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catheter securement: Trends in performance and complications associated with the use of either traditional methods or an adhesive anchor device

Nancy Moureau, BSN, CRNI

Anita L. Iannucci, PhD

Introduction

The use of intravenous (IV) catheters is associated with a wide variety of medical problems including phlebitis and infection, but it is catheter motion and bacterial colonization at the catheter insertion site that contribute to many catheter-related problems during infusion therapy via peripheral catheters. Many of these problems result in unscheduled IV catheter restarts, which cause increased risk of needlestick exposure to the clinician and greater expense in treatment in terms of increased nursing time and higher supply costs. Improved stabilization of IV catheters, having them remain exactly as initially attached to the patient's skin by the clinician, is better for both patients and clinicians. Patients would be more comfortable and at considerably less risk for catheter-related complications, while health care professionals would spend less time restarting catheters, and be at lower risk for accidental needlestick injuries that can occur

during catheter restarts.

Since the beginning of IV therapy, catheters have been secured with a variety of methods, most of which involve suturing or taping the catheter to the patient's arm. A new method of catheter securement became available in the 1990s as an alternative to the traditional tape and/or suture securement that had been consistently used over the last 50 years. This new method is an adhesive pad with an integrated posted retainer designed to hold the catheter in place more securely than allowed by tape and/or suture. Additionally, this method does not require the use of needles, which are required when suturing. Thus, adhesive anchors may reduce the risk of complications in both patients (if caused by loose securement) and healthcare workers (no securement-related needlestick injuries).

During the past five years, few studies have been published that compare complication rates and costs between traditional catheter securement meth-

ods and the newer adhesive anchors in a variety of health care settings and for different catheter types. Currently there is only one manufacturer of this sort of adhesive anchor/built-in retainer (StatLock, Venetec International, San Diego, CA), but these studies show a trend of fewer complications associated with the use of adhesive anchors than with the use of tape and/or suture for peripheral IV catheter securement.

Background

A literature search using MEDLINE was performed to locate all studies comparing standard catheter securement techniques with adhesive anchor securement. This search used intravenous, securement, IV protection, IV suturing, central line taping, catheter dislodgment, accidental dislodgment, catheter indwelling, catheter complications, and vascular access as the key words. The manufacturer of StatLock adhesive anchors brought additional studies, not included in MEDLINE

Table I. Complications associated with different methods of securement of short peripheral and central venous catheters (CVCs).

	Short peripheral Catheter				Midline and PICCs	
	Tape & Transparent Dressing (N=55) ¹	Adhesive Anchor (N=50) ¹	Tape & Biocclusive Dressing (N=15) ²	Adhesive Anchor (N=15) ²	Steri-Strip & Transparent Dressing (N=78) ³	Adhesive Anchor (N=100) ³
Percent Dislodged While Indwelling	42%	2%	300%*	87%	12%	7%
Unscheduled Restarts	67%	18%	367%*	160%*	17%	9%
Complications Of all types	69%	20%	520%*	273%*	47%	35%

*This percentage is higher than 100% because some patients had multiple restarts with short peripheral IV catheters, so the number shown is the total number of restarts divided by the total number of patients.

search results, to the authors' attention, which brought the total number of studies reviewed to seven.

Although these studies vary in both research setting and quality, all were reviewed due to the limited number of studies on this topic. The research settings of these varied widely (from pediatric cases in hospitals to adult homecare settings), as did the type of IV catheter used and the patient population.

Results

The first study published was 1997 and was a prospective, quasi-experimental study comparing two methods of peripheral IV catheter securement, tape and the adhesive anchor device (both with transparent dressing covering the site) in hospital patients over the age of 18.¹ All patients enrolled in the study were adults and new admissions, mostly to the emergency room, with no previous catheter insertions. During the first two months of the study, tape was applied, using a chevron method, to 55 patients and then for the next two months the adhesive anchor device was used with 50 patients. The focus of this study was complication rates. The percentage of patients with at least one complication was 65% in the tape group and 20% in the adhesive anchor group, a decrease of 69% and statistically significant ($p < 0.001$). As for specific complications, patients whose IV catheter was secured with tape had higher incidence of catheter dislodgment and infil-

tration than did patients using the adhesive anchor device.¹ Incidence of phlebitis was similar between the two groups. Although significance tests for the specific complications were not provided in the paper, our calculations using the Fisher's Exact test found that the two groups differed significantly in their numbers of dislodgments ($p < 0.001$), but not in their numbers of infiltrations or phlebitis cases.

