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EFFECT OF PERIPHERAL INTRAVENOUS CATHETER CARE BUNDLE INSTRUCTIONS ON PHLEBITIS, INFILTRATION, AND CATHETER DWELL TIME AMONG PATIENTS UNDERGOING CHEMOTHERAPY

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Abstract

Background Peripheral intravenous catheters (PIVCs) are widely used in clinical settings but are often associated with complications such as phlebitis, infiltration, and infection. The implementation of a peripheral intravenous catheter care bundle has been shown to reduce these preventable complications. **Aim:** The study aimed to evaluate the effect of peripheral intravenous catheter care bundle instructions on phlebitis, infiltration, and catheter dwell time among patients undergoing chemotherapy. **Design:** A quasi-experimental research design (pre/post-test control group design) was used to achieve the aim of the study. **Research Hypotheses:H1:** Patients who receive the PIVC care bundle will have significantly lower phlebitis grades compared to those who receive routine care. **H2:** Patients who receive the PIVC care bundle will have significantly lower infiltration grades compared to those who receive routine care. **H3:** Patients who receive the PIVC care bundle will have significantly higher mean catheter dwell time compared to those who receive routine care. **Sample:** A convenient sample of 60 patients was recruited over a 6-month period. **Tools:** Four tools were used to collect data: (1) Personal and Medical Data Form, (2) Peripheral Intravenous Catheter Insertion Assessment Data, (3) Chemotherapy-Induced Phlebitis Severity Scale, and (4) Infusion Nurse Society Infiltration Scale. **Results:** Despite the occurrence of phlebitis in both study and control groups, there was a highly significant difference between the two groups. Furthermore, there was a statistically significant difference between the study and control groups in terms of infiltration grade, as well as catheter dwell time, with the study group (which received the PIVC care bundle instructions) showing better outcomes than the control group (which received routine care). **Conclusion:** Peripheral intravenous catheter care bundle instructions were effective in reducing phlebitis and infiltration grades, as well as improving catheter dwell time, in the study group compared with the control group. **Recommendations:** Replication of the study on a larger probability sample from different geographical areas in Egypt is recommended to enhance the generalizability of findings. Further research should also be conducted to implement innovative, up-to-date nursing measures aimed at preventing PIVC-related complications.

Keywords: Peripheral Intravenous Catheter, Phlebitis, Infiltration, Catheter Dwell Time and Peripheral Intravenous Catheter Care Bundle.

INTRODUCTION

Almost all patients undergoing chemotherapy require at least one peripheral vascular

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device for the delivery of chemotherapy, intravenous fluids, and medications during their hospital stay (Sharma et al., 2024). According to Santos-Costa et al. (2022), attaining venous access is often challenging, particularly in patients undergoing chemotherapy, due to repeated exposure to peripheral intravenous (IV) catheters, long cycles of antineoplastic treatment, and the high pH and osmolality of chemotherapy drugs. These factors irritate the endothelial layer, resulting in both local and systemic complications. Peripheral intravenous catheters may cause various local complications such as phlebitis, extravasation, infiltration, hematoma, occlusion, accidental dislodgement, and local infection (Behairy, Abdel Hakeim & Abd El-Naby, 2023). Marsh et al. (2020), in a systematic review and meta-analysis entitled “Peripheral intravenous catheter non-infectious complications in adults”, reported that the incidence of phlebitis was 19.3%, infiltration 13.7%, occlusion 8%, leakage 7.3%, pain 6.4%, and dislodgement 6%. Phlebitis refers to inflammation of the veins, manifested by pain, erythema, swelling, a palpable venous cord, and purulent discharge at the catheter site. It is classified into three types: mechanical, chemical, and infectious.

