



Comparison of Outcomes of Extended Dwell/Midline Peripheral Intravenous Catheters and Peripherally Inserted Central Catheters in Children

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Abstract

Background: Insertion of extended dwell/midline peripheral intravenous (EPIVs) catheters is not common practice in pediatric hospitals. An interdisciplinary team in 1 pediatric hospital developed a venous access decision tree based on current standards that included EPIVs. The purpose of this evaluation was to assess the process and pediatric patient outcomes associated with use of EPIVs and with peripherally inserted central catheters (PICCs).

Methods: A retrospective record review over 22 months was conducted for 375 patients who received either a PICC (67.5%) or EPIV (32.5%). Data collected included patient demographic characteristics, diagnosis category, type and purpose of the line, insertion and removal dates, catheter size, placement location, and complications encountered.

Results: EPIVs were inserted with a 1.9F or 3F catheter, whereas PICCs generally used a 3F or 4F catheter. EPIVs were more commonly inserted in children younger than age 1 year, whereas children aged ≥ 11 years more often had a PICC inserted. EPIVs remained in place an average of 9 days compared with 20 days for PICC lines. Significantly more complications occurred during the placement of PICCs, whereas EPIVs had more complications during use such as leakage, dislodging, and infiltration.

Conclusions: EPIVs were a successful alternative to PICC or peripherally inserted venous catheters for children in an inpatient acute-care facility who need 30 days or fewer of nonvesicant intravenous therapy. The venous access decision tree provided useful guidance in determining the appropriate venous access device for pediatric patients and the decision tree was adhered to by the vascular access team.

Keywords: extended peripheral intravenous, midline intravenous catheters, pediatric vascular access, vascular access decision tree

Introduction

Vascular access in hospitalized pediatric patients poses many challenges. Maintenance and preservation of vascular access is an important patient safety and quality concern. In our 263-bed full-service free-standing children's hospital, and in most other hospitals,¹ more than 90% of pediatric patients have some type of vascular access device placed while in the hospital.

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Background

Short peripheral intravenous (PIV) catheters, typically the first choice for obtaining vascular access, are appropriate for short-term, nonvesicant therapies and can be placed by staff nurses or the vascular access team. Although PIVs are relatively easy to place, they typically have short dwell times, particularly in neonates,² and require frequent replacement as a result of infiltration, leakage, occlusion, or dislodgement.³ These limitations can lead to multiple attempts at reinsertion, causing patient pain and anxiety.

Peripherally inserted central catheters (PICCs) have been widely used in pediatrics as a less invasive means of gaining access to central vessels for long-term venous access or infusion of caustic agents. PICCs have also become widely used when a PIV is difficult to access or maintain. Unfortunately, there is greater risk of bloodstream infection with central venous catheters, including PICC lines, compared with peripheral lines.^{4,5} Therefore, reduction of the use of PICC lines is a goal.

Extended dwell/midline peripheral intravenous catheters (EPIVs), which have been used with adults for more than 2 decades, are effective in delivering fluids and medications, and in allowing daily blood draws with a very low rate of infection or phlebitis.⁵⁻⁷ Appropriate use of these catheters in place of PICC lines has also resulted in a decrease in central line-associated bloodstream infection.⁵ EPIV catheters are shorter than PICC lines or central catheters, and may dwell in a peripheral vein for up to 29 days,⁸⁻¹⁰ although in 1 study of 140 midline catheters, some were in place as long as 49 days without incident, prompting O'Grady et al⁷ to recommend that extended dwell/midline catheters be replaced only when there is a specific indication. In children, EPIVs may be inserted in the upper or lower extremities or scalp.^{7,11} EPIVs can often be inserted without sedation and do not require fluoroscopy for placement, thus avoiding exposure to radiation. Despite the

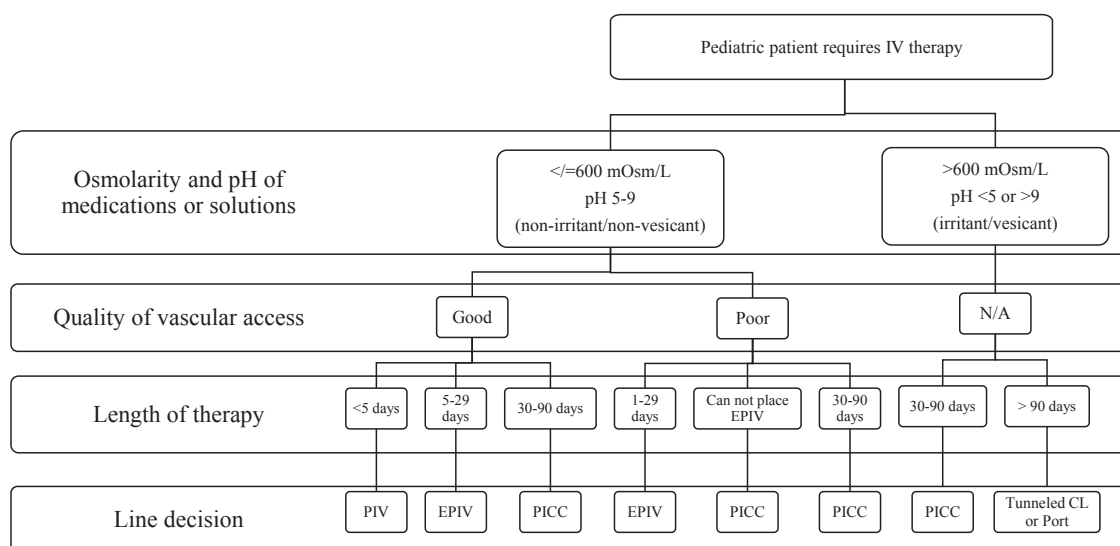
potential benefits and low risks, EPIVs to date have not been widely used in pediatric populations.

Similar to other institutions,¹² the use of EPIVs in our pediatric hospital began in the neonatal intensive care unit with positive results. In 2013, vascular access nurses initiated placing EPIVs in other pediatric patient populations. Originally, EPIVs were considered a bridge between PIVs and PICCs for patients requiring reliable, noncentral access. The use of EPIVs was successfully expanded to include placement when venous access for longer periods of time was required, for infusing noncaustic agents such as pain medication or sedation, and in ventilated patients with respiratory syncytial virus or bronchiolitis who needed venous access for sedation drips. Other examples included cardiac pediatric patients requiring venous access as a precaution for their entire length of stay and patients receiving nonvesicant antibiotics for bacterial infections. Because EPIV lines can be used in children of all ages and in any area of the hospital they have provided a dependable venous access and a safe alternative to PICC line placement.

Venous Access Decision Tree

Choosing the most appropriate venous access device for pediatric patients can be challenging. As an aid in decision making, the vascular access team, in collaboration with physicians and pharmacists, developed a venous access decision tree (see the [Figure](#)). The tool was developed based on current Infusion Nursing Standards of Practice related to venous access device selection and placement⁸ and is used regularly to guide clinicians in determining the safest and most appropriate venous access device for patients. Venous access devices included on the decision tree are PIVs, EPIVs, PICCs, and central lines.

As illustrated in the [Figure](#), there are 2 main categories of infusates on the decision tree based on the drug's osmolarity and pH. Irritants and vesicants have an osmolarity > 600



Note: PIV = Peripheral intravenous catheter; EPIV = Extended dwell intravenous catheter; PICC = Peripherally inserted central catheter; CL = Central line

Figure. Vascular access decision tree.

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