

Establishing an Ultrasound-Guided Vascular Access Program

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How St. Joseph's Healthcare System successfully set up a program with nurse leadership

Establishing vascular access is one of the most commonly performed medical procedures and plays a central role in patient care. Annually, 200 million peripheral intravenous (PIV) catheters are placed in U.S. hospitals for volume resuscitation and delivery of nutrients, lifesaving medications and blood products.[i] However, obtaining PIV access is difficult in about 35% of patients who present to the emergency department (ED), particularly if traditional “landmark” or palpitation methods are used, according to a recent meta-analysis.[ii] Multiple failed attempts can cause patients to suffer pain, delays in care, and increased risk for infection, the investigators reported.

In a 2016 policy statement, the American College of Emergency Physicians (ACEP) recommends procedural ultrasound, performed at the bedside, to facilitate placement of PIV and central venous catheters (CVCs), citing such benefits as “improved patient safety, decreased procedural attempts, and decreased time to perform many procedures in patients [for] whom the technique would otherwise be difficult.”[iii] Widespread adoption of this technique would also help enable clinicians to achieve a “one-stick standard” for vascular access, ACEP noted.

Safety Improvements and Vast Cost Savings

The recommendations in this article are based on the authors’ experiences in implementing a system-wide ultrasound-guided vascular access program at St. Joseph’s Healthcare System in New Jersey under nurse leadership. Launched in February 2014, the program has achieved the following outcomes in its first three years:

- Striking improvements in the safety and quality of care for patients ranging from 2-pound premature infants to adults weighing up to 500 pounds
- Cost savings of \$3.5 million, using a six-person team of nurses trained in vascular access and ultrasound machines at [the] bedside.
- A 97.3% first-pass success rate for PIV placement, including difficult-access patients
- Increased patient satisfaction across our healthcare system, comprised of St. Joseph’s Regional Medical Center and St. Joseph’s Children’s Hospital (651 adult and pediatric beds) in Paterson, N.J.; St. Joseph’s Wayne Hospital (229 beds); St. Vincent’s Healthcare and Rehab Center (151 beds) in Cedar Grove, N.J., and our more than 30 outpatient facilities



- A dramatic increase in the number of patients seen by our team, from 1,341 in 2014 to 5,550 in 2017. Our program offers ultrasound-guided vascular access for both peripheral and central lines, across all hospital departments from the NICU to the ICU. The work of its clinicians has recently been recognized with the nomination of one of our team members for the 2018 Suzanne LaVere Herbst Award for Excellence in Vascular Access, the highest honor the Association of Vascular Access bestows upon a member in recognition of outstanding contributions to the art and science of vascular access.

How did we achieve these results? Here are five lessons learned from our experience in implementing a successful ultrasound-guided vascular access program with nurse leadership.

1. Identify and satisfy unmet needs. We started our program at our Paterson, N.J., hospital by hiring one vascular access specialist. He initially handled peripherally inserted central catheter (PICC) placements and PIV cases in which there had been three failed attempts with traditional methods. However, the ease at which the specialist was able to achieve vascular access with ultrasound guidance, even in difficult cases, resulted in such a surge of demand that our program grew to include six specialists, all of whom are nurses. In June 2017, we expanded to a system-wide program. Key ideas that have contributed to the success of our program include the following:

- **Accelerating lifesaving care.** Until vascular access is achieved, many common therapies cannot be initiated, nor can ED patients be transferred to other departments—such as surgery, the cardiac catheterization lab, or the critical care unit—for additional treatments they urgently need.

Achieving One-Stick Vascular Access, Value-Based Care for Patients (continued)

- **Highlighting the value of ultrasound guidance to colleagues.** Use of this imaging modality is now standard throughout our system, so all patients receive the same top-quality care, no matter which department administers their treatment.
- **Educating patients and their families about the benefits of ultrasound-guided vascular access.** Initially, our vascular access specialists only worked with adult patients, but we quickly discovered a major role for their services in pediatric care. After chronically ill children learn that their PIV lines can usually be placed on the first try if ultrasound guidance is used, versus multiple painful jabs without it, they've started asking for our vascular access specialists as soon as they arrive at the hospital for treatment.

2. Locate the safest, most cost-effective catheter site with ultrasound. Before the launch of our vascular access program, patients with difficult PIV access often received PICCs, which typically take 40 to 45 minutes to perform, at a cost of \$280 for supplies alone at our center. Real-time ultrasound visualization, however, enables practitioners to map the patients' blood vessels, access their patency and identify the best catheter site. As a result, PIV access in patients with problematic vasculature is nearly four times more likely to succeed if ultrasound guidance is used, compared to traditional techniques, according to the meta-analysis cited above.

