Catheter Dwell Time and Its Risk of Failure for Adult Patients with Peripheral Venous Catheters

Mona Abed El-Rahman M[1], Elsaida Gamal Aly B[2], Alaa Abdelhamied F[3]

Assist Prof. of Medical-Surgical Nursing Department-Faculty of Nursing- Port Said University[1], Lecturer of Medical-Surgical Nursing Department- Faculty of Nursing- Port Said University[2], Master's Degree of Medical-Surgical Nursing- Faculty of Nursing- Port Said University[3]

ABSTRACT

Background: Peripheral venous catheters, which are often used in adult patients, may have a critical threshold dwell length associated with a higher risk of catheter failure. **Aim**: This study aimed to assess catheter dwell time and its risk of failure for adult patients with Peripheral Venous Catheters. **Subjects and method**: **Design**: The study design was descriptive. **Setting**: The study was conducted at the Universal Health Insurance Hospitals (El Mabara, Al Salam, and Alhayat Port Fouad) in Port Said City. **Subjects**: convenient sample contained (110) adult patients with peripheral venous catheter. **Tool: Peripheral Venous Catheter Assessment Sheet for Adult Patient; Part 1:** patient's characteristics, **Part 2**: Assessment of Catheter Failure-related Factors: Presence of co- morbid diseases, skin assessment, peripheral venous catheter assessment, dwell time, monitoring risk factors (phlebitis, infiltration., occlusion, dislodgement, local infection, psychological factors, and quality of nursing management) .**The results**: The current findings showed that there is a statistically significant difference between dwell time with occlusion ($p \leq 0.048$), infiltration ($p \leq 0.024$), leakage ($p \leq 0.001$), and phlebitis ($p \leq 0.001$). There were not any statistically significant relationships between dwell time and displacement ($p \leq 0.229$). **Conclusion:** The current results showed positive correlation between dwell time and peripheral catheter phlebitis, occlusion, infiltration, leakage, infection, and displacement. Moreover, the studied patients' dwell time were 48-72 hrs. accounted for one-third of all analyzed patients' dwell times. **Recommendation:** Continuous education should be provided to nurses to teach them how to manage dwell time and prevent peripheral venous catheter PVC failure.

Keywords: Catheters Failure, Dwell Time, Peripheral Venous Catheters.

INTRODUCTION

Dwell time refers to the period of time that elapses between the insertion of a peripheral venous catheter (PVC) and its subsequent removal due to device failure, regular replacement, or the conclusion of intravenous treatment. For short-term infusion treatment, the peripheral venous catheter (PVC) is the most common vascular access method. Worldwide, it is predicted that 2 billion PVCs would be marketed in 2016 (Guenezan et al., 2021). In healthcare settings, short-term PVCs are among the most often used medical devices.

Most hospital patients need a PIVC for intravenous fluids, medications, or blood samples. The rate of device insertion and usage issues is unacceptable. Nearly half of adult and child first insertion attempts fail. Venous access failure due to complications (dislodgement, infiltration, occlusion, local inflammation). Studies have found that increased catheter dwell time may increase the risk of PVC failure in adult patients (Sato et al., 2017), but not phlebitis or catheter-related infections (Braga et al., 2018). Longer dwell time increases bacteria exposure (accessing the line); however, it is uncertain whether the daily risk of infection rises.

Infected individuals may be more likely to persist with a peripheral venous catheter for longer than is customary. Although the risk of infection is minimal, those who do get it are more likely to have complications during their hospital stay and potentially die (Guembe et al., 2017). Many clinical nurses (85%) report that infusion treatment makes up the most of their daily labor. Most patients undergoing short-term infusion treatment choose to utilize a peripheral venous catheter (PVC) (García-Expósito et al., 2021).

Peripheral catheters are chosen for short-term IV access, where direct access to the central circulation is undesirable, and when smaller gauge catheters are sufficient. Central access is riskier, harder to get, and more unpleasant than peripheral access. Peripheral access for anticoagulants provides direct compression of puncture sites and less hematoma problems than central venous catheters (Pezeshkmehr, 2022). One of the most frequent clinical procedures is PVC insertion, since most hospitalized patients have one. Hospitalized patients in the US get nearly 300 million of these devices from doctors, advanced practitioners, and nurses (Engstrom & Forsberg, 2019).

Peripheral venous catheter failure often requires replacement, which may be costly (Liu et al., 2022). Peripheral venous catheter-related catheter-associated bloodstream infections (CABSI) cost between US$35,000 and US$56,000 per patient. Patients who need a replacement device, especially those with limited vascular access, may need numerous insertions attempts to replace peripheral venous catheters. Hospital-acquired infection rates and death are roughly 20 times higher in underdeveloped countries, making peripheral venous catheter-related major adverse events even more worrying (Engstrom & Forsberg, 2019).

Several evidence-based interventions can reduce peripheral venous catheter failure rates. To prevent infection, peripheral venous catheters should be placed in a non-flexion area like the forearm to provide stability and reduce patient discomfort, secured to reduce catheter movement at the insertion site and within the blood vessel, and covered with occlusive dressings (Gorski et al., 2021).

Large-bore catheters (18G or above) had a greater risk of phlebitis, whereas smaller-bore catheters (22G or below in adults) had higher rates of dislodgment and occlusion/infiltration. The newest data recommends 20G catheters for adults in most therapeutic applications. Most healthcare institutions worldwide and best practice standards mandate medical record documenting of peripheral venous catheter insertion, maintenance, and removal (Blanco-Mavillard et al., 2022).

