Short Peripheral Catheter Performance Following Adoption of Clinical Indication Removal

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ABSTRACT

Two years following the adoption of clinical indication policies for short peripheral catheters (SPCs), a large community hospital undertook 2 extensive point prevalence reviews at 1-year intervals to study the overall outcomes associated with the SPCs. The findings were used to enhance documentation as well as staff awareness. A bundled approach was taken, focusing on insertion as well as care and maintenance needs. Consistent outcomes included at least 20% of catheters remaining functional more than 7 days and 35% more than 5 days.

Key words: clinical indication, dislodgement, dressing disruption, infiltration, peripheral IV, short peripheral catheter, vascular access

Since the Infusion Nurses Society's (INS') *Infusion Nursing Standards of Practice*,[1] now the *Infusion Therapy Standards of Practice* (the *Standards*),[2] revised its recommendation regarding frequency of short peripheral catheter (SPC) replacement in 2011, organizations have carefully reviewed their dwell time policies regarding peripheral intravenous (IV) catheters.[1,2] Previous versions of the *Standards* directed clinicians to remove peripheral devices at scheduled intervals not to exceed 72 hours, or sooner if complications were noted.

The most recent versions of the *Standards* have removed any time-based recommendations and instead rely on an assessment of the catheter's performance, the absence of complications, and the clinical necessity of the device. Following the publication of the 2011 *Standards,* numerous articles examining the performance and complications of these devices have been published, yet there appears there is no systematic means of evaluating the overall performance of these often-overlooked catheters. As indicated by Helm et al,[3] each SPC failure positions the patient for subsequent failures, so improving first-insertion success and extending dwell time should be of interest to patients and health care facilities alike.[3] Ongoing monitoring through point prevalence surveys and a review of all infections has been the standard for the authors' organization, along with continued efforts to improve documentation and review of device necessity; the latter is discussed by Yagnik et al.[4] More recent studies have looked further into securement options and decision tools to help improve overall outcomes, and overall predictors of failure.[5-7] A large, worldwide study, which the authors' organization participated in, further identified the variation in practices and outcomes when SPCs are studied systematically.[8]

When the *Standards* were updated, there was no framework available to help hospitals thoughtfully consider the changes needed to support a successful rollout of clinical indication for SPC dwell time. Efforts to create a framework for adoption are promising and sorely needed.[9,10] In 2011, the terminology in the Centers for Disease Control and Prevention's (CDC's) *Guidelines for the Prevention of Intravascular Catheter-Related Infections*[11] was updated at the same time that the *Standards* were revised. However, many were left confused about how to interpret the significance of the change, specifically that the guidelines'

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Ms DeVries serves on the speaker bureaus of Access Scientific, Becton Dickinson, Eloquest Healthcare, and Ethicon. She has received investigator-initiated grant funding from Johnson and Johnson. The work presented in this article was neither funded nor influenced by any organizations. Ms Strimbu has no conflicts to declare.

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DOI: 10.1097/NAN.0000000000000318

terminology, which previously stated that SPCs needed to be changed "at least every" 72 to 96 hours, was replaced with "no more frequently" than every 72 to 96 hours. This allowed the authors' organization to move forward confidently, knowing that a strategy was being implemented that was not in conflict with CDC guidelines. Others have continued to question why the CDC left the topic of clinical indication removal policies for adult SPCs an unresolved issue, while the document continues to support it as the appropriate approach for devices used in pediatric patients. There have been repeated *Cochrane Reviews* on this topic[12] that authoritatively address the concept and report no increases in phlebitis and infection when clinical indication, rather than time-based site rotation, policies are followed.

When this large, urban, community hospital adopted clinical indication for SPC removal 5 years ago (February 2014), it invested significant time and resources in planning an implementation approach that would allow the extension of functional dwell time without increasing the risk of infection.[13,14] With that specific objective in mind, the authors' strategies included the use of chlorhexidine gluconate (CHG)-impregnated sponge dressings, SPCs with stabilization platforms and integrated extension sets, integrated securement dressings, alcohol-impregnated caps, and sterile gloves.

