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"A Study To Assess The Effect Of Needle Free Connector And Pre-Filled Normal Saline Flush Syringe On Reduction In Catheter - Related Blood Stream Infection In Bgs Apollo Hospital, Mysore".

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Abstract
Background:
Background: Maintaining catheter patency is crucial to maintaining patient health. Catheter flushing has been endorsed by a number of international guidelines, including the 2016 infusion nurse's society standards of practice, which established flushing as the standard to maintain catheter patency. In addition, these, guidelines recommended prefilled syringes to reduce the risk of catheter related blood stream infections and save staff time on syringe preparation.[1]
Manually filling syringes with flushing solution involves multiple steps, which may increase the risk of contamination and infection. In fact, approximately 8 % of manually prepared flush syringes are contaminated prior to administration, and over 33% of all hospital acquired bacteraemia are associated with central and peripheral IV catheters. Using prefilled syringes – including needle free connectors can help reduce the risk of infections, while improving work flow and reducing overall healthcare costs. [2]
The CDC reports that of-98,000 healthcare Acquired infections related deaths per year, approximately 30,000 of them are caused by bloodstream infections , What many health care professionals are beginning to realise, however, this is the impact IV access devices may have an catheter related blood stream infection (CR- BSI) cases, Although a small and seemingly inconsequential component of an infusion therapy system, a needless access device can be the place of origin for microbial growth.[3] Purposefully simple in design and function, Split spectrum device eliminate the complexities of mechanical valves, and with them, the places that may harbour bacteria. In fact, studies comparing devices found that patients are three times more likely, on average, to develop a catheter-related bloodstream infection (CR-BSI) with the use of mechanical valves Vs. a split – spectrum needleless access system. The split spectrum concept was introduced to the needless IV access device, this device features such as simple internal design, ease of use, and a straight, clear fluid path, are critical to achieve catheter related blood stream infection (CR- BSI) reductions[3] The ***objective*** *of this study was to use needle free connector and Pre -Filled normal saline flush syringes on patients for IV Injections. To increase indwelling time of the cannula and reduce the overall cost burden for the patients and to assess the effect of needle free connector and Pre -Filled normal saline flush syringes on patient outcome.*
Aim: *Needle free connectors are devices that ensure a simple and safe connection to venous catheters, reducing the risk of accidental punctures and infections and also reduce the risk of occlusion, microbial and / or water ingress or seepage from the cannula. Prefilled syringes provide reliable, cost effective alternatives to vial based flushing systems, is a mixture of salt and water that is compatible with your body's fluids and tissues, it is used to push any residual medication or fluid through the IV line and in to vein, this keeps the IV line clean and reduces the risk of infection or occlusion.*
Materials and Methods: *This Hospital based prospective study was conducted in Apollo BGS hospital Mysore.we conducted two sets of audits over a 6-month period. The focus was predominantly on 3 aspects - Tracking, Training and Technology. For the first study, A total of 100 patients and 274 peripheral lines were considered for the study. The second round of audit was done on another 100 patients and 153 lines. 100 Patients who met the inclusion criteria were enrolled in the study.*
Results: *The total number of PIVCs insertion decreased from 274 to 153, and the average number of PIVCs per patient decreased from 3 to 2. The total indwelling time also decreased from 10,557 to 9,328. Consequently, the average indwelling time per cannula increased from 36 hours to 61 hours. Additionally, there was a reduction*

in the average cost per cannula and charges. Further savings in indirect costs are expected, including time and energy saved by nurses during line changes, reduced stress loads, and simplified complication management.
Conclusion: *This study significant improvement in enhancing the lifespan of IV lines, moving from 36 hours 61hours due to the implementation of new protocols, The identified issues with the previous method, such as the absence of timely flushing and the lack of connection to the needle free connectors,were crucial factors contributing to the shortness lifespan of the IV lines.The introduction of a flush system before and after medication and ensuring the connection to the needle free connectors seems to have made a substantial positive impact. Its impressive to see such changes resulting in a significant increase in the IV line's lifespan, almost doubling the previous duration. Continued efforts and improvements in protocols and practices could potentially help reach and maintain that target. In the near future. The study highlights the importance of refining procedures to optimize patient care and resource utilization within the healthcare settings.*
Key Words: *Pre -Filled normal saline flush syringes, Needle free connectors , CR- BSI & PIVCs.*