Significance of the study

Widely used in adult patients, peripheral venous catheters may have a critical threshold dwell time associated with an increased risk of catheter failure, with the risk increasing per hour **(Wei et al., 2019).** This may necessitate close and frequent monitoring of the insertion site for the initial 38 hours. In both Egyptian hospitals, peripheral venous infections are prevalent, and complications include phlebitis, local infection, systemic infection, infiltration, occlusion, extravasation, and inadvertent removal. Because they cause personal suffering, greater medical treatment and hospitalization, higher costs, and mortality, the researcher examined them **(Ismail, 2015).**

AIM OF THE STUDY

This study aimed to assess catheter dwell time and its risk of failure for adult patients with Peripheral Venous Catheters.

Research Objectives

1. Determine the dwelling time for adult patients who have peripheral venous catheters.
2. Assess dwelling time failure risk variables in adult peripheral venous catheter patients.
3. Evaluate the relation between catheter dwell time and risks of failure.

SUBJECT AND METHOD

A- Technical Design

The technical design is comprised of the design, setting, subjects, and the instruments used in data collecting.

Design of the study

For the purpose of this research, a descriptive design will be used.

Setting of the study

The main location of the study was the Universal Health Insurance Hospital (El Mabara, Al Salam, and Alhayat Port Fouad) at Port Said City.

Subjects

A convenience sample, composed of 110 patients with peripheral venous catheters will be included.

Inclusion criteria

All the patients who were scheduled to get infusion treatment at one of the three institutions (El Mabara, Al Salam, and Alhayat Port Fouad) had to be at least 18 years old and utilize peripheral venous access.

Exclusion criteria

Patients were not acceptable if they had any of the following conditions: (a) wounds or other skin injury in the forearm or dorsum of the hand; (b) a history of deep vein thrombosis, burns, or uncontrolled infection; (c) immune deficiencies; and (d) chemotherapy infusions scheduled.

Sample size

Equation: At 95% confidence, the statistical efficacy of the investigation. The researchers calculated the sample size using the following formula (Daniel, 1999).

$$\mathbf{n} = \frac{NZ^2P\,(1-p)}{d^2(N-1)+Z^2P\,(1-p)}$$

n= Sample size
N= Total society size= (200)
D= error percentage= (0.5)
P= percentage of availability of the character and objectivity= (0.1).
Z= the corresponding standard class of significance 95%= (1.96).

$$\mathbf{n} = \frac{190(1.96)^2 0.1\,(1-0.1)}{(0.05)^2(190-1)+(1.96)^2 0.1\,(1-0.1)}$$

$$\mathbf{n} = \frac{64.98}{0.81} = 110$$

10% drop out.

Tool of data collection: This study included the following tool

Peripheral venous catheter assessment sheet for adult patient. This tool was developed by the researcher after reviewing the recent literature review to collect necessary data related risk factors of peripheral venous catheter failure, it contained two parts**.**

Part (1) Patient's characteristics as age, gender, department, level of education, marital status and occupation, diagnosis.

Part (2) Assessment of Catheter Failure-related Factors

It was included questions about presence of comorbid disease, skin assessment, peripheral venous catheter assessment, peripheral venous catheter dwell time, monitoring

risk factors regarding peripheral venous catheter failure as (phlebitis, infiltration., occlusion, dislodgement, local infection, psychological factors, and quality of nursing management)

Phlebitis Scale

A standardized Likert scale, the Infusion Nurses Society Phlebitis Scale has been adopted from **Groll et al. (2010),** Davies, Donald, Nelson, and Virani. It aimed to assess the degree of peripheral intravenous phlebitis among patients with peripheral intravenous catheter and includes five grades.

Scoring system

There are five grades of the scale, as follow: Grade 0 denotes no symptoms, grade 1 when there is pain at the access site but no erythema, grade 2 when there is pain at the access site together with erythema and/or edema, and grade 3 when the access site is erythematous. Grade 3 if there is concomitant pain, edema, banding, and palpable venous trunk; Grade 4 if there is pain, erythema, and/or edema at the access site; palpable venous trunk >1 inch); and purulent discharge.

Infiltration Scale

It was adopted by Groll et al. (2010) and aimed to assess. The Infusion Nurses Society helped advance and post infiltration scales for use in acute care and network care settings. It includes five grades.

Scoring system

The scale ranges from 0 (no symptoms) to 4 (severe symptoms) (all signs and symptoms present). to investigate infiltration indicators, symptoms, and signs of infiltration. This scale includes 5 grades divided as follows; Grade 0 indicates that there are no symptoms, grade 1 indicates that the skin has blanched, edema is 1 inch (2. five cm) in any direction, cool to the touch without or with pain, grade 2 indicates that the edema is 1 to 6 inches (2. five to 15 cm) in any direction, cool to the touch without or with pain, and grade 3 indicates that there are no symptoms at all. grade 3 While skin blanching, transparent, significant edema measuring 6 inches (15 cm) in any direction, coolness to the touch, moderate to mild pain, and possible numbness are possible, Grade 4 is when the

skin may be blanched, translucent, tight, leaking, discolored, bruised, swollen, and grossly edematous, measuring 6 inches (15 cm) in any direction. It also includes circulatory impairment, mild to severe pain, and infiltration of any amount of blood product, irritant, or vesicant.

B- Operational Design

There are many components that make up the operational design: the pilot study, the area of operation, the validity, and the dependability.

Preparatory phase

Study involves looking at books, journals, the internet, periodicals, magazines, and EKB websites like PubMed, Cochrane Liberary, EBESCO, and so on to learn about the topic from multiple angles.

