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Research Article

Effect of Heparin Solution versus Normal Saline for Maintaining Patency of Intravenous Line for Infant

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Abstract: Flushing venous access by normal saline was keeping patent as flushing with heparin solution. Normal saline is effective as heparin and it does not had severe complications. **The aim of this study was to** evaluate the effect of flushing heparin Solution versus normal saline on maintaining patency of peripheral intravenous line for infants. The study was conducted at pediatric intensive care unit of Tanta University and Pediatric Intensive Care Unit of Al Mabra Health Insurance at Tanta hospital. **A purposive sample** of 60 infants who had the following criteria: infants of both sexes, Required IV therapy for an expected duration longer than 5 days. Infants divided randomly into 2 equal groups Group (1): flushed with 0.7 mL normal saline. Group (2): flushed with 0.7 mL heparin solution 10 units/ml. **Two tools** were used to data collection: Assessment sheet to collect socio demographic characteristics for infant and nurses. Observation checklist of Intravenous line schedule to assess patency of intravenous access. **The result revealed that** Flushing venous access with normal saline was keeping intravenous access patent as flushing with heparin solution**. The study concluded that** Normal saline was effective as heparin and it does not had severe complications associated with heparin. **The study recommended that** flushing and locking of all peripheral intravenous cannula should be established in organizational policies, procedure and practice guidelines, Normal Saline should be used as an alternative to heparin in intravenous catheters**.**

Keywords: heparin Solution, normal saline, maintaining patency, intravenous line.

INTRODUCTION

The majority of infants admitted to hospital require intravenous line for hydration, feeding and/or the administration of drugs, and it has been calculated that approximately 150 million peripheral intravenous line are inserted annually in the United States. However, these devices may cause substantial morbidity, and frequently need early replacement as results of occlusion or superficial phlebitis (Gallant, P., & Schultz, A.A. 2006).

Most of infants in Pediatric Intensive Care Unit receives continuous intravenous therapy in the first weeks after birth. Interruption of continuous intravenous medication (for example, inotropic, sedatives and anesthetics) for the administration of intermittent medication is undesirable in severely ill infants in the Pediatric intensive care unit (De Jonge, R. *et al.*, 2005; Mok, E. *et al.*, 2014). This interruption is avoided by administration of intermittent medication and/or blood products using an additional intravenous catheter or peripheral intravenous lock (Hanrahan, K.S. *et al.*, 2014; Baskin, J. L. *et al.*, 2009).

The intravenous cannula is capped with a needleless connection. Such a peripheral intravenous line should remain patent for as long as possible because insertion of a peripheral intravenous line is a painful procedure for the infant. Moreover, the limited number of useful veins for cannula insertion in this patient group makes prolonged patency of the cannula an important issue. Therefore, administration of intermittent heparin solution is usually used as a regular flush solution to prevent occlusion of the peripheral intravenous line by clots (Dougherty, L. 2008).

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Based on available evidence, the use of saline as flush solution for peripheral intravenous line instead of heparin has become common practice in adult and adolescent patients. However, this may not be the best option for infant, as adults and adolescents differ greatly from the infant many ways. The intravenous cannula used in infants is smaller than those used in adults and thus can be more easily obstructed (Webster, J. *et al.*, 2008; Cornely, O.A. *et al.*, 2002).These intravenous line devices may cause substantial morbidity, and frequently need early replacement as results of occlusion or superficial phlebitis. Although many interventions have been developed to improve the outcome of intravenous line, including new line materials, the occurrence of phlebitis remains a common event (Udeh, C.I. *et al.*, 2013).

The issue, whether heparin should be used or not, is clinically important, as the use of heparin is not without risk. Heparin can be associated with the occurrence of intraventricular hemorrhage and heparin induced thrombocytopenia in infant (Goh, L. *et al.*, 2011). In particular, premature neonates have an increased risk of cerebral hemorrhage in the first few days of life (Alexander, H. 2010).