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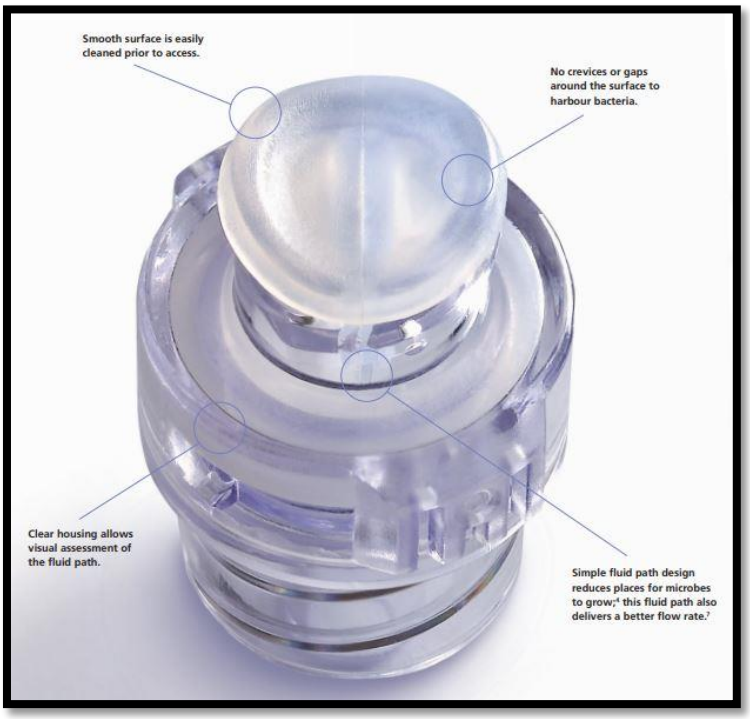
I. Introduction:

A Split-Septum needleless access system exhibits 64% to 70% lower catheter-related bloodstream infection (CR-BSI) rates compared to mechanical valves. According to the CDC, of the 98,000 Healthcare Associated Infections (HAI)-related deaths annually, approximately 30,000 are attributed to bloodstream infections. Healthcare professionals are increasingly recognizing the potential impact of IV access devices on catheter related blood stream infection catheter related blood stream infection (CR- BSI) (CR- BSI) cases. Despite being a seemingly inconsequential component of an infusion therapy system, a needleless access device can serve as the source of microbial growth. [4]

Purposefully simple in design and function, split -septum devices eliminate the complexities of mechanical valves, and with them, the places that may harbour bacteria. In fact, studies comparing devices found that patients are three times more likely, on average, to develop a catheter-related bloodstream infection (CR-BSI) with the use of mechanical valves. a split- spectrum needleless access system. Split - septum features such as simple internal design, ease of use, and a straight clear fluid path, are critical to achieve catheter-related bloodstream infection (CR-BSI) reductions.[6] This device provides: Dramatically higher flow rates, A Low priming volume and Flexibility to use ISO –compatible luer slip or luer lock connection.[5]



IV catheter-related complications put patients at risk and needlessly increase the cost of care. Pre - Filled normal saline flush syringes are used to clean out an intravenous (IV) catheter, which helps prevent

blockage and removes any medicine left in the catheter area after an IV infusion. International guidelines recommend to use pre-filled saline syringes to flush vascular access devices.[6]

Infusion Nurses Society (INS) recommendations for Vascular Access Device flushing

• Flush all vascular access devices with sterile preservative-free 0.9% sodium chloride.

• Flush prior to each infusion to access catheter function and prevent complications.

• Flush after each infusion to clear the infused medication from the catheter lumen, reducing the risk of contact between incompatible medications.

• Lock the device after completion of the final flush to decrease the risk of intraluminal occlusion and catheter-related bloodstream infections.

• Commercially available pre-filled syringes may eliminate contamination, reduce the risk of infections and save staff time for syringe preparation. Pre-filled saline syringes can help improve outcomes.

Pre -Filled normal saline flush syringes is a ready-to-use sterile, pre-filled saline flush syringe. It contains sodium chloride (NaCl) 0.9% and is specifically designed to enhance best clinical practice. The sterile fluid path (SP) syringes are designed for all standard IV procedures.[7]

II. Material and Methods

The quantitative research design is used to achieve the objectives of the study, this study was a hospital based prospective study and Quasi experimental design was used in this study. This study was carried out on patients at Apollo BGS Hospitals, Mysore, from 01 June 2023 to 01 December 2023. Total enumerative Sampling technique was used in the study. A total of 100 patients were selected for this study, who met the inclusion criteria. The Tool used for the study had two sections, one was the demographic details (Age and Gender) and other tool was regarding study variables (To assess the compliance of IV line management and to assess the effect of needle free connectors and Pre -Filled normal saline flush syringes on patients outcome. The Objectives of the study: To use needle free connectors and Pre -Filled normal saline flush syringes on patients for IV Injections. 2. To increase the indwelling time of the cannula and to reduce the overall cost burden on the patients. 3.To assess the effect of needle free connectors and Pre -Filled normal saline flush syringes on patients outcome. Subjects and selection method : This study was conducted at Apollo BGS hospital Mysore from 01 June 2023 to 01 December 2023. We conducted 2 sets of audits over a period of 6 months. The focus was predominantly on 3 Aspects-Tracking, Training and Technology. All healthcare workers were aligned with their support extended. The first audit conducted was considered as baseline data to analyze the existing protocols and practices among the clinicians. A total of 100 patients and 274 peripheral lines were considered for the study. The total indwell time taken observed was 10557 hours. It was learned that a total of 181 (66%) lines

