



Original Research Article

## Comparative Efficacy of Heparin Saline and Normal Saline Flush for Maintaining Patency of Peripheral Intravenous Lines: A Randomized Control Trial

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### ABSTRACT

**Background and Aims:** The purpose of this study was to compare the efficacy of normal saline with heparin saline flush in keeping peripheral intravenous (IV) lines patent among patients admitted in medical and surgical wards of selected hospital.

**Subjects and Method:** Conveniently recruited 75 patients were equally randomized into 3 groups i.e. Control Group, Normal Saline group and heparin saline group. Normal saline flush (1ml) using SAS technique (Saline flush, Administration of drug, followed by Saline flush) and heparin saline flush (10 units heparin in 1 ml of normal saline) using SASH technique (Saline flush, Administration of drug followed by Saline Flush proceeded by Heparin saline flush) was administered in normal saline and heparin saline group respectively each-time following IV medication administration consecutively for 72 hours; with no intervention in control group.

**Results:** There was significant difference ( $p < 0.05$ ) in duration of patency of IV line between control group ( $53.84 \pm 19.46$  hours) and normal saline group ( $64.44 \pm 14.70$  hours); and between control group and heparin saline group ( $66.96 \pm 11.70$  hours). However, normal saline and heparin saline group had no significant difference in duration of patency of IV line ( $p = 0.50$ ).

**Conclusion:** The study concludes that normal saline is as effective as heparin saline in maintaining patency of IV lines.

**Key words:** Heparin saline flush; Intravenous lines; Normal saline flush; Patency; Phlebitis.

### INTRODUCTION

In rapidly growing number of patients who do not require continuous fluids intra-venously, it is desirable to provide an immediately accessible, established intravenous route for intermittent intravenous drugs administration in the form

of Peripheral Intravenous Devices. Maintenance of the patency of these indwelling catheters in a peripheral vein is an important concern. Once placed, the peripheral lines may be left in place for days. However, if they become occluded by clotted blood or some other mechanical

obstruction then they cannot be cleared by flushing agents. Thus while a person is hospitalized, the nurse need to check the IV site off and on to make sure the catheter remains in the vein. If the IV line is not delivering a continuous solution, the nurse has to flush the catheter routinely to prevent it from clotting.

Maintenance of the patency of indwelling catheters in a peripheral vein is important for minimizing patient's discomfort and the expense associated with replacement. Heparin Flush solutions in low doses i.e.10-100 units of preservative free heparin in 1 ml of preservative free NS can be used to flush the I/V lines. On the other hand Saline is compatible with most of the medications when administered intravenously, less expensive, less irritating to veins and also incidence of phlebitis and pain is less.

Heparin sodium used to be the traditionally used medication as anticoagulant in Intravenous catheters in order to prevent clotting, & minimize the incidence of phlebitis.<sup>[1]</sup> Heparin infusion prolongs the duration of peripherally inserted central venous catheter usability, which permits a higher percentage of therapy completion without increasing adverse effects.<sup>[2]</sup> Jeannette Robertson (1994)<sup>[3]</sup> and other studies<sup>[4]</sup> also found heparinized saline solution as a superior flushing agent to normal saline For IV lines in a randomized control trial on one fifty two inpatients between the ages of 2 months and 18 years.

However, although health caregivers believe that small doses of heparin used in flushing of peripheral intravenous lines are harmless, heparin could cause many side effects like hemorrhage, allergic reactions, thrombocytopenia and pain at the injection site.<sup>[5,6]</sup> Heparin could also have interaction with many other frequently used medications, like acetylsalicylic acid,

antihistamines, digoxin etc. So its use premises good knowledge of incompatibility between drugs.<sup>[7]</sup>

Various studies performed all over the world in various racial and ethnic groups to compare the effect of heparin versus saline solution on intermittent infusion device irrigation showed Normal saline as better option for flushing IV lines than Heparin saline as it overcomes the hazards of later<sup>[8-16]</sup> however, fewer data is available from India regarding this issue.