At the time of the policy change, the hospital had more than 10 years of data on SPC-associated bloodstream infection, following the National Healthcare Safety Network's Laboratory Confirmed Bloodstream Infection protocol; these data were used to develop proactive strategies to address known organization-specific opportunities for improvement. The initial focus was to ensure that infection risk did not inadvertently increase when longer functional dwell time became the organization's standard. The organization's experience was published after the first year of success, but the process continues to be monitored, as it is with all vascular access outcomes.[14] The infection control team conducts surveillance using the CDC's surveillance protocols for laboratory-confirmed bloodstream infections for all primary bacteremias, not just central line-associated bloodstream infections (CLABSIs). Once the infection risk was ascertained and found to be consistent with some decreases observed from the baseline period, the authors began to review questions about the impact of SPCs beyond infection—that is, learning factors about the performance of the ubiquitous devices in patients. Two large point prevalence studies were conducted in 2016 and 2017 to better describe device performance in the organization.

Some of the studies that examine average dwell time of SPCs before and after implementation of clinical indication policies showed only modest differences in dwell time.[15] Others have shown some concern about infectious complications increasing with longer dwell time.[16,17] Of interest to the authors' organization is that the studies do not reveal any specific measures that were implemented to support the goal of safe, longer functional dwell time. Anecdotal reports received through personal communications from around the world have suggested that adoption without an overall improvement in attention to the catheters may be associated with an increase in poor outcomes, including *Staphylococcus aureus* bacteremia.

A review of infections through the Pennsylvania Patient Safety Authority[17] noted a spike in bloodstream infections in patients without a central line temporally associated with the increased length of dwell time for the peripheral catheters. It is notable that this would have occurred in organizations that had a policy expectation that devices would be removed by 96 hours. Infectious disease physicians, as well as infection prevention teams, have a need to understand the possible association and to implement strategies to prevent it. Through his review of numerous studies, Mermel[18] noted a similar trend and expressed caution when moving ahead with policies regarding potentially longer dwell times.

This article focuses on outcomes after practices are established to support successful implementation of clinical indication to allow longer functional dwell time. While the concept of conducting surveillance on SPC bloodstream infections has not been adopted by most organizations, there are examples around the world of institutions that have done so for years, not only measuring but also creating interventions to improve outcomes. The basic efforts to review and update practices according to guidelines and standards, as well as facility-specific needs and continuous surveillance, were used by Saliba's group[19] in Barcelona. Although the elements studied and implemented were not the same, the basic approach was similar to the author's method of implementation and study.

As previously described, the bundled approach attempted to address gaps in the authors' institution compared with the *Standards*[2] as well as lessons learned through ongoing review of outcomes associated with all vascular access devices (VADs) in patients.[13] Elements in the bundle included CHG skin preparation solution, sterile gloves, an SPC with a stabilization platform and integrated extension set, a CHG-impregnated sponge dressing, alcohol-impregnated caps, a bordered securement dressing, and beginning in 2017, gum mastic liquid adhesive used with adhesive remover on dressings. SPCs inserted in inpatients and patients in the emergency department (ED), who were expected to be admitted, were placed using the bundle and allowed to dwell until there was a clinical indication for removal or therapy was completed and the patient was discharged. Dressing changes were performed at 7 days or earlier if the dressing was loose, wet, or soiled.

A separate kit was provided in outpatient procedural areas to minimize unnecessary additional costs. (The kit does not include sterile gloves, a CHG-impregnated sponge, securement dressing, or gum mastic.) The inpatient insertion kit, combined with a catheter with the appropriate gauge, created a carefully curated bundle developed to increase successful outcomes with extended dwell time,

when combined with staff understanding of the purpose for each element. The same considerations were not believed to be necessary for a catheter inserted for an outpatient encounter. While other organizations have adopted clinical indication without creating such a distinct kit, this institution's strategy differs because the kit was designed with a significant understanding of existing risks within the organization, based on long-standing process and outcome surveillance for all devices.

