Development and Implementation of an Ultrasound-Guided Peripheral Intravenous Catheter Program for Emergency Nurses

Authors: Courtney Edwards, MSN, MPH, RN, CCRN, CEN, TCRN, and Jodi Jones, MD, Dallas, TX

Contribution to Emergency Nursing Practice

- Increasing rates of success and decreasing time for placement of vascular access are critical for optimal patient management in the emergency department.
- When obtaining peripheral intravenous access in the traditional manner has failed, ultrasound guidance is an effective and safe alternative available to emergency nurses.
- Development of an educational program, including both didactic and hands-on training, can achieve successful competency for emergency nurses in establishing ultrasound-guided peripheral intravenous access.

Abstract

Problem: Emergency medical care often necessitates placement of peripheral intravenous (PIV) catheters. When traditional methods for obtaining PIV access are not successful, ultrasound guidance is a rescue technique for peripheral vascular placement that improves the quality of patient care.

Methods: The aim of this training program was to develop a process where emergency nurses would be competent to perform ultrasound guided PIV to improve the quality of patient care delivered while reducing throughput time. Administrative program development required creating a nursing practice statement, procedure guideline, operational plan, and competency validation. A training program comprising both didactic and hands-on training was developed and provided by emergency medicine physicians with formal ultrasound fellowship training.

Results: In determining whether the training program was adequate in preparing the student to place an ultrasound-guided PIV, 92.9% of students "agreed" or "strongly agreed." In having confidence in their ability to obtain an ultrasound guided PIV catheter placement, 35.7% of respondents "agreed" and 64.3% "strongly agreed." In finding it difficult to be successful in achieving ultrasound guided PIV catheter placement, 71.4% of students "strongly disagreed" and 14.3% "disagreed." All students (100%) felt it was a feasible task to train nurses to successfully place ultrasound-guided PIV catheters and 71.4% of students strongly support continuing to provide this training program and competency validation.

Implications for Practice: Establishment of an effective didactic and hands-on training program resulted in emergency department nurses becoming competent in placement of ultrasound guided PIV catheters to provide optimal patient care.

Key words: Emergency nurse; Ultrasound guided; Peripheral intravenous; Training

Emergency medical care often necessitates placement of vascular access to provide for fluid resuscitation, administration of medication and blood products, and imaging studies. Ideally, this is achieved through a peripheral intravenous catheter (PIV). Most often, PIV access is obtained using direct visualization and vessel palpation using landmark-based techniques. However, this is often not as simple as described. Conditions such as obesity, chronic illness, hypovolemia, intravenous drug abuse, and vasculopathy can lead to difficulty in obtaining vascular access.[1] In one reported study, 39% of patients required more than 1 attempt to achieve PIV placement, contributing to delays in medical care.[2] When PIV access cannot be readily obtained, serious complications can result, including delays in medical diagnosis and treatment,

Courtney Edwards, *Member, ENA, Dallas County Chapter*, is Trauma Outreach Education, Injury Prevention, & Research Manager, The Rees-Jones Trauma Center at Parkland, Parkland Health & Hospital System, Dallas, TX.

Jodi Jones is Assistant Professor, UT Southwestern Medical Center, Emergency Medicine Faculty Physician, Parkland Health & Hospital System, Dallas, TX.

For correspondence, write Courtney Edwards, MSN, MPH, RN, CCRN, CEN, TCRN, 5200 Harry Hines Blvd, Dallas, TX 75235; E-mail: courtney.edwards@phhs.org.

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increased nonproductive nursing time, additional costs from use of medical supplies, more expensive and higher-risk vascular procedures, and patient pain and suffering.[3] Alternative vascular accesses to PIV catheter placement include intraosseous needle placement, peripherally inserted central catheters (PICC), or placement of central venous catheters. These procedures carry additional substantial risks including the risk of infection, pneumothorax or hemothorax, hematoma, pseudoaneurysm, or fracture and consume additional time and resources by the health care team.[2]

When traditional methods for obtaining PIV access are not successful, ultrasound guidance is a rescue technique for PIV placement that improves the quality of patient care.[2] Ultrasound is a noninvasive procedure that allows the user to view images of organs, tissues, and blood flow in real time, using high-frequency ultrasound waves. Ultrasound guidance of PIV catheter placement has demonstrated decreased delays with medical care, decreased patient throughput times, reduced use of central venous catheters, increased staff autonomy, and improved patient satisfaction.[4,5] The feasibility and success of nurses placing ultrasound-guided PIVs is well documented.[4,5]

Initiated as a quality improvement project, the specific aim of our training program was to develop a process in which emergency nurses would be competent to perform ultrasound-guided PIV catheter placement to improve the quality of patient care delivered while reducing throughput time in our urban, high-volume emergency department. The goals of the program were to eliminate delays in treatment due to inability to perform vascular access and use of nonessential central venous catheters, advance clinical practice, foster physician–nurse collaboration, and improve the patient experience.

Methods

The quality improvement project was first conceived in a conversation among 2 senior nurses and the emergency room director regarding visualization devices available to aid in difficult PIV access. The conversation included discussion regarding a local hospital's development of an ED nurse ultrasound-guided PIV catheter program.[6] Following the conversation, the ED director tasked the 2 senior nurses with establishing a steering committee to investigate the potential implications for developing and implementing an ultrasound-guided PIV catheter program for emergency nurses.

The steering committee comprised the 2 senior nurse champions, an emergency medicine physician champion, and the ED director. The first task of the steering committee was to reach out to the local hospital that had previously demonstrated success with an ED-based ultrasound PIV program and request assistance and collaboration. Arrangements were made with the mentoring facility to allow the members of the steering committee and 6 additional senior nurses from the emergency department to attend their training program.

Before implementation of the training program, several administrative processes needed to be defined and implemented. These included the development of a nursing practice statement, procedure guideline, operational plan, and competency validation. Expertise and experiential knowledge were offered by the mentoring facility throughout this process.

The nursing practice statement and procedure guideline were developed based on available evidence-based resources at the time. Ultrasound-guided PIV catheter placement was limited to only those patients for whom traditional PIV access could not be achieved: patients who have extremely limited peripheral veins of the upper extremity that are neither visual nor palpable for standard landmark insertion, those who have complicated vasculature, or those for whom there have been multiple unsuccessful attempts for PIV access. Once finalized by the steering committee, these documents were presented to the departmental nursing directors, service line vice president, and chief nursing officer for support and approval.

Following the approval of hospital leadership of the nursing practice statement and procedural guideline, the operational plan was devised. Targeted staff members to undergo training for ultrasound-guided placement of PIV catheters were senior staff nurses whose clinical skills in standard landmark PIV insertion were strong. It was also the desire of the organizational leadership to reward and further strengthen those senior staff nurses who had advanced clinical skills. Plans were implemented for the procurement and stocking of additional necessary medical supplies. Documentation practices and physician ordering were addressed through the electronic medical record with the development of a provider order and procedure note template. Ultimately, the steering committee completed a full workflow diagram of the intended process to identify and perform ultrasound-guided placement of PIV catheters.

The didactic portion of the training program is provided by an emergency medicine physician who has completed an ultrasound fellowship. Training content is 90 minutes and includes ultrasound physics, ultrasound equipment and knobology, vascular anatomy of the upper extremities, ultrasound-guided vascular techniques, selecting the appropriate vein for cannulation, prevention of infection, complications, care of the equipment, and documentation of procedures. This is in accordance with the recommendations of the World Congress of Vascular Access that training programs include simulation-based training, prevention of infection, complications, care, and