Mechanical phlebitis results from trauma to the vessel wall caused by a peripheral intravenous catheter (PIVC); chemical phlebitis occurs due to infusion of fluids or solutions with extreme pH or osmolarity that irritate vascular tissue; and infectious phlebitis may develop as a result of breaches in aseptic technique during catheter insertion or maintenance (veFlebit, 2023). Infiltration is defined as the inadvertent administration of a non-vesicant solution or medication into the surrounding tissues of an intravenous catheter. It typically presents as edema, pale skin, and pain at the insertion site. While minor injury may occur with small volumes of infiltrated fluid, large volumes can lead to severe complications such as compartment syndrome (Barton, 2024). Care bundles are structured approaches designed to improve patient care through a set of evidence-based practices that, when performed together, have been shown to improve outcomes and reduce risks associated with intravenous catheters. Peripheral intravenous catheter (PIVC) care bundles are relatively simple to implement and suitable for most healthcare settings. They typically consist of insertion and maintenance components, with the overarching goal of preventing PIVC-related complications and infections (Aung et al., 2025).

The American Centers for Disease Control (CDC), the Infection Control Nurses Association (ICNA), and other guidelines for preventing infections associated with peripheral intravascular catheters (Zingg et al., 2023) have developed evidence-based care bundles. These bundles include measures for both insertion and maintenance of PIVCs, aiming to improve patient outcomes.

This bundle approach was selected for the current study as it is comprehensive, evidence-based, and applicable to routine practice. Nurses play a critical role in vascular access care, which requires knowledge, skill, and clinical judgment. Their responsibilities extend from selecting the optimal device and insertion site, ensuring proper site preparation, and managing catheter use to timely removal of vascular access. Competent practice in these areas helps reduce vascular access complications.

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Furthermore, understanding associated risk factors, along with implementing prevention, detection, and recovery strategies supported by evidence-based guidelines, contributes to improving patient outcomes (Mohamed, Ahmed & Tawfik, 2020).

Significance of the Study

Peripheral intravenous catheter insertion is the most common invasive procedure performed in healthcare settings, with up to 70% of inpatients requiring a PIVC during hospitalization (Liu et al., 2022). Despite their importance, up to 69% of PIVCs are removed before therapy completion due to dislodgement, phlebitis, occlusion, infiltration, or infection. Globally, more than two billion PIVCs are used annually (Larsen et al., 2021). PIVC failure leads to negative patient outcomes such as increased pain, anxiety, delays in treatment, and repeated reinsertions, as well as increased workload for nurses and higher healthcare costs. Consequently, strategies to prevent these negative outcomes are essential.

The findings of this research are anticipated to contribute to the nursing body of knowledge, enhance nursing practice, and open avenues for further research. Implementation of PIVC care bundles may improve the quality of care, reduce hospital stay, and minimize complications among patients. Additionally, incorporating PIVC care bundle training into nursing curricula could better prepare student nurses for clinical practice. Finally, the results of this study are expected to provide evidence-based data that may motivate future research on innovative nursing interventions to reduce PIVC-related complications.

MATERIALS AND METHODS

Aim of the Study

The aim of the current study was to evaluate the effect of peripheral intravenous catheter care bundle instructions on phlebitis, infiltration, and catheter dwell time among patients undergoing chemotherapy.

Research Hypotheses

To achieve the aim of the study, the following research hypotheses were formulated:

H1: Patients who receive a PIVC care bundle will have a significantly lower phlebitis grade compared to those who receive routine care.

H2: Patients who receive a PIVC care bundle will have a significantly lower infiltration grade compared to those who receive routine care.

H3: Patients who receive a PIVC care bundle will have a significantly higher total mean catheter dwell time compared to those who receive routine care.

Research Design

A quasi-experimental design (pre/posttest control group) was used to achieve the aim of the current study.

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Setting

The study was conducted at a governmental hospital affiliated with Cairo University, Egypt.

Sample

A convenient sample of adult male and female patients was recruited. The sample size was calculated using G*Power for comparing two independent proportions with Fisher's exact test. A large effect size (0.7), significance level of 0.05, and power of 80% were assumed, with a 10% attrition rate. The final sample consisted of **60 participants**, with 30 assigned to each group.