Heparin is incompatible with many types of medication, making it necessary to flush the peripheral intravenous line with extra saline prior to use, which gives a risk of fluid overload. The management of a peripheral intravenous line in infants depends on individual knowledge and practice. This varies between hospitals. There are no clinical practice standards for using a flush solution for peripheral intravenous line in infants (Young, G. 2007; Cotillo, M. D. *et al.*, 2008). The alternative, normal saline solution increases the accuracy of patients' coagulation status and enhances safer clinical practice (Hoste, E. A. *et al.*, 2002; Hanrahan, K. *et al.*, 2002) .

During recent decades more studies have analyzed the patency of a peripheral intravenous line flushed with heparin versus saline in infant and children. Results of these studies, analyzing a peripheral intravenous line patency flushed with heparin versus saline in only infants are conflicting. Several studies showed no differences between heparin (with concentrations of 1–10 units/mL) versus saline on the longevity of a peripheral intravenous line (Mok, E. *et al.*, 2007; Schultz, A. *et al.*, 2002). Other studies suggested that heparin solution is more effective in maintaining patency than saline (Shah, P., & Sinha, A. 2005).

A meta-analysis included 10 randomized or quasi randomized controlled trials and a review concluded that a recommendation for heparin use in infant with peripheral intravenous catheters could not be made due to clinical and outcome parameters heterogeneit .They concluded a lack of blinding in interventions and allocation. The dose of heparin and the administration method also varied widely. The frequency of flushing the peripheral intravenous line was not always mentioned. In these studies, we could not find a clear recommendation for flush solutions giving a prolonged patency of a peripheral intravenous line. A trial with sufficient power and well-defined criteria is recommended (Garrett, E. 2007; Von Klitzing, K., & Bürgin, D. 2005).

The flushing amount (0.7 mL) is determined by the volume of the total peripheral intravenous lines system, including catheter, infusion line, needleless adapter and a little amount extra volume to ensure a total flush of the peripheral intravenous line system. As flush procedure, all nurses will use the same method. This contained disinfection with 80% chlorhexidine of the needleless adapter, flushing the 0.7 mL solution (using a 2 mL syringe) over 3 seconds, removing the syringe while maintaining continuous pressure and disinfecting the needleless adapter with 80% chlorhexidine (Garrett, E. 2007)

The Aim of This Study Was To:

Evaluate the effect of heparin Solution versus saline as flush solution on maintaining patency of peripheral intravenous line for infants.

Research Hypothesis:

The administration of heparin Solution as flush solution expected to maintain patency of peripheral intravenous line for infants.

II. MATERIALS AND METHOD

Research Design:

Quasi experimental research design was used.

Setting:

The study was carried out at:

- Pediatric Intensive Care Unit of Tanta University.
- Pediatric Intensive Care Unit of Al Mabra Health Insurance at Tanta city.

Subject:

- A purposive sample of sixty (60) infants who fulfilled the following inclusion criteria criteria: Both sexes, Required IV therapy for an expected duration longer than 5 days,
- All nurses in pediatric intensive care unit of Tanta university hospital were included in the study(Total number of 30 nurses)

Exclusion Criteria:

Infant who take anticoagulant therapy as (warfarin, heparin, or other), Platelet count less than 100 × 109/L, any coagulation defects, previous adverse reaction to heparin, programmed cytotoxic therapy, and Take continuous intravenous fluid or nutrition.

The subjects were randomly assigned into two groups, who equally divided into:

- **Group (1):** Consist of 30 Infants with peripheral line flushed by 0.7 mL normal saline.
- **Group (2):** Consist of 30 Infants with peripheral line flushed by 0.7 mL heparin solution 10 units/mL.

Tools of Data Collection:

Two tools were used to collect the required data in this study.

Tool 1: Socio Demographic Characteristics of Studied Infants:

Assessment sheet was developed by the researcher after review the related literature and consisted of two parts namely.

Part One:

Socio-demographic characteristics of the studied infants such as age, sex, duration (days) of hospital stay, and diagnosis.

Part Two:

Socio-demographic characteristic of nurses such as educational level, age, experience and attendance of any program related to infant.

