Effect of Normal Saline Versus Heparin Flush Solution on Peripheral Intravenous Cannula Patency for Patients Receiving Intermittent Intravenous Medication

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Abstract

Background: Among hospitalized patients, intravenous catheterization is the most commonly performed invasive procedure. To ensure the continued administration of IV medications and to mitigate issues related to the cannula, it is essential to maintain a "non-infusing" peripheral intravenous cannula line. **Aim**: This study aimed to evaluate the effect of normal saline versus heparin flush solution on peripheral intravenous cannula patency for patients receiving intermittent intravenous medication. **Design**: A quasi-experimental research design utilizing a pre-test post-test control group framework was employed to fulfill the study's objective. **Settings**: The research was carried out in the Medical Department at Sohag University Hospital, Egypt. **Sample**: The study sample consisted of patients with peripheral IV cannulas who were receiving intermittent IV medications. A total of 150 samples were selected using a convenient sampling technique, which were randomly assigned into three equal groups (50 each): experimental group 1 (normal saline flush), experimental group 2 (heparin saline flush), and a control group. **Two tools were utilized for data collection:** Tool (I): A structured interview questionnaire comprising three sections; section (I): Patient personal characteristics, section (II): Medical data of patients, section (III): Factors influencing the administration of IV medications, and Tool (II): An observation checklist. **Results**: The results of the present study revealed a significant relationship between the patency of peripheral IV cannulas and the flushing method employed. A noteworthy correlation was identified between the normal saline and heparin saline groups. Additionally, there was a significant variation in the average scores of local vascular complications among all three groups, with the control group showing the highest average score. Nevertheless, no significant difference was detected between the average IV complication scores of the normal saline and heparin saline groups. The study concluded that flushing IV cannulas is highly effective, and both normal saline and heparin saline flush (10 units) are equally effective in maintaining the patency of peripheral IV cannulas and preventing complications. **Conclusion**: Saline flush and heparin saline flush demonstrate comparable effectiveness in preserving patency and preventing local vascular complications in intravenous applications. The practice of using heparin as a flushing agent may be replaced with normal saline flush, which is both safer and more cost-effective than heparin saline flush. The use of normal saline appears to be more beneficial than the heparin solution in maintaining the patency of peripheral venous catheters. **Recommendations**: Normal saline should be regarded as an alternative to heparin for application in intravenous catheters.

Keywords: Heparin flush solution, Normal saline, Peripheral intravenous cannula patency , Patients receiving intermittent intravenous medication.

Introduction:

The majority of patients who are admitted to the hospital, a peripheral intravenous catheter is placed for either continuous or intermittent delivery of fluids and medications. Given the widespread use of peripheral venous catheters for intravenous infusions, the significance of flushing these catheters has garnered considerable attention from numerous healthcare professionals. Ensuring the patency and functionality of the venous catheter is crucial in minimizing pain, discomfort, and costs related to its replacement, as well as in preventing complications such as catheter blockage, thrombophlebitis, visible scarring, and infections **(Wang et al., 2020).**

Maintaining the patency of venous catheters has been of concern to many researchers since the mid-1970s. Today, both heparin and normal saline are used to flush venous catheters although there is no convincing evidence in favor of heparin. The instructions of some clinicians recommend washing the peripheral intravenous cannula with heparin solution as it is believed that the antithrombotic properties of heparin will more effectively prevent the accumulation of red blood cells and thus the thrombus formation **(Xu et al., 2022).**

Heparin is a sulfated polysaccharide belonging to the glycosaminoglycan family with strong anticoagulant activity. It has been widely used for the insertion and maintenance

of intravascular catheters in patients requiring intra- venous medication **(Patidar et al., 2024).** Regarding the mechanism of action, heparin binds to the Wang et al, antithrombin III by inducing a change in its molecule and accelerating the thrombin inactivation **(Wang et al., 2022)**. It is believed that heparin prevents the formation of thrombus in the intravascular catheter, but since the 1980s, the necessity of the heparin solution for peripheral intravenous cannula flushing has been questioned in several clinical trials. In addition, heparin may interact with many commonly used drugs, such as acetylsalicylic acid, antihistamines, digoxin and others, therefore its use requires good knowledge of incompatibility between drugs **(You et al., 2020).**

A study by **Choudhary (2023)** involving 1,000 patients found that 2 ml intermittent normal saline flushing every two hours maintained the patency of peripheral IV cannulas, reducing the need for frequent removal and insertion. Comparison with Heparin Saline: Research by **Patidar (2024)** compared the efficacy of heparin saline and normal saline flushes in 75 patients. While the study's specific findings aren't detailed, other studies suggest that both solutions are equally effective in maintaining cannula patency. Benefits of Normal Saline: Normal saline flushes have several benefits, including Reduced Patient Discomfort: Normal saline flushes may cause less discomfort compared to heparin saline flushes. Lower Healthcare Costs: Using normal saline flushes can reduce healthcare costs, as it's a more cost-effective solution. Equal Effectiveness: Studies have consistently shown that normal saline and heparin saline flushes have similar effectiveness in maintaining cannula patency. Overall, normal saline flushes appear to be a reliable and cost-effective option for maintaining peripheral IV cannula patency, with benefits for both patients and healthcare providers.