Validity

It is utilized to alter the instruments. It is evaluated by a Jury of (9) experts from academic medical surgical nursing, and modifications are made based on their opinions for clarification, relevance, comprehensiveness, readability, and applicability.

Reliability

Using Cronbach's alpha coefficients to evaluate the internal consistency of tool, the reliability test for tool revealed a value of 0.910.

Pilot study

After completing a pilot study on 10% of the sample (9 patients) to assess the usefulness and clarity of the tool, calculate an estimate of the time required for data collection, and verify the feasibility of conducting the research, appropriate adjustments were made. These patients were left out of the main research.

Field work

Before collecting data, the director of hospitals at the Universal Health Insurance Hospital in port- said. And unit managers (supervisor physician and head nurse) signed

agreements in the first week of July 2021. The director of hospital was informed about the purpose of the study and then gave written consent to conduct the study, the researcher used pre-constructed tool to collect data from the selecting setting, the study was conducted on 110 patients after oral consent was given, the researcher filled out Peripheral venous catheter assessment sheet for adult patients, and the data were collected and completed over six months. the researcher was individually observed using the previously mentioned study tool for 1 hour according to suitable time for the procedure, the researcher observed presence of risk factors of peripheral venous catheter failure, monitored peripheral vascular catheter dwell time for patients.

Ethical consideration

All ethical issues were addressed during the study process. The inquiry was authorized by the local ethics committee on 9/5/2021, with permission number NUR (9/5/2021) (2). For research participation, informed permission was acquired. Moreover, each patient was informed about the study's goal and methods prior to data collection. At any point, patients might accept, refuse, or withdraw from the research. On the other hand, the confidentiality and anonymity of the participants were preserved by the researcher.

Administrative Design

Before proceeding with the study, the Dean of the Faculty of Nursing at the Universal Health Insurance Hospital in Port-Said issued an official letter. This letter outlines the purpose of the study and requests permission to conduct the research.

The purpose of the present study was conveyed to the patients who participated, and their consent was also obtained.

C- Statistical Design

The collected data were recorded, tabulated, and analyzed on a personal computer using version 20.0 of the Statistical Package for the Social Sciences (SPSS) program at a significance level of P 0.05. The study utilized both descriptive and inferential statistics to analyze the pertinent data.

RESULTS

Table (1): Distribution of studied patients regarding patient's characteristics. The table shows that 46.4% of the studied patients were administered via peripheral venous catheter at emergency department. Regarding age, 39.1% of studied patients were more than 60 years old, with mean value 50.78±17.46, also 60.9% of studied patients were male.

Table (2): Distribution of studied patient's regarding presences of comorbid diseases**.** The table reveals that approximately two thirds of studied patients, 46.4%, 41.8% of studied sample suffered from diabetes mellitus, hypertension respectively. Whatever 9.1% of studied patients experienced hemophilia

Table (3): Distribution of studied patient's regarding Peripheral venous catheter assessment**.** The table shows that peripheral venous catheter medium size was inserted to 55, 4% of studied patients. While cephalic vein was the main insertion site for 30.9% of studied patients. On the other hand, only 48.2% of studied patients were experiences one attempt as number of insertions. Peripheral venous catheter dwell time between 48 and 72 hours was monitored in 29.1% of the studied patients.

Table (4): Distribution of the studied patient's regarding peripheral venous catheter risk factors. The table shows that 45.5% of studied patients suffered from phlebitis, according to presence of occlusion 45.5% of studied patients had occlusion. 46.4% of studied patients had infiltration, 31.4% of them grade 1, 35.5% of studied patients having displacement, 56.4% of them at insertion site, and 43.6% out insertion site. 44.5% of studied patients having peripheral venues catheter leakage. 53.1% of them at insertion site, 46.9% out insertion site. Also, 52.7% of studied patients had infection. Fear of pain was the most common cause for PVC failure 76.4% followed by needle phobia 62.7%.

Table (5): Nursing management regarding patients with peripheral venous catheter**.** The table shows that 75.5% of nurses apply hand washing, 80.9% follow aseptic technique, 86.4% of nurses check the insertion site every 1 hour for the first 6 hours, 77.3% of nurses avoid area of flexion and pain during infusion, 46.4% of nurses palpate peripheral venous site.

Table (6): Relation between peripheral venous catheter failure and dwell time. The table shows that there is positive correlation between risk factors of failure and various dwell times**.** The correlation is statistically significant $p \leq 0.05$ for all expect displacement.

Table (1): Distribution of studied patient's characteristics (n = 110).

		No.	**%**
Department	Emergency room	51	46.4
	Intensive care unit	59	53.6
Age	< 30	8	7.27
	30-45	40	36.36
	45-60	19	17.27
	≥60	43	39.10
	Min.–Max.	18.0 – 80.0	18.0 – 80.0
	Mean±SD.	50.78 ± 17.46	50.78 ± 17.46
	Median	49.0	49.0
Sex	Male	67	60.9
	Female	43	39.1
Level of education	Primary education	28	25.5
	Secondary education	33	30.0
	Postsecondary/higher education	49	44.5
Occupation	Work	54	49.1
	Not work	56	50.9
Marital status	Single	14	12.7
	Married	17	15.5
	Divorced	56	50.9
	Widowed	23	20.9

Table (2): Distribution of studied patient's regarding presences of comorbid disease.

Presence of chronic diseases? (one or more)	**No.**	**%**
Diabetes mellitus	51	46.4
Hypertension	46	41.8
Cardiovascular disorder	36	32.7
Hemophilia	10	9.1
None	9	8.2

Table (3): Distribution of studied patient's regarding Peripheral venous catheter assessment (n = 110).

