

The Incidence and Factors Associated with Peripheral Intravenous Catheter Failure in a Tertiary Care Teaching Hospital

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Abstract

The insertion of peripheral intravenous catheter is a common practice in hospitals. The present study is aimed to assess the incidence and factors associated with peripheral intravenous catheter failure. The objective were the estimation of the incidence of peripheral intravenous catheter failure among patient admitted in tertiary care setting and to assess the factors associated with it. The design used for this study was prospective survey. The data were collected from 294 participant with a semi structured interview schedule and an observation checklist. The findings of the study revealed that the incidence of peripheral intravenous catheter failure were 50.3% and mean dwell time were 71.7 hours. The factors associated with PIVC failure was gender, type of ward, duration of hospital stay, purpose of PIVC insertion.

Keywords:- peripheral intravenous catheter failure, incidence, dwell time.

Background

Peripheral intravenous cannula (PIVC) insertion is most widely used procedure in a hospital or in a community setting. Peripheral venous devices were introduced more than 40 years ago.¹ Approximately 90% of all patients entering the hospital environment for care have some form of intravenous therapy during their hospital stay.² Peripheral intravenous cannulation is a technique in which cannula is placed inside a vein to provide venous access. This allows sampling of blood as well as administration of fluid, medication, total parenteral nutrition, chemotherapy and blood products.³ A study conducted about the international prevalence of the use of peripheral intravenous catheters in Australia showed that the prevalence of PIVC and their management practices varies across different regions of

the world. Among 479 patients screened for the presence of peripheral intravenous catheter they found 59% of patients had at least one peripheral intravenous catheter in place, and 16% had other types of vascular devices.⁴

There are so many risk factors and complications develop after peripheral intravenous catheter insertion. Due to different reasons premature removal of cannula occurs in hospital setting. Common factors associated with peripheral intravenous catheter failure include therapeutic removal, phlebitis, edema, pain, infiltration, blockage, improper securement, accidental dislodgement, type of medication and site of insertion.⁵ Peripheral intravenous catheter failure is associated with a triad of definitions some which are not mutually exclusive; (i) infiltration, that is where the infusion inadvertently escapes the vein lumen and is infused into the subcutaneous tissues.⁶ (ii) occlusion, also referred to as blocked, where flushing or aspirating from the PIVC is not possible¹⁰ and (iii) phlebitis and/or thrombophlebitis leading to infection (either local or systemic), with systemic infection being particularly serious.

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Nursing care is the key factor in the outcome of hospitalized persons and nurses play key role in IV therapy.^{7,8} Peripheral intravenous catheters are one of the most ubiquitous medical devices with many patients requiring the insertion for administration of medication or fluid. Peripheral intravenous catheter failure is common with accidental dislodgement, phlebitis and occlusion commonly causing the premature removal of the devices.⁹ However the paucity of studies tertiary population to estimate the incidence of failure to identify factors associated with peripheral intravenous catheter failure. This study aimed to provide preliminary data on peripheral intravenous catheter dwell time and failure rates, identify the significant risk factor of peripheral intravenous catheter failure. By identifying the significant factors we can assess those factors and by taking necessary interventions to prevent such risk factors to reduce the peripheral intravenous catheter failure. Thereby we can reduce the patient discomfort due to repeated cannulation and interference that develop in treatment.

Material and Method

The design selected for the study was a prospective survey. The setting was the medical and surgical wards of a tertiary care teaching hospital. The Population consisted of patient above the age of 18 years admitted

with PIVC in situ receiving intravenous drugs and intravenous infusion therapy. The data were collected from 294 patients and the exclusion criteria were edema, burns, impaired skin integrity, and patient receiving chemotherapy. The data collection tools were semi-structured interview schedule and observation checklist. After obtaining the permission from the Institutional Review Board, the investigators met the patients individually in the medical and surgical wards obtained written informed consent for participating in the study. The participants were observed on 24th, 48th and 72nd hours or until the removal of cannula. Peripheral intravenous catheter failure was operationally defined as the removal of catheter within 72 hours of insertion due to non-therapeutic indications like blockage of cannula, signs of phlebitis, dislodgement or leakage.

Findings

Among the 294 samples 66.3% were males and 33.7% were females. The study included patients from medical and surgical wards there percentages were 76.5% and 23.5% respectively. The median duration of hospital stay was 4 days and there were 68.7% patient's duration of hospital stay is less than 4 days and 31.3% were more than 4 days. The mean (SD) PIVC dwell time was 71.8 (24.47) hours. Table 1 below describe the PIVC related factors.

TABLE 1: PIVC characteristics of sample

Variable	Frequency	Percentage
PIVC insertion limb		
Right hand	159	54.1%
Left hand	135	45.9%
Site of PIVC insertion		
Ulnar	39	12.9%
Ante-cubital fossa	52	17.7%
Dorsum of palm	163	55.4%
Wrist	40	13.9%
Size of PIVC		
18G	13	4.4%
20G	52	17.7%
22G	180	61.2%
24G	49	16.7%
Purpose of PIVC insertion	100	66.6%
Medication administration	138	46.9%
IV infusion	24	8.2%
Medication & IV infusion	107	36.4%

Cont... Table 1: PIVC characteristics of sample

Others	25	8.5%
Type of adhesives	8	5.3%
Adhesive tape	164	55.8%
Top'O plast	8	2.7%
Other methods	122	41.5%
History of previous PIVC insertion		
Yes	136	46.3%
No	158	53.7%
PIVC Inserted by		
Staff nurse	290	98.6%
Student nurse	4	1.4%
Skin turgor		
Intact	176	59.9%
Wrinkled	118	40.1%

