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A PROSPECTIVE CLINICAL AUDIT TO COMPARE THE EFFECTS OF TWO PERIPHERAL INTRAVENOUS CATHETER (PIVC) SECUREMENT DEVICES ON THE INCIDENCE OF PIVC FAILURE

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Abstract

Background: Over 60% of all hospitalized patients require peripheral venous (PVC). catheterization. Reported failure rates, or unscheduled restarts, range from 33% to 69%. Reliable securement of PVCs is an important factor in its maintenance**.** The aim of the study is to compare the effects of transparent polyurethane dressing and adhesive dry dressing at peripheral intravenous catheter insertion site on the incidence of PIVC failure

Methods: A quantitative approach with a comparative observational study design was adopted in this study. The study was conducted in the medicine wards of a tertiary care hospital. Simple random sampling was used, the sample size was 180, with 90 in each arm. One group got transparent polyurethane dressing and the other adhesive dressing. They were monitored for 72 hours and the site was observed for five days or till discharge.

Results: The study revealed that there was no statistical significant difference between the two securement devices ie., transparent polyurethane and adhesives on PIVC failure at 0.05 level of significance. Hence both securement devices can be used for securing the PIVC insertion site and both are equally effective in prevention of PIVC failure.

Conclusion: Hence both securement devices can be used for securing the PIVC insertion site and both are equally effective in prevention of PIVC failure. Although not significant, transparent polyurethane was better in terms of identifying PIVC failure. Hence nurses need to follow the protocols correctly, use securement devises appropriately and be proactive in prevention of PIVC failure.

Key words: Transparent polyurethane, adhesive dry dressing, peripheral intravenous catheter failure

Introduction

A peripheral venous catheter (PVC) is typically used for short-term delivery of intravascular fluids and medications. It is an essential element of modern medicine and the most frequent invasive procedure performed in hospitals, with over 60% of all hospitalized patients requiring peripheral venous catheterization. It has been conservatively reported that patients have a PVC for 15% to 20% of the total time they spend in an acute care hospital. The Infusion Nurses Society Standards recommend that PVCs be re-sited when clinically indicated. The decisions about when to re-site should be based on an assessment of the patient's PVC site, including: skin and vein integrity, type of intravenous (IV) therapy prescribed, the treatment setting, and patency of the PVC and securing dressing or stabilization device. PVCs often fail before intravenous treatment is completed. Reported failure rates, or unscheduled restarts, range from 33% to 69%. PVCs fail for a wide range of reasons. The most commonly identified causes of failure are partial dislodgement or accidental removal, phlebitis, occlusion/infiltration, leakage and infection [1.2.]

Reliable securement of PVCs is an important factor in their maintenance**.** It has been found that peripheral IV care standards can be poor; the reasons offered being forgetfulness, carelessness, mistakes, no one to take responsibility, bad routines and stress. Approaches to care may not be standardized and little ownership exists over the care provided. Recent changes have brought a new insight into vascular access and infusion therapy. The alternative approach is based on evidence, standardization, staff development and improved patient safety outcomes. The most prolific example of these new approaches to IV care is that of bundle implementation associated with central venous catheter infection prevention. Historical pre-bundle central line-associated blood stream infections (CLABSIs) rates are suggested to be in the region of three to five infections per thousand catheter days (Memish et al, 2003). In contrast, a review of post bundle introduction has produced CLABSI rates close to zero.[3.4.5]

Prevention of failure and unscheduled restarts of PVC therapy is an important patient outcome: failure interrupts prescribed therapy, and reinsertion can be distressing and painful. A PVC that is not securely attached to the skin has the potential to migrate externally and simply fall out, or cause complications such as phlebitis and infiltration. An inadequately secured PVC also increases the risk of CRBSI, as the pistoning action of the catheter can allow migration of organisms along the catheter and into the systemic circulation. These unnecessary complications can lead to delays in treatment and increases in length of hospital stay. These factors have an impact on health resources, as PVC replacement is time consuming, requires skilled clinicians and disposable sterile equipment, and CRBSIs cause significant increases in treatment costs. Despite the many dressings and securement devices available, the impact of different securement techniques for increasing PVC dwell time is still unclear; there is a need to provide guidance for nurses by reviewing current studies systematically.[1.6]