		No.	**%**
The peripheral venous catheter size	Large (14G-16G)	25	22.7
	Medium (18G-20G)	61	55.4
	Small (22G-24G)	24	21.9
The Peripheral venous catheter Site	Cephalic vein	23	30.9
	Forearm	34	20.9
	Hand	31	28.2
	Wrist	22	20.0
The number of insertion attempts	One	53	48.2
	Two	35	31.8
	Three	15	13.6
	More than three	7	6.4
The Peripheral venous catheter dwell time	0-24 hrs.	29	26.4
	24- 48 hrs.	30	27.3
	48-72 hrs.	32	29.1
	More than 72 hrs.	19	17.3

Table (4): Distribution of the studied patient's regarding peripheral venous catheter risk factors (n = 110).

		No.	%
Peripheral venues catheter Phlebitis	Yes	50	45.5
	No	60	54.5
	If yes (n=50)		
	Grade 0	5	10.0
	Grade I	19	38.0
	Grade II	16	32.0
	Grade III	10	20.0
Peripheral venues catheter occlusion	Yes	50	45.5
	No	60	54.5
	If yes (n=50)		
	Mechanical	11	22.0
	Thrombotic	31	62.0
	Medication	6	12.0
	Thrombotic & Medication	2	4.0
Peripheral venues catheter Infiltration	Yes	51	46.4
	No	59	53.6
	If yes (n=51)		
	Grade 0	10	19.6
	Grade I	16	31.4
	Grade II	14	27.5
	Grade III	10	19.6
	Grade IV	1	2.0
Peripheral venues catheter displacement	Yes	39	35.5
	No	71	64.5
	If Yes (n=39)		
	At insertion site	22	56.4
	Out insertion site	17	43.6
Peripheral venues catheter Leakage	Yes	49	44.5
	No	61	55.5
	If Yes (Q1) (n=49)		
	At insertion site	26	53.1
	Out insertion site	23	46.9
Peripheral venues catheter infection	Yes	58	52.7
	No	52	47.3
	If Yes (infection sign) (n=58)		
	Redness	58	100.0
	Pain	55	94.8
	Fever	24	41.4
	Pus	13	22.4
	Erythema	34	58.6
Second daily check	Yes	75	68.2
	No	35	31.8
Psychological factors (one or more)	Needle phobia	69	62.7
	Anxiety	33	30.0
	Discomfort	37	33.6
	Pain	84	76.4
	Hyperactivity	40	36.4

Table (5): Nursing management regarding patients with peripheral venous catheter (n = 110).

		No.	%
Apply hand washing	Yes	83	75.5
	No	27	24.5
Adhere aseptic technique during PVC care	Yes	89	80.9
	No	21	19.1
Checks the insertion site every 1 hour for the first 6 hours.	Yes	95	86.4
	No	15	13.6
Avoids areas of flexion and pain during infusion.	Yes	85	77.3
	No	25	22.7
Palpate peripheral venous site.	Yes	51	46.4
	No	59	53.6

Table (6): Relation between peripheral venous catheter failure and dwell time.

Failure	**The Peripheral venous catheter dwell time**								χ^2	**P**
	0-24 hrs. (n=29)		24-48 hrs. (n=30)		48-72 hrs. (n =32)		More than 72 (n=19)			
	No.	%	No.	%	No.	%	No.	%		
Peripheral catheter Phlebitis										
Yes	8	27.6	14	46.7	24	75.0	4	21.1	19.582*	<0.001*
No	21	72.4	16	53.3	8	25.0	15	78.9		
Peripheral catheter occlusion										
Yes	15	51.7	18	60.0	13	40.6	4	21.1	7.884*	0.048*
No	14	48.3	12	40.0	19	59.4	15	78.9		
Peripheral catheter Infiltration										
Yes	12	41.4	10	33.3	22	68.8	7	36.8	9.480*	0.024*
No	17	58.6	20	66.7	10	31.3	12	63.2		
Peripheral catheter displacement										
Yes	12	41.4	6	20.0	13	40.6	8	42.1	4.317	0.229
No	17	58.6	24	80.0	19	59.4	11	57.9		
Peripheral catheter Leakage										
Yes	12	41.4	16	53.3	21	65.6	0	0.0	22.074*	<0.001*
No	17	58.6	14	46.7	11	34.4	19	100		
Peripheral catheter infection										
Yes	19	65.5	19	63.3	19	59.4	1	5.3	20.997*	<0.001*
No	10	34.5	11	36.7	13	40.6	18	94.7		

χ^2: **Chi square test**

*: Statistically significant at $p \leq 0.05$

DISCUSSION

Peripheral venous catheter (PVC) is the most frequently used to administer intravenous therapy but can be complicated by soft tissue or bloodstream infection. Monitoring PVC safety and quality through clinical auditing supports quality infection prevention, however, is labor intensive (Marsh et al., 2021). But peripheral venous catheter failure is a communal problem occurred among adult patients, making it the main reason for PVC removal (Miliani et al. 2017). Determining a critical dwell time in adults at which the risk of PVC failure becomes considerably higher would be beneficial for clinical staff, as PVCs could be routinely replaced before this critical time point was reached (Stefanos et al., 2023). So that the present study aimed to assess catheter dwell time and its risk of failure in adult patients with peripheral venous catheters.