Additionally, time to insert and secure the catheters and dress the site averaged 14.1 minutes for patients whose catheters were secured with tape and 4.6 minutes for those secured with adhesive anchor devices, a reduction in time of 67%. More important to the success of the IV therapy, the catheter indwelling time averaged 44 hours when tape was used and 65 hours with use of the adhesive anchors, an increase in indwelling time of 48%. Finally, the total time spent on initial IV placements, troubleshooting, and catheter restarts averaged 36.4 minutes per patient with tape and 7.2 minutes per patient with adhesive anchors, a reduction of 80%.¹ (Significance tests could not be calculated for these items because standard deviations are not included in the article.)

A prospective study of patients in a skilled nursing facility reports on 15 patients whose catheter securement was medical grade adhesive tape and biocclusive dressing and 15 patients receiving securement with an adhesive

anchor device.² While the focus of this study was dwell time and complications, nursing time data were collected also. Catheter dislodgment occurred a total of 45 times in the tape group but only 13 times in the adhesive anchor group, a reduction of 73%. Infiltration occurred 20 times in the tape group and 28 times with the adhesive anchors, an increase of 40%. Phlebitis occurred 3 times and skin damage 10 times in the tape group; neither event occurred in the adhesive anchor group.²

The total time spent correcting dislodgments was 340 minutes for patients in the tape group and 137 minutes for those in the adhesive anchor group. Average dwell time was 58.8 hours with tape securement versus 94.8 hours with the adhesive anchor securement, a relative increase in indwelling time of 61% with use of the adhesive anchors.²

A retrospective chart review of consecutive admissions of all patients with either peripherally inserted central catheter (PICC) or midline catheters placed was performed at two homecare settings in two states.³ Seventy-eight patients received Steri-Strips, tape, and transparent dressing to secure their catheters (the Steri-Strips were placed over insertion site, the site was also covered with transparent dressing, and additional tape was used for extra securement), while one hundred patients had the adhesive anchor device placed for catheter securement. In this review,

catheters, midline and peripherally inserted central catheters (PICCs),

PICCs		CVCs			
Sterile Threaded Tape (N=50) ⁴	Adhesive Anchor (N=50) ⁴	Sutures (N=85) ⁵	Adhesive Anchor (N=85) ⁵	Sutures (N=50) ⁶	Adhesive Anchor (N=50) ⁶
10%	0%	14%	12%	0%	4%
14%	4%	NR**	NR	NR	NR
74%	30%	47%	25%	24%	8%

**Not reported.

47% of the patients with tape and Steri-Strip securement developed complications, while only 35% of the adhesive anchor patients developed problems

For five of the six types of complications reported, the tape group of patients tended to have more problems: 12% of the tape patients and 7% of the adhesive anchor patients experienced dislodgment; 9% of the tape patients and 6% of the adhesive anchor patients experienced loose or leaking catheters; 12% of the tape and 8% of the adhesive anchor patients developed phlebitis; 3% of the tape patients but no adhesive anchor patients experienced blood loss; and 5% of the tape patients and 4% of the adhesive anchor patients had skin damage. As for incidence of occlusion, the tape patients had a rate of 8% and the adhesive anchor patients had a rate of 10%.³

Interestingly, the authors included data on the need for troubleshooting while the devices were indwelling. For example, 32% of the tape group required unscheduled nursing visits while only 13% of the adhesive anchor group did, a reduction of 59%.³ While the authors did not report an analysis of this difference, our use of the Fisher's Exact test shows this difference to be highly significant ($p=0.003$).

In a prospective, randomized study, 50 hospitalized pediatric patients had their peripherally inserted central catheters (PICCs) secured with sterile threaded tape while 50 patients' PICCs

were secured with an adhesive anchor device.⁴ The primary purpose of this study was to compare complication rates and associated costs. The incidence of dislodgment of the PICCs was higher (10%) for patients in the tape group than the rate for patients whose PICC was secured by an adhesive anchor (0%).⁴ Other complications reported were occlusion of the PICCs while indwelling (24% with tape versus 12% with adhesive anchors), and infections (8% with use of tape and 2% with use of adhesive anchors, a 75% reduction but not statistically significant).