Staff in the ED insert approximately 40% of the SPCs observed in admitted patients. Because of this, including the ED in the creation of a bundle was a key factor in helping ensure consistent outcomes. Except in emergent circumstances in which aseptic technique cannot be assured, patients should expect to receive the same standard of care whether their devices are inserted in the ED or on an inpatient unit. Pujol and colleagues' work found that SPCs inserted in the ED had an onset of bloodstream infection 2 days sooner than those placed in an inpatient setting.[20] By standardizing policy, supplies, and training, it was hoped that the disparity in outcomes could be minimized.

METHODS

A student intern was trained on the use of the electronic health record (EHR) and entries to the flow sheets relevant to SPCs, as well as patient demographics. A report capturing all VADs present on the first day of the student's summer internship was generated to serve as the selection of patients for the prevalence study. This was achieved through a user-specified query for all VADs in the facility and then filtered to include only SPCs. The report served as the initial data source to identify which patients would be included in the prevalence study. Each patient who was present in the hospital on the day of the report and who had an SPC in situ according to the report was included. Neonates; pediatric patients; behavioral health patients; and labor, delivery, and postpartum patients were excluded. Patients' health records were abstracted to capture information on every SPC appearing in the flow sheet throughout that admission episode, not just the device that appeared on the day the report was generated. This allowed information on the number of devices patients had inserted during their hospitalizations to be collected.

The review was completed over 2 consecutive summers, with a total sample of 1161 documented SPCs reviewed. A single day was selected each year to create the report. Information collected included patient age and gender, hospital location at the time of SPC insertion, hospital location at the time of SPC removal, anatomical location of the device, gauge of the device, and the documented reason for removal, as well as the dates of insertion and removal. Elements missing in the EHR were left blank, rather than seeking alternate sources of information, to allow for consistent assessment based on the legal document the EHR represents. This information was aggregated each year and presented internally to the vascular access and infection control teams, nursing leadership, and the quality department as a written report, as well as an interactive presentation. Institutional review board approval was not required for this quality improvement-driven performance assessment. It was not an interventional project; the goal was to gain a better understanding of how the catheters were performing and to identify potentially predictive factors for better or worse outcomes.

RESULTS

Basic demographics on age and gender were abstracted, with no predictable trend between the 2 time periods (Table 1). The gender percentages were reversed in 2 samples, resulting in a relatively equal number of SPCs between the genders in the overall sample. The same reverse pattern was seen regarding dwell time differences between the sexes, meaning that 1 year favored males and the other favored females for longer dwell time. These nonmodifiable risk factors were included to describe the basic demographics of the sample and to allow for an understanding of how the patient population might differ from those in other studies that might be conducted.

Age distribution, another nonmodifiable factor identified as a potentially relevant dwell time predictor, was reviewed in a similar manner (Table 2). The hospital's demographics are apparent in these samples, with less than 2% of SPCs

TABLE 1

Gender Distribution

Gender	2016			2017			*P* Value[a]
	Dwell Time	Number of Catheters	Percentage of Each Gender	Dwell Time	Number of Catheters	Percentage of Each Gender	
Male	3.86	231	43%	4.65	356	56.7%	.0099
Female	4.64	301	57%	3.99	273	43.3%	

[a]The goal was to show that the gender distribution, ratio of male to female, differed between the years. There is no separate *P* value for each gender. *P* value is significant at .05.

TABLE 2

Age Distribution

Age Range (Years)	2016			2017			*P* Value (Difference in Age Percentage Between the Years)[a]
	Dwell Time (Days)	Number of Catheters	Percentage of Total Catheters in Study	Dwell Time (Days)	Number of Catheters	Percentage of Total Catheters in Study	
0-9	2.00	7	1.32%	1.00	2	0%	.067
10-19	6.00	1	0.19%	2.50	4	1%	.292
20-29	3.79	24	4.51%	2.80	25	4%	.676
30-39	3.16	32	6.02%	2.68	25	4%	.131
40-49	4.60	30	5.64%	4.25	53	8%	.874
50-59	3.63	102	19.17%	4.67	89	14%	.0526
60-69	4.40	156	29.32%	4.71	167	27%	.430
70-79	4.99	84	15.79%	4.89	140	22%	.0215[a]
80-89	5.11	73	13.72%	3.99	100	16%	.373
90-99	3.87	23	4.32%	3.79	24	4%	.676