As regards patient's characteristics of patients with PVC complications, the present study showed that nearly two fifth of the studied patients age were more than 60 years old. This finding may be due to impaired inflammatory response or structural changes in the vein wall associated with ageing. Literature supported this finding, the study conducted by Wei et al. (2019) who observed that the PVC failure increased with increasing the patient's age especially patient more than 60 years. Also (Anand et al., 2020) reported that the chance of having phlebitis was also found to be more in the age group of 60-70 years.

Concerning the presence of co morbid diseases, the present study revealed that about half of studied patients are diabetic. According to the researcher opinion result may be due to the endothelial damage induced by diabetes that predispose patient to phlebitis. These findings are in line with Witting et al. (2017) who reported that there was statistical significance for diabetes as an independent risk factor. Also consist of with Salma et al. (2019) who found that in hypertensive, diabetic and dyslipidemia group phlebitis rate is significantly higher than normotensive, non-diabetic and patients with normal lipid profile. Additionally, Joaquin-Apaza et al. (2021) reported that patients with hypertension and metabolic diseases present high incidence of phlebitis.

Regarding peripheral venous catheter assessment, the present study indicated that more than a half of studied patients had peripheral venous catheter size medium (18G-20G), from the researcher view of point the medium PVC size increased the risk of PVC

failure compared with small PVC because smaller caliber catheters leave more buffer room around them, allowing for less mechanical, chemical trauma and irritation to the interior walls of the veins.

The current results supported by Wei et al. (2019) who found that medium PVC increased the risk of PVC failure compared with small PVC. Also, Chen et al. (2021) who emphasize that infiltration and all-cause failure were also significantly associated with catheter sizes 22 G and 24 G compared to 14 G and 18 G catheters. And Lv, and Zhang (2020) who noticed that cannula gauge may also affect phlebitis rate. While Liu et al. (2020) observed that the 26G PVCs were less likely to fail from phlebitis and occlusion than 22G PVCs.

The current results in agreement with Salgueiro-Oliveira et al. (2019) who verified that the selection of the caliber and the anatomic site used to insert the PVC in some situations were not those recommended by the guidelines, since the nurses usually selected the largest PVC caliber and inserted in the lower limb. While guidelines recommend the use of the smaller PVC caliber to prevent phlebitis as it enables blood flow in adjacent tissues and reduces contact between the catheter and the internal layer of the vein, thereby reducing the risk of vascular trauma. On the other hand, Gorski et al. (2021) concluded that infiltration is significantly associated with the insertion site in the wrist/hand or antecubital fossa, and with smaller gauge. While, the current results disagreed with Simin et al. (2019); Lulie et al. (2021) who reported that the forearm and the back of the hand are the most commonly used indwelling sites.

Regarding dwell time, the present study showed that the highest percent was nearly one third of studied patients dwell time were (48-72 hrs.). Sato et al. (2017) have reported that increased dwell time increase the risk of PVC failure in adult patients. Also, Wei et al. (2019) reported that in the first 38 hrs., dwell time increased the risk of PVC failure, but at >38 hrs., dwell time did not contribute to increased PVC failures. While Braga et al. (2018) also indicated that there was no association between catheter dwell time and PVC failure.

The present study indicated that more than two fifths of studied patients have phlebitis. and more than one third of them suffered from the first grad phlebitis. This may be due to early recognition of adverse signs or symptoms and immediate treatment,

which prevented phlebitis. This rate is much lower than the result from the studies conducted by Liu et al., (2022); Kassahun et al (2022) who revealed that one-third of the first peripheral intravenous cannula had catheter failure outcomes either in the form of phlebitis or infiltration. Also indicated that most of studied sample had suffered from infiltration (93.7%) were grade 1.

The current findings indicated that less than a half of studied patients had infiltration, this was higher than other study with rates of 23% and 31.5% (Danski et al., 2015; Saini et al., 2017) and higher than the study conducted by Kassahun et al (2022) who revealed that 17.8% and 6% of the first peripheral intravenous cannula had catheter failure outcomes either in the form of phlebitis, infiltration.

Regarding presence of peripheral venous catheter displacement, the present study illustrated that more than one third of studied patients were had peripheral venous catheter displacement, more than a half of them at insertion site. This association has been reported in the study by Marsh et al. (2021) who observed that 50% decrease in the risk of catheter displacement associated with vascular access team-inserted catheters.

Regarding presence of peripheral venous catheter leakage, the present study indicated that more than two fifth of studied patients have peripheral venues catheter leakage, and more than a half of them insertion site. Present results agreed with the results of Miliani et al. (2017) who reported that there were risk factors of PVC that were related to failure in device handling reflecting breaches in the upkeep quality. The release of thromboplastic substances and platelets promotes blood clotting and may cause the constriction and occlusion of the catheterized vein.

Regarding presence of peripheral venous catheter infection, the present study revealed that more than a half of studied patients were suffering from local infection. In the researcher point of view, this result may be due to poor nursing care with dressing of the PVC device or the length of its dwelling time. This result supported by the study conducted by Rickard et al. (2023) who reported that 35.7% of patients were had local infection and considered as significant risk factors for PVC failure. Whereas, Sato et al. (2017) reported that the results might be explained in part by the failure to carefully examine the insertion site; thorough examination is imperative to prevent hematogenous complications.

Regarding psychological factors, the present study revealed that more than three quarters of studied patients were afraid of pain, followed by more than two thirds of them had needle phobia. compared with the study by Gold et al. (2021) who found that pain, anxiety were the most common causes for PVC failure. While the present result in agreement with (Jenkins, 2014) who found that the needle phobia is a more extreme psychiatric disorder than generalized fear. Needle phobia often involves visual avoidance of the phobic stimulus and may lead to an initial rise in blood pressure followed by a sudden drop, thus leading to fainting. Also, McLenon and Rogers (2019) described that the incidence of needle fear varies between 20-50% in adolescents, 20-30% in young adults, and below 5% in older adults.

