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Brief Report

Hand hygiene and needleless connector decontamination for peripheral intravenous catheter care—time and motion observational study

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Good hand hygiene and “scrub the hub” practices are important to prevent bloodstream infections. This observational study (n = 108) found high compliance with “scrubbing the hub,” although scrub time was shorter than the recommended duration (average 6.1 seconds). Compliance with hand hygiene before medication preparation (33%) and before medication administration (43%) showed room for improvement compared with postadministration (65%), the emergency setting and glove use were associated with poorer compliance ($P < .01$).

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Most hospital patients have peripheral intravenous catheters (PIVCs), which, like central vascular access devices, can lead to bloodstream infections (BSIs).¹ Commonly, PIVCs have needleless connectors (NCs) as an access point to administer intravenous fluid, medication, or blood. NC decontamination prior to each PIVC use decreases microbial load and the likelihood of microorganisms being injected into the bloodstream.² Noncompliance with NC decontamination increases risk of BSI, with attendant prolonged length of stay, increased morbidity and mortality, and higher costs.^{3,4}

Hand hygiene is important for preventing BSI. Guidelines state that hand hygiene should be performed immediately before accessing an intravascular device.⁵ There is some debate as to what procedures require aseptic, and which a clean, technique.⁴ What is clear is that when decontaminating NCs, health care workers should have clean hands and disinfect the NC without their hands touching the injectable surface. Observational studies and health care worker surveys suggest that NC disinfection is variable, inconsistent, and frequently overlooked.⁶ Hadaway⁷ argues that there is a critical lack of knowledge regarding how NCs work and the care they require.

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Conflicts of interest: None to report.

Ethics approval and consent to participate: Ethical approval was obtained from the human research ethics committee. Nursing staff were advised in ward meetings that this was a time and motion study of routine peripheral intravenous catheter care (decontamination focus not explicit). Where possible, written consent was obtained prior to the day of observation to reduce potential “Hawthorne effect.” Each nurse was observed only once.

Moureau and Dawson⁸ are two of the few authors who describe the NC decontamination procedure in sufficient detail to standardize practice. Standardized clinical practice has been demonstrated to lead to substantial reduction in health care–acquired infections.

METHODS

Aim and study design

The aim of this study was to observe and measure compliance with infection prevention measures of nurses preparing and administering medication in PIVCs via NCs. The study included 2 medical and surgical wards and the emergency department of a major metropolitan teaching hospital.

Data collection and analysis

Data were collected on weekdays over the course of 5 weeks. Observations were undertaken by the same clinical nurse with expertise in vascular access using a standardized data collection tool. Hand hygiene was observed prior to medication preparation, preadministration, and postprocedure. NC decontamination and drying times and adherence to basic infection control practices, such as protecting the syringe tip (key part protection), were also observed. NC decontamination between hospital departments was compared using Fisher exact test. Duration of NC decontamination was compared between hospital departments using 1-way analysis of variance. Hand hygiene compliance (yes/no) was compared for the 3 phases

using repeated measures logistic regression. Finally, hand hygiene total compliance was compared for clinician factors using Fisher exact test. Analysis used Stata 15 (StataCorp, College Station, TX), and *P* values <.05 were considered significant.

RESULTS

One hundred and eight observations were undertaken. Only 4 of 108 (3.7%) nurses complied with the 15-second NC scrub required in the local procedure (Table 1). Around half, or 56 of 108 (52%), decontaminated the NC for 5 seconds or less. The majority (80%) allowed the NC to dry for 6 seconds or longer, and most (98%) covered the syringe tip after medication preparation (typically using the sodium chloride flush ampoule from which flush was drawn as recommended by the manufacturer). Only 1 nurse decontaminated the NC at the completion of the procedure.

Hand hygiene before medication preparation was 36 of 108 (33%); before medication administration, 46 of 108 (43%, odds ratio, 1.48 [95% confidence interval: 0.87–2.54], *P* = .15); and postprocedure, 70 of 108 (65%, odds ratio, 3.68 [95% confidence interval: 2.14–6.35], *P* < .001). Total compliance with hand hygiene was 11% (12 of 108). Significantly higher hand hygiene compliance was observed in surgical nurses (Table 1) and by those not wearing gloves (*P* < .01) (Table 2). Other factors were not significant, although hand hygiene compliance of full-time workers was more than twice that of part-timers (7 of 38, 18%, vs 5 of 70, 7%, *P* = .11) (Table 2).