[a]Significant, with a confidence interval of .05.

observed in individuals under 20 years of age. More than a third of patients in both samples were at least 70 years old, accounting for more than 40% of patients during the second year. The potential impact of limited vascular access options can be observed in these older patients with multiple comorbidities. This was noted several years ago when the authors' organization began efforts to introduce an evidence-based midline catheter program after a review of peripherally inserted central catheter (PICC) insertion practices revealed that 35% of PICCs placed by the vascular access team were noted in patients with difficult vascular access.

Anatomical location was reviewed to evaluate differences in dwell time for different sites. The choice of placement is made primarily by the individual inserter (Table 3). Despite the *Standards* and literature strongly favoring the forearm as the preferred site, practice change to adopt that location has been slow within the authors' organization. Baseline data are not available for prior years to identify any incremental improvements. There is no essential variation in site choices between the 2 samples. Hand sites accounted for 24% of the sample each year, antecubital sites accounted for 29%, and the forearm between 29% and 31%. Of additional concern was

TABLE 3

Anatomical Location

Anatomical Location	2016			2017		
	Dwell Time in Days (Average)	Number of Catheters	Percentage in Each Location	Dwell Time in Days (Average)	Number of Catheters	Percentage in Each Location
Ankle	1.000	1	0.19%	N/A	0	0%
Foot	2.000	5	0.94%	4.67	3	0%
Hand	3.853	128	24.06%	4.05	154	24%
Wrist	4.290	62	11.65%	3.77	61	10%
Antecubital	4.452	157	29.51%	4.60	183	29%
Forearm	4.433	157	29.51%	4.48	193	31%
Lower leg	4.500	2	0.38%	N/A	0	0%
External jugular	N/A	0	0%	3.2	5	1%
Upper arm	5.667	15	2.82%	5.72	18	3%
Location not charted	6.000	4	0.75%	4.33	12	2%

Abbreviation: N/A, not applicable.

catheter placement in the wrist, documented as the site in 12% and 10% of the reviewed catheters, respectively. In the study's sample, both the forearm and the antecubital fossa tended toward slightly longer average functional dwell time than the hand, which is discussed further in this article (Table 3). Orientation and ongoing education have focused on selecting the forearm, but this review revealed that there is still significant work to be done to achieve a more favorable distribution to drive improved outcomes.

For each sample, complication rates were calculated among the anatomical site selections (Tables 4a and 4b). Infiltration presented as the most frequently documented complication noted, resulting in device removal. Infiltration rates ranged between 19% and 26% in 2016 and 13% and 40% in 2017 depending on site. Slight, but not significant, decreases in infiltration were noted in the rate for the antecubital fossa, forearm, and hand between the years. There were no external jugular catheters represented in the first year of the review, and only 5 during the second year, however those 5 devices had a reported 40% infiltration rate. Device dislodgement was the next most frequent occurrence. This was described in the charting in a variety of ways, such as "patient pulled out," "removed by patient," or "IV fell out." These rates ranged between 0% (external jugular) and 33% (foot), but both extremes had an insufficient number of catheters to evaluate. Hand sites were noted at 10% and 16% dislodgement in 2016 and 2017, respectively. Antecubital fossa sites were cited 4% and 9% dislodgement for the 2 years, and infiltration rates of 14% and 21% during the same period (Tables 4a and 4b).

The organization wanted to better understand how dwell time was affected by changes made related to the rollout of the clinical indication bundle. In both samples, more than 30% of SPCs remained in place at least 5 days (Table 5). In 2016, there was no charting option to indicate patient discharge as the reason for removal, yet a "per protocol" option remained despite the change to "clinical indication" for device removal. Between the 2 point prevalence reviews, EHR charting elements were updated to include "patient discharge" as a reason for removal and to discontinue "per protocol." Subsequent decreases in "reason not documented" were achieved, and the ability to more precisely capture significant outcomes was enhanced (Table 6).