Tool II: Observation Checklist schedule for patency of Intravenous line:

Part One:

Observation for patency of peripheral line was measured by time in hours (duration (hours) of vein cannulation /patient)

Intravenous Line Patency Was Divided Into:

The length of patency which started when a new peripheral line was inserted or when an intravenous cannula used for continuous infusion and it ends when the line was removed. It included length of patency by hours without complication.

a-The main outcome was the duration of intravenous line patency. It was calculated in hours from the moment of cannula insertion (primary peripheral line), or peripheral infusion was presented until the nurse decided to be removed it was (secondary peripheral catheter).

b- There were elective reasons for cannula removal such as end of therapy, dislocation, when the peripheral catheter had become a continuous catheter infusion and discharge or death.

C-There were non-elective reasons for cannula removal such as infiltration of the area, phlebitis, obstruction of the cannula and fluid leakage which were considered as a failure of the peripheral catheter.

Part Two: Intravenous Line Insertion Site Assessment:

Line insertion sites was inspected daily by the researcher who **recorded any** adverse event as:

- Phlebitis: as the presence of two or more symptoms/signs among pain, tenderness, warmth, erythema, swelling, or a palpable cord
- Occlusion: resistance to flushing as evidenced by the inability to administer 1 mL of flushing solution within 30 seconds.
- Ecchymosis: purple discoloration of the skin around the catheter insertion site larger than 1 cm.
- Infiltration: the movement of a needle or cannula from within a vessel into the surrounding tissue. The typical symptoms were a slowed flow of fluids, swelling, pallor, coolness of the skin, and discomfort in the area; severity of the symptoms depend on the amount and type of fluid infused.

Part Three: Heparin Induced Thrombocytopenia Assessment:

The researcher assessed platelet count at baseline and, subsequently, daily for 5 days. Heparin induced thrombocytopenia was assessed as a fall in platelet count >50% of baseline value without any alternative explanation.

III. METHOD

An official permission to conduct this study was obtained from the faculty of nursing Tanta University and Pediatric Intensive care Units of Tanta University Hospital and of Al Mabra Health Insurance at Tanta city. Ethical consideration for privacy and confidentiality of the data and results were considered. Informed consent from the parents was obtained after explaining the purpose of the study. The parent was informed that they can withdraw from the study at any time. Study not harm or cause pain to study subject.

Pilot study:

A pilot study was carried out before starting the data collection. It was done on a sample of 10% of the infants to test clarity, visibility and applicability of study tools .The required changes were done accordingly. Two tools were developed by the researcher after reviewing of the relevant literature, to assess Socio demographic characteristics of infants and nurses Tool (I). Observation checklist to assess the patency of peripheral line, intravenous line insertion Tool (II) and assessment of heparin induced thrombocytopenia. Validity and reliability of it was tested by expert in the field of pediatric nursing and test, retest was done by using Tool (II).

Implementation of the Study:

The studied infants were divided into 2 groups according their type of flushing were flushed by normal saline Group I and Heparin solution Group II. All infants meet the criteria were observed by the researcher and

subjected to complete physical assessment and follow up. The researcher asked nurses about flushing of venous access to keep it patent, assessment of cannula and reassessment was done during follow up at 5th days of flushing with special attention to signs of complication like platelet count and patency of venous access. Peripheral line was flushed with 0.7 ml/hr normal saline for group I [67] and group II was flushed with 0.7 ml/hr heparin solution 10 units/ml.[67] Socio demographic characteristics was collected for nurses using Tool(I). The time required to fill sheet for each nurse was ranged from 10 – 20 minutes is depending on the response of the nurse and observation of infant status. Intravenous line insertion site were assessed for both group and recorded, reassessment. Follow up was done by reassess mean of heparin induced thrombocytopenia check platelet count every day for 5 days.

Duration of Data collection:

The field work was carried out through a period of 6 months from October 2015 to April 2016.

Statistical Analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 16, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, (which describe a categorical set of data by frequency, percentage or proportion of each category, comparison between two groups and more was done) using Chi-square test ($\chi 2$). For comparison between means of two groups of parametric data of independent samples, student t-test was used. For comparison between means of two groups of non-parametric data of independent samples, Z value of Mann-whitney test was used. For comparison between means of more than two means of non-parametric data of related groups (base line and subsequent four assessments every five days), ($\chi 2$ value) of Friedman test was calculated. Correlation between variables was evaluated using Pearson's correlation coefficient (r). Significance was adopted at $p<0.05$ for interpretation of results of tests of significance.

