



# Proactive Planning for Vascular Access Therapy: One Hospital's Plan for Success

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## Abstract

**Background:** Vascular access is a critical component of care for patients in neonatal intensive care units (NICUs). Our NICU had only a small number of nurses cross-trained to perform peripherally inserted central catheter (PICC) insertions and was not able to provide coverage 24 hours a day, 7 days a week. We combined the vascular access team (VAT) and NICU PICC team to improve the timeliness of NICU PICC insertions, standardize care, and use ultrasound for all PICC placements.

**Methods:** A paper guide tool was developed to prioritize PICC placements as emergent, same-day, or nonemergent. NICU nurses were trained to insert PICCs using ultrasound. Catheter insertion and care processes were standardized for the new centralized PICC team. NICU and VAT staff worked together to improve daily communication, hand-offs, and referrals. Criteria were developed to determine the appropriate hospital location for PICC insertions. Charge nurses began capturing information about patients with PICCs on daily planning sheets.

**Results:** Following implementation of the new combined VAT, the average wait time for emergent and same-day insertions decreased 10%. No adverse events were reported due to a delay in PICC placement or the PICC referral process.

**Conclusions:** Combining the NICU PICC insertion nurses and the VAT into a new centralized PICC team provided an opportunity for growth in both areas. NICU PICCs are now placed efficiently based on patient acuity and referral prioritization throughout the hospital. NICU and VAT physicians and nurses have developed a strong partnership for the provision of PICC services for NICU patients.

**Keywords:** neonatal intensive care unit, peripherally inserted central catheter, planning, vascular access therapy

## Background

Vascular access is a critical component of care for patients in neonatal intensive care units (NICUs). The provision of certain infusates via peripheral intravenous access for prolonged time periods may put NICU patients at higher risk for extravasation.<sup>1</sup> Such high-risk infusates may include total

parenteral nutrition, lipids, caustic antibiotics, and vasopressors. Once the need for a peripherally inserted central catheter (PICC) has been identified, the insertion should happen as soon as possible so patients have the vascular access for needed therapy.

At our medical center, NICU PICC nurse coverage and training for PICC insertion via ultrasound was limited. The NICU had a small number of nurses cross-trained to perform PICC insertions and was not able to provide coverage 24 hours a day, 7 days a week. Standardization of practice and maintenance of competency needed to be established throughout the organization. We used quality improvement methods<sup>2</sup> to address these issues. By combining the vascular access team (VAT) and NICU team, we believed we could provide 24/7 coverage and increase the proficiency of the PICC insertion nurses through the high volume of insertions

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required throughout the hospital. One of our goals was to improve the timeliness of PICC insertion for NICU patients, from order through placement. We also wanted to standardize care and include the use of ultrasound in all PICC placements.

### **Prioritization**

Prioritization of PICC referrals was an area that required improvement. Frequently, multiple patients were referred for PICC insertion at the same time, requesting same-day or immediate placement. However, referrals were made without identification of priority based on patient needs. An improvement team was formed consisting of NICU and VAT registered nurses, advanced practice nurses, and NICU and VAT physicians. Based on input from staff and prescribers, the improvement team developed a guide tool that categorized 3 priorities for PICC placement: emergent (within 90-120 minutes of referral), same-day (within 8-12 hours of referral), and nonemergent (can be scheduled 24 hours or more in advance). This paper tool was used by NICU and VAT nurses to assist in the decision-making process for timely PICC referrals. Staff members received education on use of the tool and, once final revisions were made, the tool was embedded in the hospital electronic medical record system. Staff members used the tool as a guideline when discussing the vascular access needs for patients during daily rounds. The prioritization tool also allowed staff to schedule PICC insertions based on acuity to improve flow and allow for standard expectations related to prioritization among the VAT and NICU teams.

A survey developed by the NICU and VAT leadership team to evaluate PICC services to date was completed by 14 NICU physicians and advanced practice nurses. Ninety-three percent knew the process for initiating a PICC referral, 86% had initiated a PICC referral, 71% had not experienced any significant delay, and only 8% had filed a safety report regarding a delay.

### **Ultrasound Insertion**

In the past, at our medical center PICCs could be placed in NICU patients by the specially trained NICU staff or members of the VAT, which provided PICC insertion for patients hospital-wide. When the practices of these 2 groups were compared, differences in standards were noted, such as the size of PICC used, the method of insertion, use of ultrasound, and the methods used to measure the length of the PICC before insertion. To improve safety, it was necessary to standardize practice and streamline care.

Before the routine use of ultrasound guidance, unsuccessful catheter insertion attempts and mechanical and infectious complications were common.<sup>3-6</sup> The use of bedside ultrasound-guided venipuncture has been associated with simplified vein selection; improved catheter insertion rates; fewer complications; decreased time to catheter access; and, likely, diminished patient pain as a result of venipuncture attempts.<sup>7-18</sup> Based on such studies, evidence from pediatric patients,<sup>19,20</sup> and other guidelines,<sup>14</sup> the Pediatric guidelines on vascular access care in pediatrics recommend a thorough assessment of the vein(s) using ultrasound to guide choosing

the appropriate vein, predicting vessel patency, determining the correct catheter size to place, increasing insertion success rates, and decreasing complications.<sup>21</sup> Therefore, use of ultrasound was seen as a top training priority at our medical center.

Education on the use of ultrasound began in May 2011 for the NICU staff, because they had little opportunity to learn this technique in the NICU. They first trained using a Blue Phantom (Sarasota, FL) ultrasound training model, then progressed from large patients to infants. Using the Blue Phantom training model provided a safe method for nurses to get the repeat practice required to perfect the technique for successful insertion of a PICC with ultrasound guidance without risk to actual patients.

NICU staff members were also required to learn how to measure a patient's vein before PICC insertion to ensure that the diameter of the catheter does not exceed the diameter of the vein. Vein measurements were obtained using the ultrasound machine. The policy at our medical center, based on the recommendation of the VAT medical director, is to not occlude the vessel more than 30%. Therefore, measuring the vein diameter and comparing this to the catheter's outer diameter provides very useful information.<sup>22</sup> As noted by Nifong and McDevitt,<sup>23</sup> the presence of a catheter within the lumen of a vein is presumed to decrease flow and potentially create stasis. In addition, existing clinical data suggest that the size of the catheter affects thrombosis rates.<sup>24,25</sup>

### **Process Standardization**

When assessing a patient in the NICU for a PICC insertion, anatomic measurements are required to ensure appropriate placement of the catheter tip. As cross-training began with the NICU staff, it was discovered that they were consistently able to measure for a shorter external visible length of catheter. A shorter external visible length is preferred so that there is decreased opportunity for internal or external migration of the PICC and decreased opportunity for contamination. The measurement from the insertion site to the right sternal notch and then down to the third intercostal space closely correlates with the distance from the insertion site to the superior vena cava, giving nurses a close estimation for trimming the PICC, if necessary, to an appropriate external length.<sup>26,27</sup>

As we began the process of centralizing the PICC team by adding the NICU staff to the VAT, we examined all their processes and techniques to determine best practices that could be adopted by all PICC team members. Because the NICU PICC insertion nurses only placed PICCs in babies, catheter measurement for PICC tip placement needed to be very precise to avoid excess external visible length under the PICC dressings in these very small patients. In contrast, the VAT placed PICCs in patients of all ages. Their process allowed for longer PICCs to address possible differing vascular anatomy in their patients. Other processes, such as PICC insertion using ultrasound, tray arrangement, and supply storage, were examined and standardized to improve safety and efficiency within the hospital.

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