eventually developed phlebitis and were changed for a new line. The focus on maintenance was with regards to flushing and use of needle free connectors on peripheral IV line by the nurses. It was observed that 98 % of the nurses were flushing as per the requirement but only 9% complied with the accurate protocol. Either the flushing volume was insufficient or the prefilled syringe was reused by the staffs. It was also observed to contain blood in them. Other key observations were site dressing noncompliance, unsecured needle free connectors and use of 3way stopcocks (open system). Keeping all these observations in mind, a series of training was initiated amongst all the nursing staff. Two weeks of rigorous training and follow up was done to ensure that new protocols were adhered to, the aim was to ensure that all lines had extension sets and were flushed at regular intervals as per the guidelines of INS and INICC.

The second round of audit was done on another 100 patients and 153 lines. The total indwell time taken was 9327 hours, A total of 49 (32%) lines developed phlebitis. the compliance on flushing and use of needle free connectors was 98.5 %. Implementation of transparent dressing also done for a better visibility of site. It is seen that the average indwell time has increased from 34.2 hours to 60.9 hours. The average cost per line change for a patient was calculated to be around rs.1800(iv set 408 + extension 339 + posiflush 25 +iv dressing 250 +procedure charges 300 + iv cannula 475 + 5 for alcohol swab) . This result in an additional saving of 527 rs per day in terms of direct cost only. Indirect costs will further increase in the form of time and energy spent by the nurse to change the line, additional stress load on the nurse, complication management etc., The study hence proves that the use of proper flushing and extension sets can result in better patient outcomes and also helps in saving costs for the patients. There is still immense scope of for improvement in terms of maintenance and care of IV lines, and we will continue to strive to upgrade its practices.

Variables:
Dependent Variables: Indwelling time of the cannula.
Independent Variables: Pre-filled saline syringes (Posi flush) and Needle free connectors.

Inclusion criteria:
Patients who have IV cannulisation & Injection in BGS Apollo hospital, Mysore. (From June 2023 to December 2023).

Exclusion criteria:
New born & central line patient.

Procedure methodology:

This is a hospital based prospective study, a sample of 100 Patients were selected in the study. This study was carried out on Patients in Apollo BGS Hospital Mysore from 01 June 2023 to 01 December 2023 at Apollo BGS Hospital Mysore. Data was collected from direct observation and evaluate the values by using research statistical method.

Ethical approval:

The institutional Ethics committee – Bio medical research, Apollo BGS hospitals, Mysore accepted the protocol for this study under reference number: EC – CT -2019 – 0114.The study was explained to participants in their native language, and consent was obtained . Confidentiality will be maintained throughout the study.

II. Results

SECTION A: DESCRIPTION OF THE DEMOGRAPHIC VARIABLES OF THE PATIENTS

Table 1: Age-wise frequency, Percentage distribution of patients.
AGE (N= 100)

Majority of the patient age group was from 15 to 30 yrs is 19 (19 %) 31 to 35yrs is 20 (20 %) 46 to 60 yrs is 28 (28 %) 61 to 75yrs is 24 (24 %) 76 to 90 yrs is 09 (9 %)

I) AGE (N= 100)			
1	Age (in years)	Frequency	Percentage %
	15 to 30yrs	19	19%
	31 to 45 yrs	20	20%
	46 to 60 yrs	28	28%
	61 to 75 yrs	24	24%
	76 to 90 yrs	9	9%