RESULTS

Table (1) Demonstrate that the mean age was 5.22±3.48 months for group I and 6.33±3.22 months for group II. There was no statistically significant difference between the age of two groups **(**P Value = 0.203). As regards to their sex, it was noticed that more than half (56.7%) of group I were males while**,** nearly half 43% were female. Regarding their days of hospital stay, the result revealed that the mean of days of group I was 8.47±2.85 and 7.17±2.07days for group II. The Table also revealed that the diagnosis of 16.7% and 10% of studied children in both group were bronchopneumonia, pneumonia and acute bronchitis respectively, while 16.7% and 6.7% of them in group II and of group I had gastroenteritis respectively. Whereas the diagnosis of 13.4% of group II and only 3.3% of group I were hypoglycemia and diabetic ketoacidosis. Epilepsy and recurrent convulsion are represented by 13.4% of group I and 10.0% of group II and only 6.7% at both group were encephalitis and meningitis, 23.3% at both group were renal failure and heart failure. 13.3% of group I were intracranial hemorrhage ,only 3.3% at both group were auto immune disease and 3.3% of group I were respiratory distress.

Table (2) illustrates Percentage Distribution of Studied Nurses Related to Socio-Demographic Characteristics. It was observed that, the mean age of studied nurse in both groups were 26.63±2.47 year. Regarding to educational level of the studied nurse, three quarter (75%) of nurses had bachelor degree and 25% had technical institute of nursing. In relation to the mean of the years of experience, it was 3.57±2.70 year. Concerning the attendance of any educational program, it was evident that, all studied nurses 100% were attended programs.

Table (3): Present intravenous catheter cannulation characteristics, this table clarified that there was statistically significant difference with **(**P Value = 0.0001) among both groups regarding numbers of cannulation, duration between cannulation by days. Also, the result revealed that there was statistically significant difference with **(**P Value = 0.033) regarding hours of cannulation among both groups. Regarding the days of cannulation, this table presented that, the mean of group I were 505.20±170.26 and 419.77±129.56 for group II. There was statistically significant difference with **(**P Value = 0.029) among both groups. In relation to the number of cannulation, it was found that, the mean of group I were 3.00±0.99 and 1.00±0.41 for group II. Concerning the duration between cannulation in days, it was observed that mean of group I were 2.70±0.47 and 4.67±1.03 for group II.

Figure (1): Presents causes of removal of peripheral intravenous catheter and complications if present among the studied infants in both groups with peripheral intravenous line. It was noticed that the catheter removal was elective removal in three quarter 70% for group I and 73.3% for group II while as for non-elective removal causes were one third 30% for group I and 26.7% for group II respectively. Moreover, it was evident that there was statistically significant difference between the two groups regarding the reasons of elective removal of cannula (P Value = 0.023).

Table (4):Illustrates percentage distribution of phlebitis signs observed at intravenous catheter insertion among the studied infants with peripheral intravenous line in both groups .It was found that the majority of infants (96.7% and90.0%) in group I and

group II had no pain, 90.0% and 93.3% of infants don't have tenderness in the site of cannula in both group respectively. The same table also revealed that 93.3% of infants in group I, and 96.7%of infants in group II had no warmth at intravenous catheter insertion. Regarding the erythema or ecchymosis at intravenous catheter site insertion, this table showed that the majority of infants in both groups 86.7% in group I, 96.7% in group II had no erythema and no swelling in the site of intravenous access.

Table (5): Clarifies occlusion and erythema signs observed at intravenous catheter insertion among studied infants with peripheral intravenous line in both groups. It was found that the majority of group II (90.0%) and about slightly three quarter of group I (73.3%) don't had signs of occlusion. Moreover, it was evident that, most of infants in both groups (86.7%) and (96.7%) don't had erythema.In relation to presence of swelling at the site of insertion, it was found that, the majority of group II (96.7%) and most of group I (86.7%) don't had swelling at the site of cannula insertion. It was noticed that both group had no skin coolness. There was statistically significant difference between the two groups regarding the discomfort of cannula insertion

Table (6): Shows Percentage distribution of platelets count for diagnosis of heparin induced thrombocytopenia among both groups of studied infants at baseline and subsequently every day for 5 days. It was observed that, the mean of platelet count at the first day as a base line for both groups were 246.47±109.34 and 294.77±93.28 respectively.Regarding the mean of platelets count significant difference among the two groups from 1st to 4th day. Whereas there was statistical significant difference (p=0.020*) among both groups. Mean platelets count during 5th day were 271.45±89.62 and 213.37±124.94 for group I and group II respectively.

