RESEARCH ARTICLE

PREVALENCE OF PHLEBITIS AMONG PATIENTS RECEIVING PERIPHERAL INTRAVENOUS THERAPY IN A TERTIARY CARE HOSPITAL IN INDIA

Dhatchayani M.[1], Sharon Jude[2], Alphonsa George[3], Hemakumari C.[4], Sunita Mitchel Domingo[5], Rohini Sharma[6] and Rachana Das[7]

1. Nursing Supervisor, Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.
2. Registered Nurse- Pain management, Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.
3. Nurse Educator, Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.
4. Infection Control Nurse, Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.
5. GM Nursing (Former), Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.
6. Vice Principal, Apollo School of Nursing, Sarita Vihar, New Delhi.
7. Assistant Manager, Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.

……………………………………………………………………………………………………....

Manuscript Info

……………………..

Abstract

………………………………………………………………………

Background: Phlebitis is a common complication associated with the use of peripheral intravenous catheters. Main uses of a peripheral intravenous catheter are infusions, blood sampling, administration of parenteral medications and blood products. It is one of the commonly performed procedure in hospital. Almost all of hospital admissions lead to intravenous catheter placement.

Aim: To assess the prevalence of phlebitis among patients on peripheral intravenous catheter and identify predisposing factors of phlebitis in patients.

Methodology: 398adult patients in wards, with Peripheral intravenous catheter (PIVC) were included in the study during a period of 4 months. Catheter insertion site of these patients were observed for signs of phlebitis using Visual Infusion Phlebitis scale, until discharge or until the resite of next catheter. The data collection and analysis included patient demographic details and data related to catheter (including number of attempts during insertion, experience of staff performing the cannulation, reasons for removal etc.), as well as the data on the type of administered medications and intravenous therapy.

Results: A total of 398 patients were enrolled, among which 228 were males and 170 were females. A total of 192 patients (48.24%) showed one or other early signs of phlebitis. Among these 192 patients with early signs of phlebitis, 128 patients (66.67%) had score 1 in VIP scale while 64 patients (20.47%) had score 2 and 3.Phlebitis was found to be associated with mobility status of the patients (<0.001).

Conclusion: This study showed a high prevalence of phlebitis among inpatients in wards. However, most of these cases were mild Grade 1 phlebitis.Its crucial to train and upskill staffs on PIVC insertion and monitoring to ensure proper placement and assessment. Daily

Corresponding Author:- Dhatchayani M.
Address:- Nursing Supervisor, Department of Nursing, Apollo Hospitals Bannerghatta Road, Bengaluru, India.

assessment of insertion site and need for PIVC and patient awareness on PIVC maintenance is crucial in prevention of phlebitis.

………………………………………………………………………………………………......

Introduction:-

Venous access allows sampling of blood, as well as administration of fluids, medications, parenteral nutrition, chemotherapy, and blood products.[1] Venous access can be peripheral or central depending on the access site or blood vessel.Theyallow fluids, medications and other therapies such as blood products to be introduced directly into the cardiovascular system, bypassing other barriers to absorption and reaching most target organs quickly.[2]

Peripheral line placement, also referred to as peripheral intravenous (IV) cannulation, is the insertion of an indwelling single-lumen plastic conduit across the skin into a peripheral vein. Such devices may be referred to as peripheral IV (or venous) lines, cannulas, or peripheral intravenous catheters (PIVC) depending on the country.[2]

PIVC placement is the most common invasive procedure performed in the hospital setting worldwide. Significant complications related to the presence of a peripheral intravenous site include localized infection, bacteremia, phlebitis, and infiltration or extravasation.[3]It is also associated with certain rare complications such as deep vein thrombosis, air embolism, infection, and superior vena cava syndrome. [4]

Phlebitis is the inflammation of a vein.[5] It is manifested with pain, erythema, edema, hardening and/or a palpable thread.[6]

Phlebitis can occur in both the surface (superficial) or deep veins.
1. Superficial phlebitis affects veins on the skin surface. The condition is rarely serious and, with proper care, usually resolves rapidly. Sometimes people with superficial phlebitis also get deep vein thrombophlebitis, so a medical evaluation is necessary.
2. Deep vein thrombophlebitis affects the larger blood vessels, usually deep in the legs. Large blood clots can form, which may break off and travel to the lungs. This is a serious condition called pulmonary embolism.[7]