The hospital protocols for flushing IV lines vary from the no flushing, use of 0.9% NS solution to the use of 10-100 units of heparin in India. There were lots of differences about maintaining the peripheral IV lines, even in the same hospital. Also, in this current era of economic crisis, cost-effectiveness has become a top priority for healthcare organizations as well as the patients. LeDuc K (1997)<sup>[17]</sup> in a prospective study to assess efficacy of normal saline solution versus heparin solution for maintaining patency of peripheral intravenous catheters estimated annual savings of nursing time and unit cost of solutions equaling \$27,594 in normal saline group. The savings per procedure was estimated at \$9.45. Cost saving with the use of Normal Saline Flush as compared to Heparin Saline flush is also reported in few western studies.<sup>[18,19]</sup>

There are no universal directives governing the most appropriate form in which to implement it, while maintenance of the patency of these catheters is essential as re-citing a catheter may produce discomfort to patients and increases health care cost.

As balancing the risks and benefits of catheter maintenance techniques is becoming need of the hour, the researcher decided to compare efficacy of heparin versus normal saline to provide patient with cost effective and evidenced based care.

## MATERIALS AND METHODS

**Setting and Sample:** The volunteer adult subjects (N=75) with newly inserted peripheral intravenous lines admitted in medical and surgical wards of selected hospital, and meeting inclusion and exclusion criteria were recruited in this study. Criteria for inclusion in the study included patients having newly inserted peripheral intravenous line of size 22 G and braun brand, inserted by staff nurses, patients receiving IV medicine thrice a day and those who were willing to participate. However patients with coagulopathy, altered coagulation profile, hypertensive disorder, aneurysm, history of hemorrhagic stroke, receiving chemotherapy, steroid therapy, perioperative heparin, anti - coagulants and thrombolytic therapy, with absolute contraindication to heparin and receiving stat ordered IV drugs, Platelet and blood

transfusion within 72 hours of IV line insertion were excluded from the study.

**Operational Definitions:** Patency was defined as free flow of 1ml of normal saline and medication through a peripheral venous catheter and absence of phlebitis.

Phlebitis was defined as the presence of one or more of symptoms like pain, erythema at access site, edema, streak formation, palpable venous cord, and purulent discharge at access site as per infusion nursing standard of practice, 2011.

**Data Collection Procedure:** Written permission was taken from Institutional Ethics Committee of selected Hospital. Permission has also been taken from Medical Superintendent and concerned heads of the department. Written consent was taken from the subjects before starting the study. It was ensured that prescribed treatment of patient was not affected.

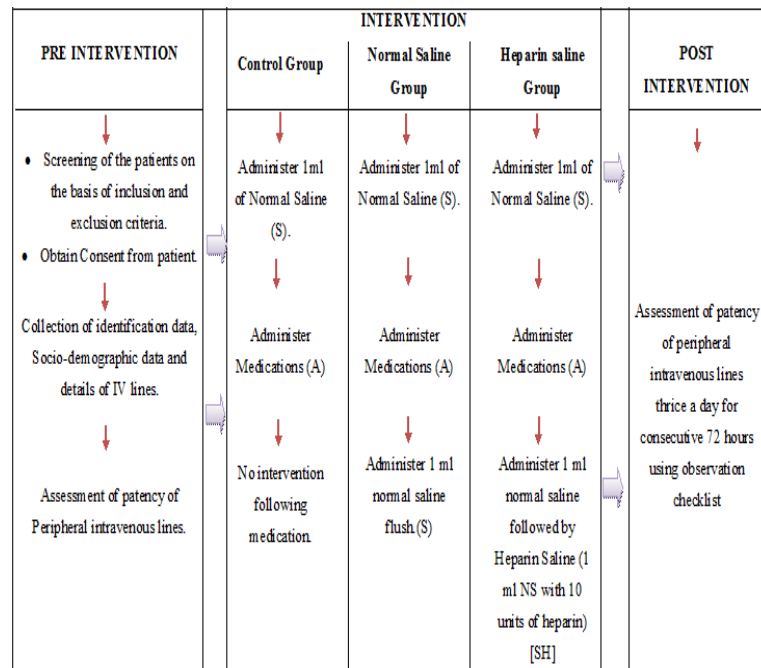


Figure 1: Algorithm of data collection & intervention.