Maintaining the patency of peripheral intravenous cannulas is crucial for Continuing IV medications: Ensuring uninterrupted treatment and Preventing complications: Reducing the risk of cannula-related issues. Heparin sodium was traditionally used for flushing IV cannulas, but it has several side effects, including, Hemorrhage: Increased risk of bleeding, Allergic reactions: Potential for adverse reactions, Thrombocytopenia: Low platelet count, and Pain at the injection site: Discomfort for patients **(Ashton , 2020).**

There is ongoing debate about the best method for maintaining IV cannula patency. Nurses play a vital role in ensuring the proper functioning of peripheral IV cannulas, which can Reduce costs: Minimizing the need for repeated cannula insertion, Save time: Decreasing the time spent on IV line maintenance, Improve patient outcomes: Reducing stress, pain, and local vascular complications Given the importance of IV cannula patency and the limitations of heparin, it's essential to explore alternative solutions that are safe, effective, and minimize complications **(Hephzibah ,2020).**

Hospital protocols for the maintenance of venous catheters vary from lack of flushing, the use of normal saline 0.9% and the use of heparin solution (10-100 IU/ml). There are many differences in the maintenance of peripheral ve- nous lines, even in the same hospital **(Patidar et al., 2024).**

The Queensland Government's guidelines (2023) of Australia for the maintenance of the peripheral intravenous cannula, recommend flushing the PIVC with saline, using only single-dose solutions (ampoule). A sufficient volume of the flushing solution should be at least 2ml. PIVC flushing should be performed immediately after insertion, before and after IV administration and at least every 24h if not used (strong indication for removal) **(Institute for Safe Medication Practices, 2023).**

The guidelines of the Western Australia Department of Health (2022) recommend washing the peripheral intravenous cannula with normal saline, using a 5-10 ml of solution. Flushing of peripheral intravenous cannula should be done after its insertion, before and after each use, be- tween multiple drug injections to avoid interactions and incompatibilities and at least every 12h if the peripheral intravenous cannula is not used (strong indication for removal if not access has been made for 12h) .

Significance of the study:

These central lines will remain in place for days or even weeks each time. Prolonged use may result in catheter occlusion, which may give rise to a requirement for the catheter to be treated, removed or replaced. Inserting a new central line creates latent threats, which could lead to disrupted treatment, increasing morbidity, and greater spending on health care **(Schallom et al., 2022).** Generally, catheter obstruction can be defined as partial occlusion (inability to aspirate blood but ability to flush freely) or complete occlusion (inability to flush freely and with- draw blood). It is estimated that the occlusion rate is

be- tween 0% and 33% when using heparin saline (HS) solution **(Mitchell et al., 2021).** Factors leading to catheter obstruction can be generally classified into three categories: mechan- ical causes, drug/mineral precipitates and clot formation, which is the most common reason overall. To avoid the risk of catheter occlusion, thrombosis and catheter- related bloodstream infection (CRBSI), proper catheter flushing and locking are always considered to be the pri- mary intervention because of the effect of reducing blood reflux into the lumen **(Goossens , 2019).**

There have been numerous publications in this field over the last few years, including a guideline **(Schiffer et al., 2023)**, several trials **(Heidari et al., 2019; Schallom et al., 2022)** and several reviews **(Mitchell et al., 2021; ,Goossens , 2019).** Most of these studies indicate that normal saline (NS) is safe and efficacious in preventing catheter occlusion in adult populations with CVCs. The recent guideline concluded that routine flushing with NS is recommended. However, the Cochrane review showed that there is no clear evidence to indicate whether NS flushing is superior to flushing with HS solution **(Skinner et al., 2019).** Therefore, the study was conducted to evaluate the effect of normal saline versus heparin flush solution on peripheral intravenous cannula patency for patients receiving intermittent intravenous medication.

Aim of the study:

To evaluate the effect of normal saline versus heparin flush solution on peripheral intravenous cannula patency for patients receiving intermittent intravenous medication.

Research hypothesis:

Normal saline and heparin flush solution expected to have a positive effect on maintaining peripheral intravenous cannula patency for patients receiving intermittent intravenous medication.

Subjects and Method:

Research design:

A quasi-experimental research design was employed for this study. Pre-test post-test control group quasi-experimental research design was utilized to achieve the aim of the current study. A quasi-experimental design is one type of experimental design that is very similar to the true experimental design except it lacks one criterion as randomization or control (**Gray et al., 2019).**

Settings:
The study was conducted in Medical Department at Sohag University Hospital, Egypt.

Sample:
The study consisted of 150 patients with peripheral IV cannulas receiving intermittent IV medications, divided into three groups:

- Experimental Group 1: Normal saline flush (n=50)
- Experimental Group 2: Heparin saline flush (n=50)
- Control Group: No intervention or standard care (n=50)

Sampling Technique
The samples were selected using a convenient sampling technique, and participants were assigned to one of the three groups.

Data collection tool:

After evaluating the pertinent literature and research data **(De la Cruz et al., 2019; Cohen et al., 2020; Onyeneho et al., 2021),** the researchers created the following tools which included:

Tool I: A Structured interview questionnaire

This tool included three parts;
Part (I): Patients' demographic characteristics; It consisted of 4 items for obtaining information about the selected **personal characteristics** such as patient age, gender, residence, and working status.
Part (II): Data relevant to patient health: Patient Information: This section collected data on: Date of admission, Diagnosis, Previous hospitalizations including Cause and Duration.

This information likely helped provide context for the patient's medical history and current condition.

Part (III): Factors related to patients involved in the administration of IV medication: The study collected data on 9 items, categorized into 3 main areas:

1. IV Cannula-Related Factors
- Date and time of insertion
- Individual who inserted the cannula
- Size of the IV cannula
- Duration of insertion

2. Patient-Related Factors
- Site of IV cannula
- Avoidance of previous insertion sites
- Patient's activity level

3. Treatment-Related Factors
- Duration of IV therapy
- Type of medication administered

These factors were likely analyzed to identify potential associations with IV cannula patency and complications.

Tool:(II): Observation checklist: The study used two observation schedules:

Section I: IV Cannula Patency Assessment

- Single item to evaluate patency
- Assessment based on:
  - Resistance felt when pushing distilled water through the cannula
  - Observation of any leakage from the cannula

Section II: Local Vascular Complications Assessment

- 3 items to evaluate complications:

1. Thrombophlebitis: Assessed using the Visual Infusion Phlebitis Score
2. Infiltration: Evaluated using the Infiltration Scale (Infusion Nurses Society)
3. Pain: Measured using the Universal Numeric Pain Rating Scale

These standardized tools helped ensure accurate and reliable data collection on IV cannula patency and local vascular complications.