Numerous factors can influence the development of phlebitis, such as inadequate technique when inserting the catheter, the patient's clinical situation, the characteristics of the vein, drug incompatibility, tonus and pH of the medicine or solution, ineffective filtration, catheter diameter, size, length and material of manufacture; prolonged use.[6]

Phlebitis can be split into four types :
1. mechanical, when movement of the cannula inside the vein causes friction and inflammation, or when the cannula is too wide for the vein;
2. chemical phlebitis, caused by the drug or fluid infused through the catheter, where factors such as pH and osmolality can significantly impact the incidence of phlebitis;
3. bacterial, when bacteria penetrates the vein, starting as an inflammatory response to catheter insertion and subsequent colonization of the site by bacteria. Bacterial phlebitis can create serious complications due to the potential for the development of systemic sepsis
4. Post-infusion phlebitis normally appears 48 to 96 hours after the catheter is removed. Incidence is related especially to catheter material and the length of time the catheter remained in the patient's vein. [6]

Presence and severity of phlebitis is evaluated by Jackson's Visual Infusion Phlebitis Scoring System. Phlebitis manifests in four grades: Grade 1 - erythema around the puncture site, with or without local pain; Grade 2 - pain at the puncture site with erythema and/or edema and hardening; Grade 3: pain at the puncture site with erythema, hardening and a palpable venous cord; Grade 4: pain at the puncture site with erythema, hardening and a palpable venous cord that is > 1 cm, with purulent discharge. [6]

The incidence of phlebitis in the literature varies quite a bit, with reports ranging from 61.2% to 1.3%.[6]

A Mondal et al. in a study identified that most common complication associated with PIVC insertion is phlebitis with reported incidence ranges from 25% to 59%.[8]In another study Simit et. Al. found that Phlebitis ranked first

among complications with occurrence of 44%, followed by infiltration of 16.3%, while the incidence of occlusion and catheter dislodgement was 7.6% and 5.6%.[9]Lulie et. Al., in another study, found incidence of phlebitis as 70% among the study subjects.[6]In another study, R Singh et al. found the incidence of Phlebitis was 59.1%.[10]

Phlebitis not only causes patient discomfort and frequent catheter change it may also cause further complications like cellulitis, septicemia, DVT, and make the patient stay in the hospital for a longer time and increase the cost of healthcare.[8]

The present study aims toassess the prevalence of phlebitis among patient on peripheral intravenous catheter in a tertiary care hospital in India and identify predisposing factors of phlebitis in patients. The study will help to identify risk factors and implement measures for better care of PIVC and prevention of phlebitis.

Methods and Materials:-
1. StudyApproach& Design: For the study a Quantitative approach was used with an observational design
2. Settings of the study – A tertiary hospital in Karnataka
3. Duration of the study- 6 months including planning, data collection and analysis
4. Inclusion criteria – Adult inpatients to the wards of the hospital as per the sample size.
5. Exclusion criteria – Patients who are admitted in day care, pediatric patients, oncology patients receiving chemotherapy, ICU patients, patients who have preexisting skin diseases, vascular disorders, bleeding disorders, patients who have a history of allergy to any medications, burn patients and patients who refused to give written consent were excluded.
6. Sampling Method – Convenient sampling.
7. Data collection method- Four senior nurses were identified, as researchers, and trained for data collection. They observed and followed up,398 patients in wards who were put on peripheral intravenous catheter (PIVC) till discharge or till the catheter was resited. The PIVC site of patients were assessed using Visual Infusion Phlebitis (VIP) scale.
8. Study Tool- Researchers used VIP scale for assessment of PIVC insertion sites. Additionally, an observational tool was developed for researchers to record their daily observation and follow up. (Appendix 1)
9. Data analysis- Data entry and statistical analyses are performed using SPSS version 29. Descriptive statistics by the simple table arepresented as frequency. Chi squire test was used and significance differences (P) was adjusted with confidence interval (CI) 95% ($P < 0.05$ significant, $P > 0.05$ not significant). Results were analyzed, discussed and recommendations suggested.
10. Ethical considerations – Permission was obtained from Institutional ethical committee.