Table (1): Percentage Distribution of studied infants related to Socio-demographic Characteristics.

Socio-demographic characteristics of the studied infants	**The studied infants with peripheral intravenous line (n=60)**					
	Group I (Flushed with normal saline) (n=30)		**Group 2 (Flushed with heparin solution (n=30)**		**Total (n=60)**	
	No	**%**	**No**	**%**	**No**	**%**
Sex:						
Males	17	56.7	15	50.0	32	53.3
Females	13	43.3	15	50.0	28	46.7
Age in months:						
1-<6	18	60.0	12	40.0	30	50.0
6-12	12	40.0	18	60.0	30	50.0
Range Mean±SD	1-12 5.22±3.48		1-11 6.33±3.22		1-12 5.77±3.37	
Days of hospital stay:						
Range Mean±SD	5-15 8.47±2.85		5-12 7.17±2.07		5-15 7.82±2.55	
Diagnosis:						
-Bronchopneumonia and Pneumonia -Acute bronchitis	5 3	16.7 10.0	5 3	16.7 10.0	10 6	16.6 10,0
-Gastroenteritis	2	6.7	5	16.7	7	11.7
-Hypoglycemia and Diabetic ketoacidosis.	1	3.3	4	13.4	5	8.3
-Epilepsy and Recurrent convulsion	4	13.4	3	10.0	7	11.7
-Encephalitis and Meningitis	2	6.7	2	6.6	4	6.7
-Renal failure -Heart failure	5 2	16.7 6.7	2 3	13.3 10.0	14	23.3
-Intracranial hemorrhage	4	13.3	0	0	4	6.7
-Auto immune disease	1	3.3	1	3.3	2	3.3
-Respiratory distress	1	3.3	0	0	1	1.7

Table (2): Percentage Distribution of Studied Nurses Related to Socio-Demographic Characteristics.

Socio-demographic characteristics of studied nurse	The study nurses providing care for the studied infants with peripheral intravenous line (n=30)	
	No	%
Educational level:		
Technical Institute (Technician)	8	25.0
Bachelor degree	22	75.0
Age in years:		
Range	18-31	
Mean±SD	26.63±2.47	
Years of experience:		
Range	1-13	
Mean±SD	3.57±2.70	
Attendance of any program related to infant:		
Yes	30	100

Table (3): Percentage Distribution of studied infants related to Intravenous Catheter Cannulation characteristics.

Intravenous catheter cannulation characteristics	The studied infants with peripheral intravenous line (n=60)				χ^2	P
	Group I (Flushed with normal saline) (n=30)		Group 2 (Flushed with heparin solution (n=30)			
	N	%	N	%		
Hours of cannulation:						
180-<300	4	13.3	8	26.7	4.416	0.220
300-<500	13	43.3	16	53.3		
500-<600	5	16.7	3	10.0		
600-897	8	26.7	3	10.0		
Range	180-897		280-715			
Mean±SD	505.20±170.26		419.77±129.56			
t-test	2.187					
P	0.033*					
Number of days of cannulation:						
3-<5	4	13.3	6	20.0	5.971	0.051
5-<10	15	50.0	21	70.0		
10-15	11	36.7	3	10.0		
Range	3-15		5-12			
Mean±SD	8.63±2.92		7.17±2.07			
t-test	2.245					
P	0.029*					
Number of cannulation:						
1 – 2	6	20.0	30	100	40.000	0.0001*
3 – 4	21	70.0	0	0		
5 – 6	3	10.0	0	0		
Range	2-6		1-2			
Mean±SD	3.00±0.99		1.00±0.41			
t-test	10.877					
P	0.0001*					
Duration between cannulations by days:			**(n=6)**			
2	9	30.0	0	0	29.127	0.0001*
3	21	70.0	1	16.7		
4-6	0	0	5	83.3		
Range	2-3		3-6			
Mean±SD	2.70±0.47		4.67±1.03			
t-test	7.518					
P	0.0001*					

