association for Vascular Access (AVA) recommendations:

Practice Recommendations

Given the variability of facilities, personnel and training, organizational capabilities, and practices, AVA recommends the following steps regarding vessel visualization for the insertion of peripheral intravenous catheters:

1. Healthcare providers using vein visualization technologies for the insertion of peripheral intravenous catheters will be adequately **trained** on the use of the technology, its benefits and limitations.
2. Peripheral intravenous catheter **outcomes** will be measured and understood including first stick success and catheter dwell time. Improvement measures may include (but are not limited to) team member training, patient education, and implementation of vein visualization technology.

3. **Transillumination** technology should be considered as a visualization tool if more advanced visualization technology is not available.
4. In an effort to prevent vessel depletion and improve patient comfort, the use of i**nfrared/near infrared** visualization technology or **ultrasound guidance** should be considered for peripheral intravenous catheter insertion as a first intervention when used by trained healthcare providers.
5. For technology that comes in contact with the patient, follow the manufacturer's recommendations for appropriate covers to ensure proper protection of the patient. Training should also include proper care of the technology including cleaning and charging. For ultrasound, refer to the Association for Vascular Access guidance document on transducer disinfection.

Conclusion:

Technology, coupled with a skilled clinician, offers patients a safer, more reliable and less invasive solution for achieving vascular access. Peripheral intravenous catheters are getting more attention today than ever before as the opportunity to improve this aspect of care becomes better understood. ECRI Institute identified PIVC infections on the 'Top 10 Patient Safety Concerns' list for 2019.[26] Professional organizations are launching formal curricula to support insertion, care and maintenance of PIVCs. In addition new and revised standards, guidance, and position papers are promoting best practice. Evolving clinical practice to include the implementation of evidence-based practice surrounding PIVC insertion will provide precision, decreased pain, time and institutional costs and one day hopefully eradicate the term "difficult access". "One Stick" should be the standard for vascular access.[27]

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Ms. Pitts has been a Pediatric Registered Nurse for 21 years. She developed the pediatric vascular access team at St. Joseph's Children's Hospital (Tampa, FL) and is a vascular access nurse on the team. She is a passionate patient advocate and hasn't "stuck blind" since advancing her ultrasound skills many years ago. She is the Director of Healthcare Innovation and Strategy for B. Braun USA (Bethlehem, PA). Stockholder, AngioDynamics, Inc. (Latham, NY). Board of Directors for Navi Technologies (Melbourne, Australia). She is a Director-at-Large for The Association of Vascular Access Board of Directors and Interim-President of the AVA Foundation. Ms. Pitts has multiple publications, specifically related to pediatric vascular access, is an international speaker on vascular access, and was awarded the 2018 Janet Pettit Scholar Award in Neonatal and Pediatric Vascular Access.

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Matthew Ostroff is an advanced practice nurse working as the vascular access coordinator and lead clinician for the award winning hybrid ultrasound guided bedside vascular access program at St.Joseph's Health (Paterson, NJ) specializing in pediatrics and adults. After earning the "Outstanding Graduate Award"from Drexel University in the Adult-Gerontology Acute Care Nurse Practitioner Track, Matthew advanced his scope of practice working under the Chairman of Surgery. Mr. Ostroff is also a speaker for 3M, B. Braun, BD, Vygon, Adhezion Biomedical and Sonosite. Matthew has had the privilege of sharing his vision for vascular access speaking throughout the US, Canada, and Latin America with an emphasis on critical thinking with complicated cases to advance our specialty as evidenced by his work and publications on the use of the femoral vein in the mid-thigh and subcutaneous tunneling.

Disclaimer: This document is meant to serve as a basis for evidence-based decision making. Nothing contained within this position paper should take the place of following a medical device's approved instructions for use provided by the manufacturer.

The Association for Vascular Access (AVA) was founded in 1985 to promote the emerging vascular access specialty. Today, AVA stands at the forefront of protecting and saving lives via establishing best practices and promoting patient advocacy. AVA's multidisciplinary membership advances research, provides professional and public education to shape practice and enhance patient outcomes, and partners with the device manufacturing community to bring about evidence-based innovations in vascular access. To learn more or join, visit www.joinAVAnow.com.

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