Inclusion criteria:

1. Adults (≥18 years) undergoing chemotherapy for the first time.
2. Patients diagnosed with solid tumors (colon, pancreatic, rectal, or colorectal cancer).
3. Willingness and ability to provide informed consent.

Exclusion criteria:

1. Presence of any local signs of catheter complications.
2. Difficulty in catheter insertion due to obesity class II or III, or non-visible veins after tourniquet placement.
3. Presence of a porta-cath or subclavian line.

Data Collection Tools

Four tools were used for data collection. Both English and Arabic versions were validated for content by a panel of experts from the Medical-Surgical Nursing Department, Faculty of Nursing, Cairo University.

1. Personal and Medical Data Form (PMDF):

Developed by the researcher, consisting of two parts: Part I: Demographic data (e.g., age, gender). Part II: Medical data (e.g., comorbid diseases).

2. Peripheral Intravenous Catheter Insertion Assessment Data:

Adopted from Simin, Milutinović, Turkulov, and Brkić (2019). It includes items on catheter insertion characteristics such as catheter size, number of attempts, dwell time, and insertion site.

3. Chemotherapy-Induced Phlebitis Severity (CIPS) Scale:

A five-point scale designed to assess chemotherapy-induced phlebitis severity. The CIPS scale was designed with five levels of symptom grades to assess severity of phlebitis. The CIPS scale contains a comprehensive list of recognized symptoms to grade the severity of phlebitis and the effects on the patients' activities of daily living especially impairment of arm function or movement, in addition to pain Likert scale was used to

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determine the severity of the discomfort from 0–10 where score of 1–3 was described as mild pain, 4–7 as moderate and 8–10 as severe pain. Reliability was originally reported by Harris et al. (2020) with inter-rater reliability of 0.89. After Arabic translation, Cronbach's alpha was re-established at 0.93.

4. Infusion Nurse Society Infiltration Scale (INSIS):

Developed by the Infusion Nurses Society (2006), this scale consists of five grades: Grade 0 = no infiltration, Grade 1 = mild symptoms, Grade 2 = moderate symptoms, Grade 3 = marked symptoms, Grade 4 = severe symptoms.

Reliability was reported as Cronbach's alpha = 0.85 (Braga et al., 2018). After Arabic translation, the tool was re-tested, yielding Cronbach's alpha = 0.81.

Ethical Considerations

Approval to conduct the study was obtained from the Research Ethics Committee of the Faculty of Nursing, Cairo University (IRB no. 00006883). Official permission was also obtained from hospital administrators. Eligible participants were informed about the aim and nature of the study, and those willing to participate provided written informed consent. The researchers emphasized that participation in the study was voluntary, and anonymity and confidentiality were assured. Moreover, the researchers informed the participants that they have the right to withdraw from the study at any time after informing the researchers.

Procedure

Once official permission was granted from Research Ethics Committee at Faculty of Nursing Cairo University and an official permission was obtained from hospital administrators to proceed with the proposed study, then the researchers initiated the data collection that extended from January 2024 to August 2024. **Data was collected from the control group** all patients who met the inclusion criteria were interviewed individually to explain and clarify the nature and purpose of this study, as well as the ethical considerations mentioned previously were considered. Then, patients were asked to sign a consent form. Then, the researchers completed baseline data from the control group using Personal and Medical Data Form. Chemotherapy Induced Phlebitis Scale, Infusion Nurse Society Infiltration Scale, as well as the researchers observed all patients daily after PVC insertion to observe for occurrence of peripheral intravenous catheter complications until PVC removal or at least 3 days after PVC insertion for each patient (Guenezan et al.,2019). **Then** the researcher implemented the instructional sessions to staff nurses about peripheral intravenous catheter care bundle to refresh nurses' information and ensure consistency in practice through two teaching sessions, each session was between 20 to 30 minutes and included four to five nurses using illustrative booklet. The first session: involved information and demonstration regarding catheter insertion bundle as, aseptic technique, hand hygiene, personal protective equipment, skin preparation, dressing and documentation. While, the second session, covered information regarding catheter maintenance bundle contains; hand hygiene, continuing

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clinical indication, site inspection, dressing, administrative set replacement, cannula access, cannula replacement and documentation (Ray-Barruel et al.,2019& Hanna., 2020). Moreover, the researcher observes nurses during peripheral intravenous catheter insertion and maintenance.

