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Original Article

Effectiveness of Magnesium Sulphate with Glycerine Versus Ice Chips on Patients with Peripheral Intravenous Cannula Induced Phlebitis

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1.ABSTRACT

Background: Phlebitis is one of the most common complications of peripheral intravenous cannula. Magnesium sulfate with glycerin and ice are simple, inexpensive and effective non pharmacologic intervention for management of phlebitis. **Aim of the study:** Assess the effectiveness of magnesium sulfate with glycerin versus ice chips on patients with a peripheral intravenous cannula induced phlebitis. **Methods:** A quasi-experimental research design was used in this study. Purposive sampling technique was used to select the sample from medical departments at Mansoura Main University Hospital and Medical Specialized Hospital. **Results:** Both magnesium sulfate with glycerin (χ^2=93.601, p<0.001) and ice chips (χ^2=85.350, p<0.001) were found to be effective in reducing the peripheral intravenous cannula induced phlebitis. **Conclusion:** Both magnesium sulfate with glycerin and ice application were effective in decrease level of phlebitis but magnesium sulfate with glycerin was more effective than ice chips.

Keywords: *Ice chips, Magnesium sulfate with glycerine, Peripheral intravenous cannula, Phlebitis*

2.Introduction:

Intravenous therapy is an effective and fast-acting manner to administer fluids or medication treatment in an emergency situation and for patients who are unable to take medications orally, that aimed to infusion of intravenous fluids, blood, or blood products, medications, directly into a vein. Approximately 80% of hospitalized patients are receive intravenous therapy **(Tolpadi, Mane, Modak, Verma & Ambekar, et al. 2021).**

Over billion peripheral intravenous catheters (PIVCs) are inserted each year in hospitalized patients worldwide. The annual use of PIVCs in North America has been stated to be in excess of 330 million. The estimated number of PIVCs used across greater Europe or other regions of the world is mostly unknown, although estimates from global device sales have been reported to be approximately 1.2 billion. On the other hand, international data on prevalence and management of these devices are missing **(Alexandrou, Ray - Barruel, Carr, Frost & Inwood, et al. 2015).**

About up to 20 - 80% of patients receiving intravenous therapy develop phlebitis.
Infusion phlebitis is one of the most common complications in patients with peripheral intravenous cannula. Phlebitis is an inflammation of vein, or more specifically its inner lining, the tunica intima. Clinical signs of phlebitis include localized redness, warmth and swelling, which can path along of the vein, finally leading to induration and a palpable venous cord **(Arias, Mier, Ortega & Lana, 2017; Sicilia, Gómez, Peraza, Gómez & Salgado, et al. 2021).**

There are several methods for management of phlebitis. Common managements used for managing phlebitis were magnesium sulfate with glycerin, heat and cold applications and heparin creams, these therapies are commonly administered independently or in combination **(Varghese & Moly, 2018).** Cold application is a simple, inexpensive and effective non pharmacologic intervention for pain management. It has physiological effects include decrease pain, edema, blood flow, muscle spasm, inflammation and metabolic demand **(kusuma, komarudin, arfin, listiandi, & Putro, 2021).**

2.1Significance of the study

Peripheral intravenous catheters are the most common invasive devices, approximately 330 million devices inserted each year in the USA. It has been reported that risk for PIVC-related bloodstream infection is associated with phlebitis which is the most important complication of PIVCs **(Mermel, 2017).** Through researcher clinical experience, observed that about four from ten patients with intravenous cannula in medical departments at Mansoura University Hospital suffering from phlebitis and this effect on

patient comfort and continuity of intravenous therapy.

2.2Aim of the study

The aim of this study was to evaluate the effect of magnesium sulphate with glycerine versus ice chips on patients with peripheral intravenous cannula induced phlebitis.

2.3Research hypothesis:

H_1- There will be significant difference between pretest and post test scores in magnesium sulphate with glycerin group.

H_2- There will be significant difference between pretest and post test scores in ice chips group.

H_3- There will be significant difference between post test scores in magnesium sulphate with glycerin group and ice chips group.

3.Methods

3.1Study Design:

A quasi-experimental research design was used in this study.

