ORIGINAL ARTICLE

Temporary Central Venous Catheter Utilization Patterns in a Large Tertiary Care Center: Tracking the "Idle Central Venous Catheter"

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OBJECTIVES. Although central venous catheter (CVC) dwell time is a major risk factor for catheter-related bloodstream infections (CR-BSIs), few studies reveal how often CVCs are retained when not needed ("idle"). We describe use patterns for temporary CVCs, including peripherally inserted central catheters (PICCs), on non-ICU wards.

DESIGN. *A retrospective observational study.*

SETTING. A 579-bed acute care, academic tertiary care facility.

METHODS. A retrospective observational study of a random sample of patients on hospital wards who have a temporary, nonimplanted CVC, with a focus on on daily ward CVC justification. A uniform definition of idle CVC-days was used.

RESULTS. We analyzed 89 patients with 146 CVCs (56% of which were PICCs); of 1,433 ward CVC-days, 361 (25.2%) were idle. At least 1 idle day was observed for 63% of patients. Patients had a mean of 4.1 idle days and a mean of 3.4 days with both a CVC and a peripheral intravenous catheter (PIV). After adjusting for ward length of stay, mean CVC dwell time was 14.4 days for patients with PICCs versus 9.0 days for patients with non-PICC temporary CVCs (other CVCs; $P < .001$). Patients with a PICC had 5.4 days in which they also had a PIV, compared with 10 days in other CVC patients ($P < .001$). Patients with PICCs had more days in which the only justification for the CVC was intravenous administration of antimicrobial agents (8.5 vs 1.6 days; $P = .0013$).

CONCLUSIONS. Significant proportions of ward CVC-days were unjustified. Reducing "idle CVC-days" and facilitating the appropriate use of PIVs may reduce CVC-days and CR-BSI risk.

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Central venous catheters (CVCs) are used in approximately 30% of hospitalized patients.[1] While they are necessary for many lifesaving interventions, they expose patients to the risk of a catheter-related bloodstream infection (CR-BSI). The majority of CVC-days and CR-BSI events in hospitals occur outside the intensive care unit (ICU), with an estimated 20.1 million CVC-days and 23,000 CR-BSIs occurring on non-ICU wards in 2009.[1-4]

Each day a CVC remains in place increases the odds that the patient will develop a CR-BSI.[5-7] Consequently, prompt removal of unnecessary CVCs carries a category IA recommendation in published Centers for Disease Control (CDC) guidelines for the prevention of CR-BSIs.[2,8] Although duration of exposure to a CVC is a major risk factor for CR-BSI, little published evidence addresses the frequency with which CVCs are retained when no longer necessary ("idle") and, similarly, few have published strategies to reduce these idle CVC-days.

Successful interventions to reduce CR-BSI have largely targeted insertion practices and have occurred in the ICU setting, where recent reports suggest a 58% reduction in CR-BSI events from 2001 to 2009.[2,8] Little attention, however, has been paid to strategies to reduce CR-BSIs outside the ICU or to reduce unnecessary CVC-days.[1,9] While focusing on CR-BSIs in the ICU may target the population with the highest CVC utilization ratio, it misses the population of patients with the largest number of CVCs: non-ICU (ward) patients.

We suspect that an increased availability of peripherally inserted central catheters (PICCs) in hospitals has changed CVC use patterns. A heightened awareness of CVC use patterns and idle CVCs could eventually allow active intervention to reduce the risks for patients with unnecessary CVCs. We

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TABLE 1. Definition of an Unnecessary (Idle) Central Venous Catheter (CVC)–Day

For each calendar day, a CVC was considered justified[a] if any of the following criteria were met:
Patient instability, defined as:
Respiratory rate less than 10 or greater than 30 bpm
Oxygen saturation reading less than 90% for more than 5 minutes
Heart rate less than 40 or greater than 130 bpm
Systolic blood pressure less than 80 or greater than 200 mmHg
Diastolic blood pressure greater than 120 mmHg
Need for infusion of at least 3 incompatible continuous infusions or 2 continuous infusions plus blood products
Use of medications requiring central venous access[b]
Comfort care
CVC placed for administration of antimicrobials for active or suspected infection
Reason for CVC insertion stated as difficult access and patient did not have a PIV[c]
Day of CVC insertion
First hospital day if the patient was transferred to our tertiary care hospital and the CVC was placed at an outside hospital
Last day of hospitalization if the patient was discharged from the hospital with the CVC in place

NOTE. bpm, beats per minute; PIV, peripheral intravenous catheter.