The lower rate of dislodgment with use of the adhesive anchor device resulted in a lower average cost per PICC (including insertion, maintenance, and complications) of \$344.34 as compared to a cost of \$604.88 per PICC when tape was used for securement.⁴

In another prospective randomized study, 85 adult hospital patients had sutures to secure their PICC catheters and 85 had an adhesive anchor device used for the catheter securement.⁵ The average time required to achieve securement averaged 4.7 minutes with the suture and 2.7 minutes for the adhesive anchors, a statistically significant reduction ($p < 0.001$). Patients were followed after discharge via home infusion nurses' reports and phone calls every other day. Total complications were 31% lower in the adhesive anchor group than in the suture group, but this difference was not statistically

significant. Specifically, the incidence of PICC dislodgment was 14% with suture used as the securement method and 12% with use of an adhesive anchors (a 14% reduction). The PICCs secured by suture experienced 2 leaks, 4 occlusions, 1 central venous thrombosis, and 18 became detached or loose; the adhesive anchor group experienced 1 leak, 3 occlusions, 1 CV thrombosis, and 17 detached or loose catheters. None of these differences was statistically significant. However, 10 of the sutured patients acquired infections while only 2 of the adhesive anchor group did, an 80% reduction that was statistically significant ($p=0.032$).⁵

In a similar prospective, randomized study with central venous catheters (CVCs), 50 pediatric hospital patients had their CVCs secured with sutures and 50 had their CVC secured with an adhesive anchor device.⁶ As for complication rates, fourteen percent of the sutured patients presented with infections while only 4% of the adhesive anchor patients did, but none of the sutured patients suffered dislodgment while 4% of the adhesive anchor patients did. In addition, two percent of the sutured patients suffered leaks, 6% suffered occlusions, and 2% were associated with needlestick injuries, but none of the patients in the adhesive anchor group had these complications.⁶ The time required for catheter attachment by suture averaged 6.4 minutes while catheter attachment by adhesive anchor averaged 2.4 minutes, a 63% and statistically significant reduction in time.⁶

Summary statements of a series of 1128 patients at an HMO noted that when a medical center changed from an occlusive dressing and tape method of securement to the adhesive anchor device, the rate of unscheduled catheter restarts was reduced from 10% to 0%, resulting in an estimated annual savings of \$36,000.^{7,8}

Discussion

These published studies varied so greatly in study design, sample size, and types of IV catheters used; however, they still show trends and issues associated with the use of adhesive anchor devices that should be considered by the infusion clinician in choosing a

Table II.
Relative percentage change in complications and indwelling times when an adhesive anchor securement system is used rather than a traditional securement method.

Percent reduction noted when an adhesive anchor securement device was used as compared to the rate noted with a traditional securement method

	Short peripheral IV catheter		PICC & midlines	PICCs		CVCs
	Wood ¹	Sheppard et al. ²	Wood & Bowe-Geddes ³	Schears et al. ⁴	Yamamoto et al. ⁵	Schears et al. ⁶
Dislodgment Of the device	95%	71%	42%	100%	14%	NA*
Unscheduled Restarts	73%	56%	47%	71%	NR**	NR
Total Complications	71%	48%	26%	59%	47%	67%

*NA= rate of dislodgment was higher with use of the adhesive anchor device in this one study.
 **Not reported in the study.

method to secure infusion devices.

The actual percentages of dislodgments and other complications varied considerably among the studies (Table I), and this at least partly results from differences in study setting, type of catheter used, patient group involved, and complications recorded.

The incidence of catheter dislodgment during the indwelling period increased in one study but was reduced by 14% to 100% in the other five studies with use of the adhesive anchor device (Table II). Complications were reduced from 26% to 71% and unscheduled restarts were reduced from 47% to 100% with use of the adhesive anchor device. At the same time, catheter indwelling time increased from 48% to 61% with use of the adhesive anchor device, for the two studies reporting it.

Five of the seven studies were restricted to PICCs, CVCs, and/or midline catheters only, while two of the studies included short peripheral IV catheters. With all types of catheters studied, adhesive anchors show a 67% relative reduction in dislodgments, 50% relative reduction in total complications, and 78% relative reduction in unscheduled restarts (Table III). There also was a 53% relative increase in dwell time with adhesive anchor securement as compared with traditional catheter securement methods. (Stated in terms of relative risk, the risk for dislodgments, total complications, and unscheduled restarts are 33%, 50%, and 22%, respectively.) When short

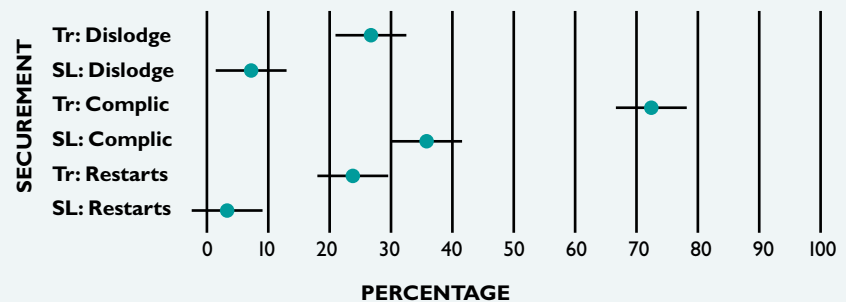
peripheral IV catheters are excluded from the calculations the results are nearly as striking, with adhesive anchors associated with a relative reduction in dislodgments of 32%, in total complications of 44%, and in unscheduled restarts of 87% over traditional securement (Table III). All subjects were weighted equally in the calculation.