Results:-
Study included 398 adult inpatients including 228 males and 170 females. They were all admitted in wards. Majority of study participants were of average body built (61.8%) and 67.6% of them belonged to age between 31-70 years.

Table 1:- Demographic characteristics of study participants (n=398).

Characteristics	Frequency	Percentage
Gender		
Male	228	57.3
Female	170	42.7
Age		
Less than 30 years	48	12.1
31-50 years	143	35.9
51-70 years	126	31.7
71 years and above	81	20.4
Body built		
Thin built	114	28.6
Average Built	246	61.8
Heavy	38	9.5
Mobility Status		
Ambulatory	250	62.7
Confined to bed but conscious	69	17.4

Partially mobile with assistance	70	17.6
Altered sensorium	9	2.3

Data analysis also revealed that only 10.8 % of PIVC insertion were done in more than one attempt. Most of the insertions 46.5% were performed by staffs with 0-1 years of experience and 20 G PIVC size was the most commonly used catheter (70.9%). Also metacarpel vein (38.2%) , cephalic vein (35.4%) and basilic vein (22.9) were the most commonly used site for insertion.

Table 2:- Frequency distribution for PIVC insertion related variables.

PIVC inserted related variables	Frequency	Percentage
Number of attempts		
1	355	89.2
2	41	10.3
3	2	0.5
Experience of staff performing PIVC insertion		
0-1 years	185	46.5
1-2 years	114	28.6
2-3 years	15	3.8
3-5 years	27	6.8
5 years and above	57	14.3
Size of PIVC needle		
< 18	3	0.8
18	80	20.1
20	282	70.9
22	33	8.3
Site of PIVC placement		
Basilic vein	91	22.9
Brachial Vein	3	0.8
Cephalic vein	141	35.4
Metacarpel vein	152	38.2
External jugular vein	7	1.8
Other veins	4	1.0

Table 3:- Frequency distribution forTherapy related variables.

Therapy related variables	Frequency	Percentage
Duration of Therapy		
Continuous	125	31.4
Intermittent	273	68.6
Use of Antibiotics		
No antibiotics administered	90	22.6
Antibiotics administered	308	77.4

The data analysis also revealed an occurrence of phlebitis among 48.2 % of participants. Most of these were minor phlebitis of grade 1 (66.67%) with 3rd catheter day, being the day when majority (46.35%) of phlebitis early signs were observed.

Table 4:-Phlebitis Prevalence.

Phlebitis variable	Frequency	Percentage
Prevalence		
No phlebitis	206	51.8
Phlebitis	192	48.2
Grade of Phlebitis		
Grade 1	128	66.67
Grade 2	61	31.77

Grade 3	3	1.56
Duration of PIVC retention for occurrence of early signs of phlebitis		
2	37	19.27
3	89	46.35
4	66	34.37

Analysis also revealed that phlebitis is associated with duration of therapy (continuous or intermittent infusion), gender, Mobility status of patient, number of attempts during insertion, experience of staff inserting PIVC, duration of PIVC catheter insitu.

Table 5:- Association between study variables and Phlebitis.

Variable	Chi Square p value
Gender	0.04
Age	0.38
Body built	0.4
Mobility	<0.001
Number of attempts	0.003
Experience of staffs	0.009
Size of needle	0.23
PIVC site	0.29
Duration of therapy	0.006
Antibiotic usage	0.41
Duration of PIVC in situ	<0.001

Moreover, correlation statistics revealed that the severity of phlebitis is significantly and positively correlated with number of attempts and days of PIVC in situ.

Table 6:- Correlation between variables and VIP scoring of phlebitis.

Variables	Pearson test value	P value
Age in years	0.027	0.59
Number of attempts	0.216	<0.001
Experience of staff	0.084	0.095
Size of needle	0.013	0.80
Duration of PIVC in situ	0.844	<0.001

Discussion:-

This study aimed at identifying the prevalence of phlebitis among inpatients and the risk factors associated with phlebitis with a goal to be able to implement measures to target those risk factors in prevention of phlebitis in our hospital.

Analysis revealed a high prevalence of phlebitis in the hospital and its association with number of attempts during PIVC insertion and the experience of staff performing the procedure. This mandates that all nursing staffs are to be upskilled on the procedure to ensure safe PIVC insertion. The need for training and hand on upskilling becomes more crucial with the number of novice nurses in the hospital.