[a] All other CVC-days were considered unnecessary (= unjustified = idle).

[b] Includes certain continuous infusions, vasopressors, antiarrhythmic drugs, chemotherapy, total parenteral nutrition, and others.

[c] Presence of a PIV alone did not make a CVC idle. CVCs were idle only if the provider documented lack of intravenous access and the patient had no other indication for a CVC.

anticipate that reducing idle CVC-days will ultimately reduce the number of CR-BSI events. We describe the use patterns for temporary CVCs, including PICCs, on the wards of a large tertiary care center.

METHODS

Design and Setting

The study was approved by the institutional review board. Data were collected retrospectively on patients admitted to 3 hospital wards (2 medical wards managed by hospital medicine, 1 subspecialty medical/surgical ward) in a 579-bed acute care, academic tertiary care facility.

Patients

Inclusion criteria. We identified patients who had an indwelling CVC over a 12-month period in 2007, using a random number generator to select 9 days over that period. A search of the clinical data repository from our electronic medical record (*PowerChart,* Cerner) yielded all patients on the 3 wards of interest who had a CVC present on the sample dates. Patients who had a PICC or a temporary central line in the subclavian, femoral, or internal jugular locations were included in the study.

Exclusion criteria. Those patients whose only CVC was a dialysis or pheresis catheter and those patients with only an implanted vascular access were excluded. Most of these CVCs are intended for long-term use and would not typically be removed in the hospital.

Data Collection

Line necessity was assessed only for days on the hospital wards; all ward-days on the selected wards were included, even if there were intervening days in the ICU. Daily ward CVC use and justification were determined through a manual chart review of intravenous (IV) medications, vital signs, and other patient data. Electronic and paper patient charts were reviewed by a single trained physician (C.P.) using a standardized chart abstraction tool. CVC-days were counted, using National Health Safety Network methodology: each CVC-day was either justified or idle, regardless of the number of CVCs in place. The presence of a peripheral intravenous catheter (PIV) was recorded in 3 ways: for all ward-days, at the same time as CVC, and during idle CVC-days. For each patient, any stay in an ICU during the same hospital admission was recorded. The Universal Bill 2004 provided diagnoses and procedure codes.

Patients who had a PICC at any time during their ward stay (PICC group) were evaluated separately from patients who had only non-PICC, nontunneled, short-term catheters (other CVCs group). Patients who spent at least 1 night in the ICU (ICU group) were evaluated separately from patients who had no ICU stay (no ICU group).

Case/Outcome Definition (Idle CVC-Days)

Each day a CVC was in place it was characterized for that day as "justified" for 1 or more medical reasons or "unjustified" (idle; Table 1). The administration of IV antimicrobials of any type justified a CVC-day if the CVC was inserted for the purpose of antimicrobial administration or because of a suspected infection. Anticipated duration of IV therapy could not be determined with the retrospective study design and existing data source. The concomitant presence of a PIV was not considered when the number of idle CVC-days was determined. The number of idle CVC-days ("idle days"), the

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number of CVC-days in which IV antimicrobial administration was the only justification for the central line, and the number of idle days in which the patient had a PIV were determined.

Statistical Methods

Proportions were compared between groups (PICC/other CVC; ICU stay/no ICU stay), using the χ^2 or Fisher exact test. Continuous variables were compared between groups, using the Wilcoxon rank-sum test or the *t*-test. Analysis of covariance (ANCOVA) was used to describe changes in CVC dwell time, idle days, and PIV use after adjusting for ward length of stay (LOS) for patients in the comparator groups. Assuming a common slope model for the ANCOVA analysis, a ward LOS-adjusted mean was estimated for CVC dwell time for patients with PICCs and other CVCs. A LOS-adjusted mean for CVC dwell time was defined as the predicted response value obtained by evaluating the regression equation for each group (PICC vs other CVC and ICU vs no ICU) at the mean ward LOS for the 2 subgroups. Since the assumption of normality was tenuous for each outcome, a Poisson distribution was assumed for each outcome and estimates of the standard errors of parameters were used to perform statistical tests and construct 95% confidence intervals. The analyses were performed with the generalized estimation equations approach, using SAS Proc Genmod (ver. 9). All statistical tests were 2 sided. A value of $P \leq .05$ indicated statistical significance.