A- Visual Infusion Phlebitis (VIP) Scale

Score	Observation
0	IV site appears healthy
1	One of the following is evident: • Slight pain near IV site • Slight redness near IV site
2	Two of the following are evident: • Pain at IV site • Erythema • Swelling
3	All of the follwoing signs are evident: • Pain along path of cannula • Erythema • Induration • Palpable venous cord
4	All of the following signs are evident and extensive: • Pain along path of cannula • Erythema • Induration • Palpable venous cord

B -Infiltration Scale

Grade	Clinical Criteria
0	No symptoms
1	Skin blanched Edema < 1 inch in any direction Cool to the touch With or without pain
2	Skin blanched Edema 1 to 6 inches in any direction Cool to the touch With or without pain
3	Skin blanched Gross edema >6 inches in any direction Cool to the touch Mild to moderate pain Possible numbness (per resident)
4	Skin blanched, translucent Skin tight, leaking Skin discolored, bruised, swollen Gross edema > 6 inches in any direction Deep pitting tissue edema. Circulatory impairment Moderate to severe pain. Infiltration of any amount of blood products, irritant, or vesicant.

Source: Infusion Nurses Society. Infusion Nursing Standards of Practice. *Journal of Intravenous Nursing* **Supplement 23 (6S) Standard 60: Infiltration, p. 57(s).**

C:- Numeric Rating Scale (NRS) for pain: **(Hawker et al., 2011)**:

Pain Assessment Tools

A widely used scale to measure pain severity. However, its reliability varies between literate (r = 0.94) and illiterate patients (r = 0.71).

2. Numeric Rating Scale (NRS): An 11-point scale (0-10) to rate pain intensity. The NRS has strong test-retest reliability in both literate (r = 0.96) and illiterate patients (r = 0.95).

NRS Pain Severity Classification

The NRS classifies pain severity as follows:

- 0: No pain
- 1-3: Mild pain
- 4-6: Moderate pain
- 7-10: Severe pain

The NRS is a reliable tool for assessing pain severity, suitable for diverse patient populations.

Procedure:

Beginning **from the first day of July2023 to the end of December 2023**, fieldwork was done.

Tool validity and reliability:

Five experts in the fields of Medical Surgical Nursing and medicine evaluated the data collection tool's validity for its clarity, thoroughness, appropriateness, and relevance. The internal consistency approach was used in the current study to evaluate the reliability of the two tools, 0.907 for the first tool, and 0.923 for the second tool, all showed very excellent reliability.

Pilot study:

For testing the usefulness of the tools and the time required to complete it, 10% of the total sample size (15 patients) were used. The patients who took part in the pilot study were incorporated into the main study sample because no alterations were made.

Ethical considerations:

Research approval was obtained from the ethical research committee at the Faculty of Nursing, Sohag University, prior to the start of the study. An informed consent was obtained from the study subjects after explanation of the aim of the study. Right to refuse to participate or withdraw from the research were assured during the study. Privacy and confidentiality of the collected data were maintained during implementation of the study.

The research was carried out through the phases of assessment, implementation, and evaluation.

In the assessment phase:

To create the tools necessary for data collection, the researchers examined both current and historical literature, including textbooks, articles, magazines, and online resources.

The implementation phase:

The data pertaining to patients was gathered from the medical unit at Sohag University Hospital. A total of 150 patients were selected for the study using a convenience sampling technique and subsequently assigned randomly to three groups: experimental group 1 (saline flush), experimental group 2 (heparin flush), and a control group. Following the selection of sample subjects, informed written consent was obtained from both the subjects and their relatives. Patients were interviewed to collect demographic and medical data utilizing a structured interview questionnaire. The information regarding factors related to the administration of intravenous medication through a peripheral IV cannula was documented in the tool. After examining the IV cannula site and verifying its patency, intermittent medication was administered, followed by flushing the IV cannula with different solutions in both groups every 12 hours. A post-intervention assessment was conducted to record data on patency using the infiltration scale and the numeric pain rating scale. Patients were monitored for 60 hours (3 days), with assessments occurring twice daily (at 8 AM and 8 PM) at 0 hours, 12 hours, 24 hours, 36 hours, 48 hours, and 60 hours, with the same intervention, and the assessment data was recorded immediately in the observation schedule.

The data collected for this study was based on the sensation of resistance encountered while pushing distilled water through the cannula, as well as the observation of any leakage from the cannula. Section II: The observation schedule was designed to assess intravenous local vascular complications, which included three items evaluated with standardized tools: (a) Thrombophlebitis - assessed using the Visual Infusion Phlebitis Score, (b) Infiltration - evaluated using the Infiltration Scale by the Infusion Nurses Society, and (c) Pain - measured using the universal numeric pain rating scale.

Formal approval was obtained from relevant authorities.

2. Informed Consent: Written consent was secured from patients after explaining the study's purpose.

3. Data Collection: Patients were interviewed using a questionnaire to gather demographic data and information on IV medication administration.

Intervention:

- Experimental Group 1: Saline flush every 12 hours.
- Experimental Group 2: Heparin saline flush every 12 hours.
- Control Group: No flush intervention.

4. Assessment: Patency and local vascular complications were assessed at 0, 12, 24, 36, 48, and 60 hours.

5. Monitoring: Patients were monitored twice daily for 60 hours (3 days).

The evaluation phase:

Patients were monitored for 60 hours (3 days), twice daily (8 AM and 8 PM), at 0 hr, 12 hr, 24 hr, 36 hr, 48 hr, and 60 hr, with the same intervention and assessment to evaluate the effects of normal saline versus heparin flush solution on the patency of peripheral intravenous cannulas for patients receiving intermittent intravenous medication.

Statistical analysis:

Version 25 of the Statistical Package for the Social Sciences (SPSS-v25) was used to analyze the data. To provide percentages means, and standard deviations for the patients' medical and demographic data, descriptive statistics were performed. The independent t-test and chi-square test were used. The study employed the independent t-test to assess any variations in pain and stress. At p-value <0.05, the statistical significance criterion was reached.

Results:

Table (1): Reflects that the studied patients were mostly (28%, 52%, and 46%) between 29-38 years respectively in the three studied groups, 1, 2, and control group . regarding gender,56% in Experimental Group 1 (saline), 44% Experimental Group 1 (heparin), and 60% in the control group were females. Concerning residence, 64%, 60%, and 70% of them in Experimental Group 1 (saline), Experimental Group 1 (heparin), and in the control group were living in urban areas respectively. According to Occupation 60% in Experimental Group 1 (saline), compared to 50% and 58% in Experimental Group 1 (heparin), and in the control group were not working.

