Central Vascular Access Device Guidelines for Pediatric Home-Based Patients: Driving Best Practices

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Abstract

Central vascular access device (CVAD) care for infants and children in home settings is challenging due to small catheter sizes, patient activity, and variation in care and maintenance practices. CVADs require detailed care to prevent complications and unnecessary line replacement. Guidelines that address CVAD care and maintenance for pediatric home-based patients do not exist. This article reviews evidence-based central venous catheter maintenance practices for pediatric home care patients.

Keywords: *pediatric, central vascular access device, flushing, dressing, blood sampling, complication*

Introduction

For pediatric patients receiving infusion therapy at home, a central vascular access device (CVAD) represents a lifeline to treatment. CVADs are commonly used in home care settings for the administration of antibiotics, parenteral nutrition, and fluids as well as blood sampling for both acute and chronic conditions.[1] Maintaining the CVAD to allow uninterrupted delivery of the prescribed infusion therapy is a primary goal of home infusion providers; however, this goal can be challenging to accomplish given the wide range of professional and lay caregivers who may be involved in a patient's home infusion treatment. Guidelines that address CVAD care and maintenance considerations for pediatric home-based patients do not exist.

In early 2012, a panel of clinicians specializing in pediatric care representing hospital and home-based infusion providers met to review published guidelines and standards of practice with a goal of developing a simple tool promoting a standardized, evidence-based approach to CVAD care that meets the unique needs of pediatric home-based patients. With few randomized, double-blind clinical trials performed in home care settings, and even fewer focused on pediatric patients, this pediatrics-specific CVAD guideline tool evolved from a combination of acute care-based research, published standards and guidelines, and professional experience. As new research is published, it is vital for clinicians who work in home-based care to review and continuously integrate evidence-based care into their home infusion clinical practice.

Organized into functional sections, the CVAD Guidelines for the Pediatric Home-Based Patient (Appendix 1) is intended to provide a concise, quick-reference tool for the care and maintenance of CVADs in home-based pediatric patients. Because the guideline begins with the care and maintenance of an access device that is already in place, and therefore does not address CVAD selection or placement considerations, this topic is covered briefly before addressing the specific recommendations contained within each functional area of the guideline.

Types of CVADs Used in Pediatric Patients

CVADs provide reliable and safe access for many types of infusion therapies.[1] The catheter tip location is important for decreasing complications and maximizing catheter dwell

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time.[2] The optimal tip location for all CVADs is the distal superior vena cava for upper extremity sites, and the inferior vena cava for sites in lower extremities.[2] The vena cava provides rapid hemodilution of infusates, which minimizes trauma to the vessel wall.[2] Catheter selection begins with the type and length of infusion therapy prescribed, diagnosis, age, developmental level, and patient/parent/clinician preference along with available veins to access.[3] In home care settings, patient comfort and ease of use are also factors to consider when selecting a CVAD. The acute care hospital from which a pediatric patient is discharged often drives the decision on what type of CVAD a patient will receive.

Table 1 provides specific information for pediatric CVADs. The chart serves as a resource for types of pediatric CVADs, description, priming volumes, and special considerations. In addition to choosing an appropriate CVAD for a young patient, proper care and maintenance is critical.[4] Central line maintenance bundles that focus on evidence-based practices grouped together have gained momentum for identifying best practices for pediatric CVAD care. There have been several recent publications on proven success in reducing central line-associated bloodstream infection (CLABSI) and improved catheter outcomes with pediatric central line bundles.[5] Although the bundle includes many key areas related to infection control, collaborate with the prescribing provider in planning for timely CVAD removal upon completion of therapy.[6]

Flushing or Locking a CVAD

Catheter flushing serves 2 primary purposes: it verifies the patency (in conjunction with a blood return) and serves as a barrier when administered between incompatible medication to prevent precipitation.[7] Due to the higher risk of catheter occlusion in small-size catheters, robust flushing protocols are essential in preventing fibrin attaching to the catheter wall.[4] In pediatric populations, there is evidence linking fibrin formation to CLABSI.[8]

Basic tenets of CVAD flushing include syringe size, type and amount of flush, and frequency. The volume of flush should be at least 2 times the internal volume of the catheter and any add-on devices.[9] The internal volume of the catheter or priming volume can be located on the catheter manufacturer's instructions for use. Documentation of the flushing volume should be documented in the patient's home care medical records as an ongoing reference.[9]

Preservative-free normal saline is the most commonly used flush solution, instilled before and after blood sampling and medication administration.[4] Dextrose 5% in water is an alternative flush solution when administering medications that are not compatible with normal saline, such as amphotericin. A 10-mL syringe is recommended when performing the initial CVAD flush to assess for patency, and with routine flushing.[10] Syringe sizes smaller than 10 mL can generate excessive intraluminal pressure and lead to catheter damage.[4] For low-volume medication administration that necessitates a smaller syringe size for dose accuracy, the CVAD should be initially flushed and assessed for patency with a 10-mL syringe.[9] Upon establishment of patency, a smaller syringe can be used to carefully administer the medication.[8] Regardless of the syringe size, flushing should not continue if resistance is met.[11] All syringes are for single-use only.[6]

Locking solutions may be instilled as a final flush to maintain CVAD patency. Pediatric locking solutions include 1 to 3 mL heparinized saline (10 units/mL) when the CVAD is not in use.[4]

Implanted ports are the exception as they require locking with 5 mL of 100 units/mL heparinized saline before being deaccessed. Valved CVADs should be flushed per the manufacturer's instructions for use. For patients requiring a long-term valved CVAD, heparinized saline may be necessary for preventing catheter occlusion. In select patient populations, ethanol lock therapy has been shown to reduce the incidence of CLABSI. The population includes intestinal failure or patients receiving long-term parenteral nutrition.[12,13]

Needleless Connector/Injection Cap Care

The Needlestick Safety and Prevention Act of 2000 mandated, among other things, that health care employers implement engineering controls such as needleless connectors to protect health care workers from needlestick exposures. Numerous published studies now suggest that whereas devices such as needleless connectors have protected health care workers and reduced needlestick injury rates over the past 11 years, design characteristics of some needleless connectors are also associated with an increased risk of bloodstream infections.[14]

Some of the increases in bloodstream infections observed with needleless connector use have been associated with a convoluted connector surface or gaps that are difficult to clean and disinfect. As needleless connectors become increasingly complex in their overall design, the possibility of incorrectly or inadequately cleaning, flushing, and clamping the connector further adds to these risks. In July 2010, the US Food and Drug Administration sent a letter to infection control practitioners regarding positive displacement needleless connectors.[14] The agency now requires companies that manufacture these devices to conduct after-market surveillance research to assess if the connectors are associated with a higher rate of bloodstream infections. A number of needleless connector manufacturers have responded to this initiative by posting their data on their websites.

Clinicians, as well as caregivers who are taught how to administer the prescribed therapy, should vigorously disinfect the needleless connector with an appropriate agent before each use.[9,14] The use of friction is essential for working the solution into any recesses or irregular surfaces on which microorganisms can thrive.[14] A solution of at least 70% alcohol has been found to be very effective following a 15-second scrub and a relatively short drying time, and may be the most cost-effective option for needleless connector antisepsis.[9,14] A combination chlorhexidine gluconate-alcohol solution has also been used for needleless connector antisepsis, with several configurations available from ampule-based applicators to pre-moistened gauze pads.[15] Povidone iodine and/or an iodine tincture are less commonly used because of the prolonged