Figure 1: Age wise frequency and percentage distribution of Patients

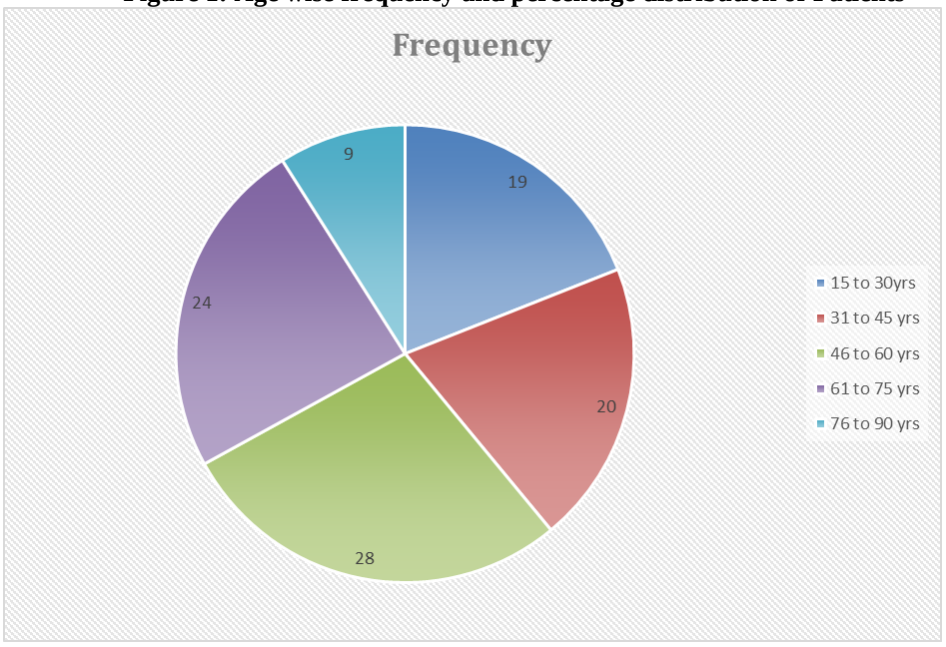


Table 1:Age wise Frequency, Percentage distribution of Patients

II) GENDER (N= 100)

Out of 100 Patients Majority of the Patients were Male 60(60%) and Females were 40 (40%)

	Gender	Frequency	Percentage %
2	Male	60	60%
	Female	40	40%
	Other	0	0

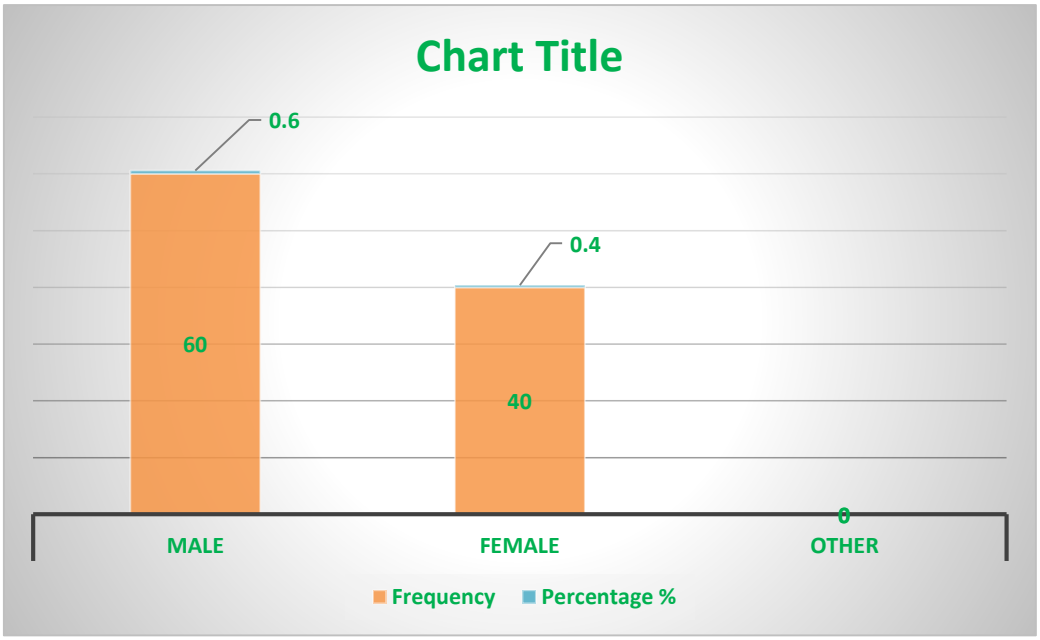


Figure 2: Gender wise frequency and percentage distribution of patients.