Implementing this technique system-wide at our centers has reduced the need for central lines by 40%, even in challenging cases. For example, we recently treated a woman who was pregnant with triplets and had been hospitalized for a month of treatment to reduce the risk for premature labor. Although her physician initially thought a PICC line would be necessary, these can be problematic for pregnant women. Using ultrasound guidance, we were able to map her veins and identify a safe location for PIV access for the patient, who later delivered healthy triplets.

PIV lines take 5 to 10 minutes to place, at a supply cost of \$25 to \$30. This simple, but important, change in catheter site for many of our patients has resulted in cost savings of nearly \$1 million to date for our healthcare system. The vascular access program also saved St. Joseph's more than \$2.5 million by reducing referrals to interventional radiology for PICCs—freeing up these specialists to focus on more complex procedures with higher reimbursement rates—and shortening length of stay in our ED.

The ability to use ultrasound as a visual GPS to map the patient's vasculature and locate the safest vascular access site has also enabled our hospital system to become the first in the United States to off the relocation of the traditional femoral central line insertion site from the groin to the mid thigh, with the procedure performed at the bedside.

One of our clinicians began implementing mid thigh femoral central lines in 2015 and since then, physicians throughout the hospital have adopted this new, safer insertion site in many different patient populations. This advancement in vascular access placement has several benefits, including avoiding the stigma associated with having a femoral line in the groin, decreased risk for infection, and the preservation of the vasculature in the upper body.

3. Use ultrasound-guided PIV as an alternative to high-risk central lines. Like many hospitals nationally, our center has rising rates of patients with problematic PIV access due to such factors as chronic illness, chemotherapy, obesity, and IV drug abuse. Without ultrasound guidance, such patients—sometimes called “difficult sticks”—often end up with CVCs because clinicians find it impossible to obtain PIV access.

However, CVCs can have serious risks, including central line-associated bloodstream infections (CLABSIs) and the accidental puncture and collapse of the patient's lung (iatrogenic pneumothorax). Both of these adverse events are targeted by Medicare's Hospital Acquired Conditions (HAC) Reduction Program, which penalizes the 25% of hospitals with the highest rates of these and other preventable medical errors 1% of their annual reimbursements. In fiscal year (FY) 2017, 769 hospitals were docked approximately \$430 million in penalties.[iv]

Thanks to our ultrasound-guided vascular access program, our healthcare system has a bloodstream infection rate well below the national benchmark—and for many patients, zero vascular complications of any kind.

4. Recognize the vital role nurse leadership can play in implementing a successful vascular access program. Nurse-led ultrasound-guided vascular access programs have achieved impressive improvements in the safety and quality of care, particularly for patients with problematic vasculature. In what is believed to be the first such program, in 2004, nurses at a Level 1 trauma center in Georgia were trained to use ultrasound to access deep peripheral veins. Of 258 patients identified as difficult sticks before this technique was used, 80% were rated as “hard” and none as “very easy.”

With ultrasound guidance, the nurses reported in a 2006 survey that only 11% of these patients remained “hard” and 42% were “very easy,” with an overall success rate of 85% to 89%.[v]

A recent study at Texas Health Harris Methodist Hospital[vi] found that after launching a registered nurse-led ultrasound-guided vascular access program, CVC and PICC placements due to problematic PIV access decreased by 74%, resulting in annual savings of \$200,000. Other investigators have reported PIV success rates of up to 100%[vii] with ultrasound guidance, while fewer jabs and faster care have also been shown to significantly increase patient satisfaction.[viii]

Achieving One-Stick Vascular Access, Value-Based Care for Patients (continued)

5. Leverage the nurse/physician partnership to optimize patient care.

Our vascular team recently worked closely with our geneticists to treat a newborn with a usually fatal metabolic condition. During one year of pioneering treatment that included administration of IV medications every two weeks, along with drawing 10 vials of blood for lab tests, we were able to achieve a 100% first-pass PIV success rate with ultrasound guidance. Not only did the baby's veins remain open, without a need to escalate to more invasive devices, but she is also making medical history by developing normally, without any of the usual life-threatening complications of her disorder.

As nurses providing hands-on care to patients ranging from the frail elderly to the tiniest preemies, we find these success stories fuel our passion for spreading the word about the many benefits of ultrasound guidance. We hope that sharing our experiences will inspire other healthcare professionals to join the growing movement toward the one-stick standard and adopt the ideal technology to achieve it: Ultrasound machines at the bedside to help clinicians provide safer, more compassionate care.

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