An audit in a district general hospital compared the occurrence of PVC restarts between a 3-month period in 2010 and the same 3 months in 2011. The only difference in the PVC care bundle between these dates was the implementation of an advanced securement dressing for cannulae in 2011. Results show a significant increase in cannulae attaining the maximum local protocol duration of 72 hours during 2011. Also, restarts owing to dressing influenced factors (dislodgement, infiltration and leakage) were significantly lower in 2011 when the new dressing was used. The total number of PVC restarts during the comparative audit periods was 9% lower in 2011 compared with 2010.

This data suggests that better PVC securement is leading to an overall reduction in PVC insertions but further evidence is required to support this conclusion.[4]

A study was done to compare the use of transparent polyurethane(TPU) and dry gauze dressings for peripheral IV catheter sites on rates of phlebitis, infiltration, and dislodgment by patients. Two hundred twenty-nine patients were randomized to receive either gauze (n = 121) or transparent polyurethane (n = 108) dressings, and observations were recorded. The results showed that the frequency of catheter dislodgment by the patient was significantly higher (P < .05) in patients with the gauze dressing (15%) than in patients with the transparent polyurethane dressing (6%). A trend toward lower frequencies of phlebitis (1.8% vs 3.3%) and infiltration (17.6% vs 20.7%) was noted in the patients with the transparent polyurethane dressings. The study concluded that use transparent polyurethane was preferred to that of gauze dressings at insertion sites for peripheral IV catheters.[7]

Intravenous dressings usually have a number of qualities that broadly ensure adequate securement of the device and a barrier to extraluminal device infection. It is acknowledged that the dressing must be sterile, easy to apply (and remove), ensure secure fixation of the device, enable visualization of the insertion site and prevent moisture building beneath the dressing. Many of the polyurethane intravenous dressings supplied by different manufacturers have a number of similarities. At a basic level these similarities include sterility, transparency and it usually extends to the inclusion of fixation and date strips. The adhesive on an IV dressing is a key part and as such this key part must be protected from touch contamination. Rowley et al (2010) explain the role of key parts and key part protection in the prevention of infection, stating that if contaminated, key parts provide a direct route for transmission of pathogens between the procedure and the patient'. Hence a good dressing technique is important in reducing peripheral cannula associated infection rates. PIVC failure in many of the research studies has been defined as premature device removal before the end of therapy because of pain, occlusion, leaking, phlebitis, infiltration, extravasation, hematoma, accidental removal or dislodgement and local or catheter-related bloodstream infection. [8.9.10.11.]

Based on the above theoretical and empirical findings it is seen that securement devices play a vital role in the prevention of PIVC failure. Studies have shown that polyurethane dressings is a safe method in prevention of PIVC failure. The existing practice in the setting where the study was being conducted was the use of adhesive dressing in the wards and transparent polyurethane in critical care units. There was a plan to use TPU in all areas. Looking into both, cost factors as well as advantages and disadvantages, this study was taken up. Hence the Investigators have chosen to do a comparative study on the use of two securement methods. "A prospective clinical audit to compare the effects of two peripheral intravenous catheter (PIVC) securement devices on the incidence of PIVC failure."

METHODOLOGY

Objective

To compare the effects of transparent polyurethane dressing and adhesive dry dressing at peripheral intravenous catheter insertion site on the incidence of PIVC failure

Operational definition:

1. **PIVC failure**: In this study peripheral intravenous catheter failure is defined as premature device removal before the end of therapy because of pain, occlusion, leaking, phlebitis, infiltration, extravasation, hematoma, accidental removal or dislodgement and local or catheter-related bloodstream infection.
2. **Transparent polyurethane dressing (TPU)**: in this study it refers to the use of transparent polyurethane dressing for securing the peripheral intravenous catheter insertion site.
3. **Adhesive dry dressing**: in this study it refers to the use of adhesive dressing to secure the peripheral intravenous insertion site.
4. **Clinical Audit**: in this study refers to the systematic review regarding the use of transparent polyurethane and adhesive dry dressing on the PIVC insertion site as measured by information and scores obtained by means of an infusion therapy monitoring chart to monitor incidence of PIVC failure.