3.2Setting:

This study was carried out in a medical department at main Mansoura University Hospital that consists of medical department (3) of male patients that present in the first floor and medical department (14) that located in the fourth floor, also Specialized Medical Hospital form cardiovascular department in the second floor, gastroenterology and a hepatology in the third floor and diabetes & endocrinology in the fourth floor.

3.3Sample:

A purposive sample of 100 adult patients of both sexes with peripheral intravenous cannula induced phlebitis was involved in this study throughout six months. The study participant distributed in to two equal groups.

Magnesium sulphate group: which include 50 patients was managed with magnesium sulphate with glycerine two times a day for two days.

Ice chips group: which include 50 patients was managed with ice chips two times a day 5 minutes for two days.

The study sample was selected based on following criteria:

Inclusion criteria:

Patients with peripheral intravenous cannula induced phlebitis who is:

1. Aged from 20 to 60 years.
2. Able to communicate.
3. Willing to participate in the study.

Exclusion criteria:

Patients have peripheral intravenous cannula induced phlebitis with following conditions:

1. Skin disorder.
2. Vein section.

3.4Tools of data collection:

Two tools were utilized in this study to collect base line data.

Tool I: **Structured interview questionnaire:**

This tool was developed by researcher for collection of base line data and assess intravenous site based on review of recent relevant literature; it was included two parts:

Part I: Demographic and medical data sheet: This part of tool was used to address demographic and medical data such as age, sex, level of education, occupation, marital status, diagnosis, length of hospital stays and previous hospitalization.

Part II: Intravenous access assessment sheet: This part of tool was used to assess intravenous access such as purposes of intravenous cannula, size of cannula, site of cannula, number of pricks during cannulation, cannula stabilization, duration of IV cannulation, use of infusion pump, Infusion rate and types of medication infused.

Tool II: Visual infusion phlebitis scale: This tool developed by **(Jackson, 1998)** to assess the severity of phlebitis. It contains 6 main items and each item has sub items**.** Scoring system ranged from 0 to 5 as following:

Visual infusion phlebitis scale	Score	Indicates
I.V site appears healthy	**0**	**No signs of phlebitis**
One of the following is evident: • Slight pain near I.V site or • Slight redness near I.V site.	**1**	**Possible first signs**
Two of the following are evident: • Pain at I.V site. • Erythema. • Swelling.	**2**	**Early stage of phlebitis**

All of the following signs are evident: • Pain along path of cannula. • Erythema. • Induration.	**3**	**Mid-stage phlebitis**
All of the following signs are evident and extensive: • Pain along path of cannula. • Erythema. • Induration. • Palpable venous cord.	**4**	**Advanced stage of phlebitis or start of thrombophlebitis**
All of the following signs are evident and extensive: • Pain along path of cannula. • Erythema. • Induration. • Palpable venous cord. • Pyrexia.	**5**	**Advanced stage of thrombophlebitis**

3.5Validity:

These tools were verified for validity by five experts, one from faculty of medicine and four from faculty of nursing, who reviewed the tools for clarity, relevance and applicability for implementation. The necessary modifications were done according their critiques.

3.6Reliability: Internal consistency and a reliability coefficient (Cronbach's alpha) of 0.763 for the assessment tool tested by SPSS software. It means good reliability of the tool.

3.7Pilot study: pilot study was conducted on 10% of study sample (10) patients with phlebitis related to intravenous cannula to examine the applicability and clarity of the tools. These patients were not included in the study sample.

3.8Ethical consideration:

The proposal for this study was submitted to the Mansoura University Faculty of Nursing's Research Ethical Committee for approval. The Mansoura University Hospital's relevant authorities for the medical departments gave their official written consent to carry out this study. Each participant in the study gave oral consent after being informed about the study's purpose. Anonymity, privacy, safety, and confidentiality were all guaranteed throughout the whole study and participation was absolutely voluntary. Participants were made aware of their freedom to discontinue participation in the study at any time.

3.9Date collection procedure: Once permissions were taken to carry out the study from Research Ethical Committee, Faculty of Nursing and hospital authority, patients were interviewed individually to explain the nature, purpose of the study and verbal consent was taken from all patients before the study. Data was collected throughout 6 months from the beginning of November 2018 to end of April 2019.The frame work of the study was carried out according to three phases:

A- Assessment Phase: In this phase the two groups were assessed by researcher as follows.