Table (2) Reveals that the studied patients (42%, 36%, and 40%) were diagnosed with Typhoid, Fever, Acute,Gastritis, Anaemia, etc respectively in the three studied groups, 1, 2, and control group . Regarding Previous Hospitalization , 80% in Experimental Group 1 (saline), 84% Experimental Group 1 (heparin), and 70% in the control group were not Previously Hospitalizatized. Concerning Duration of previous hospitalization, 40%, 46%, and 34% of

them in Experimental Group 1 (saline), Experimental Group 1 (heparin), and in the control group were Hospitalizatized for 6-10 days.

As reflected in **Table 3,** reveals that the in Experimental Group 1 (saline), the patients were walking occasionally (46%) followed by 54% of patients with restricted activity and no one was completely ambulatory. In Experimental Group 1 (heparin), the patients were walking occasionally (50%) followed by 50% of patients with restricted activity and no one was completely ambulatory, and in the control group, the patients were walking occasionally (54%) followed by 36% of patients with restricted activity and (10%) was completely ambulatory. Data further shows that in Experimental Group 1 (saline), Experimental Group 1 (heparin), and in the control group of the patients were on antibiotics with IV push only 40%,22% Antibiotics through IV push+antibiotics through infusion+corticosteroids,20%Antibiotics through IV push + antibiotic through infusion and followed by 20% Antibiotics through IV push+antibiotic through infusion and 18% Antibiotics through IV push Corticosteroids.

As shown in **figure 1**, the results of the current study revealed that There was a significant decreasing in IV local vascular infiltration mean score of experimental group 1, experimental group 2 and control group.

As shown in **figure 2,** the results of the current study revealed that There was a significant reduction between IV local vascular pain level of experimental group 1, experimental group 2 and control group.

As shown in **figure 3** the results of the current study revealed that There was a significant difference between post-intervention IV local vascular complications mean score of experimental group 1, experimental group 2 and control group

Data of IV cannula related factors shows that 64% in Experimental Group 1 (saline), 70% Experimental Group 1 (heparin), and 68% in the control group were having cannula of 20G size that is 52%, followed by 22 G (32%) and minimum number of patients with 18 G size cannula(16%) only as shown in **figure 4.**

Data as regard to duration of cannulation and duration of therapy shows that, that 64% in Experimental Group 1 (saline), 70% Experimental Group 1 (heparin), and 68% in the control group of patients had IV cannula insertion and duration of IV therapy between 13-24 hours(46%), followed by 32% up to 12 hours and 22% upto 25-36 hours as shown in **figure 5.**

As regard to the patient related factor, the data shows that the site of IV cannula insertion in most of the patient, in Experimental Group 1 (saline), Experimental Group 1 (heparin), and the control group was wrist 38%, followed by 32% at dorsum, 22% on the fore arm and 8% at the anticubital region as shown in **figure 6.**

Table 4 describes the finding related to frequency and percentage of post intervention potency of peripheral IV cannula of patients receiving intermittent IV medication through peripheral IV cannula on 3 days of post intervention observation. The data given in table shows that-Patency of IV cannula was found to be 100% among all the groups on day1Patency of IV cannula in experimental group1was100%,experimental group 2 was 100% and control group it was 80%on day2.Patency of IV cannula in experimental group 1 was 90 %, experimental group 2 was 95% and ,whereas it was 60%in control group on day3. The data of all 3 days at different time show that increase in time duration of peripheral IV cannulation results more number of blockage (non patency) in IV cannula of control group as compared to experimental group1 and experimental group2 in which IV cannula were flushed.

Table 5 reveals that There was significant association between experimental group1, experimental group2,and control group in maintaining the patency of IV cannula on day 1. As the obtained Chi-Square value 4.1387was less than the table value. There was significant association between experimental group 1, experimental group 2, and control group in maintaining the patency of IV cannula on day 2.as the obtained Chi-Square value 2.0347was less than the table value.There was no significant association between experimental group 1, experimental group 2, and control group in maintaining the patency of IV cannula on day3.as the obtained Chi-Square value was more than the table value. The data given in **Table 6** shows that with each day, the Chi-Square value is increasing due to loss of patency in control group. So, as the number of cannula blockage is increased in control group on 3rd day there was a significant different found between experimental group and control group as evident from obtained Chi-Square value (10.00) which is more than the table value(5.66) this shows that initially the patency of IV cannula was same in experimental group and control group but with the increase in the time duration there was different found in the IV cannula patency in these groups.

The data given in **Table 6** reveals that There

was a significant association found between experimental group 1 and experimental group 2 in maintaining the patency of IV cannula on day 1. The data obtained Chi-Square value was less than the table value. There was a significant association found between experimental group 1 and experimental group 2 in maintaining the patency of IV cannula on day 2. The data obtained Chi-Square value (4.13) was less than the table value . There was a significant association found between experimental group 1 and experimental group 2in maintaining the patency of IV cannula on day 3.

The data obtained Chi-Square value (2.034) was less than the table value. Also, This data is given in Table 6 shows that experimental group 1(saline flush) and experimental group 2 (heparin flush) are showing similar result in terms of maintaining the patency of IV cannula of patient receiving intermittent IV medication. In all 3 days there was no statistically significant difference found between experimental group1 and experimental group2 as evident from obtained Chi- Square value which is very less than the table value (5.66) in all 3days, so the association between experimental group 1 and 2 is true association and not by chance.

