Securing vascular access devices

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Using the right securement method can improve outcomes and reduce costs.

MANY CLINICIANS consider the placement of peripheral and central vascular access devices (VADs) to be a routine and mundane interventional procedure, yet these devices are associated with significant morbidity and mortality. Localized complications of peripheral intravascular (intravenous) catheters (PIVCs), such as phlebitis and infiltration, are underreported, but they're known to contribute to PIVC failure. (See *Understanding the cost of PIVC failure.*) This underreporting has made it difficult to identify contributing factors for failure, which may include inserter characteristics, patient-related factors, and anatomic placement, as well as healthcare facility adherence to international best practices and infection prevention guidelines.

Central VAD (CVAD) failure also causes significant problems. For example, a systematic review by Ullman and colleagues described the rate of CVAD failure and complications across CVAD types in pediatrics within the international healthcare community. Applying the rate of failure described in their study, 5,457 pediatric and neonatal CVADs in U.S. hospitals failed before treatment completion in 1 year alone. These failures place a massive economic and physical burden on the U.S. healthcare system, patients, and families.

Many peripheral and central VAD complications can be avoided with clinician attention to technique, appropriate securement during device selection and placement, and up-to-date organizational guidelines, policies, and procedures. This article focuses on securement.

Importance of securement—and the right dressing

After any VAD is inserted, it must be appropriately secured to reduce complications. Fortunately, the last 2 decades have seen advancements in securement techniques. Nurses, providers, and other clinicians need to apply evidence-based best practices when selecting securement options to help prevent VAD complications, including catheter-related infection and thrombosis.

The dressing protects the insertion site, and the securement method directly influences dressing management. Movement frequently disrupts dressing adhesion, and dressing removal is a pivotal procedure that can affect VAD stability. Small movements, whether in and out or side to side, can increase the potential for securement problems.

Global clinical practice guidelines state that PIVC dressings should be clean, dry, and intact, and that they should be well secured. However, 21% to 71% of PIVC dressings are soiled, moist, loose, or inadequately secured, according to a study by Rickard and colleagues.

Securement solutions

Current VAD securement solutions can be grouped into five categories: sutures, adhesive securement devices, subcutaneous securement devices, tissue adhesives/"superglue" (cyanoacrylate), and integrated securement solutions. (See *Securement options: Pros and cons.*) Adhesive and subcutaneous securement devices are grouped under the term engineered securement devices, as noted by the Infusion Nurses Society. (Tape and gauze aren't included in this overview because they don't provide adequate or appropriate securement.)

Sutures

Sutures are primarily a skin-closure solution, but they've been used as a securement option for I.V. lines and are considered the standard of practice for central venous catheter (CVC) securement. Sutures are frequently tied, often too tightly, close to the insertion site and catheter securement wings, creating multiple suture points. This method makes correct cleaning of the skin under the catheter difficult. Also, sutures create additional puncture sites in the skin, allowing bacteria to enter the subcutaneous surface via the suture material. This contaminated suture then resides under the dressing, which creates a moist environment for bacterial growth.

Adhesive securement devices

There devices, also known as engineered securement devices, were developed in response to the poor performance of sutures for CVC securement and to prevent accidental needlestick injury. Like sutures, these devices also can provide immediate securement. However, over time, adhesive degradation and loosening may occur. Strong adhesives that resist moisture require specific solvents for easy removal, and incorrect solvent use may result in skin damage. In addition, adhesives

Understanding the cost of PIVC failure

Peripheral intravascular catheters (PIVCs) contribute to a significant portion of device-related failure.

- According to Rupp and colleagues, patients experience more than 450 million PIVC days each year (15 times more than the number of central vascular catheter days).
- Over 300 million PIVCs are used yearly in the United States, resulting in up to 146,000 cases of bloodstream infections, according to a study by Alexandrou and colleagues.
- PIVC failures include phlebitis, infiltration, occlusion/mechanical failure, dislodgment, and infection, any of which can lead to catheter removal before the end of its intended dwell time.
- Failure can lead to delays in I.V. therapy as well as increased length of hospital stay, cost, and patient anxiety and pain.
- According to Helm and colleagues, a single case of catheter-related bloodstream infection adds 7 to 20 days to hospital length of stay and up to $56,000 in additional costs, with total costs reaching as much as $2.3 billion in U.S. intensive care units alone each year.

must be removed from the skin's surface for proper cleaning of the insertion site and dressing area.

Subcutaneous securement device

Recently developed subcutaneous securement promotes stabilization and avoids pain receptors by securing the catheter to subcutaneous tissue at the insertion site, rather than the skin. Within 48 to 72 hours, the anchor heals into place, preventing catheter pistoning and side-to-side movement. The lack of movement promotes healing of the insertion site and allows the remodeled tissue to act as a barrier to surface bacteria. Because this securement option is stabilized in the puncture site, the VAD can be gently lifted above the insertion site, allowing for thorough cleaning.