SECTION B:

Compliance of use needle free connector and Pre -Filled normal saline flush syringes on patients for IV Injections and to increase indwelling time of the PIVCs Line maintenance Practices : COMPARISON BETWEEN PRE & POST DATA (N = 100)

Table 3:

SN	DATA COLLECTION	POST DATA (N =153)	PRE DATA (N = 274)
1	Total Number of PIVCs used	153	274
2	Total Number of Patients	100	100
3	Average No. of PIVCs per patient	2	3
4	Total Indwelling Time	9328	10557
5	Average Indwelling Time in hours (per cannula)	61	35

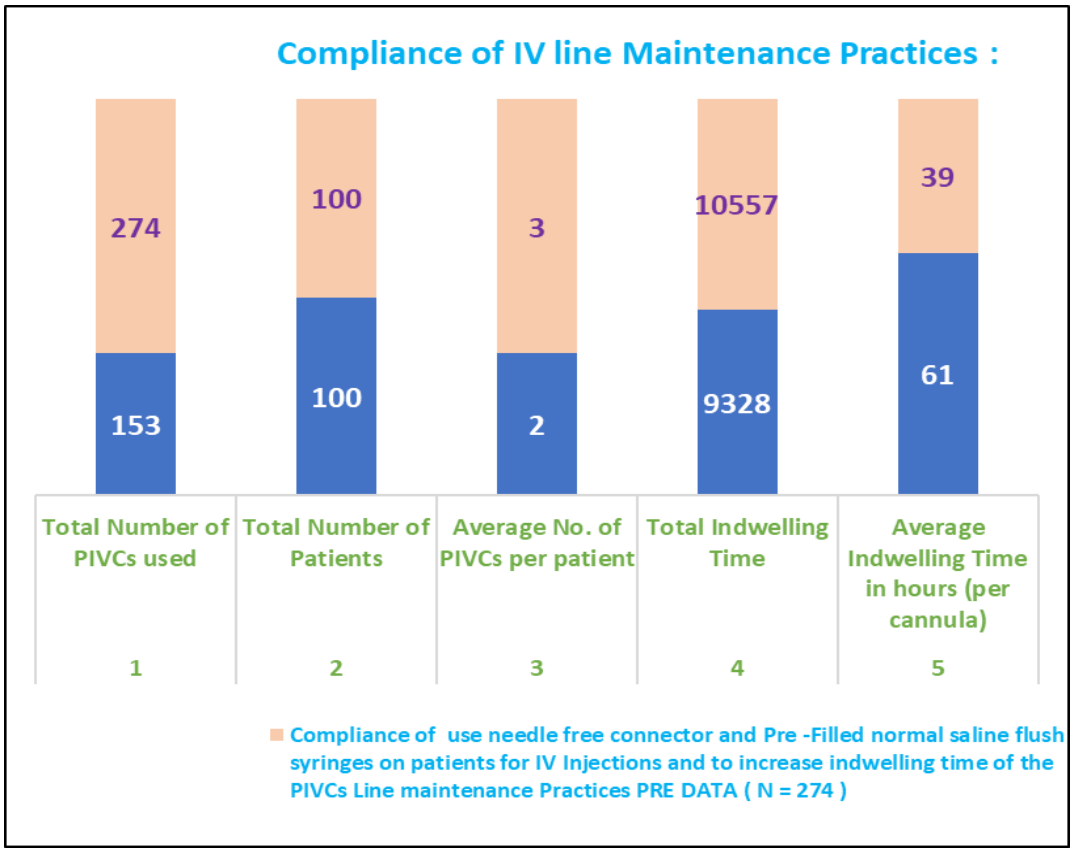


Figure 3: Compliance of IV line maintenance practices.

Table 4:

Compliance of IV Line maintenance Practices			
SN	**DATA COLLECTION**	**POST DATA (N =153)**	**PRE DATA (N = 274)**
6	Total number of times closed ports were used	153	28
7	Total number of times blood was found in line	0	102
8	Total number of times soiled dressing was observed	0	13
9	Total number of times disinfection occurred before access	153	302
10	Total number of times cannula was flushed before access	153	40
11	Total number of times cannula was flushed after access	153	274

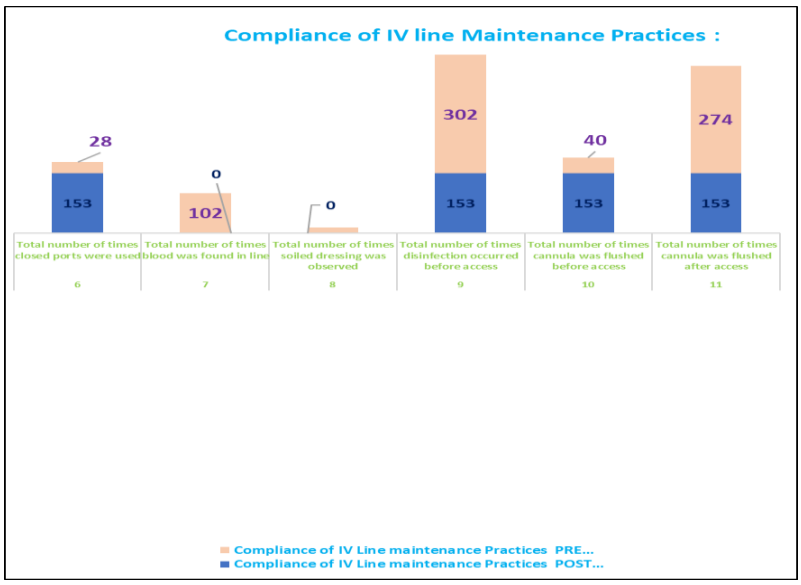


Figure 4: Compliance of IV line maintenance practices.