Assumption: Peripheral intravenous catheter (PIVC) securement devices play an important role in the prevention of PIVC failure.

Delimitation: The study is limited to patients admitted the medicine wards of a selected hospital

Projected Outcome: The study will reveal which of the two methods of securement of PIVC is more effective in prevention of PIVC failure and also the cost factor involved.

Hyothesis:

H_1- There will be a significant difference between the use of transparent polyurethane dressing and adhesive dry dressing at peripheral intravenous catheter insertion site on the incidence of PIVC failure at 0.05 level of significance.

H_2- There will be a significant association between the use of transparent polyurethane dressing and adhesive dry dressing on the incidence of PIVC failure with selected baseline variables at 0.05 level of significance

Materials and methods:

Quantitative approach, True experimental, with a comparative observational study design.

Variables under study

Independent variables : transparent polyurethane dressing and adhesive dry dressings

Dependent variable: incidence of PIVC failure

Demographic variables: Age, gender & diagnosis

Setting:

The study was conducted in the medicine wards of a St John's Medical College Hospital, Bangalore, which is a teaching hospital and tertiary level referral centre with 1250 beds.

Population The population comprised of all patients admitted to the Medicine wards of a selected hospital who needed a PIVC insertion as part of their treatment.

Sample size and sampling procedure: Simple random sampling was used, 180 was the calculated sample size with, 90 in each arm.

Inclusion criteria

All Adult patients admitted to medicine ward who are in need of a PIVC, as part of their treatment

Exclusion criteria

Patients who are aggressive or delirious

Instruments used :

Section A: Structured Interview Schedule to collect Demographic data

Section B : An infusion therapy monitoring chart to monitor the incidence of PIVC

Data collection method:

After IEC approval and permission from hospital authorities:

Phase1- Orientation was given to the staff regarding application of the securement devices both transparent polyurethane dressing and adhesive dry dressing, they were also instructed how to do the recording and monitoring in the infusion therapy monitoring chart.

Phase II -Samples were selected based on inclusion criteria. Informed written consent was obtained. The samples were randomly allocated to Group A and Group B by lottery. For the Group A, a transparent polyurethane dressing was applied at the PIVC site and Group B, an adhesive dry dressings was applied which was the existing practice. The recording in the infusion therapy monitoring chart was done by the investigators who started the line and monitoring was continued for 72 hours and follow up of site for 5 days for both groups. Auditing of the chart was done on completion for a minimum of 5 days for each sample or at the time of discharge.

Results

The study revealed that there was no statistical significant difference between the two securement devices ie., transparent polyurethane and adhesives on PIVC failure at 0.05 level of significance. Hence both securement devices can be used for securing the PIVC insertion site and both are equally effective in prevention of PIVC failure. In Both groups the reason for removal was due to routine protocol 76(84.44%) for adhesive and 71(78.89%) for transparent polyurethane. In relation to reasons for removal, transparent polyurethane group had a greater number of PIVC failures 19(21.11%) when compared to 14(15.56%) adhesives, though not statistically significant. The inference is that transparent polyurethane was more effective in identifying the PIVC failures when compared to adhesives. Thrombophlebitis was equally seen in both the groups (7). Adhesive (54.07%)

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showed greater indwelling time of catheter than transparent polyurethane (50.32%) though it was not significant. This shows that adhesives are more durable. Though not significant transparent polyurethane was better in terms of identifying PIVC failure.