Table 1. Patients demographic characteristics (n=150)

Demographic characteristics	Experimental Group 1 (saline)n=50		Experimental Group 2 (heparin)n=50		Contro lgroup n=50	
	N	%	N	%	N	%
GENDER						
Male	22	44	28	56	20	40
Female	28	56	22	44	30	60
AGE				0		
18-≤28	7	14	5	10	10	20
28-≤38	13	28	26	52	23	46
38-≤48	14	26	7	14	7	14
48-≤58	11	22	5	10	6	12
≤60	5	10	7	14	4	8
Residence						
Urban	32	64	2	60	2	70
Rural	18	36	2	40	2	30
Occupation						
Worked	20	40	25	50	21	42
Not working	30	60	25	50	29	58

Table 2. Patients Health relavent data (n=150)

Patients Health relavent data	Experimental Group 1 (saline)n=50		Experimental Group 2 (heparin)n=50		Contro lgroup n=50	
	N	%	N	%	N	%
DIAGNOSIS						
Respiratory diseases	12	24	10	20	9	18
cardiac diseases	8	16	12	24	14	28
Gastro enterological Diseases	9	18	10	20	7	14
Others	21	42	36	36	20	40
Previous Hospitalization (lastone year)						
Yes	10	20	8	16	15	30
No	40	80	42	84	35	70
Duration of previous hospitalization						
Less than 5days	13	26	11	22	15	30
From 6 and less than10 days	20	40	23	46	17	34
From 10 and less than 15 days	10	20	6	12	10	20
More than 15 days	7	14	10	20	8	16

Table 3. Patients related to factors involved in the administration of IV medication (n=150)

Items	Experimental Group 1 (saline)n=50		Experimental Group 2 (heparin)n=50		Contro lgroup n=50	
	N	%	N	%	N	%
(1) IV cannula-related factors:						
Avoidance of previous site						
Yes	50	100	48	96	45	90
No	0	0	2	4	5	10
(2) patient-related factors -						
Activity of Patient						
Completely ambulatory	0	0	0	0	5	10
Walk occasionally	23	46	25	50	27	54
Restricted activity	27	54	25	50	18	36
(3) treatment-related factors:						
Duration of IV Therapy						
Upto12 hrs.	12	34	10	28	9	36
13-24 hrs	8	52	12	58	14	48
25-36 hrs						
IV Medication Administration						
Antibiotics through IV push	20	40	18	36	13	46
Antibiotics through IV push + antibiotics through infusion	12	24	13	26	12	24
Antibiotics through IV push corticosteroids	11	22	12	24	10	20
Antibiotics through ivpush + antibiotics through Infusion + corticosteroids	7	14	7	14	5	10

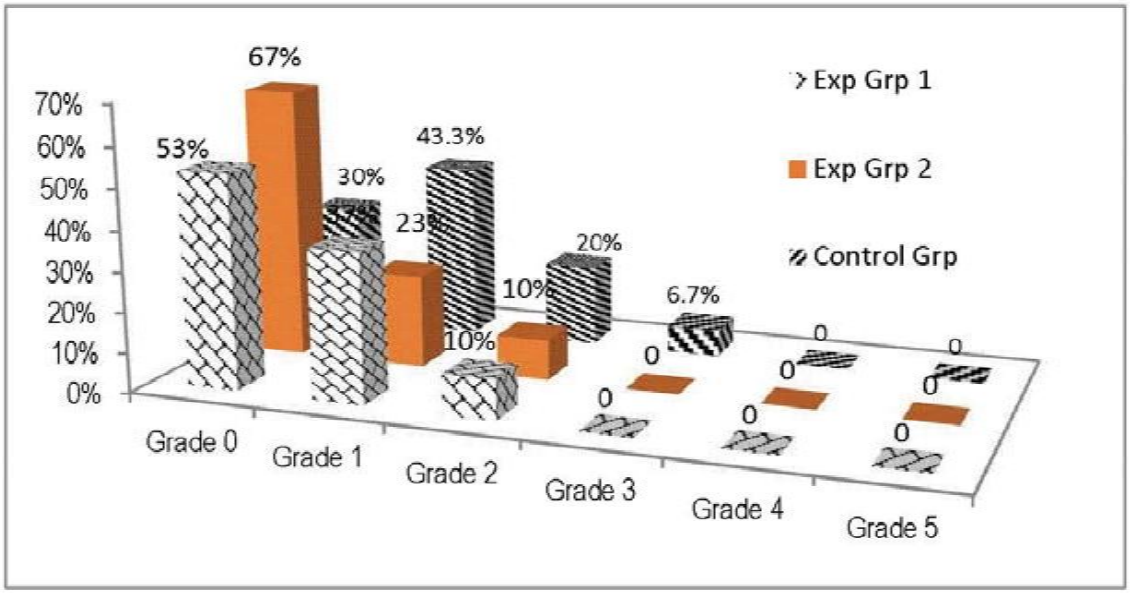


Figure 1: Percentage distribution of thrombophlebitis grade in experimental groups and control group patients on Day 3 (at 60 hrs).

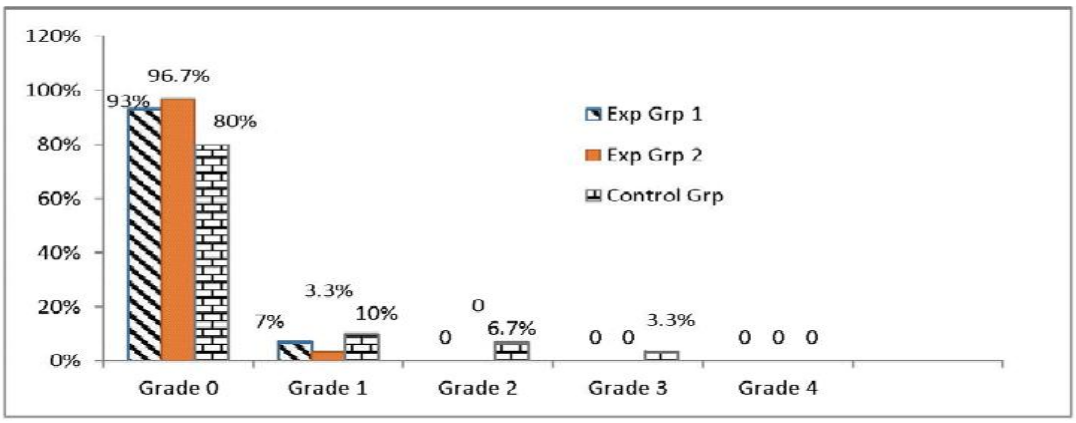


Figure 2: Percentage distribution of infiltration grade in experimental groups and control group patients on Day 3 (at 60 hrs)