Table 5:

Compliance of IV Line maintenance Practices : COMPARISON BETWEEN PRE & POST DATA (N = 100)			
SN	**DATA COLLECTION**	**POST DATA (N =153)**	**PRE DATA (N = 274)**
12	Compliance of closed ports with extension %	100%	9%
13	% Instances of blood in line	0%	34%
14	% Instances of soiled dressing	0%	4%
15	Compliance of flushing before access %	100%	70%
16	Compliance of flushing after access % / As per Protocol	100%	85%

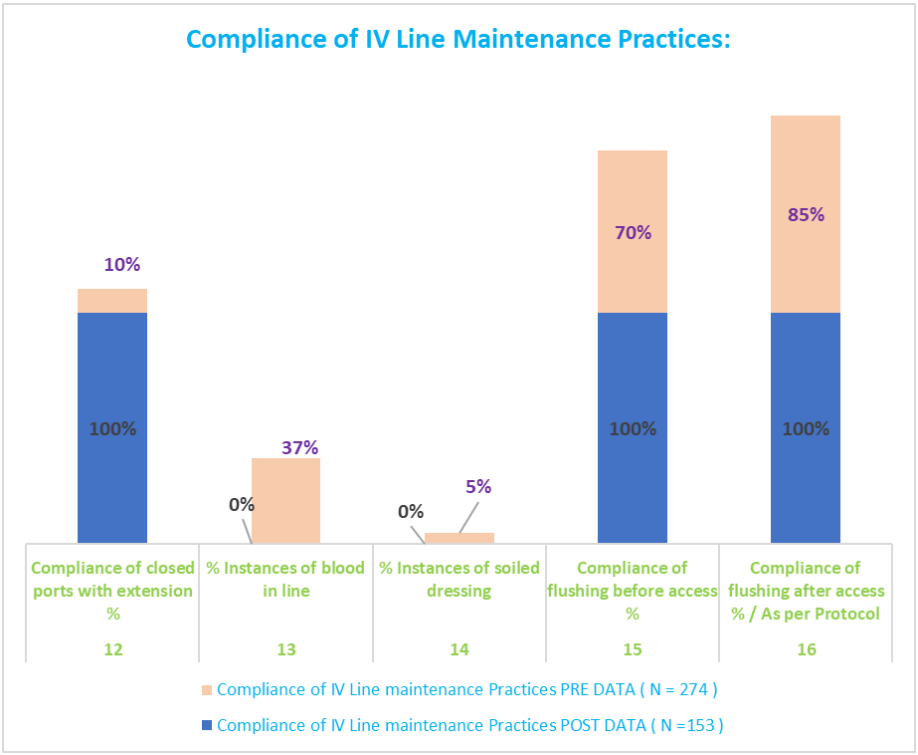


Figure 5: Compliance of IV line maintenance practices.

Table 6:

Compliance of IV Line maintenance Practices			
SN	**DATA COLLECTION**	**POST DATA (N =153)**	**PRE DATA (N = 274)**
17	**Reason's for PIVCs Removal**		
	1.Phlebitis	49	181
	2.Occlusion	0	0
	3.Extravasation	0	0
	4.Infiltration	0	0
	5.Shifted to tablet	10	40
	6.Patient Discharged	123	12

SECTION C:

Table 7 : Assess the effect of needle free connector and Pre -Filled normal saline flush syringes on patient outcome

SN	DATA COLLECTION	POST DATA (N =153)	PRE DATA (N = 274)
1	Total Number of Patients	100	100
2	Average No. of PIVCs per patient	2	3
3	Total Indwelling Time	9328	10557
4	Total Number of PIVCs used	153	274
5	Eventually developped Phlebitis	49	181