RESULTS

Patients, CVC Types, and CVC-Days

Eighty-nine patients with 146 eligible CVCs were studied (Tables 2–4). Patients had a mean of 20.4 ± 14.7 ward-days and 16.1 ± 13.4 ward CVC-days.

Patients who had a PICC line during their hospitalization ($n = 67$) outnumbered the patients in the other CVC group ($n = 22$). Patients with a PICC had a longer hospital LOS, more catheter episodes, and longer CVC dwell times (Table 3). Patients with a PICC line had more ward CVC-days (mean ± standard error [SE], 18.8 ± 13.9) than the other CVC patients (8.0 ± 7.3; $P = .0008$). Patients with a PICC had significantly longer CVC dwell times for all ward LOSs (Figure 1), with the difference at the mean ward LOS shown in Table 5. Patients who spent any time in the ICU ($n = 51$) had a longer LOS and more CVC episodes and were more likely to have a CVC other than a PICC when compared with those who did not experience any ICU stay ($n = 38$; Table 3).

Idle CVC-Days and Justification for CVC Use

There were 1,433 ward CVC-days, of which 361 (25.2%) were idle. A majority (62.9%) of patients had at least 1 idle day, and 46.1% had 2 or more idle days. In addition to the 361 idle days, there were another 603 days (42.1% of ward CVC-days) in which the only justification for a CVC was IV antimicrobial administration. The entire group of patients had an average of 4.1 ± 6.6 idle days, but among those patients with at least 1 idle day, the mean number of idle days was 6.4 ± 7.3.

TABLE 2. Primary Diagnosis of Patients with a Central Venous Catheter

Primary diagnosis category	No. (%) of patients, $N = 89$
Infection	32 (36.0)
Vascular disease	12 (13.5)
Pulmonary (pneumonia, pulmonary embolism, cystic fibrosis flare)	13 (14.6)
Gastrointestinal disease (hemorrhage, liver disease)	16 (18.0)
Renal disease	7 (7.9)
Neurologic disease	2 (2.3)
Diabetes	4 (4.5)
Other	3 (3.4)
Major surgery during hospitalization	21 (23.6)

The total number of idle days in the PICC and other CVC groups was similar; however, patients in the PICC group had more days in which the only reason for the CVC was IV antimicrobial administration (8.5 ± 9.6 vs 1.6 ± 2.6 days; $P = .0013$). Daily justification for CVC-days is presented in Table 4. CVCs could have multiple justifications in a given day.

Concurrent PIV Use

Among the 89 patients, 72 (80.9%) had at least 1 day in which a PIV was in place, with a mean of 7.4 ± 8.3 PIV-days. Patients had a mean of 3.4 ± 4.9 days with both a CVC and a PIV in place, and 10 (11.2%) patients had more than 1 day with both an idle CVC and a PIV in place. The other CVC group had greater use of PIVs compared with the PICC group for all ward LOSs (Figure 1), with the difference at mean ward LOS shown in Table 5 ($P < .0001$).

Patients with any ICU stay had more ward-days with both a CVC and a PIV in place (4.5 ± 5.9 vs 2.0 ± 2.4 in the non-ICU group; $P = .01$). Additionally, the ICU group had 9 patients (17.7%) with more than 1 day with both an idle CVC and a PIV in place, compared with 1 (2.6%) in the non-ICU group ($P = .04$).

CVC Status on Day of Discharge

Thirty eight patients (43%) left the hospital with their CVC in place. Of the remaining 51 patients, 30 (58.8%) had their CVC removed on the day of discharge (Table 3).