Regarding nursing management for patients with peripheral venous catheter, the present study showed that, more than three quarter of nurses were applying hand washing, followed aseptic technique, Palpated the insertion site every hour for the first 6 hours after insertion, and avoid area of flexion, area of pain during infusion , while more than a half of nurses were palpate IV site. These findings concur with study conducted by Capdevila et al. (2016) who reported that following disinfection, the insertion site shouldn't be handled, the catheter must be handled from its proximal end when inserted, the nurse inserting the PVC must previously perform hand hygiene with water and soap and/or wash hands with alcohol solution, single-use clean gloves must be used, and an enhanced asepsis is not required if the endogenous segment of the PVC is not manipulated.

Concerning the relation between failure and dwell time, the current results cleared that, there is a statistically significant positive correlation between increasing dwell times with peripheral catheter phlebitis, occlusion, infiltration, leakage, and infection. While there was no significant correlation between dwell time and peripheral catheter displacement, these results in line with the results of Wei et al. (2019) who emphasized that the incidence rate of catheter failure significantly increased by 1.1%/h in the first 38 hr. after catheter insertion. From 39–149 hr., the incidence rate significantly decreased, and at >149 hr., there was no significant change in the incidence rate. And asserted that the relationship between dwell time and PVC failure might be improved by controlling for risk factors. Also, the present results agreed with the results of (Mermel, 2017; Sato et al., 2017) who reported that increased dwell time may increase the risk of PVC failure in adult patients.

While the current findings disagreed with Braga et al. (2018); Guembe et al. (2017) who indicated there was no association between catheter dwell time and phlebitis and catheter-related infections. Whereas, Miliani et al. (2017) reported that there was a negative correlation was established between the dwell time of catheter and the risk of PVC related complications.

CONCLUSION

Concerning the relation between failure and dwell time, the current results cleared that, there is a statistically significant ($p \leq 0.05$) correlation between various dwell times with peripheral catheter phlebitis, occlusion, infiltration, leakage, and infection. While there was no significant correlation between dwell time and peripheral catheter displacement. Regarding dwell time, the present study showed that the highest percent was nearly one third of studied patients dwell time were (48-72 hrs.). There were not any statistically significant relationships between peripheral catheter displacements. Significant issues with peripheral venous catheter treatment for risk failure such as flushing technique, dressing and securement, catheter characteristics such as size and site. The significant risk variables (occlusion, infiltration, leakage, displacement, infection, and phlebitis) were identified in this study.

RECOMMENDATIONS

For clinical practice, this study can provide clinical nurses with more knowledge on the association between dwell time and catheter failure. Clinical nurses can also give appropriate interventions within 24 hr. to reduce catheter failure. Finally, establishing a reporting system for patients is encouraged to help nurses identify adverse events in time.

Further Research

Replication of the current study on a large sample from different geographic areas to achieve a more generalized result.

References

Anand, L., Lyngdoh, V., Chishi, L., Chyne, I. D., Gandhimathi, M., & Borgohain, U. (2020). Risk factors of phlebitis in adult patients of tertiary teaching hospital of North-Eastern India. *IOSR Journal of Nursing and Health Science*, *9*(2), 27-39.

Blanco-Mavillard, I., Castro-Sánchez, E., Parra-García, G., Rodríguez-Calero, M.Á., Bennasar-Veny, M., Fernández-Fernández, I., Lorente-Neches, H. and de Pedro-Gómez, J., (2022). What fuels suboptimal care of peripheral intravenous catheter-related infections in hospitals? A qualitative study of decision-making among Spanish nurses. Antimicrobial Resistance & Infection Control, 11(1), 1-9.

Braga, L. M., Parreira, P. M., Oliveira, A. D. S. S., Mónico, L. D. S. M., Arreguy-Sena, C., & Henriques, M. A. (2018). Phlebitis and infiltration: vascular trauma associated with the peripheral venous catheter. *Revista Latino-Americana de Enfermagem*, *26*: e3002

Capdevila, J.A., Guembe, M., Barberán, J., de Alarcon, A., Bouza, E., Fariñas, M.C., Gálvez, J., Goenaga, M.A., Gutiérrez, F., Kestler, M. & Llinares, P. (2016). 2016 Expert consensus document on prevention, diagnosis and treatment of short-term peripheral venous catheter-related infections in adults. *Cirugía Cardiovascular*, *23*(4), 192-198.

Chen, S., O'Malley, M., & Chopra, V. (2021). How common are indwelling devices in hospitalized adults? A contemporary point prevalence study in a tertiary care hospital. *American Journal of Infection Control*, *49*(2), 194-197.

Daniel, E. (1999). Provision of electronic banking in the UK and the Republic of Ireland. *International Journal of bank marketing*, *17*(2), 72-83.

Danski, M. T. R., Oliveira, G. L. R. D., Johann, D. A., Pedrolo, E., & Vayego, S. A. (2015). Incidence of local complications in peripheral venous catheters and associated risk factors. *Acta Paulista de Enfermagem*, *28*, 517-523.

Engström, Å., & Forsberg, A. (2019). Peripheral intravenous catheter difficulty–A clinical survey of registered nurse and critical care nurse performance. *Journal of Clinical Nursing*, *28*(3-4), 686-694.

García-Expósito, J., Reguant, M., Canet-Vélez, O., Mata, F. R., Botigué, T., & Roca, J. (2021). Evidence of learning on the insertion and care of peripheral venous catheters in nursing students: A mixed study. Nurse Education Today, 107, 105157.

