Retrospective Analysis of a Pediatric Vascular Access Program and Clinical Outcomes

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Abstract

Background: *The specialty of pediatric vascular access has grown rapidly during the past 5 years across the United States. The majority of children's hospitals have nurse-led vascular access teams that are providing comprehensive services, including the placement of peripherally inserted central catheters. A children's hospital in the southeastern United States conducted an Internal Review Board approved, retrospective analysis of 669 patients who had a peripherally inserted central catheter placed.*

Objective: *The objective was to have a better understanding of the program and clinical outcomes as well as identify areas for improvement.*

Methods: *A data collection tool was developed to review the medical records of patients receiving a peripherally inserted central catheter from January 2009 through June 2011. Variables of interest included patient age, admitting diagnosis, intended therapy, procedure location, sedation type and usage, procedure success, insertion attempts, vessel selected, catheter size and type, catheter tip location, reason for discontinuation, and infection. The data was collected and analyzed by a nurse researcher from the University of South Florida.*

Results: *Using the Modified Seldinger Technique and ultrasound, the team inserted a full line of polyurethane catheters, including computed tomography-injectable catheters, with an insertion success rate of 94%. We identified a significant reduction in our hospital's infection rate—from 9.12 per 1,000 catheter line days to 2.0 per 1,000 catheter line days—during the first year and a half of the program. The use of sedation and anesthesia was significantly reduced, with 49% of patients receiving an oral anxiolytic dose of midazolam and the integration of certified child life specialists into the procedure.*

Conclusions: *Pediatric vascular access is a rapidly growing specialty in nursing. Nurse-led vascular access teams have become commonplace in children's hospitals throughout the United States. Although the specialty has grown rapidly during the past 5 years, there is a need for data sharing to contribute to the knowledge base of pediatric vascular access.*

Keywords: *pediatric, peripherally inserted central catheters, vascular access, modified Seldinger technique, certified child life specialists*

Introduction

The pediatric vascular access nursing team at St Joseph's Children's Hospital of Tampa conducted an analysis of their program. St Joseph's Children's Hospital is a not-for-profit community hospital in the southeastern United States. The hospital has 186 beds, is a level-2 trauma center, and has a pediatric and neonatal intensive care unit as well as a pediatric cardiac surgical intensive care unit. Our analysis looked at 669 pediatric patients who received a peripherally inserted central catheter (PICC) from January 2009 through June 2011.

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Background

PICCs are commonly placed for pediatric patients requiring long-term venous access.[1-3] The benefits of utilizing a PICC include ease and safety of insertion, patient comfort, minimizing repeated venipuncture, cost savings, and infection reduction (compared with other central venous catheter

devices).[3-5] Before a nurse-led pediatric vascular access team was established at the hospital, PICCs were placed using sedation or anesthesia and inserted by physicians, surgeons in the operating room, and radiologists in interventional radiology. The pediatric vascular access program at St Joseph's Children's Hospital was started in October 2008. The 3-nurse team (2.4 full-time equivalents) places PICCs using the modified Seldinger technique with ultrasound. The team is also responsible for difficult intravenous line starts, difficult lab draws, central line dressing changes, and education for patients and staff caring for patients with a vascular access device.

Methods

A retrospective review spanning 18 months of data was conducted. The analysis looked at 669 pediatric patients who received a PICC from January 2009 through June 2011. The hospital's Internal Review Board approved the analysis. Support for data collection and analysis was provided by the research committee. A data collection tool was developed (Table 1) to include these specific data points: patient age, admitting diagnosis, intended therapy, procedure location, sedation type and usage, procedure success, number of attempts, vessel selected, catheter size and type, tip location, reason for discontinuation, and incidence of infection. Once the data collection and retrospective review were completed, analysis was performed by a nurse enrolled in the doctorate program at the University of South Florida College of Nursing. Data analysis methods included description of the univariate data and frequencies.

Data Collection Points

Patient Age

This pediatric vascular access team is challenged with placing PICCs in patients from birth through age 21 years (Figure 1). The team does not routinely place PICCs in the neonatal intensive care unit; however, neonates (infants aged <30 days) are often in the pediatric intensive care units. Decision making for PICC placement involves many factors, including the patient's age, developmental level, consideration for sedation services, education provided to the child, and availability of appropriately sized equipment and other resources needed for the procedure.[6,7] Patient age does not determine catheter size; however, the younger the patient, typically the smaller the vein presentation and therefore the need for smaller catheters and devices to place the PICC.

Admitting Diagnosis

Of 669 patients reviewed, 222 different admitting diagnoses were recorded (with many repeated). Diagnoses were categorized by medical subspecialty to provide meaningful interpretation for the organization (Table 2). This information provides some insight into the patient population served by this vascular access team. Important to note is that the admitting diagnosis does not necessarily explain the reason the PICC was placed. For example, a patient may have an admitting diagnosis of "abdominal pain" and a discharge diagnosis of "appendicitis." In this example, the PICC may have been placed for long-term antibiotic therapy.

Gastrointestinal and surgical-related patient groups accounted for the largest population of patients in this review. The gastrointestinal diagnosis group accounted for 27.7% of patients having a PICC inserted. Most common diagnoses include ulcerative colitis, Crohn's disease, and bowel obstruction. The surgical diagnosis group represented 25.2% of the studied patients. Common diagnoses in this group include perforated appendix, appendicitis, and abdominal abscess. Awareness of the patient diagnosis provides information that can lead to early assessment and advocacy for patients who will likely need a PICC during hospitalization.

Intended Therapy

Intended therapy is a designated documentation point in the PICC documentation of the medical record. The main reasons for PICC placement include long-term antibiotics therapy (46.6%), infusion of total parenteral nutrition (26.7%), limited venous access (25.8%), infusion of vesicant or irritant medication (8.1%), replacement of a short-term central venous line in the jugular or femoral region (5.1%), and for outpatient therapy (2.3%). Some patients had a PICC placed for >1 reason, resulting in multiple responses in the documentation.

Procedure Location

The patient's bedside was the procedure location for 75.2% of the patients. This was made possible due to the pediatric vascular access team coordinating and collaborating with the certified child life specialists to best prepare each individual patient. The team of certified child life specialists provided excellent patient and family preparation and support. The team observed that patients were more comfortable remaining in their own room as opposed to having the procedure performed in a treatment room. The mean age of patients with PICCs placed at the bedside is 9 years. Other procedure locations used for PICC insertion include the treatment room, outpatient procedure unit, radiology, and the operating room.

Sedation Type and Usage

Sedation practices in pediatrics vary across the country. Individual patient assessment is performed to identify the patient's expected tolerance of the procedure. This includes family when available and is usually performed during the preassessment time in which a tourniquet is applied and ultrasound is used to locate the vessel. At this time the vessel is marked and topical lidocaine cream is applied. The patient's tolerance of the preassessment along with planning and coordinating with the child, family, and bedside nurse result in the best plan for the patient.[6-8]

The options available in this study include a certified child life specialist for procedural preparation and distraction, sedation, administration of anxiolytic medication (oral midazolam 0.5 mg/kg, maximum 10 mg), procedural sedation provided by a pediatric intensivist, and anesthesia. Anxiolytic medication was used with 49% of the patients in the study (Figure 2). The use of sedation or anesthesia was necessary for the majority of children aged 4 years and younger. For patients aged 5 years, half received sedation or