Reasons for removal were reviewed based on charting in the nursing notes and the vascular access flow sheet in the EHR to identify opportunities for improvement, such as education or necessary product or policy changes (Table 6). Consistent with findings reported by others, infiltration was the most frequent complication reported with device dislodgement, frequently charted as "removed by patient," the next most often documented reason for removal.

Previous work by the institution demonstrated that the incidence of infection of SPCs in the ED correlated with the volume of catheters placed. After the introduction of

TABLE 4a

Reasons for Removal Based on Anatomical Location, 2016

Anatomical Location	Total Number of Catheters	% Damage	% Infiltration	% Dislodgement	% No Reason	% Leaking	% Drainage	% Occluded	% Per Protocol/ Site Change/Per Order	% Patient Discharge	% Patient or Family Request
Ankle	1	0	0	0	100	0	0	0.00	0	0	0
Antecubital fossa	157	1.3	21.02	4.46	36	0.6	6.4	2.55	20.38	0	1
Forearm	157	0	22.93	6.37	39	0	3.8	1.91	17.83	0	3
Wrist	62	1.6	25.81	0	35	0	1.6	6.45	22.58	0	3
Upper arm	15	6.7	26.67	0	27	0	0	20.00	13.33	0	0
Foot	5	0	20	0	20	0	0	0.00	40	0	20
Hand	129	2.3	18.6	10.1	32	0.8	3.9	6.20	19.38	1	3

TABLE 4b

Reasons for Removal Based on Anatomical Location, 2017

Anatomical Location	Total Number of Catheters	% Damage	% Infiltration	% Dislodgement	% No Reason	% Leaking	% Drainage	% Occluded	% Per Protocol/ Site Change/ Per Order	% Patient Discharge	% Patient or Family Request	% Emergent Start
Antecubital fossa	183	1.1	13.66	9.29	15	0.5	6	5.46	3.279	36.6	3	4.37158
Forearm	193	1	19.69	18.1	15	0	6.2	2.59	5.181	29.5	2	1.03627
Wrist	61	0	27.87	19.7	0	1.6	3.3	1.64	3.279	29.5	2	4.91803
Upper arm	18	0	16.67	5.56	0.2	5.6	11	5.56	5.556	27.8	0	5.55556
Foot	3	0	33.33	33.3	0	0	0	0.00	0	33.3	0	0
Hand	154	1.9	14.29	16.2	20	0.6	3.2	2.60	8.442	26	3	3.24675
External jugular	5	0	40	0	0	0	0	0.00	0	20	0	0

the protected clinical indication bundle, there was no disparity in timing from insertion to infection compared with the catheters placed once a patient was admitted to the facility. The phrase "protected clinical indication" is used to describe the active process put in place when the goal of longer functional dwell time was established. The word "protected" is included to emphasize the effort to address potential failure points when the change was made. Data were stratified in these subsequent reviews to determine whether overall longevity of the catheter differed between those placed in the ED versus those placed in the inpatient setting. In 2016, 43% of catheters originated in the ED. The overall average dwell time for all SPCs in the study was 4.36 days, but the ED's average was 4.45 days, suggesting that its success in extending dwell time was contributing to the hospital's overall success. In 2017, the ED placed 35% of the SPCs included in the review, with 1 campus having an average dwell time of 4.14 days and the other 4.75 days compared with the hospital's average of 4.3 days for that year. This finding underscores the potential for having an impact on overall inpatient vascular access by engaging the ED personnel in practice changes. In this example, the dwell time of the catheters placed in the ED meets or exceeds those placed on the inpatient units.