Pooling the data presented by these studies and measuring a proportion of the catheter securement-related problems for both securement types, the proportion of the catheters with securement-related complications differs significantly (Figure 1). The fact that the confidence intervals do not overlap for the two types of securement methods in any of the three catheter complication measures shows

that the proportion of problems differs significantly between traditional securement and adhesive anchor securement. In each case, there is a significantly smaller proportion of problems with the adhesive anchors than with the traditional securement technique.

This trend has been reported with the use of another nontraditional securement method, an adhesive foam pad with transparent dressing (Venigard, CONMED, New York). In a study of 76 patients with a single lumen catheter indwelling, the adhesive lasted until the patient was discharge 71% of the time, whereas standard dressings lasted until discharge only 24% of the time.⁹ For those patients with double lumen catheters, 56% of the adhesive pad dressings and 0% of the traditional

Figure 1. Percentages and 95% confidence intervals for traditional securement and adhesive anchor securement: dislodgments, total complications, and unscheduled restarts.



TR = Traditional methods of securement (e.g. tape)
 SL = Statlock adhesive anchor device

Table III.

Percentages of complications and indwelling times among the studies with use of an adhesive anchor device and traditional methods of catheter securement for short peripheral and midline catheters, and peripherally inserted central venous catheters (PICCs) and central venous catheters (CVCs).

	Traditional Securement Methods		Adhesive Anchor Device	
	PICC, CVC Midline & Short peripheral Catheters ¹⁻⁶	PICC, CVC & Midline Catheters ³⁻⁶	PICC, CVC Midline & Short peripheral Catheters ¹⁻⁶	PICC, CVC & Midline Catheters ³⁻⁶
Dislodgment Of Catheter	28.2%	9.9%	9.4%	6.7%
Unscheduled Restarts	23.2%	11.1%	5.2%	1.4%
Total Complications	72.1%	47.1%	36.0%	26.3%

dressings lasted until the patient was discharged. In addition, the time to failure was significantly longer, time to apply the dressing was shorter, and total cost (including equipment and nursing time) was less with use of the adhesive pad than with use of the standard dressing.⁹

Since cost data were measured differently by the two studies that reported it,^{4,7} direct comparisons are difficult; however, it is worth noting that both studies found the adhesive anchor devices to be more cost effective than traditional securement methods.

Since devices such as Statlock and Veni-Gard do not require use of a needle for securement, their use reduces needlestick exposure for the health

care professional.

Conclusion

While the research designs and method of traditional catheter securement varied among the seven studies reviewed, the consistency of the results lends credibility to their findings. Although different studies recorded slightly different complications, overall the complication rates were lower with use of the adhesive anchor securement device than with use of traditional securement methods in all six studies that reported complications. Unscheduled restarts were reported in five of the seven studies and in all five cases there were fewer in the group of patients whose IV catheters were

secured with an adhesive anchor. Only two of the studies reported catheter dwell time, but in both cases it was longer in the adhesive anchor group. Nevertheless, additional randomized prospective studies examining in a consistent manner specific complications and actual costs in a variety of health care settings and with a variety of types of catheters would contribute to our knowledge on this subject. ♥

Nancy Moureau, B.S.N., C.R.N.I., is president of PICC Excellence, Inc., a clinical consulting firm based in Orange Park, Florida. She lectures on issues of intravenous practice and creates self-study educational programs for clinicians on PICC insertion techniques. She has 22 years experience in intravenous therapy, home care and home infusion and is an active member of the National Association for Vascular Access Networks (NAVAN), as well as of the Intravenous Nurses Society (INS) and the League of Intravenous Therapy Educators (LITE). She can be reached by phone (888-714-1951) or by e-mail (nancy@piccexcellence.com). Visit PICC Excellence on the web at www.PICCExcellence.com.

Anita L. Iannucci earned her PhD in Social Sciences from the University of California, Irvine. She has been involved in a variety of research projects over the past twenty years, most often as a statistical consultant, both for projects at the university and for businesses, organizations, and individuals. She is currently employed by the UC Irvine Center for Statistical Consulting.

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