This phase was pertinent to data collection from the study group. Each participant who met the inclusion criteria was interviewed individually to explain the nature and the purpose of the current study, and then all participants were asked to sign an informed written consent form, then data was collected from the study group participants to evaluate the effect of implementing care bundle after instructions. The researchers completed baseline data from the study group using Personal and Medical Data Form. Chemotherapy Induced Phlebitis Scale, Infusion Nurse Society Infiltration Scale, as well as the researchers observed all patients daily after PVC insertion to observe for occurrence of peripheral intravenous catheter complications until PVC removal or at least 3 days after PVC insertion for each patient (Guenezan et al.,2019).

Statistical Design

The collected data were scored, tabulated and analyzed by personal computer using statistical package for the social science (SPSS) program version 25. Descriptive as well as inferential statistics were utilized to analyze data pertinent the study. Descriptive statistics including frequency, distribution, means, and standard deviation were utilized. Inferential statistics as independent t- test was used to compare means between results of the study and control groups, as well as chi square test was used to compare qualitative variables between the study and control groups. Level of significance was adopted at p≤0.05.

RESULTS

Table 1: Frequency & percentage distribution of demographic data among the study participants in both groups (N=60).

variable	Study group n=30		Control group n= 30		Test	*P-value
	n	%	n	%		
Age 18<30 30<45 45<60 ≥60	 1 6 16 7	 3.33 20 53.3 23.3	 2 6 16 6	 6.7 20 53.3 20	t 0.474	0.637
Mean± SD	50.56 ± 9.94	49.13 ± 13.25				
Gender Male Female	 15 15	 50 50	 17 13	 56.7 43.3	X^2 0.268	0.605
Marital status Married Not married	 27 3	 90 10	 26 4	 86.6 13.3	X^2 0.352	0.839

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Level of education Can't read and write Primary education Secondary education Bachelor	 9 11 5 5	 30 36.6 16.7 16.7	 10 9 10 1	 33.3 30 33.3 3.4	X² 4.586	0.205
Employment status Employed Not employed Others	 4 24 2	 13.3 80 6.7	 7 22 1	 23.3 73.4 3.3	X² 1.586	0.811
Place of residence Urban Rural	 12 18	 40% 60%	 8 22	 26.7% 73.3%	X² 1.200	0.273

Table (1) illustrates the demographic characteristics of the study and control groups. More than half of the participants in both groups (53.3%) were aged 45–<60 years. In addition, 23.3% of the study group were aged ≥60 years, while 20% of the control group were aged 30–<45 years. The mean age of participants in the study and control groups was (50.56 ± 9.94) and (49.13 ± 13.25) years, respectively.

Regarding gender, 50% of the study group and 56.7% of the control group were male. With respect to marital status, the majority of participants were married (90% in the study group and 86.6% in the control group).

In terms of educational level, 30% of the study group and 33.3% of the control group were illiterate, whereas 36.6% of the study group and 30% of the control group had primary education.

Concerning employment status, most participants were unemployed (80% in the study group and 73.4% in the control group). Regarding place of residence, 60% of the study group and 73.3% of the control group were from rural areas. Overall, there were no statistically significant differences between the study and control groups in relation to the demographic variables mentioned.

Table 2: Frequency & percentage distribution of medical data among the study participants in both groups (N=60).

Variable	Study group n=30		Control group n= 30		Test	*P-value
	n	%	n	%		
Comorbid Diseases						
Hypertension (HTN)	4	13.3	5	16.7	X² 0.633	0.959
Diabetes mellitus (DM)	3	10.0	4	13.3		
No	23	76.7	21	70		
Smoking History					X² 0.000	1.000
Yes	2	6.7	2	6.7		
No	28	93.3	28	93.3		

Table 2 illustrates that (13.3%) of the study group and (16.7%) of the control group had hypertension. Regarding, smoking status (93.3%) of both study and control group were non-smoker. Finally, there was no statistically significance difference regarding medical data.