PICC lines often remained in place until the time of discharge and were more likely than other CVCs to be removed on the day of discharge (odds ratio [OR], 3.1 [95% confidence interval {CI}, 1.0–10.0]; $P = .0526$). Of the 30 PICC patients

TABLE 3. Demographics and Catheter Use

	Overall ($N = 89$)	Other CVC ($N = 22$)	PICC ($N = 67$)	P	No ICU ($N = 38$)	ICU ($N = 51$)	P
Mean ± SD age, years	57.3 ± 16.5	63.6 ± 14.9	55.2 ± 16.5	.04	54.1 ± 19.7	59.6 ± 13.3	.11
Race, no. (%) of patients							
White	49 (55.1)	12 (54.6)	37 (55.2)	.59	22 (57.9)	27 (52.9)	.86
Black	35 (39.3)	8 (36.4)	27 (40.3)		14 (36.8)	21 (41.2)	
Female sex, no. (%) of patients	41 (46.1)	8 (36.4)	33 (49.3)	.29	17 (44.7)	24 (47.1)	.83
Mean ± SD hospital LOS, days	23.5 ± 18.3	16.1 ± 13.3	25.9 ± 19.1	.03	18.4 ± 14.0	27.2 ± 20.3	.02
Mean ± SD ICU LOS, days	4.1 ± 8.3	3.0 ± 2.7	4.4 ± 9.5	.10	0 ± 0	7.1 ± 10.0	<.0001
Mean ± SD ward LOS, days	20.4 ± 14.7	14.0 ± 11.8	22.4 ± 15.1	.02	19.4 ± 14.0	21.0 ± 15.4	.61
Mean ± SD no. of ward CVC-days[a]	16.1 ± 13.4	8.0 ± 7.3	18.8 ± 13.9	.0008	14.4 ± 11.7	17.4 ± 14.5	.31
No. (%) of patients with at least 1 idle day	56 (62.9)	18 (81.8)	38 (56.7)	.03	22 (57.9)	34 (66.7)	.40
Mean ± SD no. of idle days occurring on the ward[a]	4.1 ± 6.6	3.2 ± 3.2	4.3 ± 7.4	.37	3.4 ± 6.6	4.5 ± 6.6	.27
Mean ± SD no. of days administration of IV antibiotics was the only justification for CVC	6.8 ± 8.9	1.6 ± 2.6	8.5 ± 9.6	.0013	6.9 ± 8.4	6.7 ± 9.3	.89
Mean ± SD no. of ward-days with a PIV	7.4 ± 8.3	8.9 ± 7.6	6.9 ± 8.5	.33	6.1 ± 6.0	8.3 ± 9.6	.21
Mean ± SD sum of days with both a CVC and a PIV	3.4 ± 4.9	3.4 ± 4.2	3.5 ± 5.1	.94	2.0 ± 2.4	4.5 ± 5.9	.01
No. (%) of patients with at least 1 day with both a PIV and an idle CVC	22 (24.7)	14 (63.6)	8 (12.0)	<.0001	3 (7.9)	19 (37.3)	.002
No. (%) of patients discharged with their CVC	38 (42.7)	1 (4.6)	37 (55.2)	<.0001	21 (55.3)	17 (33.3)	.04
No. (%) of patients with their CVC removed on the day of discharge (of those who did not go home with their CVC)	30 (58.8)[b]	9 (42.9)[c]	21 (70.0)[d]	.0526	12 (70.6)[e]	18 (52.9)[f]	.23

NOTE. CVC, central venous catheter; ICU, intensive care unit; LOS, length of stay; PICC, peripherally inserted central catheter; PIV, peripheral intravenous catheter; SD, standard deviation.

[a] Only CVC-days occurring on the ward were evaluated for device necessity.
[b] 30 / 51 = 58.8%.
[c] 9 / 21 = 42.9%.
[d] 21 / 30 = 70.0%.
[e] 12 / 17 = 70.6%.
[f] 18 / 34 = 52.9%.

who did not go home with their CVC, 21 (70.0%) had their CVC removed on the day of discharge compared with 9 (42.9%) of 21 patients with other CVCs.