DISCUSSION

The dwell time reported in this review is in contrast to other reports that have found SPC dwell times of 44 hours and Rickard and colleagues' study showing an average of 99 hours after adoption of catheter replacement based on clinical indication.[15] The authors' findings could be due in part to the capture of insertion and removal dates and not actual hours. Device days are counted according to CDC methodology, which attributes an entire day to each calendar day the device is in place.[21] Nonetheless, a count of 5 days would require an absolute minimum of 72-plus hours if the SPC was inserted just before midnight on day 1, remained in place for 3 full calendar days, and was removed immediately after midnight on day 5. Examining overall performance for both years showed substantial numbers of SPCs remaining functional beyond 7 days. This result aligns with the study's objectives of reducing the number of unnecessary vascular access procedures patients experience. During the time of these reviews, the average length of stay for the organization was approximately 5.5 days, which provides a substantial opportunity to reduce the need for an additional catheter, particularly when a patient may require just a day or 2 of additional therapy before discharge. Under earlier policy expectations, the majority of those patients would have been subjected to an SPC restart.

The significant numbers of SPCs that were lost to infiltration, particularly in the early days post insertion, could be affected by the large number of devices placed in

TABLE 5

Dwell Time Distribution and Frequency of Complications/Reasons for Removal

Number of Dwell Days	2016				2017				
	Number of Catheters	Percentage of Total	Percentage Infiltrated	Percentage Due to Device Dislodgement	Number of Catheters	Percentage of Total	Percentage Infiltrated	Percentage Due to Patient Discharge	Percentage Due to Device Dislodgement
1	43	8%	37%	5%	67	11%	15%	24%	16%
2	118	22%	26%	10%	136	22%	24%	22%	18%
3	105	20%	21%	29%	119	19%	22%	33%	19%
4	96	18%	9%	15%	88	14%	15%	44%	7%
5	40	8%	18%	5%	53	8%	13%	25%	19%
6	35	7%	17%	23%	43	7%	14%	23%	9%
7+	95	18%	8%	2%	123	20%	11%	37%	9%

undesirable locations, such as the hand, wrist, and antecubital fossa. The hospital's use of these sites exceeded international findings, which found two-thirds of SPCs placed in these sites.[8] This could be related in part to the significant percentage of SPCs placed in the ED. The performance and volume of SPCs placed in the ED setting make the inclusion of those staff members in SPC strategies imperative when looking for overall improvements. The results reported here suggest that arbitrarily requiring all ED placements to be removed on patient admission—that is, treating them as emergent insertions rather than working with the ED to incorporate best practice expectations for elective starts—may not be necessary and could unnecessarily expose patients to additional procedures and have an impact on vessel health and preservation objectives.

When infiltration rates were stratified by anatomical location, the upper arm had a very high rate, albeit a small sample to review. Without prospective performance

TABLE 6

Documented Reasons for Removal

Reason	2016			2017		
	Average Dwell Time (Days)	Number of Catheters	Percentage of Catheters	Average Dwell Time (Days)	Number of Catheters	Percentage of Catheters
Catheter damage	3.33	6	1.13%	5.00	7	1%
Patient discharged	N/A	N/A	N/A	4.64	193	31%
Drainage	3.82	23	4.32%	5.52	33	5%
Emergency medical services (emergent start)	N/A	0	0%	3.35	17	3%
Infiltration	3.44	115	22%	3.83	109	17%
Leaking	3.50	2	0%	9.00	3	0%
Occlusion	3.90	21	4%	4.09	22	3%
Painful	3.25	4	1%	4.50	2	0%
Per order	3.86	7	1%	5.47	19	3%
Per protocol	4.92	88	17%	N/A	N/A	N/A
Per request	2.75	12	2%	3.89	19	3%
Removed by patient	4.00	40	7%	3.91	89	14%
Site change	6.20	10	2%	4.69	16	3%
Unknown/not documented	4.53	135	25%	4.24	96	15%

Abbreviation: N/A, not applicable.

monitoring or adjustment in available supplies—that is, ensuring that a long-enough catheter is readily available and adequate securement for an alternative device selected—there has been ongoing discussion of the performance of SPCs in this site, as ultrasound is being used for some SPC placement.

