

# Securement for vascular access devices: looking to the future

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Vascular access devices (VADs) form a necessary component of health care; up to 90% of patients admitted to hospital require insertion of a device to enable the administration of therapies, monitoring and diagnostics (Alexandrou et al, 2015; iData Research, 2015). The range of devices inserted is as diverse as the clinical conditions they are used for: peripheral intravenous catheters (PIVCs), midlines, peripherally inserted central catheters (PICCs), non-tunnelled and tunnelled central venous access devices (CVADs), totally implanted devices and many more specialty devices. These vary in shape and function, but across all types a basic characteristic prevails: a VAD is a foreign body, and something needs to stop it becoming dislodged, either accidentally or intentionally.

Traditionally, clinicians focused on VAD dressings, rather than thinking about securement (Ullman et al, 2015a). Gauze or plastic (polyurethane) dressing products are used to cover the insertion wound to prevent contact with the environment to prevent infection. However, contemporary literature has brought attention to the common problem of accidental peripheral and central VAD dislodgement. For every 100 devices, 5–6% will be lost owing to dislodgement (Wallis et al, 2014; Ullman et al, 2015b). Clinical trials and meta-analysis comparing gauze and polyurethane products in PIVCs and CVADs (Ullman et al, 2015c, Marsh et al, 2015a) have not shown any difference in the prevention of device failure between the products. In addition, a laboratory study demonstrated that polyurethane products added no extra security against dislodgement

than when no dressing was applied at all (Simonova et al, 2012). Advances in securement technology and practice are urgently needed to reduce intentional and accidental dislodgement of VADs.

## Fundamentals to ensure VAD securement success

The Royal College of Nursing (RCN) *Standards for Infusion Therapy* (RCN, 2016) incorporate the properties of stabilisation devices within their broader recommendations for VADs. However, securement is not only about using new technology; to promote device security, fundamental vascular access (VA) management practices need also to be enhanced. Before investing in complex, expensive securement technologies, the basic principles of site preparation, skin health promotion, and regular site assessment should be optimised (Broadhurst et al, 2017). During patient assessment for VAD planning, clinicians should consider the best site for insertion to promote performance and longevity (Wallis et al, 2014), and this includes effective security. For example, a PIVC in the hand of a crawling toddler is at a high risk of dislodgement, a jugular CVC in a hirsute and diaphoretic adult male provides a high risk of dressing detachment and device dislodgement. Hair surrounding the intended VAD insertion site needs to be trimmed (RCN, 2016), and skin decontaminants (e.g. chlorhexidine gluconate) given adequate time to dry (Loveday et al, 2014), before any dressing and securement product are applied. The health of the skin surrounding the device must be maintained, and early signs of skin irritation or injury identified and effectively managed

(Broadhurst et al, 2017). The dressing and securement products used must be regularly assessed to ensure they are kept clean, dry and intact (Loveday et al, 2014; RCN, 2016). However, between 10% and 25% of hospital patients at any one time have dressings that do not fulfil these basic criteria (New et al, 2014; Ullman et al, 2017). With investment in these basic VAD management strategies, VAD securement technologies will be as effective as possible.

## The future of VA securement

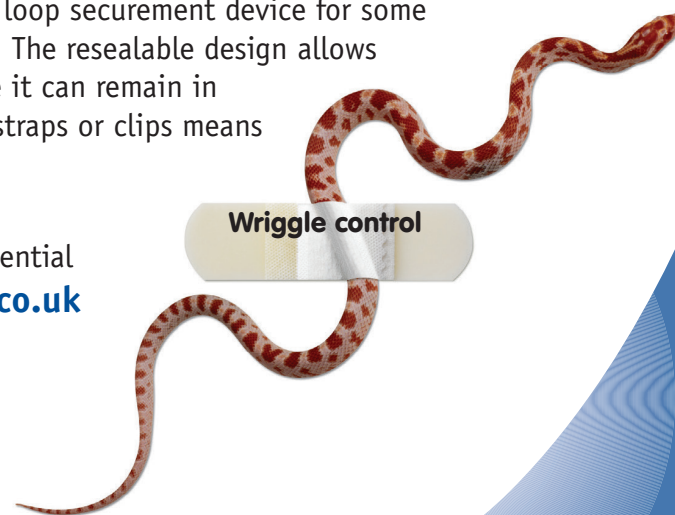
The last 20 years has seen great innovations in technology to promote VAD securement. Sutureless securement devices (SSD) were developed to replace or complement sutures for CVADs including PICCs (Ullman et al, 2015a). However, while Yamamoto et al (2002) demonstrated SSDs significantly reduced PIVC-related bloodstream infections (n=170; SSD 2%; suture 12%; p=0.032), there was no significant reduction in accidental dislodgement (SSD 12%; suture 14%; p>0.05). A recent trial by Rickard et al (2016) examining a different type of SSD in non-tunnelled jugular CVADs in intensive care found no difference in accidental dislodgement between sutures (4%) and SSD (7%; p=not provided). Pilot studies in peripheral VADs found SSDs safe and feasible to apply (Edwards et al, 2014; Marsh et al, 2015b; Reynolds et al, 2015), with a large, efficacy study soon to be published (Rickard et al, 2015).