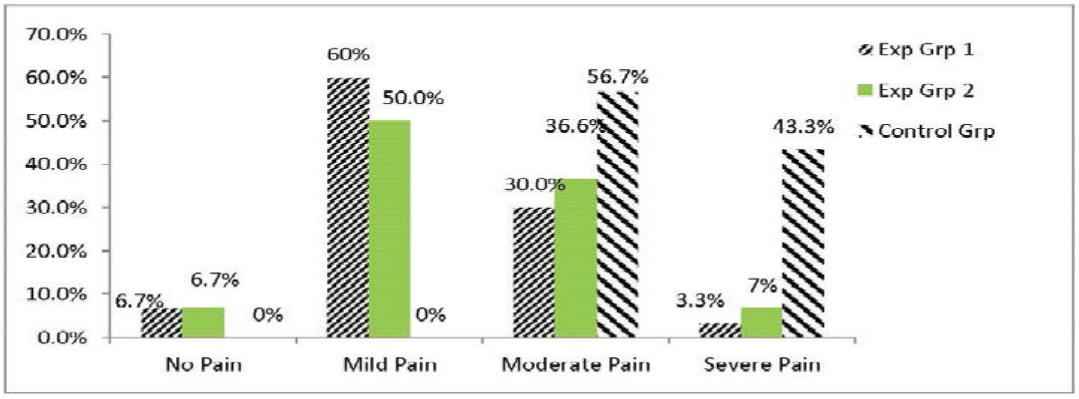


Figure 3: Percentage distribution of severity of pain in experimental groups and control group patients on Day 3 (at 60 hrs)

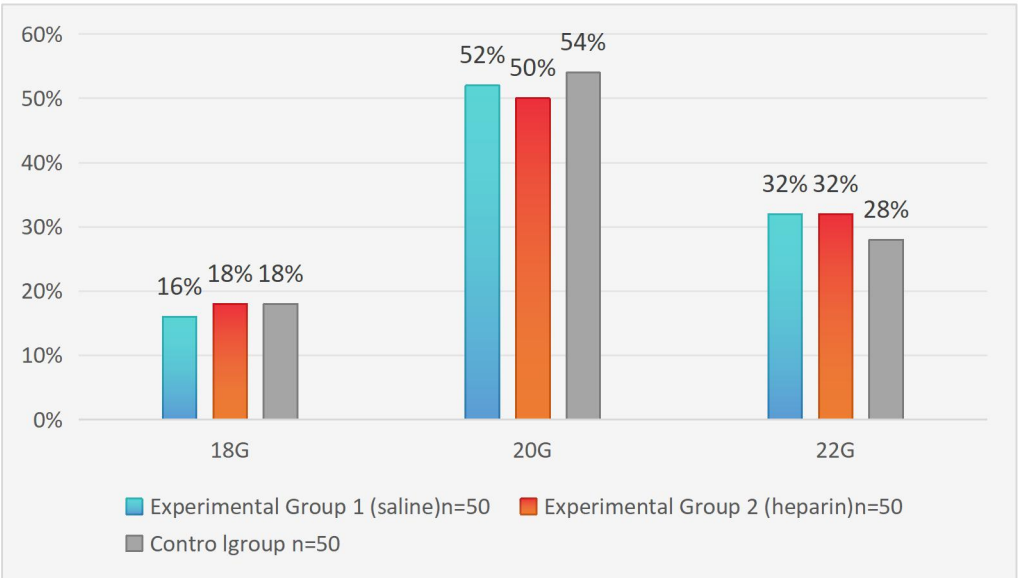
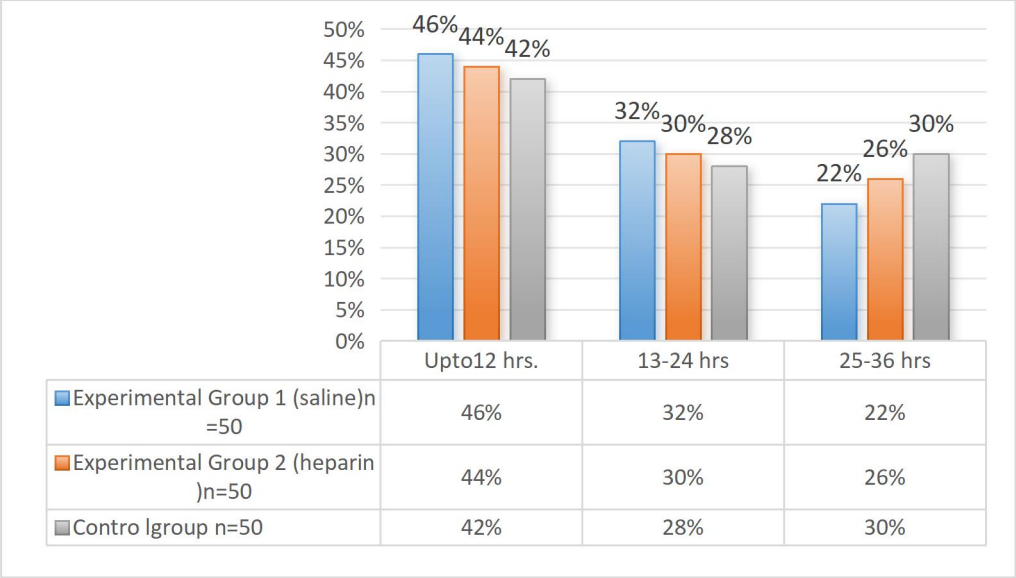


Fig. 4. percentage distribution of the studied patients regarding size of IV cannula



	Upto12 hrs.	13-24 hrs	25-36 hrs
Experimental Group 1 (saline)n =50	46%	32%	22%
Experimental Group 2 (heparin)n=50	44%	30%	26%
Contro lgroup n=50	42%	28%	30%

FIgure. 5. distribution of the studied patients regarding the duration of iv cannula insertion