- Demographic and medical data was collected from the patient and review the patient records for two groups using tool **I** part **I**.
- Intravenous cannula was assessed by researcher using tool **I** part **II.**
- The severity level of phlebitis was assessed for two groups using tool **II** as pre-test.

B- Implementation Phase:

Magnesium sulphate group: After the initial assessment, the cannula insertion site was cleaned with normal saline. The gauze (4 × 4) was then soaked in a combination of 30 mg magnesium sulphate and 50 ml glycerine that had been prepared previously. It was applied on the site of phlebitis for 10 minutes two times daily for two days.

Ice chips group: After the initial assessment, the cannula insertion site was cleaned with normal saline. Then crashed ice putted in small ice pack and stored in ice box until time of application then removed from it and covered with gauze then applied on phlebitis site for 5 minutes two times daily for 2 days.

C- Evaluation Phase:

This phase focused on assessment the severity level of phlebitis for two groups in the third day of intervention using (tool **II**) as post-test.

3.10Statistical analysis:

Using SPSS (statistical package of social sciences), version 16, the collected data were coded, calculated and statistically evaluated. The quantitative variables (frequency and percentages) and mean ± SD of the data were reported

(quantitative continuous variables). When comparing categorical variables, chi square (2) was employed. If the expected value of any cell was less than 5, Fisher exact test (FET) or Mont Carlo exact test was used in its place. Two groups of continuous quantitative variables were compared using the student's t test and continuous quantitative variables were compared using the one-way anova (F test) (more than two groups). The median was employed as a central tendency measure for continuous quantitative variables that were not normally distributed, and the Mann Whitney test (Z) was used to compare two groups. The difference was considered significant at $P \leq 0.05$.

4.Results:

Table 1: Shows distribution of studied patient according to their demographic characteristics.

In relation to age, it can be observed that nearly three fifth of studied patients among two groups ranged from 50 to 60 years with average 49.86 ± 11.83 years and 47.78 ± 13.17 years in both groups respectively. As regards sex, more than three quarters were female in both groups prevalent (86% and 84%) respectively. Concerning marital status, the majority of studied patients were married. Regarding education around three fifth of patients were illiterate (60%) in magnesium group and about half of ice group were illiterate (46%). The largest percentage of the patients were not working (94%) in both groups. There was no significant difference (P>0.05) between the studied groups as regard their demographic characteristics.

Table 2: Represent that more than one third of studied patients have hypertension (36%) and diabetes mellitus (34%) in magnesium group while in ice group were two fifth have hypertension (40%) and more than one third have diabetes mellitus (34%) with no significant difference (P>0.05). As regards length of hospital stay was mostly from one to two weeks and 6 days in the ice group with no significant difference (P>0.05). In addition to more than three-fifths of patients (72%) were previously hospitalized in magnesium group with median 6 days and four fifths (80%) in the ice group with median 7 days with no significant difference (P>0.05). The majority of studied patients in both group that previously hospitalized exposed to IV cannula and the reported complication was (92.9%) magnesium group and (87.5%) in ice group respectively, with no significant difference (P>0.05).

Table 3: Illustrates that there was no statistically significant difference (P>0.05) between the studied groups. The most common cannula size used among two groups was 22G (82%) in magnesium group and (78%) in ice group. In relation to number of breaks nearly half of patients were once break (38% and 44%) respectively and mostly cannula was stabilized in (92% and 96%) respectively. As shown in this table the intermittent infusion rate commonly used in both groups (98% and 96%) respectively. The majority of patients in both groups were treated by antibiotics with IV solution (86%) in magnesium group and (82%) in ice group, with no significant difference (P>0.05).

Figure 1: Show comparison between visual infusion phlebitis scale of the studied patients before and after intervention among the **two** groups**.** It was observed that there was no significant difference between both groups as regard visual infusion phlebitis scale level before intervention while the first group showed a significant (P<0.001) improvement then the second group after intervention**.**

Table 4: Shows relationship between severity score of phlebitis. Medical and cannula related factors of the studied patients in both groups. There was no significant relation (P>0.05) between severity score of thrombophlebitis **and** personal characteristics of patients in the group managed by $mgso_4$+glycerin before management. While in the group managed by ice chips, there was a significant relation between severity score of thrombophlebitis and occurrence of complication (P0.036) and number of breaks (P0.017).