Table 1. Frequency and percentage distribution of patients with PIVC according to diagnosis

n=180

Diagnosis	f	%
Respiratory	31	17.22
Fever	42	23.33
Diabetes	29	16.11
Cardiac	6	3.33
Blood disorders	28	15.56
Renal	1	0.56
Others	43	23.89

Table 1 shows that most of the patients were admitted for fever

Table 2 : Frequency, percentage and test of significance for reason for removal PVC in patients with PIVC

n=180

Reason for removal	TPU f	TPU %	Adhesive f	Adhesive %	Fisher's	P value
Thrombo-	7	14	7	14		
phlebitis	4	4.44	2	2.22		
Infiltration	-	-	-	-		
Hematoma	1	1.11	1	1.11	2.6016	
Extravasation	7	14	4	4.44	*0.857	
Occlusion of line	21	23.33	26	28.88		
As per protocol	39	43.33	42	46.66		
Pt. Discharged	11	12.22	8	8.88		
IV Terminated						

*Not significant

Table 2 shows that there no statistical significance in relation to reasons for removal. Hence the groups are homogenous. In both groups (43.33%, 46.66%) commonest reason for removal is discharge of patient.

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Table 3: Test of significance for comparison of securement devices on incidence of PIVC failure

n=180

Securement devices	Reasons for removal		Chi square	P-VALUE
	PIVC failure	ROUTINE		
Adhesive	14(15.56%)	76(84.44%)	0.9276	*0.325
Transparent polyurethane	19(21.11%)	71(78.89%)		
TOTAL	33(18.33%)	147(81.67%)		

*Not significant

Table 3 shows that there is no statistical significance in relation to incidence of PIVC failure in both groups. Hence H1 is rejected.

Table 4: Frequency, percentage distribution and test of significance according to stages of thrombophlebitis of patients with PIVC

n=180

Thrombo-phlebitis stage	Adhesive f	Adhesive %	TPU f	TPU %	Fisher's	p value
Stage 1	7	7.78	7	7.78	0.0000	*1.000
Stage 0	83	92.22	83	92.22		

*Not significant

Table 4 reveals that there were equal number (7) of thrombophlebitis stage I in both groups. There was no statistical significance. Hence H2 is rejected.

Table 5: Mean, SD, Independent t test of Indwelling time of cannula in hours of both groups of patients with PIVC **n=180**

Group	Mean	SD	Independent t test	p value
Adhesive	54.07	19.81	0.1972	* 0.0986
Transparent polyurethane	50.32	19.11		

*Not significant

Table 5 shows that there is no statistical significance in relation to indwelling time of cannula. Hence H2 is rejected.

Discussion and conclusion

The study revealed that there is no statistical significant difference between the two securement devices ie., transparent polyurethane and adhesive dressing on PIVC failure at 0.05 level of significance. Hence both securement devices can be used for securing the PIVC insertion site and both are equally effective in prevention of PIVC failure. It was also observed that thrombophlebitis was equally seen in both the groups. The polyurethane group had a greater number of PIVC failures when compared to adhesives group. Though not statistically significant the transparent polyurethane dressing was better in terms of identifying PIVC failure. The feedback from the investigators were that the adhesives lasted for a longer duration, it was strong enough to retain cannula, cheap and affordable, durable and does not come off easily. The disadvantage of adhesive dressing was that the cannulation site was not visible, it was painful while removing and could not evaluate for thrombophlebitis at any stage. The transparent polyurethane advantages were that the cannulation site was visible and easy to observe for thrombophlebitis, looked neat, no pain while removing and felt light. The disadvantages were that it came off when it got wet or with sweat, it is expensive, difficult to use in case of restless patients and cannot be used for a longer duration. Both have its advantages and disadvantages, but as transparent polyurethane dressing helps in early identification of thrombophlebitis, it is widely recommended and used in most NABH acquired hospitals and there is a plan to use it in all the wards in the present setting. Nurses need to follow the protocols correctly, use securement devises appropriately and be proactive in prevention of PIVC failure.

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