DISCUSSION

The CR-BSI prevention guidelines recommend "improved implementation of post-insertion line-maintenance practices and strategies to prompt removal of unnecessary lines." Because infection prevention efforts targeting line insertion practices in the ICU have little impact on many CR-BSI events that occur outside the ICU, maintenance and removal strategies become paramount.[2]

Few researchers have reported on the prevalence of idle or unnecessary CVCs. Early studies of idle venous catheters focused on PIVs.[10,11] A single-center study of idle PIVs found that 33% of 484 IV catheter episodes had at least 2 consecutive

TABLE 4. Central Venous Catheter (CVC) Types and Daily Justification for CVC

	No. (%) of CVCs	No. (%) of CVC-days
CVC type/location[a]		
PICC	82 (56)	
Subclavian vein CVC	22 (15)	
Internal jugular vein CVC	38 (26)	
Femoral vein CVC	4 (3)	
Justification for CVC-day[b]		
Intravenous antimicrobial use		872 (61)
Medications requiring a CVC		216 (15)
Unstable vital signs		155 (11)
Multiple infusions		44 (3)
No intravenous access		30 (2)
Comfort care		13 (0.9)
Other (eg, planned discharge home with CVC)		170 (12)

NOTE. PICC, peripherally inserted central catheter.
[a] $n = 146$.
[b] $n = 1{,}433$. CVCs could have multiple justifications on each day.

idle days, occurring in 17% of the patients studied and representing 19% of all patient-days of IV catheter use. They characterized a PIV as idle if no medications, blood products, nutrition, or fluids were to be given that day and there was no procedure that required a PIV.

The few previous studies of unnecessary CVCs found that non-ICU patients are more likely to have unjustified CVCs.[12] Trick and colleagues reported that 83% of patients with a CVC were outside of the ICU and 8.5% (of 388) ward CVC-days were unjustified. However, these authors included a wider variety of CVCs, including dialysis catheters and implanted ports, devices that typically have long-term indications. Our exclusion of these catheters and focus on only temporary CVCs likely accounts for our higher percentage of idle catheter-days. Recently, Tiwari et al reported on inappropriate device use in patients with all forms of venous access (PIVs and CVCs) and found that half of patients had at least 1 inappropriate device day and 31% of all catheter-days were inappropriate; 23% of patients had a CVC, and patients often had both a CVC and a PIV.[13]

We used criteria for the determination of idle CVC-days that were similar to those used in previous reports, although our "idle" criteria were lenient.[12] We even allowed 1 outlier in vitals signs and the use of IV antimicrobials of any kind (even those with an oral equivalent) to justify a CVC-day. Our analysis allowed us to determine the impact of in-hospital IV antimicrobial administration on CVC justification. Antimicrobial use explained the bulk of the justified (or non-idle) CVC-days. Of the 1,072 justified CVC-days, 56% (603 days) were justified only because the patient was receiving an in-hospital IV antimicrobial. This effect was most evident in patients with a PICC. Thus, we likely underestimated the number of idle CVC-days, since a CVC may not have been needed for each course of antimicrobials. Nonetheless, we still found that a quarter of ward CVC-days were idle.

Although the concomitant use of a PIV and a CVC did not factor in our idle CVC definition, presence of a PIV suggests that lack of venous access was not likely an indication for the CVC. In our study, patients who had been in the ICU had more days with both a PIV and an idle CVC in place compared with patients who had not been in the ICU. This overlap of PIVs and CVCs in former ICU patients suggests that providers may be reluctant to remove CVCs from patients who have been in the ICU or that CVCs are neglected after patient transfer from the ICU to the care of another service. Standardizing the assessment of CVC needs prior to transfer out of the ICU may reduce the tendency to retain idle CVCs in this population of patients.

Our study is unique in that it compares use patterns of PICCs with those of other CVCs. PICC use in the acute care setting has increased, although the rates of CR-BSI with PICCs in inpatients are similar to those of other temporary CVCs.[14-16] We suspect that one reason for this trend is the convenience (via dedicated line teams or radiology) of obtaining a PICC. Increased utilization of PICCs has been reported when skilled IV therapy teams who are tasked with placing difficult PIVs are withdrawn.[17] PICCs comprised 56% of devices in our study, compared with 11% in the Trick study, which was based on data from 2001.[12] While it is possible that the patients in our PICC group had limited venous access or needed to receive IV therapies at home, our data do not support this. In the PICC group, 52 (77%) of 67 patients who had a PICC had at least 1 day with a PIV, and the patients with PICCs had a mean of 6.9 days with a PIV and 3.5 days with both a CVC and a PIV. We observed that a high proportion of PICC lines not intended for use outside the hospital were not removed until the day of discharge, even in patients who had previously had a successful PIV. We suspect that staff and patient convenience are major drivers of their inpatient use; this convenience needs to be weighed against the risk of CR-BSI.