Gold, J. I., SooHoo, M., Laikin, A. M., Lane, A. S., & Klein, M. J. (2021). Effect of an immersive virtual reality intervention on pain and anxiety associated with peripheral intravenous catheter placement in the pediatric setting: a randomized clinical trial. *JAMA network open*, *4*(8), e2122569-e2122569.

Gorski, L. A., Hadaway, L., Hagle, M. E., Broadhurst, D., Clare, S., Kleidon, T., Meyer, B.M., Nickel, B., Rowley, S., Sharpe, E. & Alexander, M. (2021). Infusion therapy standards of practice. *Journal of infusion nursing*, *44*(1S), S1-S224.

Groll, D., Davies, B., Mac Donald, J., Nelson, S., & Virani, T. (2010). Evaluation of the psychometric properties of phlebitis and infiltration scales for the assessment of complications of peripheral vascular access devices. Journal of Infusion Nursing, 33(6), 385-390.

Guembe, M., Pérez-Granda, M.J., Capdevila, J.A., Barberán, J., Pinilla, B., Martín-Rabadán, P., Bouza, E., Millán, J., de Oteyza, C.P., Muiño, A. & Villalba, M.

(2017). Nationwide study on peripheral-venous-catheter-associated-bloodstream infections in internal medicine departments. *Journal of Hospital Infection*, *97*(3), 260-266.

Guenezan, J., Marjanovic, N., Drugeon, B., Neill, R.O., Liuu, E., Roblot, F., Palazzo, P., Bironneau, V., Prevost, F., Paul, J. & Pichon, M. (2021). Chlorhexidine plus alcohol versus povidone iodine plus alcohol, combined or not with innovative devices, for prevention of short-term peripheral venous catheter infection and failure (CLEAN 3 study): an investigator-initiated, open-label, single centre, randomised-controlled, two-by-two factorial trial. *The Lancet Infectious Diseases*, 21(7), 1038-1048.

Ismail, M. (2015). Study of different neonatal vascular accesses in neonatal intensive care units in different universities hospitals in Egypt. *AL-Azhar Assiut Medical Journal*, *13*(2), 224-231.

Jenkins, K. (2014). II. Needle phobia: a psychological perspective. *British journal of anaesthesia*, *113*(1), 4-6.

Joaquin-Apaza, A., Vásquez, M. C., & Díaz, S. P. O. (2021). Intrinsic and extrinsic factors associated with phlebitis in hospitalized patients: Systematic Review [Factores intrínsecos y extrínsecos asociados a flebitis en pacientes hospitalizados: Revisión Sistemática]. *Journal of Global Health and Medicine*, *5*(2), 26-30.

Kassahun, C. W., Abate, A. T., Tezera, Z. B., Beshah, D. T., Agegnehu, C. D., Getnet, M. A., Abate, H.K., Yazew, B.G. & Alemu, M. T. (2022). Incidence and Associated Factors of Failed First Peripheral Intravenous Catheters among Adult

Patients at Medical Surgical Wards in Public Referral Hospitals of West Amhara, Ethiopia, 2021. *Nursing Research and Practice, 2022. Article ID 8261225*.

Keogh, S., Flynn, J., Marsh, N., Mihala, G., Davies, K., & Rickard, C. (2016). Varied flushing frequency and volume to prevent peripheral intravenous catheter failure: a pilot, factorial randomised controlled trial in adult medical-surgical hospital patients. *Trials*, *17*(1), 1-10.

Liu, C., Chen, L., Kong, D., Lyu, F., Luan, L., & Yang, L. (2022). Incidence, risk factors and medical cost of peripheral intravenous catheter-related complications in hospitalised adult patients. *The Journal of Vascular Access*, *23*(1), 57-66.

Lulie, M., Tadesse, A., Tsegaye, T., Yesuf, T., & Silamsaw, M. (2021). Incidence of peripheral intravenous catheter phlebitis and its associated factors among patients admitted to University of Gondar hospital, Northwest Ethiopia: a prospective, observational study. *Thromb Journal*, *19*(1), 48.

Lv, L., & Zhang, J. (2020). The incidence and risk of infusion phlebitis with peripheral intravenous catheters: A meta-analysis. *The journal of vascular access*, *21*(3), 342-349.

Marsh, N., Larsen, E. N., Takashima, M., Kleidon, T., Keogh, S., Ullman, A. J. & Rickard, C. M. (2021). Peripheral intravenous catheter failure: A secondary analysis of risks from 11,830 catheters. *International Journal of Nursing Studies*, *124*, 104095.

Marsh, N., Larsen, E. N., Takashima, M., Kleidon, T., Keogh, S., Ullman, A. J., Mihala, G., Chopra, V. & Rickard, C. M. (2021). Peripheral intravenous catheter failure: a

secondary analysis of risks from 11,830 catheters. *International Journal of Nursing Studies*, *124*, 104095.

McLenon, J., & Rogers, M. A. (2019). The fear of needles: A systematic review and meta-analysis. *Journal of advanced nursing*, *75*(1), 30-42.

Mermel, L. A. (2017). Short-term peripheral venous catheter–related bloodstream infections: a systematic review. *Clinical Infectious Diseases*, *65*(10), 1757-1762.

Miliani, K., Taravella, R., Thillard, D., Chauvin, V., Martin, E., Edouard, S., Astagneau, P. & CATHEVAL Study Group. (2017). Peripheral venous catheter-related adverse events: evaluation from a multicentre epidemiological study in France (the CATHEVAL Project). *PloS one*, *12*(1), e0168637.