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Table 3: Frequency & percentage distribution of peripheral intravenous catheter characteristics among the study participants in both groups (n=60).

Variable	Study group n=30		Control group n= 30		Test	*P-value
	n	%	n	%		
Catheter size						
G 24	6	20	9	30		
G 22	24	80	8	26.7	X^2 9.99	0.01*
G20	0	0	13	43.3		
G18	0	0	0	0		
Number of attempts						
Once	23	76.7	7	23.3		
Twice	7	23.3	19	63.3		
Three	0	0	4	13.3	T 4.7721	0.000**
Four or more	0	0	0	0		
Mean ± SD	1.2414± 0.43549		1.9000± 0.60743			
Insertion site						
Antecubital	1	3.3	9	30		
Hand	11	36.7	10	33.3	X^2 8.134	0.01*
Forearm	18	60	11	36.7		

*Result is significant at P-value ≤ 0.05. * * P ≤ 0 .000

Table 3 reveals that regarding to cannula gauge, size 22 was used for (80%) of the study group while (43.3%) of the control group used cannula size 20 as well as there was statistically significant difference between the study and control groups regarding catheter size (X^2 9.99, p-value .01). As regard to number of cannula insertion attempts (76.7%) and (23.3%) of the study and control group were successfully with peripheral IV cannula at first attempt respectively. Additionally, there was highly statistically significant difference between the study and control groups (T 4.772, p-value 0.000). Furthermore, in relation to cannula insertion site (60%) of the study cannula was inserted in the forearm while (36.7%) of the control group cannula insertion site was in the forearm. finally, there was statistically significant difference in relation to insertion site between study and control group (X^2 8.134, p- value 0.013).

Table 4: Comparison between the study and control groups regarding peripheral intravenous catheter associated phlebitis along the study period (N= 60)

Phlebitis grade	Study group =30		Control group= 30		Chi square Test	p- value
	n	%	n	%		
Phlebitis day 1						
Grade 0	30	100	29	96.7	1.118	0.20
Grade1	0	0	1	3.3		
Phlebitis day2						
Grade 0	30	100	24	80	5.455	0. 020 *
Grade 1	0	0	6	20		
Phlebitis day3						
Grade 0	30	100	22	73.3	9.231	0 .002*
Grade 1	0	0	8	26.7		

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*Result is significant at P-value ≤ 0.05. * * P ≤ 0 .000

Table (4) reveals that, at the 1st day there was no statistically significant difference between study and control group regarding phlebitis grade as (x^2 = 1.118, p- value= 0.20) while the 2ndand 3rdday there was statistically significant difference between the study and control groups in relation to phlebitis grades as (X^2= 5.455, p-value= 0. 020) & (X^2= 9.231, p- value= 0 .002) respectively.

Table 5: Comparison between the study and control groups regarding infiltration grade along the study period (N= 60)

Infiltration grade	Study group=30		Control group= 30		Chi square test	p- value
	n	%	n	%		
infiltration day 1					3.268	0.071
Grade 0	28	93.3	23	76.7		
Grade1	2	6.7	7	23.3		
infiltration day2					5.455	0.020*
Grade 0	28	93.3	21	70		
Grade 1	2	6.7	9	30		
infiltration day3					4.286	0.038*
Grade 0	30	100	26	86.7		
Grade 1	0	0	4	13.3		

*Result is significant at P-value ≤ 0.05. * * P ≤ 0 .000

Table (5) indicates that there was no statistically significant difference between the study and control groups in relation to infiltration grade as (X^2= 3.268, p- value= 0.071) at the 1st day cannulation. Moreover, at 2nd and 3rd day, there was statistically significant difference between the study and control groups in relation to infiltration grade as (X^2= 5.455, p- value = 0.020) & (X^2= 4.286, p- value=0.038) respectively.

