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Nursing management of peripheral intravascular access devices

Key Messages

1. Maintenance of quality venous access presents a challenge to nursing care of patients who may have to rely on intravenous access for the administration of fluids, nutrients, and medications.
2. Staff education is of utmost importance in reducing peripheral intravenous access device–related complications.
3. The use of clinical guidelines is critical in maintaining the standards of nursing practice in relation to the management of intravenous catheters.
4. Competency-based evaluation tools need to be developed to assist in providing a comprehensive intravenous therapy programme.

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Introduction

The most common invasive procedure performed in hospitals is the insertion of an intravascular access device. The use of intravascular devices, depending on the type and site of insertion, can be complicated by a variety of local or systemic causes, often associated with increased morbidity, mortality and prolonged hospitalisation.[1] A review conducted between January 1986 and July 1989 showed a 6.9% rate of hospital-acquired infection.[2] Although 30% (n=178) of these patients had intravenous catheters in situ, it was not clear whether the infection was directly related to the intravenous catheters.[3]

Maintenance of intravascular devices by use of specific guidelines about the care prior to insertion, or while in situ, can successfully achieve improved patient and hospital outcomes.[4] Therefore changing care practice requires health care professionals to be knowledgeable about the guidelines and able to incorporate them into their usual work pattern. Peripheral intravascular access devices (PIVADs) include short peripheral catheters inserted into the veins of the forearm or dorsum of the hand.

Aims and objectives

This study aimed to evaluate the implementation of clinical guidelines for the nursing management of PIVADs through changes in nurses' practice in the management of PIVADs, the prevalence of intravascular-related problems before and after the implementation of the clinical guidelines, and changes in nurses' knowledge in the management of PIVADs.

Methods

This study was conducted from February 1999 to February 2000. A pre- and post-test experimental design was used to compare change in the nurses' knowledge and clinical practice in the management of patients with PIVADs. A total of 1572 adult in-patients from two Hong Kong teaching hospitals were recruited. The sample comprised 786 pre-study patients (393 as experimental group and 393 as control group), and 786 post-study patients (393 as experimental group and 393 as control group).

The Intravascular Device Survey Tool (IVDST) developed by the Joanna Briggs Institute for Evidence-Based Nursing was used to evaluate changes in nurses' practice and compliance with the Best Practice Information Sheet (BPIS). The survey was completed pre-intervention and at 3 months post-intervention. A knowledge test was developed to assess changes in the nurses' knowledge related to the nursing management of PIVADs.

Intervention

Educational workshops were provided to all nurses working in the experimental hospital over a period of 3 months. The educational intervention included a series of workshops organised in collaboration with the Central Nursing Division of the experimental hospital. The BPIS guidelines for the nursing management of PIVADs were also provided. Follow-up visits in the wards were conducted to ensure that all nurses received the information and to monitor guideline compliance. Opinion leaders were also used on each ward to act as preceptors to

Table 1. Patient characteristics

Characteristics	Control group				Experimental group				Pre-test comparison P value	Post-test comparison P value
	Pre-test (n=393)		Post-test (n=393)		Pre-test (n=393)		Post-test (n=393)			
	No.	%	No.	%	No.	%	No.	%		
Sex (male)	202	51.4	221	56.2	189	48.1	197	50.1	0.568	0.062
Age (years)	55.2	18.1	57.7	18.5	62.7	17.8	63.0	19.2	<0.001	<0.001
Duration of hospitalisation (days)	2	1.6	2	1.6	3	1.6	3	1.6	0.268	0.279
Cardiovascular disease (yes)	70	17.8	79	20.1	123	31.3	119	30.3	0.757	<0.001
Chronic respiratory disease (yes)	41	10.4	45	11.5	50	12.7	29	7.4	0.013	0.014
Diabetes (yes)	55	14.0	52	13.2	75	19.1	70	17.8	0.646	0.009
Malignancy (yes)	27	6.9	41	10.4	43	10.9	65	16.5	0.023	0.001
Current admission problem (yes)	14	3.6	7	1.8	43	10.9	12	3.1	<0.001	<0.001

nursing staff. Appropriate statistical tools and analyses were used.

Results

A total of 1572 subjects participated in this study. No significant differences in patient characteristics were found within the pre- and post-test groups except the pre-test patients were younger. More pre-test patients had chronic respiratory disease and current admission problems and more cases of malignancy were found among the experimental group patients. There were significant differences in age, history of chronic diseases and malignancy between the pre- and post-test groups (Table 1). Nurses in the experimental group were not different in age, position held, and educational qualifications.

Changes in nurses' knowledge

A significantly higher correct response rate was noted after the educational intervention for the experimental group (P<0.001); except for question 4, which was significantly lower (P<0.001). The same results were found when comparing the post-test of the experimental group and the post-test of the control group.

Change in nurses' practice

There was no significant improvement between the experimental and control groups in the "flushing agent used" or "IV set documentation". There was a significant positive improvement in "PIVAD documentation" between the experimental and control groups (control group, relative risk [RR]=5.52, 95% confidence interval [CI]= 3.57-8.52; experimental group, RR=15.13, 95% CI=10.23-22.39) and in "site dressing" (RR=7.68, 95% CI=4.75-12.43) for the experimental group (Table 2).