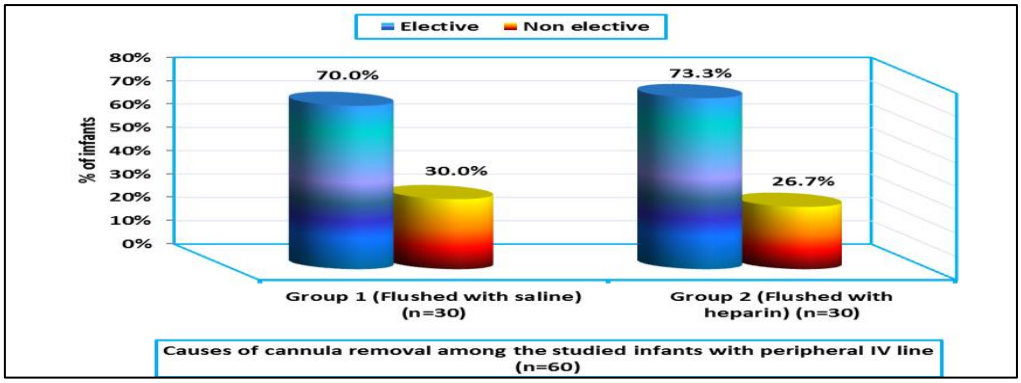

Figure (1): Causes of removal of peripheral intravenous catheter among the both of studied infants

Table (4): Percentage Distribution of cannula insertion to studied infants related to Phlebitis Signs.

signs of phlebitis at intravenous catheter insertion	The studied infants with peripheral intravenous line (n=60)				χ^2	P
	Group I (Flushed with normal saline) (n=30)		Group 2 (Flushed with heparin solution (n=30)			
	No	%	No	%		
Pain:						
Absent	29	96.7	27	90.0	1.071	0.301
Present	1	3.3	3	10.0		
Tenderness:						
Absent	27	90.0	28	93.3	0.218	0.640
Present	3	10.0	2	6.7		
Warmth:						
Absent	28	93.3	29	96.7	0.351	0.554
Present	2	6.7	1	3.3		
Erythema or Ecchymosis:						
Absent	26	86.7	29	96.7	1.964	0.161
Present	4	13.3	1	3.3		
Swelling:						
Absent	26	86.7	27	90.0	0.162	0.688
Present	4	13.3	3	10.0		

Table (5): Percentage distribution among studied infants of both groups related to Occlusion and Erythema Signs, and Infiltration Signs

Occlusion and Erythema signs	The studied infants with peripheral intravenous line (n=60)				χ^2	P
	Group I (Flushed with normal saline) (n=30)		Group 2 (Flushed with heparin solution (n=30)			
	No	%	No	%		
Occlusion:						
Absent	22	73.3	27	90.0	2.783	0.095
Present	8	26.7	3	10.0		
Erythema:						
Absent	26	86.7	29	96.7	1.964	0.161
Present	4	13.3	1	3.3		
Infiltration Signs						
Swelling at cannula insertion site:						
Absent	26	86.7	29	96.7	1.964	0.161
Present	4	13.3	1	3.3		
Pallor of the skin:						
Absent	29	96.7	30	100	1.017	0.313
Present	1	3.3	0	0		
Coolness of skin:						
Absent	30	100	30	100	-	-
Discomfort of cannula insertion site:						
Absent	17	56.7	25	83.3	5.079	0.024*
Present	13	43.3	5	16.7		

Table (6): Percentage Distribution among studied group related to Platelets Count for Diagnosis of Heparin Induced Thrombocytopenia

Platelet count x1000	The studied infants with peripheral intravenous line (n=60)		Z value	P
	Group I (Flushed with normal saline) (n=30)	Group 2 (Flushed with heparin solution (n=30)		
Platelet count (x1000):				
1st as a(Baseline):				
Range Mean±SD	85-451 246.47±109.34	160-456 294.77±93.28	1.575	0.115
Median	227.00	300.50		
2nd day:				
Range Mean±SD	65-449 244.40±102.05	94-440 257.93±90.75	0.370	0.712
Median	229.00	218.00		
3rd day:				
Range Mean±SD	90-435 245.00±95.69	97-411 241.23±101.94	0.044	0.965
Median	230.00	211.00		
4th day:				
Range Mean±SD	87-456 270.47±99.67	87-419 231.93±114.92	1.442	0.149
Median	307.00	159.50		
5th day :				
Range Mean±SD	151-439 271.45±89.62	83-421 213.37±124.94	2.328	0.020*
Median	303.00	140.50		
χ^2 value **P**	23.139 0.0001*	16.768 0.002*		