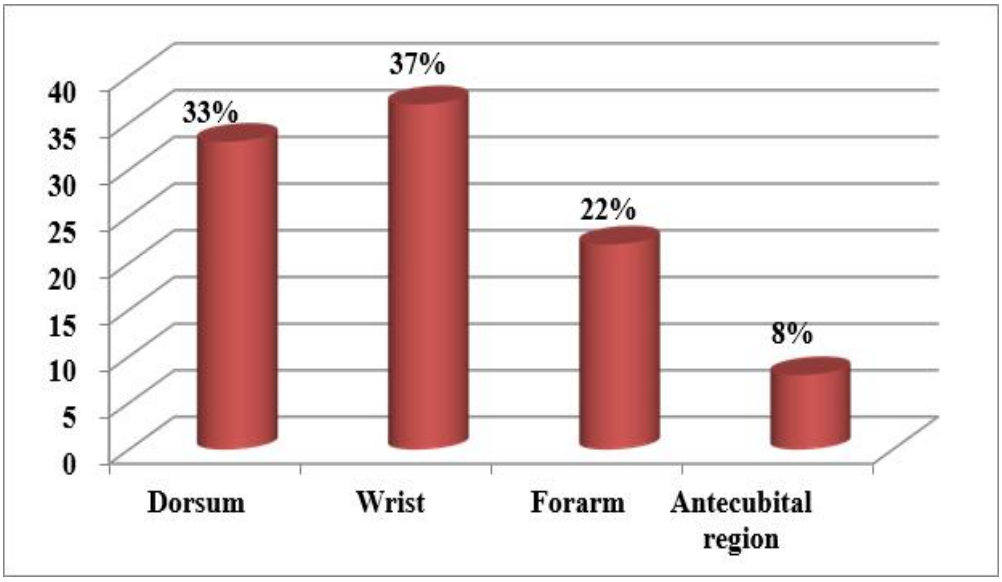


Figure. 6. distribution of the studied patients regarding the site of iv cannula

Table 4. Frequency and percentage of post intervention patency of IV cannula in experimental groups and control group N=150

Group	DAY 1(At 12 Hrs.)				DAY 2(At 36 Hours)				DAY3(At 60 Hours)			
	Patent		Non-Patent		Patent		Non-Patent		Patent		Non-Patent	
	No	%	No	%	No	%	No	%	No	%	No	%
1. Exp Group 1(Salineflush)n=50	50	100	0	0	50	100	0	0	45	90	5	10
2. Exp Group 2(Heparinflush)n=50	50	100	0	0	50	100	0	0	47	94	3	6
3.Controlgroup(Noflushin)n=50	50	100	0	0	40	80	10	20	30	60	20	40

Table 5. Association between the post intervention patency of IV cannula of Experimental groups and Control group on day1,day2,and day3 N=150

Day time	Experimental group1(salineflush) n=50		Experimental group1(heparin flush)n=50		Control group .=50		Chi sq.value	Chi square value obtained
	Patent	Non-Patent	Patent	Non Paten	Patent	Non patent		
DAY1 at 12hr	50	0	50	0	50	0		4.1387 NS
DAY2 at 36hr	50	0	50	0	46	4		2.0347 NS
DAY3 at 60	48	2	49	1	42	8	5.66	10.00* Sig.

**Significant At 0.05 Level Ns-Non Significant*

Table 6. Association between the post intervention patency of IV cannula of Experimental group1and Experimental group 2 on day 1, day 2, and day3 N=150

Dayandtime	Experimental group1(saline flush)n=20		Experimental group2(heparin flush)n=20		Chi sq.value	Chi sq.Value
	Patent	Non Patent	Patent	Non Patent		
DAY1 (at12hrs)	50	0	50	0		4.13
DAY2 (at36hrs)	50	0	50	0	5.87	4.13
DAY3 (at60hrs)	48	2	49	1		2.034

**Significantat0.05level NS-Nonsignificant*

Discussion:

Marginally significant association was observed between using NS vs HS and the incidence of catheter occlusion. Owing to the limited numbers of included studies and the effect sizes, so the study was done to To evaluate the effect of normal saline versus heparin flush solution on peripheral intravenous cannula patency for patients receiving intermittent intravenous medication (**Schrappe, 2024)**

The results of the current study revealed that There was a significant difference between post-intervention IV local vascular complications mean score of experimental group 1, experimental group 2 and control group. From the researchers' point of view, this result reflects the effectiveness of normal saline and heparin flush solution on peripheral intravenous cannula patency.

The study revealed a significant difference in post-intervention IV local vascular complications between the experimental groups (saline flush and heparin saline) and the control group. However, no significant difference was found between the two experimental groups. The findings are consistent with previous studies by **Mok et al. (2017)** and Shoaf et al. (2022), which demonstrated that 0.9% normal saline is as effective as heparin in normal saline solution in maintaining catheter patency and preventing IV complications. No association was found between the duration of IV cannula and the development of local IV vascular complications or patency. This result is consistent with studies by **Schrappe. (2024)** and **Lai, (2018),** which suggest that routine replacement of peripheral IV catheters may not be necessary with daily monitoring. The study's findings have implications for clinical practice, particularly in terms of reducing healthcare costs. **Lai's (2018)** study estimated that prolonging IV cannula use to 96 hours could result in significant cost savings.

A significant association was found between the site of peripheral IV cannula insertion and local vascular complications. The wrist and forearm were identified as high-risk sites for developing complications. These findings are consistent with previous research by **Saini et al. (2021),** which highlighted the forearm and elbow joint as potential risk factors for IV complications like phlebitis.

The study found a significant decrease in IV local vascular infiltration mean score across all groups, indicating the positive effect of normal saline and heparin flush solutions on peripheral intravenous cannula patency. This finding is consistent with previous research by **Esin & Samiye (2018),** which identified factors associated with IV complications, including the use of forearm and elbow joint as IV cannula insertion sites. The study's results suggest that using normal saline or heparin flush solutions can help maintain peripheral IV cannula patency and reduce complications.

The results of the current study revealed that There was a significant reduction between IV local vascular pain level of experimental group 1, experimental group 2 and control group. From the researchers' point of view, this result reflects the success of normal saline and heparin flush solution on peripheral intravenous cannula patency, which meets the patients' needs and helps in reducing their pain.