Table 6: comparison between the study and control groups regarding catheter dwell time along the study period (N=60).

Catheter dwell time	Study group= 30		Control group= 30		t	p
	n	%	n	%		
One day	3	10	22	73.3	6.743	0.000* *
Two days	18	60	8	26.7		
Three days	9	30	0	0		
Mean ± SD	2.2± 0.61026		1.2667±0.44978			

*Result is significant at P-value ≤ 0.05. * * P ≤ 0 .000

Table (6) indicates that (60%) of the study group had cannula for 2days while (73.3%) of the control group had cannula for one day with the mean of catheter dwell time of participants in the study and control group were (2.2± 0.61026) and (1.2667±0.44978) respectively. Moreover, there was highly statistically significant difference between the study and control groups in relation to catheter dwell time score as (t= 6.743, p-value 0.000**).

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DISCUSSION

Regarding the sample characteristics of the study participants, the findings showed no statistically significant differences between the study and control groups in terms of demographic variables; therefore, homogeneity was ensured between the groups. The current study revealed that more than half of the participants were aged between 45 and 60 years and were male. Most participants were married. Additionally, the findings indicated that more than two-thirds of the participants had either primary education or were illiterate. The majority were from rural areas and unemployed.

This finding was consistent with Lulie et al. (2021), who conducted a study entitled “Incidence of peripheral intravenous catheter phlebitis and its associated factors among patients admitted to University of Gondar Hospital, Northwest Ethiopia: a prospective, observational study”. They concluded that the majority of participants were aged between 40 and 60 years, predominantly male, married, from rural areas, and had low levels of education.

Regarding comorbid diseases, it was found that the majority of participants had no past medical history. This finding was consistent with Kaphan et al. (2024), who conducted a study entitled “The prevalence and associated factors of peripheral intravenous complications in a Thai hospital” and concluded that more than two-thirds of participants had no comorbid disease. On the other hand, this finding was not consistent with Marsh et al. (2021), who conducted a study entitled “Peripheral intravenous catheter failure: A secondary analysis of risks from 11,830 catheters” and found that more than half of participants had two or more comorbidities. Indeed, this reflects the fact that comorbidities such as diabetes mellitus and hypertension are known to increase the risk of peripheral intravenous catheter-related complications such as phlebitis and infiltration.

With regard to cannula gauge size, the researcher found that the majority of the study group used a 22-gauge cannula, while nearly half of the control group had a 20-gauge cannula. A statistically significant difference was observed between the groups. This finding was consistent with Simões, Vendramim, and Pedreira (2022), who conducted a study entitled “Risk factors for peripheral intravenous catheter-related phlebitis in adult patients” and concluded that the majority of the sample used a 22-gauge cannula. This may be due to nurses’ adherence to catheter care bundle instructions, which emphasize appropriate cannula selection based on patient condition and therapy needs. Furthermore, according to the CDC guidelines, the Oncology Nursing Society (ONS) and the European Oncology Nursing Society (EONS) recommend using the smallest gauge and shortest length catheter appropriate for the therapy to reduce PIVC-associated complications (Gorski et al., 2021; Pittiruti et al., 2023).

In relation to the number of attempts, the current study revealed that the majority of the study group had one trial, while more than two-thirds of the control group had two trials. A highly statistically significant difference was found between the groups. This finding was consistent with Bayeh, Birhie, and Alene (2023), who conducted a study entitled “Time to Develop Phlebitis and Its Predictors Among Patients with Peripheral Intravenous Cannula

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at Public Hospitals of Bahir Dar City, Amhara, Ethiopia, 2022: A Prospective Observational Study" on 462 participants and found that the majority had one cannula insertion trial. Moreover, this may reflect the positive impact of the catheter care bundle instructions, which emphasize proper vein assessment, site selection, and skillful cannulation techniques. Fewer insertion attempts are preferable, as multiple attempts are associated with increased risks of mechanical complications such as phlebitis, infiltration, hematoma formation, and patient discomfort.