DISCUSSION

It was pleasing that 99% (107 of 108) of nurses undertook NC decontamination in some way. However, as nurses were aware they were being observed, rates may be exaggerated beyond true practice. This result is higher than the 94.3% self-report survey.⁷ There is,

Table 1
Outcomes by clinical area

	ED N = 44 (%)	Medical N = 27 (%)	Surgical N = 37 (%)	Total N = 108 (%)	<i>P</i> value
Hand hygiene*					
Premedication prep [†]	13 (30)	10 (37)	13 (35)	36 (33)	
Pre-NC access [†]	10 (23)	14 (52)	22 (59)	46 (43)	
Postprocedure [†]	27 (61)	17 (63)	26 (70)	70 (65)	
Total compliance [†]	1 (2)	2 (7)	9 (24)	12 (11)	.006 [‡]
NC decontamination time (s):					
Average	4.2	5.6	8.6 [†]	6.1	< .001 [§]
Zero (not performed)	1	0	0	1	
Up to 1	5	0	0	5	
2–5	25	15	11	51	
6–10	12	9	15	36	
11–14	1	3	7	11	
15 or longer	0	0	4	4	
NC drying time (s):					
No decontamination	1	0	0	1	
1–5	14	4	3	21	
6–10	19	11	16	46	
11–15	5	10	14	29	
16–20	4	1	2	7	
21–24	0	0	0	0	
25–29	0	1	0	1	
30 or longer	1	0	2	3	

ANOVA, analysis of variance; ED, emergency department; NC, needless connector.

*Multiple answers possible; column % values do not add up to 100%.

[†]Frequencies and column percentages shown.

[‡]Fisher exact test used.

[§]Overall *P* value of between-group differences using 1-way ANOVA.

*Statistically significantly different when compared with any of the other groups (Bonferroni correction).

Table 2
Hand hygiene compliance by clinician/treatment characteristics

	Compliance (%)		<i>P</i> value*
Sex of clinician:			
Female	10/94	(11)	.65
Male	2/14	(14)	
Work arrangement:			
Part-time	5/70	(7)	.11
Full-time	7/38	(18)	
Work position:			
Registered nurse	9/93	(10)	.28
Clinical nurse/educator	2/8	(25)	
Enrolled nurse	1/7	(14)	
Glove use:			
No	11/59	(19)	.006
Yes	1/49	(2)	

*Fisher exact test used.

however, evidence suggesting that decontamination of 5 seconds or less is insufficient for effective decontamination.⁹

The alcohol prep pads used for decontamination were 6 × 6 cm but packaged as a folded 3 × 3-cm pad. No nurse unfolded the prep pads. At folded size, it is difficult to completely cover the NC to allow for decontamination using a nontouch technique. Most procedures or guidelines advise the health care worker to decontaminate NCs, but few provide clear instruction. The alcohol prep pad itself provides brief instructions for use on skin.

Hand hygiene rates were lower than expected and differed markedly from reported rates on the national MyHospitals Web site (<https://www.myhospitals.gov.au/>). They are, however, in keeping with a 2010 systematic review.¹⁰ In particular, the low rate (23%) of hand hygiene immediately prior to accessing the NC in the emergency department was of concern. The higher rates of hand hygiene compliance observed postprocedure are in keeping with previous research, indicating that nurses perform hand hygiene to protect themselves rather than to protect patients from infection. This study also implies that nurses use gloves as a surrogate for hand hygiene. Although statistically significant results were apparent, a limitation is that only 108 observations were undertaken.

CONCLUSIONS

PIVCs are the most common vascular access devices used, and suboptimal care risks BSIs. This study observed very high rates of nurses decontaminating NCs, although for shorter durations than recommended for effective decontamination.⁵ Hand hygiene prior to both preparing and administering intravenous medication was poor but not inconsistent with the literature.

To improve and standardize care for PIVCs and NCs, practice guidelines, hospital procedures, and manufacturers' instructions need to be clear, evidence-based, and easily accessible. Regular monitoring of compliance, feedback, and reporting of BSIs associated with PIVCs is also essential. Although regular hand hygiene monitoring is carried out extensively in Australian hospitals, the complete procedure of preparing and administering medication is rarely observed. Nurses need to be reminded that good hand hygiene protects patients from infection. Consideration should be given to including out-of-hour shifts in monitoring compliance. When compliance is suboptimal, nurse leaders should use their influence to drive and sustain behavioral change.

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