Intravascular catheters whether centrally or peripherally placed, have become an essential part of modern medical care. For a catheter to perform successfully over the intended duration, they must be: made of biocompatible materials, inserted steriley, maintained pristinely, removed when no longer needed, accessed aseptically and secured optimally. Deviation from these best practices will shorten the dwell time of the catheter and lead to a catheter associated complication. The quality of securement directly impacts the functionality, duration of dwell and likelihood of a complication for a given catheter. The purpose of this article is to focus on issues related to catheter securement. It will discuss what securement is, how it has evolved, what a securement device is, distinguish primary from secondary securement, identify securement related complications and briefly review some of the clinical trials and that make up our current evidence base.

Catheter securement is a means to anchor a catheter to the skin to reduce or prevent movement. The Infusion Nurse Society (INS) textbook says "Dressing any catheter should be considered a two-step process-one to control the catheter movement and one to cover and protect the skin and insertion site." INS Standards of Practice uses the word secure for IV set junctions and stabilize for catheters. According to the INS Standards # 36.1, "Vascular access device stabilization shall be used to preserve the integrity of the access device, minimize catheter movement at the hub, and prevent catheter dislodgement and loss of access". Further, the Food and Drug Administration defines a catheter securement device as "A device with an adhesive backing that is placed over a needle or catheter and is used to keep the hub of the needle or the catheter flat and securely anchored to the skin." Catheter movement falls into two categories small, so called micromovements which are less than 2-3 millimeters and large which include over 3 millimeters to multiple centimeters. Because the skin and the underlying vasculature can move independently to some degree, micromovements are difficult to prevent even with the best forms of securement. It is theorized that these micromovements may contribute to vessel injury and complications. The idea is that the catheter tip which can lie on the endothelial surface of the vessel, can piston back and forth with normal patient activity. This pistoning can injure the endothelium causing pain and is believed to be a mechanical cause of phlebitis. Continued pistoning could initiate fibrin and platelet deposition which could cause a catheter tip thrombosis. Further pistoning with or without additional catheter flushes or medications could result in a perforation of the vessel leading to an infiltration or extravasation of a medication. Thus, these micromovements may result in catheter related complications given enough time to cause injury. The larger catheter movements can also result in

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The same complications as well as a few others. For the same type of securement a larger catheter movement would suggest more force has been applied. This may increase the likelihood of a vessel puncture. A larger catheter movement may also suggest that the securement is weaker or disrupted. Larger catheter movements can result in a catheter migration. A migration means that the catheter is still functional though it tip has moved 1 centimeter or more from its original position. For a peripheral IV catheter a 1-2 cm movement could completely dislodge the catheter from the vein. For a central line, it may not have a significant effect. If a central venous line moves out of the central system and is deemed no longer safe to perform necessary treatments or functions, it is no longer considered a catheter migration and is now called catheter dislodgement. If treatment is still required, a catheter restart may be necessary. This means additional pain for the patient, increased cost of care, potential reduction in acceptable access sites, delay in therapy and need for a sedation or anesthetic to perform the reinsertion. This is the catheter related complication domino effect of inadequate securement.

Catheter securement can be divided into primary and secondary. Primary catheter securement directly holds the catheter in place on the skin. Secondary securement acts as an additional anchor for the infusion set tubing or extension set to reduce the force the primary securement might receive when energy is applied to the tubing by accident or rapid patient movement. For central venous catheters the standard primary securement has been suture or sterile tape. Over the past decade engineered securement devices have demonstrated at least equivalency to superiority compared to these old standards and have become the preferred approach. The securement devices also offer an added healthcare worker safety feature of no needlestick exposure, thus helping to reduce needle stick injury of blood borne pathogens. For peripheral intravenous catheters (PIV) primary securement might also include a securement device. Modification of the catheters (increased wing size) has allowed transparent dressings to demonstrate non-inferiority to securement devices in a randomized clinical trial. In many centers, a transparent dressing is the only primary securement used with standard wingless catheters. This is likely to predispose the patient to catheter movement and dislodgement.

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Secondary securement is often achieved with non-sterile tape proximal to the catheter insertion site directly on the skin. Sometimes this is done by directly taping the tubing to the skin or creating an umbilicus and suspending the tubing. In the recent past safety pins clipped to hospital gowns were also often used. These sharps have now been eliminated and this approach is no longer an option. A new device, called the Linebacker provides a circumferential secondary anchor using a soft spongy cloth that is held in place with hook and loop material. This band uses an adhesive flap to control the IV tubing or infusion set. Its simple, wrap around design has many advantages such as: it avoids issues of the
breakdown of adhesive forces common to extended use of tape, it provides much higher pull strength than tape on skin, it avoids additional sensitization to adhesives and it does not hurt when pulled or removed as tape would on the skin. The importance of a solid secondary securement can not be over emphasized as it protects the primary securement and hence the catheter from an accidental dislodgement.

With the increasing recognition of the importance of quality catheter securement and the Federal mandate to reduce needlestick injuries, several companies have developed engineered solutions for primary securement. Until recently, only one company has performed prospective, randomized trials that have proven significant reductions in catheter associated complications compared to the standard method of primary securement. This device demonstrated this improvement for both central lines and PIVs. The improvements included a 71.4 % reduction in unplanned catheter removals, significant reduction in dislodgements, increase in original securement, ~70% reduction in unnecessary catheter restarts and faster securement time. Also, because there was a significant decrease in complications in the primary securement device group, there was a cost savings as well.

Recently, two companies collaborated to perform a prospective, randomized trial using an innovative catheter with large wings and a closed system to reduce blood exposure with a specialized transparent dressing to create an effective primary securement system. They compared this pairing with the prior dominant securement device and standard transparent dressing. They were able to demonstrate a reduced rate of dislodgement at 96 hours, with a cost reduction of 25%, and an overall non-inferiority of the investigational device. This study mark a new era of inter-company collaboration to help make products that perform better for our patients.

For the Linebacker (LB) secondary securement system there are no published prospective clinical efficacy trials to date. Tensile strength bench tests comparing LB to tape have demonstrated that LB is 260% stronger than 1" and 80% stronger than 2" wide tape. Healthcare providers have favored the use of LB in their facilities. Eight hundred EMS applications produced a 92% positive response. Also at a four hundred bed acute care facility use of the LB was positive 78% of the time. A product trial at a small Pennsylvania hospital also showed over a 75% reduction in IV restarts when the LB was used. It is likely that a prospective randomized
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evaluation of LB looking at the rate of catheter complications, particularly migrations and dislodgements will occur. LB is a common sense solution that may help reduce costly catheter complications. In summary, catheter securement is now recognized as a critical component of maintaining a functional vascular catheter. Both primary and secondary securement are needed for effective catheter stabilization. Engineered solutions for securement have demonstrated their superiority over the prior standards. These devices may have an increased up front cost but they provide an overall cost savings because of reduced patient complications. More inter-industry collaboration is needed to bring vascular access and securement to the next level. No doubt innovation will play a major role in this evolution. •

About Dr. Schears

Dr. Schears is a pediatric intensivist and anesthesiologist from Rochester, MN. He has a long standing interest in using technology to help reduce patient complications and has particularly focused on vascular access related issues. He is currently the physician liaison to the nurse PICC team and the medical director of the ECMO program at Mayo Clinic. He studied at the University of Wisconsin and he has certifications from American Board of Anesthesiology, American Board of Pediatrics, American Board of Pediatrics - Pediatric Critical Care Medicine, and National Board of Medical Examiners.

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