Peripheral intravenous catheter which is removed within 72 hours of insertion due to non-therapeutic indications like blockage of cannula, signs of phlebitis, dislodgement or leakage Among the 294 PIVCs inserted the failure rate was 50.3%.The major factors associate with PIVC failure is listed in the Table 2

Table 2: Factors associated with PIVC failure

Variables	PIVC failure f (%)	PIVC success f (%)	Test statistics	p value
Gender				
Male	106 (71.6%)	89 (61%)	Chi-square (3.841)	0.043*
Female	42 (28.4%)	57 (39%)		
Age				
Mean(SD)	53.5 (16.38)	54.5 (17.74)	t = .561	0.60
Ward				
Medical	121 (81.8%)	104 (71.2%)	Chi-square (4.532)	0.03*
Surgical	27 (18.2%)	42 (28.8%)		
Hospital stay				
< 4 days	101 (68.2%)	101 (69.2%)	Chi-square (0.030)	0.86
> 4 days	47 (31.8%)	45 (30.8%)		
PIVC insertion limb				
Right hand	79 (53.4%)	80 (54.8%)	Chi-square (0.059)	0.808
Left hand	69 (46.6%)	66 (45.2%)		
PIVC insertion site				
Ulnar region	19 (12.8%)	19 (13%)	Chi-square (3.991)	0.407
Ante-cubital fossa	23 (15.5%)	29 (19.9%)		
Dorsum of palm	83(56.1%)	80 (54.8%)		
Wrist	23 (15.5%)	16 (11%)		
Size of PIVC				
18 G	6 (4.1%)	7 (4.8%)	Chi-square (2.316)	0.509
20 G	30 (20.3%)	22 (15.1%)		
22 G	91 (61.2%)	89 (61%)		
24 G	21 (14.2%)	28 (19.2%)		

Cont ... Table 2: Factors associated with PIVC failure

Variables	PIVC failure f (%)	PIVC success f (%)	Test statistics	p value
Purpose of PIVC insertion				
Medication	74 (52.9%)	64 (44.8%)	Chi-square (7.921)	0.048
IV infusion	12 (8.6%)	12 (8.4%)		
Both	52 (37.1%)	55 (38.5%)		
Others	2 (1.4%)	12 (8.4%)		
Type of adhesive				
Adhesive tape	82 (55.4%)	82 (56.2%)	Chi-square (2.685)	0.261
Top O' plast	5 (3.4%)	1 (0.7%)		
Others	61 (41.2%)	63 (43.2%)		
History of previous cannula insertion				
Yes	68 (45.9%)	68 (46.6%)	Chi-square (0.012)	0.914
No	80 (54.1%)	78 (53.4%)		
PIVC inserted by				
Staff nurse	144 (97.3%)	146 (100%)	Chi-square (4.00)	0.045
Student nurse	4 (2.7%)	0 (0%)		
Skin turgor				
Intact	91 (61.5%)	85 (58.2%)	Chi-square (0.327)	0.568
Wrinkled	57 (38.5%)	61 (41.8%)		

Among the socio-demographic variables there were significant association between the gender and PIVC failure as evidenced by chi-square of 3.841 with a p of 0.043, males have more PIVC failure rate than females. The underlying condition such as admitted in medical or surgical ward is also significantly associated with PIVC failure rate chi-square of 4.532 with a P value of 0.03. There is association between purpose of PIVC insertion, Chi-square 7.92 and P value of 0.04, it is observed that the rate of medication administration was more in the PIVC failure group than the groups with intravenous fluid alone or in combination of intravenous fluids and medications.

Discussion

In the present study showed that the PIVC failure rate is 50.3% among patient with the history of PIVC insertion admitted in a tertiary care teaching hospital, i.e about half of the patient develop complaints regarding PIVC and they are removed due to the nontherapeutic

reasons. Its far higher than a similar study conducted among pediatric acute care unit in Australia , which showed that PIVC failure is only 24.8%. A prospective observational study on 'Removal of PIVC due to catheter failure among adult patients' conducted at University hospital Tokyo, Japan showed that the rate of a catheter removal as a result of catheter failure was 18.8% the reason for the removal were infiltration (41.3%) and pain(19.3%) pain was major reason for catheter failure and removal.¹⁰

The median dwell time in the study is 71.7 hours. As per different study PIVC can leave in place for more than 72 hours if not contraindicate. But the prolonged placement of catheter can cause complication. Durability and type of material used in PIVC and method of securement also play major role in their failure.A prospective study on 'Relationship between PIVC dwell time and development of phlebitis and infiltration' conducted in hospital of USA shows that to evaluate whether lengthening the dwell time of PIVC

from 72 to 144 hrs resulted in increased rate of phlebitis and infiltration and they concluded it as the lengthening the dwell time increases the risk of phlebitis and infiltrations.¹¹ The factors associated with PIVC failure is varied in different studies, it may be due the different measurements used for the assessment of various factors.

Conclusion

In the present study showed that 50.3% participants have PIVC failure. The mean dwell time was 71.8 (24.47) hours. The factors associated with PIVC failure was gender, type of ward, duration of hospital stay, purpose of PIVC insertion. The finding of the study can be utilized to improve the nursing care of patients with PIVC in the clinical setting or in community setting.

Conflict of Interest: No conflict of interest

Source of Funding

Self

Ethical Clearance:

- Institutional Review Board clearance
- Written informed consent obtained from participants

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