Another potential product to assist with VAD security is tissue adhesive, which is a medical grade 'superglue' (cyanoacrylate) used previously to close skin lacerations and soft-tissue wounds as an alternative to sutures

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or staples (Singer and Thode, 2004; Aukerman et al, 2005). Tissue adhesive used in small amounts (only 1–2 drops at the insertion site and under the hub) has been successfully applied to prevent failure for PIVCs (Marsh et al, 2015b; Bugden et al, 2016), peripheral arterial catheters (Reynolds et al, 2015), and non-tunnelled CVADs (Rickard et al, 2016). Tissue adhesive also has haemostatic properties that reduce post-insertion bleeding and haematomas; which is advantageous for CVADs immediately post-insertion. Tissue adhesive's bactericidal properties include inhibition of all Gram-positive organisms (predominant cause of VAD infections), including *Staphylococcus Aureus* (Wilkinson et al, 2008; Simonova et al, 2012). Like SSDs, tissue adhesive is used in conjunction with polyurethane dressings.

Technology in the form of subcutaneously anchored security devices is emerging in practice and in the literature. The devices are placed alongside the VAD, and incorporate a small blunt anchor that is positioned under the skin into the subcutaneous tissue during catheter placement (Elen Hughes, 2014). They can remain in place for the entire VAD dwell. Observational, clinical evaluations examining their use in PICCs have found

them acceptable to patients, and potentially effective at reducing dislodgement and migration (Egan et al, 2013; Elen Hughes, 2014; Zerla et al, 2017); however, concerns remain regarding patient discomfort and risk of PICC-related infection (Elen Hughes, 2014; Zerla et al, 2017). High-quality research regarding this technology is necessary, with a randomised trial from Belgium expected to be published in 2017.

Integrated VAD securement dressing technologies represent an alternative to the application of two separate dressing and securement products (e.g. suture and polyurethane dressings). Newer generation integrated products include reinforced fabric borders surrounding polyurethane, as well as additional adhesive components that hold the VAD from beneath, as well as above (Ullman et al, 2015a). These are currently being evaluated in clinical trials in CVADs and PICCs (Ullman et al, 2016). If shown to be effective at promoting security, the combination of these products has implications for associated costs and labour (Ullman et al, 2015a).

Also emerging in clinical practice and literature is the partial tunnelling of traditionally untunnelled CVADs, including

PICCs, to promote security and reduce bleeding and infection (Elli et al, 2017). Termed the 'extended subcutaneous route' technique, it allows the creation of a subcutaneous tunnel of less than 5 cm, without skin incision and extended manipulation (Elli et al, 2017). To date the technique has been demonstrated to be feasible, for example with femoral CVADs tunnelled a short distance down the thigh, or jugular CVADs tunnelled to exit on the chest; however, little data regarding its effectiveness to improve security are available (Elli et al, 2017).

In addition to new, potentially exciting technologies, traditional low-cost products that have not yet been rigorously evaluated should not be ruled out, for example elasticised net tubing. Non-sterile paper tape is probably the most common securement that nurses apply (Alexandrou et al, 2015), yet no targeted studies exist to advise optimal amounts, placement, or whether other forms of non-sterile or sterile tape would be more effective.

### Complex situations requiring complex solutions

Patient populations requiring VADs are varied and their histories are frequently complex. Underlying comorbidities, poor vasculature

and rapidly fluctuating clinical conditions mean that vascular access requirements are rarely static. 'One-size-fits-all' solutions for security and dressing are impractical and ineffective (Broadhurst et al, 2017). This is especially evident when considering skin injuries surrounding vascular access, such as skin tears and allergies. A recent point prevalence study in Australia found 10% of paediatric CVAD sites were associated with some form of skin injury (Ullman et al, 2017), and this may be echoed in other populations and devices. However, international and local clinical practice guidelines rarely acknowledge or provide recommendations for how to effectively dress and secure VADs in complex situations (Broadhurst et al, 2017).

## Conclusion

Re-establishing the fundamentals, reconsidering old, and implementing new technologies will likely result in improved VAD security, and outcomes for patients. With the range of innovations in development, it will be a significant advantage to have an assortment of effective VAD securement products available for different, sometimes difficult, clinical situations. However clinical decision making regarding different VAD security products must be supported by high-quality evidence (randomised trials and systematic reviews of randomised trials), to ensure effective treatment and judicious use of healthcare resources. **BJN**

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