DISCUSSION

American Heart Association (2009) concluded that normal saline is beneficial and therefore should be used for venous catheters. It might be safer to use normal saline as it does not have the risks associated with heparin [21]. The patency of peripheral intravenous cannula can be maintained through infusion continuously with fluid at a low rate or flushed intermittently (usually every 4-8 hours). During the current study practice, it was noted that the frequency of peripheral intravenous cannula patency was high as the majority number of days of cannulation for both groups was from 5-<10 day [4]. Also, the majority of infants of both groups had no signs of phlebitis, occlusion and erythema signs, and infiltration signs. Moreover, it was evident that there was no statistically significant difference between the two groups regarding the reasons of cannula removal. This result was in agreement with White, *et al.,* (2011) who found that routine 8 hourly, 0.9 percent saline flushes will maintain cannula patency (Zhong, L. *et al.,* 2017).

As well as Lyons, *et al.,* (2014) suggested that intermittent cannula flushing is associated with improved cannula patency (Lyons, M. G., & Phalen, A. G. 2014).This result was also in agreement with Selleng *et al.,* (2017),who found that no significant difference on maintenance patency of the catheter, prevention of its occlusion and catheter survival and heparin had no advantage over normal saline (Selleng, K. *et al.,* 2017).

The result of present study revealed that the duration between cannulation in days of group I (Flushed with normal saline) more than group II (Flushed with heparin solution). This result was consistent with Anna (2012) who found that a significant increase in peripheral venous catheters life when a normal saline flush is used (Perez, A. *et al.,* 2012).

This result was in disagreement with Schallom *et al.,* (2012), who concluded that heparin prolongs the duration of catheter patency (Schallom, M. E. *et al.,* 2012). In addition, Mc Callum, L., & Higgins, D. (2012), who supports the use of heparin that it is effective than normal saline, in that, it prolongs the duration of catheter patency (Mc Callum, L., & Higgins, D. 2012)

The present study revealed that, there was statistical significant difference among both groups regarding mean platelet count during 5th day flushing. it was higher in group I than group II , that indicate risk of heparin induce thrombocytopenia. This can explained in the fact that normal saline provide many advantages summarized in patients' safety while using heparin, even in a small concentration; there is a potential risk for allergic reactions, hemorrhage, and heparin induced thrombocytopenia. This result is in agreement with Lichun Xu (2017) who reported that heparin

administration may also lead to heparin-induced thrombocytopenia and hypersensitivity to heparin.

This result was incongruent with Bertolino G1 (2012), who stated that Intermittent flushing with 100 U/mL heparin is safe and more effective than saline solution for peripheral catheters' maintenance.

CONCLUSION

Based on the findings of the present study, it can be concluded that Flushing venous access by normal saline was the same as flushing with heparin solution for keeping it patent. Normal saline was effective as heparin, it had not severe complications which associated with heparin ,platelet count affected during 5th day of flushing of heparin solution. It can be concluded that normal saline was beneficial than heparin solution in flushing venous catheters.

Recommendations

Based on the findings of the present study, the following recommendations were suggested:

- In-service training programs should be conducted for pediatric intensive care unit nurses about the technique of flushing, disinfection site insertion of venous access and difference between normal saline versus heparin solution and enhancing nurses' knowledge about different flushing solution.
- Encouraging the use of normal saline as an alternative to heparin Solution in peripheral intravenous access for it is safety.
- Complete site assessment for the infant cannulation including inspection of the insertion area, occlusion, patency as systemic infection and infiltration/ extravasations at insertion site for cool skin temperature.
- Flushing and locking of all peripheral intravenous cannula should be established in organizational policies, procedure and practice guidelines and labeling Heparin as high alert medication.

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