5.Discussion

The peripheral venous catheter (PVC) is an essential device for administering fluids, nutrition, drugs, and blood products. There are several complications can be occurred from PVC. Phlebitis is one of the most common complications of intravenous cannula which can impact the patient's safety and well-being. To avoid this complication both during **and** after insertion, nursing care must be carefully planned and implemented **(Oliveira, ABasto, Braga, Arreguy, Melo, et al. 2019).**

The cooling effect of applying ice to the phlebitis is very beneficial, causing a numbing sensation and relives pain. The primary physiological response to trauma, thus facilitates tissue repair. Magnesium sulphate is a natural exfoliant and has anti- inflammatory properties. application of magnesium sulphate topically initiates a process called reverse osmosis which

absorbs excessive water and reduces edema (**Arthi & Tamilselvi, 2019)**.

As regarding age group, the majority of studied patients were from fifty to sixty years old. This finding was on the same line with (**Mavillard, Calero, Gómez, García & Fernández, et al. 2019).)** who mentioned that risk for phlebitis increased with age. The result of the present study contradicted with **(Wallis, Grail, Webster, Marsh & Gowardman, et al. 2014)** who proved that the majority of studied patient after multivariate analysis demonstrated that phlebitis risk increased with younger age. Researchers' opinion, the susceptibility to phlebitis increases with age, this may be due to poor skin elasticity and veins become fragile due to aging changes. As regarding gender, the majority of the studied patients were females. This finding was on the same line with (**Lv & Zhang, 2020)** who revealed that females were at greater risk of developing peripheral phlebitis. This in contrast with (**Lulie, Tadesse, Tsegaye, Yesuf & Silamsaw, 2021)** who found that more than half of patients with phlebitis were males.

Concerning length of hospital stay of studied patient in this study was commonly one to two weeks. This similar to **(Gargar, Cutamora, & Abocejo, 2017)** who revealed that patients who stayed for seven to fourteen days had an increased likelihood of developing phlebitis. On other hand **(Danski, Johann, Vayego, Oliveira, G & Lind, 2016)** revealed that the majority of patients remaining hospitalized for up to nineteen days. Moreover, the present study indicated that the majority of both groups had previously hospitalized and suffered from IV cannula complications. This disagrees with **(Arthi, Tamilselvi, 2019)** who found that majority of patients with peripheral intravenous cannula induced phlebitis had no history of previous hospitalization. The result of the current study may be due to that most of studied patients ranged in age group from fifty to sixty and having chronic diseases this leading to frequent hospitalization.

The present study shows that the most common duration of cannula usage was seventy-two hours. This similar to **(Atay, Şen & Cukurlu, 2018)** who approved that a large number patients have phlebitis with duration of catheterization seventy-two hours. This disagrees with **(Furlan & Lima, 2021)** who revealed that most phlebitis occurred in patients who used the intravenous cannula for twenty-four hours.

As regarding purpose of intravenous cannula, the most common purposes of IV cannula were medication administration in both groups with no significant. This agree with (**Alexandrou, Barruel, Carr, Frost& Inwood, et al. 2018)** who revealed that PIVCs were used primarily for intravenous medication. This may be due to the main purpose of intravenous canula is medication administration.

As regards site of cannula insertion the most common site of insertion was hand. This agree with **(Benaya, Schwartz, Kory, Yinnon, & Chetrit, 2015)** who found that the most common site of insertion was hand. The result of the present study on opposite direction with (**Tan, Tai, Sim & Ng, 2017)** who found that, the common insertion sites are forearm. The result of present study may be due to that hand more distal and easier for insertion.

As regards size of cannula the most common cannula size used was 22G. This agrees with **(Urbanettoa, Muniza, Silvaa, Freitasa & Oliveiraa, et al. 2017)** who found that the majority of adult patients have intravenous cannula size 22G with high incidence of phlebitis. This disagree with (**Mandal & Raghu, 2019)** who proved that the incidence of phlebitis was to be higher in patients who had an18 G catheter when compared to patients with 20 G. This may be due to that common purpose of intravenous cannula in this study was medication administration.