In addition, there is no enforcement or restriction of reserving upper arm site selection for the vascular access team, which results in some frontline staff, including ED staff, accessing this site at times. The performance noted particularly in 2016—27% infiltrated, 20% occluded—is a driving factor in establishing more formally a carefully monitored ultrasound-guided SPC program. Like many organizations, Methodist Hospitals has an opportunity to reduce the overreliance on the antecubital fossa due to a misunderstanding of requirements for power injection in patients requiring computed tomography (CT) imaging studies. Policies at the time of these reviews lacked clear definition of each anatomical site, which could also introduce some variability into performance analysis (ie, the high forearm vs the antecubital fossa or the low forearm vs the wrist). Device dislodgement also could be affected by these site selection choices, as they tend to be more uncomfortable for patients and may lie at a point of flexion, with joint stabilization not being the standard of practice in the authors' organization when these sites are chosen. Subsequent internal audits have shown strong association with those sites and increased rates of dressing disruption as well.

In mid-2017, policies were updated to reflect more clearly the expectation that the forearm be selected as the preferred site for the majority of indications. In addition, with approximately 43% of SPCs in inpatients initiated in the emergency setting in 2016, where a large number of the antecubital insertions originate, the ED and radiology departments in the organization have subsequently partnered to develop a consensus agreement on the use of large veins on the forearm, rather than relying exclusively on the antecubital fossa, for patients going to CT angiography, consistent with the *Standards*,[2] as well as the American College of Radiology guidance document.[22] In addition, a pilot program on the use of a catheter with a fenestrated tip to allow smaller gauges to be used for power injection is also being explored between the ED and radiology. The features of a stabilization platform and integrated extension set remain present in the device, while allowing clinicians to choose a smaller gauge to better accommodate vessel size in some patient populations and retaining the necessary high flow rate for the procedure. These programs, combined with continued feedback on performance and possible evaluation of a longer catheter for deeper veins, particularly when ultrasound guidance is used, will be implemented to help decrease the rates of infiltration. If rates remain elevated despite improved site selection, tissue adhesive may be considered for further assistance in decreasing catheter movement.

Following the review of the 2016 study, updates were made to the documentation fields in the EHR to allow for better charting on reasons for removal—for example, adding "patient discharge" as an option, as well as "EMS/field start," and removing "per protocol." Infiltration and phlebitis scales were also introduced, along with postremoval assessment 2 days after removal. These changes can be seen in the numbers presented in Table 6, including the decrease observed in the number of SPCs without a removal reason noted—from 25% in 2016 to 15% in 2017. There are still significant numbers of SPCs with no documented reason for removal. With the majority of them occurring on the day of discharge, it is likely that the discharge/completion of therapy is a large portion of those SPCs.

LIMITATIONS

This single-center review represents the experience in this large, urban community hospital only. The organization has a small vascular access team, but at the time of this study, SPC insertion and maintenance were tasks primarily assigned to bedside staff rather than to a specially trained team. Data were abstracted from the EHR rather than direct observation, permitting substantial potential for bias based on documentation errors or omission. Data presented were analyzed by SPC rather than by patient, which may underestimate individual patient factors that can contribute to device failures in patients who were experiencing a large number of failed devices. In addition, there was no investigation of a possible association between length of stay and number of devices required. The observational nature of this review did not include further investigation of the impact of device failure on patients, such as delayed treatment or the need to escalate to a more invasive access option for subsequent vascular access needs.