Results of the current study revealed that IV cannula related factors shows that more than three fifths in Experimental Group 1 (saline), the majority of Experimental Group 1 (heparin), and more than three fifths in the control group were having cannula of 20G size that is more than half, followed by 22 G among one third and minimum number of patients with 18 G size cannula as less than one fifth.

In an open-label, randomized clinical trial by **Bertolino et al. 2022,** the efficacy of the heparin solution (100 IU/mL) was investigated compared to normal saline in maintaining the peripheral venous catheter patency. 214 patients were included, divided into a N/S 0.9% group (107 patients) and a heparin group (107 patients). 18, 20, 22G size catheters were flushed with 3 ml of N/S 0.9% or 3 ml of heparin solution (100 IU/ml) after each IV drug administra- tion.

In a prospective clinical study by **Wang et al., 2022,** the efficacy of the two solutions, heparin and normal saline, was compared and evaluated in the flushing of peripheral venous catheters of size 22, 24G. 359 patients with gastro- enterological or hepatic diseases were studied, divided into a N/S 0.9% group (181 patients) and a heparin group (178 patients) for 3 months. The flush volume (ml) is not mentioned. The heparin solution was at a low concentration (10 IU/ml).

Results of the current study revealed that as regard to duration of cannulation and duration of therapy shows that, that more than three fifths in Experimental Group 1 (saline), less than three quarters in Experimental Group 1 (heparin), and more than three fifths in the control group of patients had IV cannula insertion and duration of IV therapy between 13-24 hours (46%), followed by 32% up to 12 hours and 22% upto 25-36 hours. In another randomized clinical study by **Patidar et al. 2024,** 75 hospitalized adult surgical department's pa- tients with a 22G venous catheter were studied over a 3 day (72 hour) period.

The study found that the duration of cannulation was longer in Group I (flushed with normal saline) compared to Group II (flushed with heparin solution). This result is consistent with **Perez et al. (2022)**, which suggest that normal saline flush can increase the lifespan of peripheral venous catheters.

However, the result contradicts other studies, including **Schallom et al. (2022) and McCallum & Higgins (2022),** which found that heparin is more effective in prolonging catheter patency compared to normal saline.

The study found a significant association between the experimental groups (Group I and Group II) and the control group in maintaining IV cannula patency. Additionally, a significant association was found between Group I and Group II in maintaining patency.

This finding is consistent with the findings of the research studies conducted by **Choudhary, (2023) and Kaur Maninder, (2019)** They reported that intermittent flush found to be highly effective and best method to be used in clinical studies to standardize the patency of cannula (Li et al., 2024) The findings of the present study showed that there is an association between normal saline flush and heparin flush (10 unit dose) in maintaining the patency of peripheral intravenous cannula. This finding is consistent with the finding of the research studies conducted by **Kathryn & Niesen, (2023) and Hephzibha (2020)** where they found that both normal saline flush and heparin flush (10 unit dose) are equally effective in the maintaining the patency of peripheral IV cannula.

The results showed Significant difference: Between the control group and both the normal saline group and heparin saline group in terms of IV line patency duration **(Wang et al., 2022).** No significant difference: Between the normal saline group and heparin saline group in terms of IV line patency duration. The study suggests that both saline flush and heparin saline flush are effective in maintaining IV line patency compared to no intervention. However, there is no added benefit of using heparin saline flush over normal saline flush **(Xu et al., 2020).**

Researchers tend to favor 0.9% N/S use due to safety and avoidance of errors, efficiency, ease of use and cost savings **(Mathews et al., 2019)**.This result was in agreement with **White *et al.,* (2021)** who found that routine 8 hourly, 0.9 percent saline flushes will maintain cannula patency **(Zhong et al., 2019).** As well as **Lyons & Phalen, (2024)** suggested that

intermittent cannula flushing is associated with improved cannula patency**.** This result was also in agreement with **Selleng *et al.,* (2019),**who found that prevention of its occlusion and catheter survival and heparin had no advantage over normal saline **(Selleng *et al.,* 2019).**

Researchers prefer using 0.9% normal saline (N/S) for flushing due to its Safety: Avoiding errors and complications, Efficiency: Ease of use and effectiveness, Cost savings: Compared to heparin-based solutions

This preference is supported by various studies: **White et al. (2021):** Found that routine 0.9% saline flushes maintain cannula patency. **Lyons & Phalen, (2024)** Suggested that intermittent cannula flushing improves patency. **Selleng et al. (2019):** Found no advantage of heparin over normal saline in preventing occlusion and maintaining catheter survival. The evidence suggests that 0.9% normal saline is a safe, efficient, and cost-effective option for maintaining cannula patency, with no significant benefits of using heparin-based solutions.

Conclusion:

Based on the results of the current study, it can be concluded that both saline flush and heparin saline flush are equally effective in preserving patency and preventing local vascular complications associated with intravenous access. The practice of utilizing heparin as a flushing agent may be replaced with normal saline flush, which is both safer and more cost-effective than heparin saline flush. The advantages of normal saline appear to surpass those of heparin solution in maintaining the patency of peripheral venous catheters.

Recommendations:

In light of the findings from this study, the following recommendations are proposed:

- In-service training programs should be organized for nurses to educate them on the flushing technique, disinfection of the insertion site for venous access, the differences between normal saline and heparin solution, and to enhance their understanding of various flushing solutions.
- Promote the use of normal saline as a safer alternative to heparin solution for peripheral intravenous access.
- Conduct thorough site assessments for infant cannulation, which should include inspection of the insertion area, evaluation of occlusion, patency, systemic infection, and signs of infiltration/extravasation, particularly noting any cool skin temperature at the insertion site.
- Establish organizational policies, procedures, and practice guidelines for flushing and locking all peripheral intravenous cannulas, and label heparin as a high-alert medication.
- This study's findings can inform evidence-based nursing practices, specifically:
- Developing clinical protocols: Administrators can use the study's results to create guidelines for IV cannula flushing.
- Adopting safe practices: Nursing staff may be motivated to use saline flushing, a safe and effective approach, to prevent IV complications.

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