The result of the present study showed that there was a significant improvement in both groups after management. This agree with **(Arivazhagi, 2018)** who revealed that glycerin magnesium sulphate application is effective in reduction of phlebitis among patient received intravenous infusion. This in the same line with **(Rahman, Tamang, & Kochhar, 2019)** who proved that cold application and glycerin magnesium sulphate, both were effective on phlebitis. Researcher's opinion, this result may be due to anti-inflammatory effect of magnesium sulphate with glycerin and analgesic anti-inflammatory effect of ice.

As regarding relationship between severity score of phlebitis before management and cannula related factors of the studied patients in both groups. There was no significant relation between severity score of phlebitis and personal characteristics of patients in the group managed by magnesium sulphate with glycerin before management. This agree with **(Vidhya, 2017)** who found that there was no association between the degree of phlebitis and selected clinical variables. While in the group managed by ice chips, there was a significant relation between severity score of phlebitis and occurrence of complication. This result in line with **(Urbanetto, Peixoto & May,**

2016) who proved that presence of association between the incidence and grade of phlebitis and some cannula related factors.

6.Conclusion

The study was concluded that both magnesium sulfate with glycerin and ice application were effective in decrease level of phlebitis but magnesium sulfate with glycerin was more effective than ice chips.

7.Recommendations:

The current study recommended the following:

1. Handout for patients about early signs and symptoms of phlebitis for early detection and management.
2. Raising patients' awareness about nonpharmacological management of phlebitis and how to use ice and magnesium sulphate.
3. Replication of the study on large sample and increase duration of intervention.

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Table 1: ***Distribution of studied patient according to their demographic characteristics***

Characters	$MgSO_4$+Glycerine (n = 50)		Ice Chips (n = 50)		Statistical test
	No	%	No	%	
Age (years)					
- 20-<30	3	6.0	6	12.0	χ^2= 2.059,
- 30- <40	8	16.0	9	18.0	*p*= 0.560
- 40-<50	10	20.0	6	12.0	
- 50 -60	29	58.0	29	58.0	
Mean ± SD	49.86 ± 11.83		47.78 ± 13.17		t=0.831,P0.408
Sex:					
- Males	7	14.0	8	16.0	χ^2= 0.078,
- Females	43	86.0	42	84.0	P 0.779
Marital Status:					
- Single	2	4.0	3	6.0	χ^2= 1.258,
- Married	35	70.0	36	72.0	*p*=0.739
- Divorced	1	2.0	0	0.0	
- Widow	12	24.0	11	22.0	
Education:					
- Illiterate	30	60.0	23	46.0	*p=0.494*
- Primary	5	10.0	5	10.0	χ^2= 2.398,
- Secondary	13	26.0	18	36.0	
- University	2	4.0	4	8.0	
Occupation:					
- Work	8	16	3	6.0	χ^2= 2.554,
- Not work	42	84	47	94.0	*p*=0.100

*χ^2 refer to chi square test. * Refers to significance if p- value < 0.05.*

Table 2: ***Medical data of the studied patients***

Characters	$MgSO_4$+Glycerin (n = 50)		Ice Chips (n = 50)		Statistical test
	No	%	No	%	
Diagnosis: (responses 79 &87)					
- Hypertension	18	22.8	20	23	
- Diabetes Mellites	17	21.5	17	19.5	
- Liver diseases	16	20.3	17	19.5	χ^2= 5.499,
- Renal diseases	7	8.9	14	16.1	*p*=0.598
- Heart diseases	12	15.2	11	12.8	
- Systemic Lupus	5	6.2	7	8	
- Endocrine diseases	4	5.1	1	1.1	
Length of stay					
- 1 - < 7 days	23	46.0	30	60.0	χ^2= 7.112,
- 1 - < 2 weeks	23	46.0	11	22.0	*P*= 0.065
- 2 - < 3 weeks	2	4.0	5	10.0	
- 3 – 4 weeks	2	4.0	4	8.0	
Min –Max	2 - 26 (days)		2 - 28 (days)		Mann Whitney
Mean ± SD	7.58 ± 5.03		7.78 ± 6.00		Z=0.423, P0.672
Median	7.0		6.0		
Previous hospitalization					
- Yes	36	72.0	40	80.0	χ^2= 1.288,
- No	14	28.0	10	20.0	*p*= 0.185
Length of the previous hospitalization					
- 1 - < 7 days	19	52.8	15	37.5	
- 1 - < 2 weeks	9	25.0	20	50.0	χ^2= 5.280,
- 2 - < 3 weeks	5	13.9	3	7.5	*p*= 0.267
- 3 – 4 weeks	1	2.8	1	2.5	
- >4 weeks	2	5.6	1	2.5	
Min –Max	2 - 30 (days)		2 - 31 (days)		Mann Whitney
Mean ± SD	9.33 ± 7.37		8.78 ± 5.78		Z=0.225, P0.822
Median	6.0		7.0		
IV cannula:					
- Yes	36	72.0	40	80.0	χ^2= 1.288,
- No	14	28.0	10	20.0	P= 0.185
Complications (36&40)					
- Yes	30	83.3	34	85	χ^2= 0.040,
- No	6	16.7	6	15	P 0.544