The 2011 CDC guidelines for the prevention of CR-BSI

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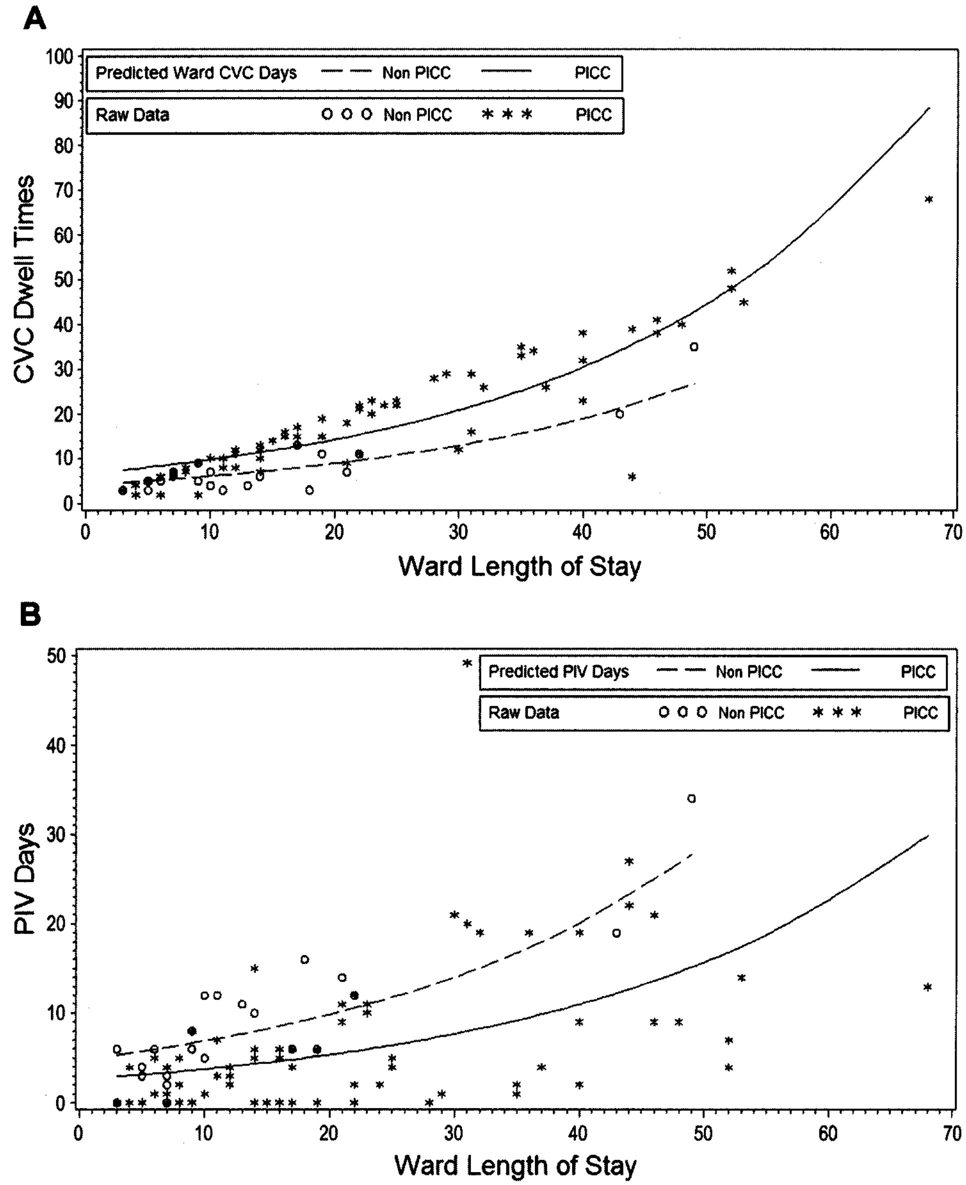

FIGURE 1. Scatterplot and fitted regression lines from analysis of covariance for central venous catheter (CVC) dwell times versus ward length of stay (*A*) and peripheral intravenous catheter (PIV)–days versus ward length of stay (*B*) for 67 patients with peripherally inserted central catheters (PICCs; solid lines, asterisks) and 22 patients with other CVCs (dashed lines, open circles).