Cyanoacrylate (tissue adhesive/"superglue")

A novel approach to PIVC and CVAD securement is cyanoacrylate, a type of tissue adhesive or medical-grade "superglue," which is typically used as an alternative to sutures for closing skin lacerations and repairing internal tissue. Tissue adhesive is a relatively new option for VAD securement, so little evidence exists to guide practice. However, growing evidence shows that glue may help prevent VAD-related infection by inhibiting Gram-positive organisms such as *methicillin-resistant Staphylococcus aureus*, a serious problem when isolated on vascular catheters. Manufacturers recommend using a solvent to remove the tissue adhesive, but Marsh and colleagues observed that some catheters came out easily without a solvent.

Integrated securement solutions

Integrated securement options represent an alternative to the application of two separate dressing and securement products (for example, suture and polyurethane dressings). Newer-generation integrated products include reinforced fabric borders surrounding the polyurethane membrane, as well as additional adhesive components that hold the VAD from beneath.

A recent randomized control trial by Goossens and colleagues found a statistically significant reduced time for dressing changes ($p < 0.001$) when comparing adhesive and subcutaneous securement options. They also showed variable pain levels overall, and the usability of the adhesive was evaluated as statistically significantly more positive than a subcutaneous method at insertion and removal. These new technologies have the potential to reduce nursing procedural time.

Assessing outcomes

Bedside clinicians, who are responsible for providing care that achieves results that meet or surpass reimbursement outcome metrics (value-based purchasing), understand that different products influence patient outcomes. Outcomes also are influenced by overall clinician experience and knowledge of the available securement options and their use.

Two studies illustrate how research can help clinicians make wise decisions when choosing a securement option.

A study by Marsh and colleagues highlighted that it took slightly longer to place a sutureless securement device, but the difference was only around 20 seconds—inconsequential compared to the time required for VAD replacement and the problems associated with VAD failure. This study also showed that tissue adhesive and other new PIVC securement products may considerably reduce failure. When converted into improvements in the patient experience and potential cost savings, this amount would be substantial.

A European study by Zerla and colleagues suggested that a subcutaneous securement device/product is highly efficient and cost-effective for securing medium (14 to 30 days) to long-term (more than 30 days) peripherally inserted central catheters (PICCs) with expected duration longer than 30 days. This engineered option had a positive impact in the researchers' organization, reducing mechanical complications and the number of PICC replacements, a net decrease in the risk of therapy interruption and improved cost savings.

Preventing failure, reducing costs

Adequate securement of any VAD can help prevent

Securement options: Pros and cons

Although sutures provide immediate securement, they don't prevent device movement over time, are associated with safety issues for the patient, and may hinder skin disinfection associated with dressing changes. Other options are usually better but also have disadvantages, as shown in the table below.

Securement option	Pros	Cons
Sutures	• Initially very secure • Initially stable during cleaning • Minimal adhesive use	• May erode through skin • Prevent complete cleaning of insertion site • May require replacement over time • Promote bacterial migration into the suture track • Loosen over time, allowing catheter movement and pistoning • Potential needlestick injury
Adhesive securement devices	• Easy application • Complete cleaning • No suture-related needlestick injuries	• Catheter is free-floating during dressing changes • Must be removed and replaced with each dressing change • May lead to skin irritation/allergic reaction • Catheter pistoning occurs during patient movement
Subcutaneous securement devices	• Easy application • Stable during site cleaning • Enables complete cleaning • Easy maintenance • Reduced skin surface complications • Minimal adhesive use • Decreased migration and pistoning • No suture-related needlestick injuries • Remains in place for duration of therapy	• Learning curve associated with placement and removal
Cyanoacrylate (tissue adhesive/"superglue")	• Easy application • Quick setting time • High tensile strength • Effective barrier to Gram-positive bacterial penetration • Hemostatic properties reduce postinsertion bleeding • Improved fixation when used with other polyurethane dressings • Does not affect catheter materials	• Not currently in general use for I.V. securement • Decreased cost-effectiveness based on individual product costs • Varying strength and other physical properties of cyanoacrylate adhesives are directly related to the structure of tissue adhesive
Integrated securement solutions	• Easy application • Tough fabric adhesive border around clear, transparent semi-permeable membrane • Provide a second adhesive component to secure the intravascular device	• Catheter is free-floating during dressing changes • Must be removed and replaced with each dressing change • May lead to skin irritation/allergic reaction

Adapted from Macklin, Blackburn 2015

mechanical and infectious complications. Using sutureless and engineered options provides a greater choice for optimizing VAD securement and, when used correctly and appropriately, minimizes potential risks of patient complications, with an overall cost savings and reduced needlestick exposure for all healthcare providers and patients. ★

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