χ^2 refer to chi square test. *MC: Monte Carlo* * Refers to significance if *p*- value < 0.05

Table 3: ***Intravenous access assessment of the studied patient***

Intravenous access assessment	$MgSO_4$+Glycerin (n = 50)		Ice Chips (n = 50)		Statistical test
	No	%	No	%	
Size of used cannula:					
- 20G Pink	9	18.0	8	16.0	χ^2= 3.110,
- 22G Blue	41	82.0	39	78.0	*p*=0.211
- 24G Yellow	0	0.0	3	6.0	
Number of bricks					
- 1 prick	19	38.0	22	44.0	χ^2= *1.984,*
- 2 pricks	17	34.0	14	28.0	*p=0.576*
- 3 pricks	6	12.0	3	6.0	
- > 3 pricks	8	16.0	11	22.0	
Cannula stabilization					
- Stabilized	46	92.0	48	96.0	*Fisher*
- Un stabilized	4	8.0	2	4.0	*P= 0.678*
Duration of IV canulation					
- 12 hours	1	2.0	2	4.0	X^2 = *0.438*
- 24 hours	9	18.0	10	20.0	*P=0.932*
- 48 hours	18	36.0	17	34.0	
- 72 hours	22	44.0	21	42.0	
Use of infusion pump					
- Yes	0	0.0	2	4.0	*Fisher*
- No	50	100.0	48	96.0	*P=0. 247*
Infusion rate					
- Continuous	1	2.0	2	4.0	*Fisher*
- Intermittent	49	98.0	48	96.0	*p* = 0.500
Type of used medication (Responses 128 & 133)					
- Antibiotics	43	33.6	41	30.8	
- IV solution	40	31.3	40	30.1	
- Corticosteroid	10	7.8	8	6	*Fisher*
- IV nutrition	1	0.8	2	1.5	*p*=0.501
- Antacid	21	16.4	19	14.3	
- Flagyle	9	7	10	7.5	
- Livobid	0	0	1	0.8	
- Lasix	4	3.1	7	5.3	
- Cardarone	0	0	5	3.8	

*χ^2 refer to chi square test. * Refers to significance if p- value < 0.05.* *FE: Fisher Exact*