Subjects who agreed to participate in the study and who met inclusion criteria were randomly assigned to control, normal saline and heparin saline group using lottery

method with 25 subjects in each group. The time of insertion of peripheral IV lines was noted. In all the three groups' patency was assessed by ability to irrigate the IV lines

with 1 ml of normal saline without resistance before administering medicine. In the normal saline group following patency assessment and medication administration, IV lines were flushed with 1 ml of normal saline by using push and pause method and SAS technique. In the heparin saline group, following patency assessment and medication administration IV lines were flushed with 1 ml of normal saline proceeded by 1ml of heparin saline which contains 10 units heparin in 1 ml of normal saline by using push and pause method and SASH technique. No intervention was done following IV medication in the control group. Patency was assessed in all the three groups thrice a day for consecutive 72 hours (3days), every time before administering medicine. If lines were found to be non patent they were removed and time and date of removal along with the reason of removal was mentioned in the observation checklist. Inferential and descriptive statistics were used to analyse the data. (Figure 1)

**Measurements and variables:**

Sociodemographic variables as age, gender, occupation and habitat were included in the study to describe the sample characteristics. Intravenous line variables such as Site of cannulation, Attempt of IV cannulation, Avoidance of previous puncture mark for cannulation, Avoidance of Joint for cannulation, Total amount of IV fluid per day and Type of medication administered were included in the study. An observational checklist to assess the patency of IV lines and reason for removal of IV lines was used.

**Statistical Analysis:** The data was analyzed using statistical software i.e. SPSS.<sup>[19]</sup> The various statistical measures used for analysis included frequency distribution, measures of central tendency (mean), measures of dispersion (standard deviation) t- test and chi square test was applied to find out the statistical significance.

**RESULTS**

The study found that there was significant difference ( $p < 0.05$ ) in duration of patency of IV line between control group ( $53.84 \pm 19.46$  hours) and normal saline group ( $64.44 \pm 14.70$  hours); and between control group and heparin saline group ( $66.96 \pm 11.70$  hours). However, normal saline and heparin saline group had no significant difference in duration of patency of IV line ( $p = 0.50$ ). Control group had double the prevalence of phlebitis with 6 (24%) than normal saline (12%) and heparin saline (12%) group ( $p = 0.40$ ).

Table 1: Comparison of Patency of IV Line in Control and Normal Saline Group n= 50.

Patency of IV lines as per days	Control Group (n=25)	Normal Saline Group (n=25)	$\chi^2$ statistics
	f(%)	f(%)	
<i>Day 1</i>			N/A
Patent Lines	25(100)	25(100)	
Non-Patent Lines	----	----	
<i>Day 2</i>			$\chi^2 = 2.91$ df=1 p = 0.08 <sup>NS</sup>
Patent Lines	17 (68)	22 (88)	
Non-Patent Lines	08 (32)	03 (12)	
<i>Day 3</i>			$\chi^2 = 4.15$ df=1 p = 0.04*
Patent Lines	12 (48)	19 (76)	
Non-Patent Lines	13 (52)	06 (24)	

\* = significant at  $p < 0.05$  NS = Non-significant N/A= Non-applicable

Table 2: Comparison of Patency of IV line in Control and Heparin Saline Group n= 50

Patency of IV lines as per days	Control Group (n=25)	Heparin Saline Group (n=25)	$\chi^2$ statistics
	f(%)	f(%)	
<i>Day 1</i>			N/A
Patent Lines	25(100)	25(100)	
Non-Patent Lines	----	----	
<i>Day 2</i>			$\chi^2 = 6.63$ df=1 p = 0.009**
Patent Lines	17 (68)	24 (96)	
Non-Patent Lines	08 (32)	01 (04)	
<i>Day 3</i>			$\chi^2 = 5.55$ df=1 p = 0.02*
Patent Lines	12 (48)	20 (80)	
Non-Patent Lines	13 (52)	05 (20)	

\* = significant at  $p < 0.05$  \*\*=significant at  $p < 0.01$   
NS = Non-significant N/A= Non-applicable

At the end of 3<sup>rd</sup> day, significantly more<sup>[13]</sup> IV lines in control group became non patent as compared to 6 lines in normal saline group ( $p=0.04$ ), depicting intermittent flushing with normal saline 1ml is effective than no flushing of peripheral IV lines (Table 1). In the course of time 20 lines

remained patent in heparin saline group at the end of 3<sup>rd</sup> day as compared to just 12 IV lines in control group, which was statistically significant at 0.05 level (p=0.02), signifying flushing of IV lines with heparin saline as an effective measure to keep IV lines patent ( Table 2). However almost equal number of lines became non

patent in both the groups at the end of 3<sup>rd</sup> day with 6 and 5 non patent lines in normal saline and heparin saline groups respectively, indicating no difference in efficacy of normal saline and heparin saline in maintaining patency of peripheral IV lines (refer table 3).