NEXT STEPS

The findings from these reviews continue to prompt clinical improvements. Following this study, there were modifications to the insertion bundle that had been in place for 3.5 years. In response to difficulty maintaining fully intact dressings, the organization chose an updated style of securement dressing and added gum mastic liquid adhesive to the insertion kits, based on trials conducted over the preceding months.[23]

In 2018, the organization studied the potential impact of these interventions on outcomes. Process measures were put in place when the updated kits were introduced, demonstrating improvements from baseline (55% fully intact dressings) to reported numbers indicating 98% fully intact dressings, with a sample of approximately 2000 observations a month and 20 000 reported observations at this time. Based on those evaluations and staff requests beyond SPCs, gum mastic has become standard for all noncontraindicated inpatient vascular access dressings. Future

publications will examine this practice change in greater detail. In addition, after 2 years of completing manual chart reviews to gather data for these studies, information technology has developed a weekly report that captures some of the main elements of SPC performance, which allows for some continuous monitoring based on electronic documentation. This report includes anatomical location, gauge, charted reason for removal, and dwell time (based on insertion and removal date and time) in hours. This level of automation will allow for more concurrent review and much larger sample sizes to be reviewed on an ongoing basis to identify changes in practices and outcomes and to pinpoint specific areas requiring education or other interventions to help improve device performance.

Using the new electronic report, 3007 SPCs were placed in July 2018, with dwell time between 0 and 1176 hours. Six hundred seventy-four remained in place at least 5 days, 305 at least 7 days, and 406 were removed the same day they were inserted. This report included all devices placed—inpatient, outpatient, and ED patients who were not admitted. In addition, the number of SPCs removed at nearly the same time as insertion suggests that, at least for short-term devices, the accuracy of insertion time and removal time may not be precise. The reports discussed in the body of this article were based solely on hospital inpatients. Unfortunately, there were no improvements noted in site selection, but this will be sampled again following the completion of annual competencies and increased manager engagement in improving key indicators for vascular access success. The inclusion of patients from the ED in this electronic sample changes the patient mix and could account for an artificially elevated percentage of antecubital fossa use, given the known historic preference for that site in the ED setting. Overall, the electronic tool provides timely data generated on a weekly and monthly basis and encompasses more than just the inpatient population that was the original focus of this project.

To expand on this work and the process measures instituted in late 2017, monthly vascular access rounds have been established to include not only hospital content experts, such as infection control specialists, clinical nurse specialists, clinical educators, nursing leadership, and quality experts, but also vendor representatives of supplies included in the hospital's insertion and maintenance bundles to help optimize appropriate use of all elements of the bundle to drive compliance and expected outcomes. This collaborative bedside rounding enhances nurses' ability to respond in real time to suboptimal vascular access findings and engage staff members with a full complement of experts to enhance their knowledge and to access assistance, if needed. During the rounds, observations and discussions with staff include a review of overall vascular access processes, including site selection, dressing placement, the use of CHG sponges and alcohol-impregnated caps, administration set dating, and on occasion, direct observation of care given, including flushing of SPCs and dressing changes. It allows the time to make direct observations of care rather than relying on what is captured in the EHR.

The findings from the vascular access collaborative rounding were used, in part, to validate the data from the overall process measures and to continue to identify unmet educational needs or product features or use to improve outcomes. The information from these process measures was included in leadership reporting each month through the Infection Control Committee and the quarterly meeting of the Leadership Performance Improvement Committee, a joint medical staff and hospital leadership committee, to aid in the discussion of contributing factors to ongoing risk to patients. Unit management scorecards incorporate the information on unit-specific incidence of CLABSIs, as well as dressing integrity and hand hygiene, to provide a snapshot with all elements of the process measures available to review in a unit-stratified manner through access to a shared drive. At the time of this writing, the organization was completing a study involving weekly, direct observation of SPCs over a 6-month period to allow for ongoing review of performance by the hospital's expert staff. This will also allow further comparison between charted and directly observed device status.

ACKNOWLEDGMENTS

The authors would like to thank Patricia Mancos, SM(ASCP), BS, SM(ASCP), CIC®, for her surveillance of all vascular access catheter-related infections; Nancy Scott, DNP, ACNS-BC, CIC®, VA-BC, for her expertise at working with staff to identify opportunities through the use of apparent cause analysis; Sally Swartz, MSN, RN, ACNS-BC, for partnering to develop and update vascular access policies and procedures; and Rhonda Planck, BSN, RN, CNRN, for continuously updating electronic health record documentation options to help capture the excellent care given.

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