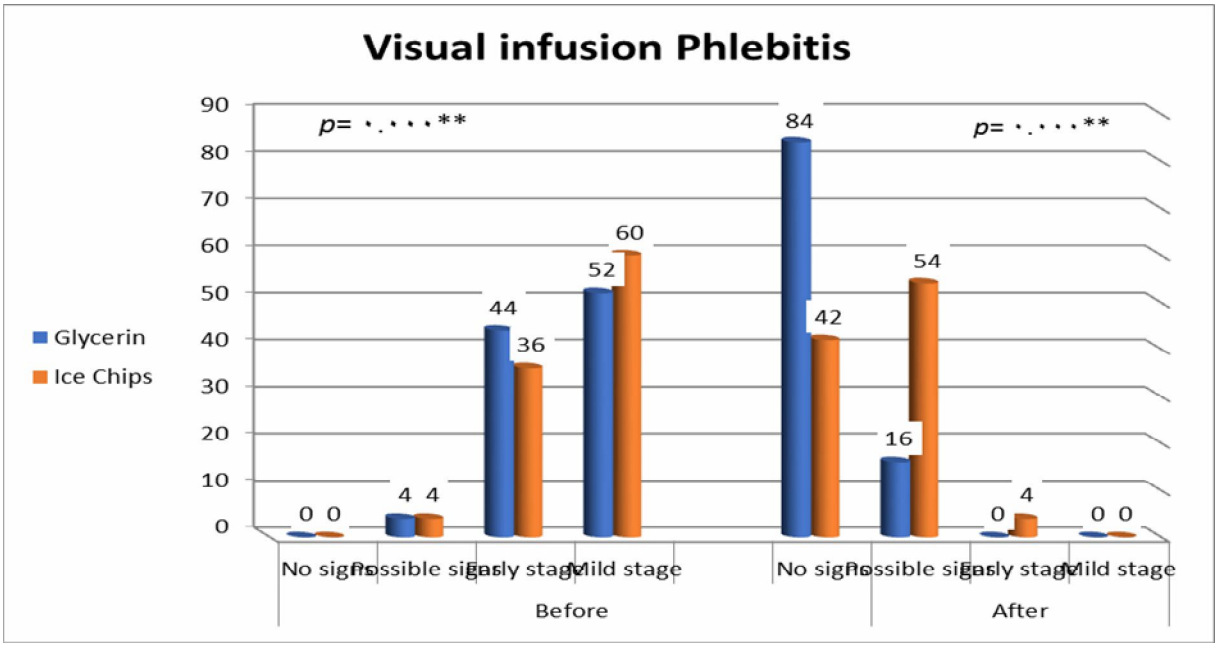

Figure1: Visual infusion phlebitis scale of the studied patients before and after intervention among both groups.

Table 4: Relationship between severity score of phlebitis and medical and cannula related factors of the studied patients in both groups

Characters	Glycerin (50)		Ice Chips (50)	
	No	Mean ± SD	No	Mean ± SD
Length of stay				
- 1 - < 7 days	23	2.26 ± 0.62	30	2.50 ± 0.63
- 1 - < 2 weeks	23	2.65 ± 0.49	11	2.73 ± 0.47
- 2 - < 3 weeks	2	2.50 ± 0.71	5	2.60 ± 0.55
- 3 – 4 weeks	2	3.00 ± 0.00	4	2.50 ± 0.58
Significance test	F=2.522, P0.069		F=0.423, P0.737	
Previous hospitalization				
- Yes	36	2.42 ± 0.61	40	2.63 ± 0.49
- No	14	2.64 ± 0.50	10	2.30 ± 0.82
Significance test	t=1.241, P0.219		t=1.619, P0.112	
Complication of IV cannula:				
- Yes	29	2.38 ± 0.56	35	2.69 ± 0.47
- No	6	2.67 ± 0.82	5	2.20 ± 0.44
Significance test	t=1.505, P0.299		t=2.168, P0.036	
Size of used cannula:				
- Pink 20G	9	2.44 ± 0.53	8	2.13 ± 0.83
- Blue 22G	41	2.49 ± 0.60	39	2.64 ± 0.49
- Yellow 24G	0		3	2.67 ± 0.58
Significance test	t=0.201, P0.841		F=2.920, P0.064	
Site of cannula				
- Hand	27	2.33 ± 0.62	23	2.43 ± 0.66
- Forearm	9	2.67 ± 0.50	8	2.63 ± 0.52
- Antecubital fosse	1	2.00 ± 0.00	4	2.75 ± 0.50
- Upper arm	0	-------	1	3.00 ± 0.00
- Wrist	13	2.69 ± 0.48	14	2.64 ± 0.50
Significance test	F=1.776, P0.165		t=0.602, P0.663	
Number of bricks				
- 1 prick	19	2.37 ± 0.68	22	2.32 ± 0.65
- 2 pricks	17	2.47 ± 0.51	14	2.93 ± 0.27
- 3 pricks	6	2.50 ± 0.55	3	2.67 ± 0.58
- > 3 pricks	8	2.75 ± 0.46	11	2.55 ± 0.52
Significance test	F=0.807, P0.497		t=3.776, P0.017	
Cannula stabilization				
- Stabilized	46	2.47 ± 0.59	48	2.56 ± 0.58
- Un stabilized	4	2.50 ± 0.58	2	2.50 ± 0.71
Significance test	t=0.071, P0.944		t=0.149, P0.883	