Incidence of PIVAD-related problems

A significant reduction in the "incidence of extravasation" between the experimental and control group was noted (control group, RR=0.52, 95% CI=0.35-0.77 vs experimental group, RR=0.000, P<0.0018) [Table 2].

There was a significant reduction in the "incidence of phlebitis" in the experimental group only (RR=0.40, 95% CI=0.16-0.91), however, there was no significant difference in reduction between the groups (Table 1). The results remained the same after adjusting for type of infusion and whether an IV set was attached to the PIVAD using multivariate logistic regression analysis.

Discussion

This study did not demonstrate conclusively that the implementation of the guideline into the hospital setting significantly improved patient outcome and decreased practice variability. We demonstrated with some degree of confidence that the implementation of evidence-based guidelines on the management of PIVADs may lead to improvement in nursing knowledge and compliance. Although nurses' knowledge level and practice changed, we could only assume that these were direct effects of the interventions provided. Nevertheless, compliance with the guidelines served as an important preventative measure for intravascular device–related complications. The results of this study also have identified quality improvement areas in intravascular therapy activities and monitoring examples for those who are evaluating quality patient care delivery.

Limitations

Although there were some changes in the nurses knowledge, practice and patient outcomes, the research design that measured change before and after the implementation of the interventions provided no indication whether these changes are sustained over a longer period of time. Repeated data collection throughout the year may provide information of the pattern of nurses' practice change through continual use of the guidelines.

There are also other limitations in this study. First, the outcome of the study depended on several factors. As mentioned previously, the doctors were responsible for the insertion of the catheter. They decided when a catheter should be removed and nurses acted on this order. Nurses in the wards made an effort to involve the physicians by

Table 2. Changes in nurses' compliance with the guidelines and the indication of phlebitis and extravasation

Compliance with the guidelines	Control group					Experimental group					P value*
	Pre-test (n=393)		Post-test (n=393)		Relative risk (95% CI) for test (post/pre)	Pre-test (n=393)		Post-test (n=393)		Relative risk (95% CI) for test (post/pre)	
	No.	%	No.	%		No.	%	No.	%		
Flushing catheter (yes)	119	30.3	105	26.7	0.84 (0.62-1.15)	117	29.8	126	32.1	1.12 (0.82-1.51)	0.1958
Flushing agent used (normal saline)†	116	95.9	105	99.1	4.53 (0.49-216.1)	77‡	68.1	125	98.4	58.44 (9.32-2390)§	0.1647‖
PIVAD documentation (yes)	29	7.40	120	30.5	5.52 (3.57-8.52)§	38	9.70	243	61.8	15.13 (10.23-22.39)§	0.0002§
Days PIVAD remains in situ (<3 days)¶	15	51.7	75	62.5	1.56 (0.69-3.52)	22	57.9	133	54.7	0.88 (0.44-1.76)	0.2952
IV set attached to catheter (yes)	181	46.1	186	47.3	1.05 (0.80-1.39)	215	54.7	226	57.5	1.12 (0.85-1.49)	0.7577
IV set documentation (yes)	114	63.0	106	57.0	0.78 (0.51-1.18)	37	17.2	137	60.6	7.41 (4.75-11.54)§	<0.0001§
Days IV set remains in situ (<3 days)#	81	71.1	85	78.0	1.44 (0.79-2.65)	27	73.0	111	81.0	1.58 (0.68-3.67)	0.8627
Site dressing (transparent/tape)	370	94.1	375	95.4	1.30 (0.69-2.44)	270	68.7	371	94.4	7.68 (4.75-12.43)§	<0.0001§
Condition of dressing (good)	329	83.7	332	84.5	1.06 (0.72-1.55)	330	84.0	327	83.2	0.95 (0.65-1.38)	0.6809
Incidence of phlebitis (yes)	85	21.6	76	19.3	0.87 (0.61-1.23)	22	5.6	9	2.3	0.40 (0.16-0.91)§	0.0999‖
Incidence of extravasation (yes)	81	20.6	47	12.0	0.52 (0.35-0.77)§	10	2.5	0	0	0‡**	0.0290§‖

* P value for Breslow and Day test for homogeneity of the odds ratio
† Those with flushing catheter only
‡ Excluded 4 missing cases
§ Significant at the 5% level
‖ Zelen test for homogeneity of the odds ratio
¶ Those with PIVAD documentation only
# Those with IV set documentation only
** Fisher's exact test P<0.0018

informing them of the guidelines. As nurses did not have full control of the specific points outlined in the guidelines, it was difficult to ascertain whether full compliance with the guidelines could be achieved.

Secondly, the use of non-equivalent control group design may have contributed to the non-significant results because we did not have any control over changes in the demographic characteristics of our sample over time.

Thirdly, a pre-test for the nurses' knowledge in the control group was not done. We were, therefore, unable to see whether knowledge changed in the control group of nurses as education in this group may have taken place through a number of informal ways or through communication with other nurses from the experimental group. In not conducting the knowledge pre-test in the control group we were unable to establish a baseline against which to measure the change relative to the intervention.

Lastly, although the researchers allowed for a 3-month washout period by discontinuing any form of educational intervention and support for the clinical staff, the results may have been otherwise influenced. This was evident in the control hospital where a significant change in practice and patient outcome also occurred. This may be related to the Hawthorne effect and that the control hospital probably had their own education programme for their nurses during the study period.

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