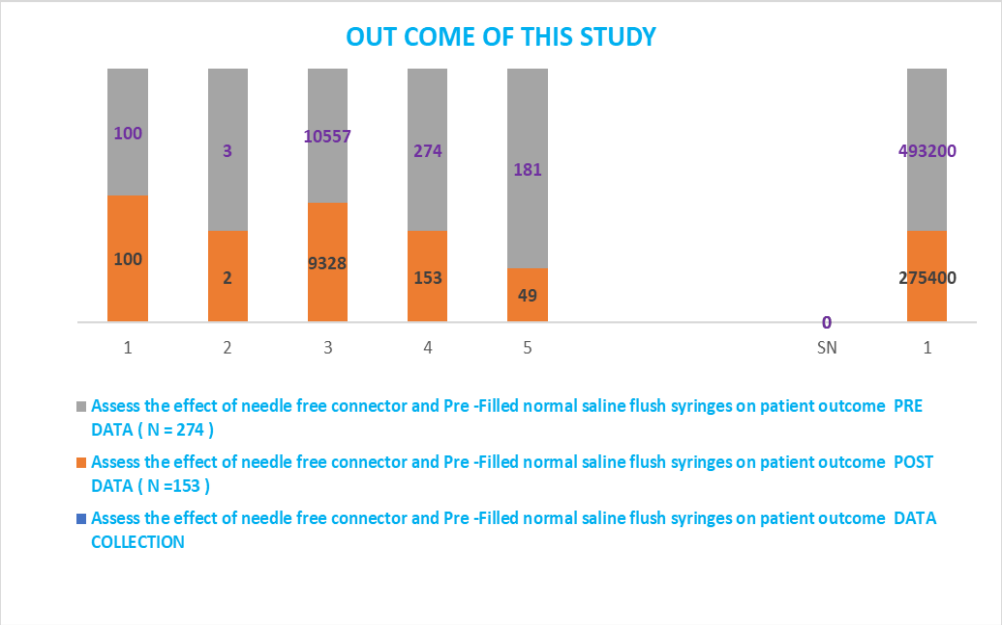


Figure 7 : Effect of needle free connector and Pre -Filled normal saline flush syringes on patient outcome

Table 8 :
Result of Additional savings:

SN	DATA COLLECTION	POST DATA (N =153)	PRE DATA (N = 274)
1	Total Cost	275400	493200
COST SAVED 2,17,800			

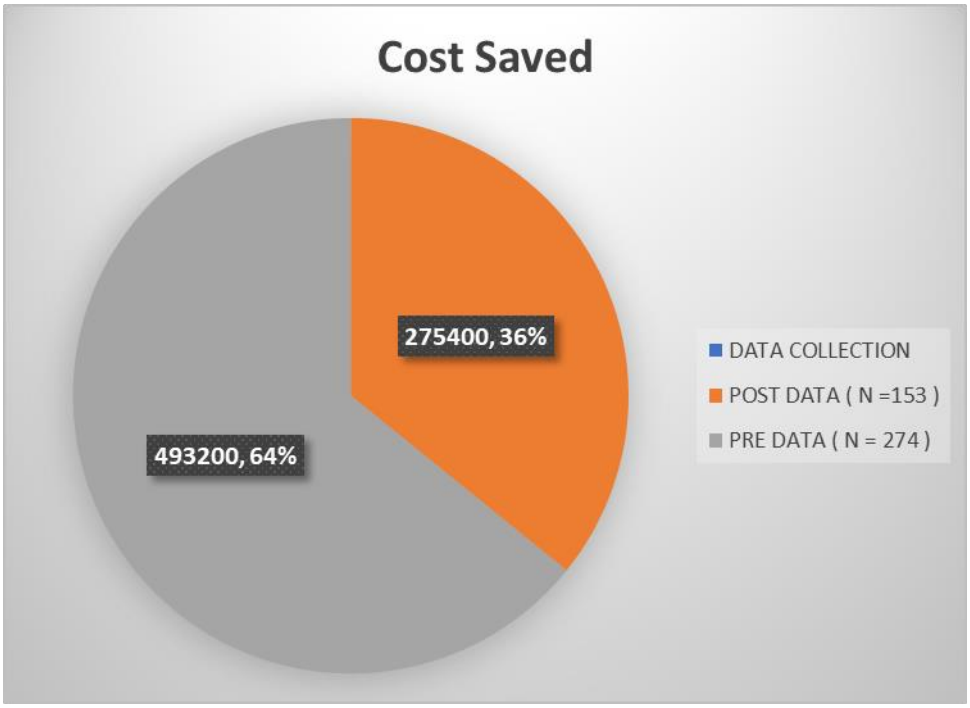


Figure 8 : Cost saving outcome

III. DISCUSSION

The present study was aimed to assess the flushing and use of needle free connector might be increased the cannula indwelling time and reduce the phlebitis. Hospital based prospective study and Quasi experimental design was used in the study. This study was carried out on patients in Apollo BGS Hospital Mysore from June 2023 to December 2023 and the population for the study was selected from Apollo BGS Hospitals, Mysore. The total 100 patients and total number of peripheral lines used for the patients were considered for the study. In this study data collection was made from direct observation on peripheral lines. The objectives of the study were to use needle free connector and Pre -Filled normal saline flush syringes on patients for IV Injections ,to increase indwelling time of the cannula and reduce the overall cost burden for the patients and to assess the effect of needle free connector and Pre -Filled normal saline flush syringes on patient outcome.. The Assumptions of the study was the use of pre-filled saline syringes and needle free connectors significantly reduced peripheral venous catheter failure and increased catheter dwell time. Majority of the patients age group was from 15 to 30 yrs. is 19 (19 %) 31 to 45yrs is 20 (20 %) 46 to 60 yrs. is 28 (28 %) 61 to 75yrs is 24 (24 %) 76 to 90 yrs. is 09 (0.9 %) Out of the 100 patients Majority of the patients were Male 60 (60%) and Females were 40 (40 %). As per the statistical variables as per direct observation total number of PIVCs used for the patients was, post data 153 and in pre data 274.average number of PIVCs per patient was,post data 2 and in pre data 1.Total indwelling time was, post data 9328 and in pre data 10557.Average indwelling time in hours (per cannula) was, post data 61hours and in pre data 35hours.total number of closed ports used were used was,post data 153 and in pre data 28,Total number of time blood found on line was,post data 0 times and in pre data 102 times,Total number of times soiled dressing was observed,post data 0times and in pre data 13 times,Total number of time disinfection occurred before access was,post data 153 times and in pre data 302 times,Total number of times cannula was flushed before access was,post data 153and in pre data 40,Total number of times cannula was flushed after access was,post data 153and in pre data 274,Reasons for PIVCs removal was in post data (due to phlebitis 49)and in pre data 181cannulas. For some of the patients all injections stopped and shifted to tablet ,the count was, post data 10 and in pre data 40,Due to discharge in post data 123 and in pre data 12 cannula s removed.Cost per cannula in pre audit 4,93200(64 %) and in post audit 2,75,000(36%) .The study concluded that,the use of proper flushing and extension sets can result in better patient outcomes and also helps in saving costs for the patients.there is still immense scope for improvement in terms of maintenance and care of IV lines and this study highlights the importance of refining procedures to optimize patient care and resource utilization within health care setting.

IV. Conclusion

In a world of advancing healthcare,there is immense focus being given to patient safety.The entire healthcare system has transitioned to ensure best patient outcomes.And hence today,in this context line care

management has turned up to be one of the most critical attributes in a hospitals, we always strive to do what is best for our patients.And in an effort to improve the quality of care, this year we decided to focus on IV line maintenance and care.

We conducted 2 sets of audits over a period of 6 months. The focus was predominantly on 3 Aspects-Tracking, Training and Technology. All healthcare workers were aligned with their support extended. The first audit conducted was considered as baseline data to analyze the existing protocols and practices among the nurses. A total of 100 patients and 274 peripheral lines were considered for the study. The total indwell time taken observed was 10557 hours. It was learned that a total of 181 (66%) lines eventually developed phlebitis and were changed for a new line. The focus on maintenance was with regards to flushing and use of needle free connectors on peripheral IV line by the nurses. It was observed that 98 % of the nurses were flushing as per the requirement but only 9% complied with the accurate protocol. Either the flushing volume was insufficient or the prefilled syringe was reused by the staffs. It was also observed to contain blood in them. Other key observations were site dressing noncompliance, unsecure needle free connectors and use of 3way stopcocks (open system). Keeping all these observations in mind, a series of training was initiated amongst all the nursing staff. Two weeks of rigorous training and follow up was done to ensure that new protocols were adhered to, The aim was to ensure that all lines had extension sets and were flushed at regular intervals as per the guidelines of INS and INICC.

The second round of audit was done on another 100 patients and 153lines.the total indwell time taken was 9327 hours, a total of 49 (32%) lines developed phlebitis. The compliance on flushing and use of needle free connectors was 98.5 %. Implementation of transparent dressing also done for a better visibility of site.

It is seen that the average indwell time has increased from 34.2 hours to 60.9 hours. The average cost per line change for a patient was calculated to be around rs.1800(iv set 408 + extension 339 + Pre Filled Normal Saline Syringes 25Rs +iv dressing 250 +procedure charges 300 + iv cannula 475 + 5 for alcohol swab) . This result in an additional saving of 527 rs per day in terms of direct cost only. Indirect costs will further increase in the form of time and energy spent by the nurse to change the line, additional stress load on the nurse, complication management etc…

The study hence proves that the use of proper flushing and extension sets can result in better patient outcomes and also helps in saving costs for the patients. There is still immense scope of for improvement in terms of maintenance and care of IV lines, and we will continue to strive to upgrade its practices.

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