Expertise of nurses in inserting, managing, and removing these devices may reduce the likelihood of complications, and increased recognition of complications associated with use of the devices is important to ensure continued improvements in the safety, quality, and efficiency of health care. Complications associated with short peripheral catheters and peripherally inserted central catheters include tourniquet retention, tubing and catheter misconnections, phlebitis, air embolism, device fragment embolization, and inadvertent discharge with a retained peripheral venous access device. Integration of prevention, detection, and recovery strategies into personal nursing practice promotes the quality and safety of health care delivery.[11]

This study did find association between occurrence of phlebitis and gender, which is in line with previous study conducted by R Singh et al. where it was found to be associated with gender.

There were very few severe grades (3 and 4 VIP score) phlebitis observed during the study. This implies that early identification of early signs of phlebitis and removal/resiting the cannula helps in preventing severe complications associated with PIVC usage. This further emphasizes adequate compliance to monitoring protocols to ensure early identification and management.

One of the enlightening finding of the study is the association of phlebitis with mobility status of the patients. This implies that ambulatory patients are at risk of phlebitis and hence they need to be sensitized about their contribution in maintenance of PIVC. Adequate health education on PIVC care is important in prevention.

Consistent application of evidence-based standards of practice in all aspects of peripheral intravenous catheter care is essential to provide infusion therapy that delivers safe and quality care. [3]

The study was limited to wards of the hospital and only adult patients were included for data collection. The scope of this study did not include classification of phlebitis in detail. Further studies need to be conducted to identify more risk factors and to identify prevalence of various types of phlebitis, in various other settings within the hospital. Hospitals need to ensure adequate training of nurses on PIVC insertion and monitoring and compliance to phlebitis prevention protocols.

Reference:-

1. Intravenous Cannulation. Gil Z Shlamovitz. Vincent Lopez Rowe. Obtained from https://emedicine.medscape.com/article/1998177-overview
2. Beecham GB et.al. [Updated 2022 Jul 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539795/
3. Barb Nickel. Peripheral Intravenous Access: Applying Infusion Therapy Standards of Practice to Improve Patient Safety. CRNI Crit Care Nurse (2019) 39 (1): 61–71. https://doi.org/10.4037/ccn2019790
4. Goli R et.al. Pneumothorax as a rare complication of peripherally inserted central catheter (PICC) in neonates: A case report study. Int J Surg Case Rep. 2021 Nov;88:106472. doi: 10.1016/j.ijscr.2021.106472. Epub 2021 Oct 7. Erratum in: Int J Surg Case Rep. 2022 Apr;93:106936. PMID: 34637990; PMCID: PMC8506958.
5. Healthline. Obtained from https://www.healthline.com/health/phlebitis#Types-of-phlebitis.
6. Lulie, M et al. Incidence of peripheral intravenous catheter phlebitis and its associated factors among patients admitted to University of Gondar hospital, Northwest Ethiopia: a prospective, observational study. Thrombosis J 19, 48 (2021). https://doi.org/10.1186/s12959-021-00301-x
7. Phlebitis. Obtained from https://www.webmd.com/dvt/phlebitis
8. Mandal A, et. al. J Family Med Prim Care. 2019 Sep 30;8(9):2827-2831. doi: 10.4103/jfmpc.jfmpc_559_19. PMID: 31681650; PMCID: PMC6820419.
9. Simin D, et al. Incidence, severity and risk factors of peripheral intravenous cannula-induced complications: An observational prospective study. J Clin Nurs. 2019 May;28(9-10):1585-1599. doi: 10.1111/jocn.14760. Epub 2019 Jan 17. PMID: 30589945.
10. Singh R, et al. Peripheral intravenous catheter related phlebitis and its contributing factors among adult population at KU Teaching Hospital. Kathmandu Univ Med J (KUMJ). 2008 Oct-Dec;6(24):443-7. doi: 10.3126/kumj.v6i4.1732. PMID: 19483423.
11. Elizabeth A. Mattox. Complications of Peripheral Venous Access Devices: Prevention, Detection, and Recovery Strategies. Crit Care Nurse (2017) 37 (2): e1–e14. https://doi.org/10.4037/ccn2017657.