Table 3: Comparison of Patency of IV Lines in Normal Saline and Heparin Saline Group n= 50

Patency of IV lines as per days	Normal Saline Group(n=25)	Heparin Saline Group(n=25)	$\chi^2$ statistics
	f (%)	f (%)	
Day 1 Patent Lines Non-Patent Lines	25(100) -----	25(100) -----	N/A
Day 2 Patent Lines Non-Patent Lines	22 (88) 03 (12)	24 (96) 01 (04)	$\chi^2 = 1.08$ df=1 p = 0.29 <sup>NS</sup>
Day 3 Patent Lines Non-Patent Lines	19 (76) 06 (24)	20 (80) 05 (20)	$\chi^2 = 0.12$ df=1 p = 0.73 <sup>NS</sup>

NS = Non-significant  
N/A= Non-applicable

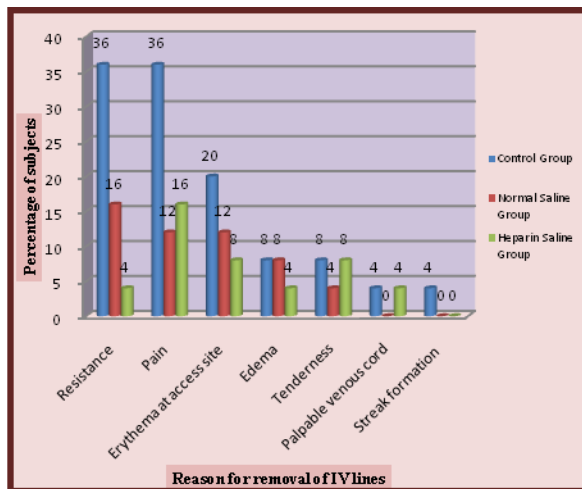


Figure 2: Reason for removal of peripheral IV lines before completion of 72 hours of therapy.

Maximum lines (16%) were removed in normal saline group due to resistance in IV lines, followed by pain (12%) and erythema at access site (12%). However, tenderness was present in least (4%) IV lines, in Normal saline group. No IV line flushed with normal saline developed palpable venous Cord and streak formation. On the contrary pain (16%) was the

dominating reason for removal of IV lines in heparin saline group, followed by erythema at access site (8%). Furthermore, resistance (4%), edema (4%) and palpable venous cord (4%) were minimum reason for removal of IV lines in the respective group. None of the IV line flushed with heparin saline had streak formation (Figure 2).

## DISCUSSION

The present study was conducted on subjects with age 18 years or above. Maximum number of subjects in all three groups i.e. Control Group, Normal saline and Heparin saline group were between age group of 18 – 40 years. All the 75 patients had IV cannula of same brand i.e. braun of size 22 G and IV cannulation done by nurses. The study found that intermittent flushing with either normal saline or heparin saline significantly increases the duration of patency of peripheral IV lines as compared to no flushing. However the study showed no significant difference (p=0.50) in mean duration of patency of IV lines when flushed

with either normal saline ( $64.44 \pm 14.70$  hours) or heparin saline ( $66.96 \pm 11.70$  hours).

The present study found that there is no significant difference in number of patent IV lines in normal saline<sup>[19]</sup> and heparin saline<sup>[20]</sup> group at the end of 3<sup>rd</sup> day ( $p=0.73$ ). It suggests that normal saline is as effective as heparin saline in maintaining patency of peripheral IV lines. The finding of study are consistent with several other studies indicating normal saline equally effective as heparin saline for flushing IV lines.<sup>[13,14,16,20-22]</sup>

The present study reveals no difference in incidence of phlebitis when lines are either flushed with normal saline or heparin saline.

In the present study no significant association was present between age, gender, avoidance of joints for cannulation, total amount of IV fluid per day and patency of IV lines.

#### Implications for practice

The study suggested use of normal saline flush to ensure cost effective and evidence based care to patients. Furthermore replacing Heparin saline with normal saline flush will ensure safe patient care by eliminating the risk of drug incompatibility with flushing agent and over dosage of heparin flush.

#### CONCLUSION

The study found non-significant difference between duration of patency of IV lines in normal saline and heparin saline group, concluding normal saline as effective as heparin saline flush for maintaining patency of peripheral IV lines. We suggest using saline flush instead of heparin flush to maintain the peripheral intravenous lines. Switching to normal saline will eliminate the risk related to heparin saline such as drug incompatibilities, thrombocytopenia and will be cost effective.

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