recommend the use of a PICC or a midline catheter when the duration of IV therapy will likely exceed 6 days, regardless of the medications to be administered via the IV line.[8] However, there are no data to support this strategy, and the recommendations from the Society for Healthcare Epidemiology of America categorize the placement of PICC lines as a non-evidence-based strategy to reduce CR-BSI rates.[18] In a small randomized trial comparing PICC placement with ongoing use of PIVs for patients needing IV access for more than 6 days, there were more major complications (sepsis and deep venous thrombosis) in the PICC group and more minor complications (superficial venous thrombosis) in the PIV group. The PICC group had increased patient satisfaction.[15] Given the increased risk of BSI from PICCs compared with PIVs, additional studies comparing ongoing PIV use with PICC insertion for prolonged in-hospital IV therapy are needed.[14,16,18,19] Our results suggest that in a large tertiary care center, PICC lines are commonplace, are retained longer than other CVCs, and may be used for sequential days for IV access alone, when a PIV may suffice.

There are several limitations of this study. Because it is a single-center study, it is difficult to generalize practice patterns to a larger group of patients or providers. Our population of patients had a long LOS, which may limit the generalizability of these data; however, PICC dwell times of more than 7 days are commonly reported in the literature.[20] Al-

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TABLE 5. Summary Statistics for Study Groups

	Other CVC	PICC	Difference, no. (%) of days	P	No ICU	ICU	Difference, no. (%) of days	P
Ward CVC-days adjusted for ward LOS	9.0 (7.8, 10.4)	14.4 (13.5, 15.4)	5.4 (38)	<.0001	12.5 (11.5, 13.7)	13.5 (12.5, 14.6)	1.0 (7)	.17
Ward PIV-days adjusted for ward LOS	10.0 (8.7, 11.5)	5.4 (4.9, 6.0)	4.6 (85)	<.0001	5.6 (4.9, 6.4)	7.2 (6.5, 7.9)	1.6 (22)	.004

NOTE. Data are number (95% confidence interval) of days unless otherwise indicated. Groups are patients with peripherally inserted central catheters (PICC; $n = 67$) and patients with other types of central venous catheters (other CVC; $n = 22$) and patients who experienced a stay in the intensive care unit (ICU; $n = 51$) and those who did not (no ICU; $n = 38$), adjusting for ward length of stay (LOS; analysis of covariance). PIV, peripheral intravenous catheter.

though medical and surgical patients were represented, not all patient types and no pediatric patients were included. The idle criteria were applied retrospectively and did not involve provider opinion of the need (or "expectant" need) for central access. Asking providers, however, whether a CVC is needed would have changed this from an observational to an interventional study, since asking about CVC necessity might prompt CVC removal. We used standardized criteria that could be replicated in a decision support tool (DST) to eliminate any bias from the determination of an idle CVC. We suspect that a DST combined with real-time provider assessment of the need for CVC may be a powerful way to remove unnecessary CVCs.

It is challenging to retrospectively determine whether a patient had difficult IV access. Only 30 central-line-days (2%) were justified for the explicitly stated reason of no IV access. Some patients whose CVCs were inserted because of "need for IV antimicrobials" may have had limited IV access, although PIV access was possible for most of the patients we studied. We therefore allowed the need for IV antimicrobial administration to justify a CVC-day even if the patient previously had a PIV and/or the IV antimicrobial had an oral equivalent. Eliminating patients who required antimicrobial therapy with an anticipated duration of less than 6 days may have allowed us to label more CVC-days as idle, but this was not feasible in a retrospective review.

It is necessary to ensure that prompt and easy placement of CVCs, especially PICCs, does not reduce the appropriate use of PIVs. We recommend providing specialized vascular access teams with decision support and financial incentive to encourage the placement of PIVs in patients with difficult IV access if there is no other indication for a CVC. Ultrasound guidance has been used successfully to facilitate placement of PIVs in patients with difficult venous access who otherwise would have a CVC placed.[21-25] We suspect that aggressive and skilled placement of PIVs combined with a formal CVC removal process would reduce idle CVC-days and prevent CR-BSIs. Efforts to reduce unnecessary CVC exposure are more likely to be fruitful outside the ICU, where more unjustified CVC-days occur.[12]

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