Regarding the insertion site, it was found that two-thirds of cannulas were inserted in the forearm in the study group, while more than one-third of the control group had cannulas in the hand. A statistically significant difference was observed between the groups. This finding was consistent with Kashiura et al. (2022), who conducted a study on 1,357 patients entitled "Risk factors for peripheral venous catheter-related phlebitis stratified by body mass index in critically ill patients: A post-hoc analysis of the amor-venus study" and concluded that the majority of participants had cannulas inserted in the forearm. This may be attributed to the application of catheter care bundle instructions, which emphasize site selection. Inserting peripheral intravenous catheters into the forearm instead of the hand reduces the risk of complications such as phlebitis and infiltration.

In relation to the study findings on research hypotheses, the current study clarified that there was a statistically significant difference between the study and control groups regarding phlebitis grade on the 2nd and 3rd days.

This may be due to the effect of peripheral intravenous catheter care bundle instructions, which include appropriate vein selection, avoiding areas of flexion, observing the PIV site twice daily, choosing the most appropriate catheter size according to the ordered infusion or medication, following aseptic techniques (such as proper skin preparation, glove use, and hand hygiene during insertion and care), and using adhesive transparent dressings that aid in early detection of phlebitis. This finding was consistent with Gunasundram et al. (2021), who conducted a study entitled "Reducing the incidence of phlebitis in medical adult inpatients with peripheral venous catheter care bundle: a best practice implementation project" and concluded that the implementation of a standardized PVC care bundle can significantly enhance phlebitis assessment and identification, thereby reducing incidence.

In relation to infiltration grade, the researchers found a statistically significant difference between the study and control groups on the 2nd and 3rd days. This may be attributed to the implementation of PIVC care bundle instructions, which include appropriate catheter size selection, appropriate cannulation site, the use of secure dressings to minimize catheter movement, checking PIVC patency before intravenous administration, frequent assessment of the PIV site, and advising patients to report any swelling or tenderness. This reflects the positive effect of the peripheral intravenous care bundle on reducing infiltration incidence. This finding was supported by Cihan Erdogan and Baykara (2024), who clarified that infiltration incidence and grade decreased after implementing training sessions regarding PIVC. Similarly, Behairy and Abd El-Naby (2020), in their study entitled "Effect of Implementing Insertion and Maintenance Bundles on the Incidence of

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Short Peripheral Intravenous Catheter-related Local Complications", found a significantly greater reduction in infiltration incidence in the study group than in the control group after bundle implementation. Finally, Hanna (2020), in a study entitled "Peripheral intravenous catheter implementation", reported a significant decrease in infiltration incidence in the study group compared to the control group following implementation of the PIVC bundle.

Additionally, regarding catheter dwell time, the researchers found a highly statistically significant difference between the study and control groups. This reflects the positive effect of peripheral intravenous catheter care bundle instructions in promoting catheter longevity. Implementing the care bundle—which included proper vein assessment, appropriate catheter gauge and site selection, regular inspection, and timely documentation—allowed the study group to benefit from prolonged catheter function without increased complication risk. Consequently, the study group retained PIVCs for more than 72 hours without complications. According to the Australian Commission on Safety and Quality in Health Care, the Clinical Care Standard on the management of PIVCs suggests routine replacement at 72 hours or replacement when clinically indicated (Zingg et al., 2023).

Behairy and Abd El-Naby (2020) also found that all participants in the study group had peripheral IV cannulas in place for 72–96 hours, with a highly statistically significant difference between the study and control groups regarding dwell time after program implementation. On the other hand, Dramowski et al. (2024), in a study entitled "Impact of a care bundle on short peripheral catheter-associated complications in a resource-limited neonatal unit", reported no significant difference in catheter dwell time between study and control groups after bundle implementation.

CONCLUSION

This study concluded that implementation of the peripheral intravenous catheter care bundle significantly reduced the incidence and severity of phlebitis and infiltration while extending catheter dwell time. These findings highlight the effectiveness of care bundles in improving patient outcomes, enhancing catheter longevity, and reducing PIVC-related complications.

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