Pezeshkmehr, A. (2022). Principles of vascular access and complications. Vascular Complications of Surgery and Intervention: A Practical Guide, 127-148.

Rickard, C. M., Larsen, E., Walker, R. M., Mihala, G., Byrnes, J., Saiyed, M., Cooke, M., Finucane, J., Carr, P.J. & Marsh, N. (2023). Integrated versus nonintegrated peripheral intravenous catheter in hospitalized adults (OPTIMUM): A randomized controlled trial. *Journal of Hospital Medicine*, *18*(1), 21-32.

Saini R, Agnihotri M, Gupta A, Walia I. (2011). Epidemiology of infiltration and phlebitis. NMRJ. [Internet]. 2011 Jan [cited May 10, 2017]; 7(1):22-33.

Salgueiro-Oliveira, A. D. S., Basto, M. L., Braga, L. M., Arreguy-Sena, C., Melo, M. N., & Parreira, P. M. D. S. D. (2019). Nursing practices in peripheral venous catheter: phlebitis and patient safety. *Texto & Contexto-Enfermagem*, *28*. e20180109.

Salma U., Sarker M., Zafrin N., Ahmed K. (2019). Frequency of Peripheral Intravenous Catheter Related Phlebitis and Related Risk Factors: A Prospective Study. *Journal of Medicine, 20*(1), 29-33.

Sato, A., Nakamura, I., Fujita, H., Tsukimori, A., Kobayashi, T., Fukushima, S., Fujii, T. & Matsumoto, T. (2017). Peripheral venous catheter-related bloodstream infection is associated with severe complications and potential death: a retrospective observational study. *BMC Infectious Diseases, 17(1), 1-6.*

Simin, D., Milutinović, D., Turkulov, V., & Brkić, S. (2019). Incidence, severity and risk factors of peripheral intravenous cannula-induced complications: An observational prospective study. *Journal of Clinical Nursing*, *28*(9-10), 1585–1599.

Stefanos, S. S., Kiser, T. H., MacLaren, R., Mueller, S. W., & Reynolds, P. M. (2023). Management of noncytotoxic extravasation injuries: A focused update on medications, treatment strategies, and peripheral administration of vasopressors and hypertonic saline. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy, 43*(4), 321-337.

Wei, T., Li, X. Y., Yue, Z. P., Chen, Y. Y., Wang, Y. R., Yuan, Z., Lin, Q., Tan, Y., Peng, S.Y. & Li, X. F. (2019). Catheter dwell time and risk of catheter failure in adult patients with peripheral venous catheters. *Journal of Clinical Nursing*, *28*(23-24), 4488-4495.

Witting, M. D., Moayedi, S., Brown, L. A., & Ismail, A. (2017). Predictors and delays associated with the need for advanced techniques for intravenous access. *The Journal of Emergency Medicine, 53*(2), 172-177.

وقت إدخال القسطرة ومخاطر فشلها للمرضي البالغين ذوي القسطرة الوريدية الطرفية

أ.م.د/ منى عبد الرحمن[١]، د/ السيدة جمال على بغدادي[٢]، آلاء عبد الحميد فهمي[٣]

[١]أستاذ مساعد التمريض الباطني والجراحي كلية التمريض جامعة بورسعيد، [٢]مدرس التمريض الباطني والجراحي كليه التمريض جامعه بورسعيد، [٣] ماجستير التمريض الباطني والجراحي كلية التمريض جامعة بورسعيد

الخـــلاصـــــة

مقدمة: القسطرة الوريدية الطرفية، المستخدمة على نطاق واسع في المرضى البالغين، قد يكون لها بداية حرجة للسكن مرتبطة بزيادة خطر فشل القسطرة. **الهدف**: هدفت هذه الدراسة إلى تقييم وقت بقاء القسطرة وخطر فشلها في المرضى البالغين الذين يعانون من القسطرة الوريدي الطرفية. **الموضوعات والطريقة**: **التصميم**: كان تصميم الدراسة وصفيًا. **المكان**: أجريت الدراسة في مستشفيات المبرة والسلام والحياة بورفؤاد بمدينة بورسعيد. **الأدوات**: الجزء ١: الخصائص الشخصية الجزء ٢: عوامل الخطر، والتاريخ الصحي للمريض، والحالة الحالية، ومقياس صغير، ومقياس كبير، وقت بقاء القسطرة الوريدية الطرفية، المكان، والعلاج بالتسريب، والالتهاب الوريدي، والانسداد، والتسلل، والخلع، والتسرب، والعدوى، والفحص اليومي الثاني والأدوية وعدد محاولات الإدخال وتغيير الضمادات. **النتائج:** أظهرت النتائج الحالية وجود فروق ذات دلالة إحصائية بين وقت الادخال والعدوى، والانسداد، والتسلل، والتسرب، والتهاب الوريد. لم تكن هناك أي علاقات ذات دلالة إحصائية بين وقت الادخال وخلع القسطرة. **الخلاصة:** عمر المريض ونوع الأمراض المزمنة، علاج القسطرة لفشل المخاطر مثل تقنية التنظيف، التضميد والتأمين، خصائص القسطرة مثل المقاس والمكان لذلك اوصت الدراسة علي: توفير التعليم المستمر للممرضات لتعليمهم كيفية إدارة وقت الاخل وفشل القسطرة الوريدية الطرفية.

الكلمات المرشدة: القسطرة الوريدية الطرفية ، فشل القسطرة الوريدية الطرفية، وقت ادخال القسطرة الوريدية الطرفية.