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Effectiveness of Intermittent Normal Saline in Maintaining Patency of Peripheral Intravenous Cannula in Children: An Experimental Study

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Abstract: ***Background: It has been estimated that as many as one in three hospital patients have a peripheral venous catheter (PVC) in-situ at any given time.[1] Proteins in the blood plasma, called the coagulation factors, respond in a complex cascade as soon as the blood vessel is injured to form fibrin strands, which strengthens the platelet plug. Thus, the need arises to keep the catheter lumen patent. Method: The aim of the study was to assess the effectiveness of intermittent saline flushing in maintaining the patency of peripheral intravenous cannula in hospitalized children. Simple random sampling technique was used to select the samples as per the inclusion criteria and then randomly divided into experimental and control group as per the computer generated research randomizer. Routine flushing was practiced in both the groups and intermittent flushing was done in experimental group. Peripheral intravenous catheter in situ is observed in both groups for resistance to flow, backflow, swelling at the site, redness, blanched skin. Results: Both the study groups were homogenous in respect to the age, gender, size of cannula, site of cannulation and antibiotics. There was significant difference in patency of peripheral intravenous cannula in the experimental group with intermittent saline flushing as compared to the control group. Conclusion: There is a significant association of intermittent saline flushing with the patency of peripherally inserted intravenous cannula. Flushing with 0.9 percent sodium chloride solution to ensure and maintaining patency, should be performed between and administration of incompatible medications and solutions. Flushing and locking of all peripheral intravenous cannula should be established in organisational policies, procedure and practice guidelines.***

Keywords: Peripherally inserted intravenous cannula, Patency, Intermittent saline flushing

1. Introduction

Intravascular access is an unavoidable tool in sophisticated modern medical practice. Insertion of peripheral intravenous cannula is very difficult in children as they have fragile veins. Venous cannulation provides relatively easy and comfortable access for intravenous therapy for hospitalised children and is frequently used to give drugs, solutions or blood products but they associate the procedure with serious illness. Resistance while flushing the cannula or absence of return blood flow cannula use indicates a non-functioning cannula. It is therefore desirable once the intravenous cannula is inserted that its patency is maintained.

Diverse practices are followed for maintaining the patency of IV cannula with different solutions. It is difficult to maintain the patency of intravenous cannula in a pediatric age group. Maintaining patency of intravenous cannula is important to minimize child's discomfort and expense associated with the replacement.

To maintain its patency, the peripheral intravenous cannula can be infused continuously with fluid at a low rate or flushed intermittently (usually every 4-8 hours). During the clinical practice, it was noted that the frequency of peripheral intravenous cannula getting blocked was high; hence, the study was conducted to assess the effectiveness of intermittent normal saline flushing in maintaining the patency of peripheral intravenous cannula in hospitalized children.

2. Materials and Method

This double blinded experimental study was conducted after the approval of institutional ethical committee, with the consent of HOD, Dept of Paediatrics, in the paediatric ward of a tertiary care hospital. All children with freshly inserted peripheral intravenous cannula of sizes 24 G, 22 G in the age group of 29 days to 6 years, receiving parenteral antibiotics such as Inj Augmentin, Inj Cefotaxime ,Inj Ceftriaxone, Inj Amikacin, Inj Gentamycin were included in the study. All children receiving potassium supplements, Inj Vancomycin, Inj Amphotericin, dextrose solutions anticonvulsants, IV fluids or with extension lines were excluded from the study.

A total of 40 patients were considered for the study, 20 each in experimental and control groups. As per the inclusion criteria, the list of the hospitalized children was prepared which formed the sampling frame. Using simple random technique, children were selected and randomly divided into experimental and control group as per the computer generated research randomizer.

Demographic data such as sample ID, age, and gender, date of hospitalization and diagnosis of the child were recorded on a predecided performa. Details of intravenous cannulation such as day of cannulation, size of cannula, site of cannulation, type of parenteral antibiotics, type of flushing were also noted.

Routine flushing was done with 1 ml of 0.9 % normal saline before and after the administration of antibiotics and in addition to the routine protocol,1 ml of saline flushing is administered intermittently every 6 hourly in the

experimental group. Pushpause technique was used uniformly in both groups to flush the cannula which refers to pushing 1 ml of the flushing solution at a time into the catheter to create a turbulent flow within the lumen, thereby decreasing the risk of fibrin and platelets becoming adhered to the internal wall of the catheter and minimizing occlusion.

Peripheral intravenous catheter in situ was observed in both groups for resistance to flow, backflow, swelling at the site, redness, blanched skin. The patency of the cannula was observed every 12 hourly from the time of insertion of cannula for 72 hours based on an observational checklist. As per the prepared tool, if a particular observation was present, 1 mark was given and 0 was given in its absence. Hence a increase in score indicated decrease in patency of cannula. A score of 3 and above indicated loss of patency of the intravenous cannula and needed to be removed and re sited.

Demographic data was analysed using frequency distribution and percentage ; Chi Square test to find out the association between demographic variables and study subjects; Mean, SD, MW test to compare the patency of peripheral intravenous cannula between the experimental and control group; KW test to compare the patency of cannula between the study groups in relation to the selected demographic variables. For statistical analysis, 5% level of significance was considered.

3. Results

3.1 Demographic data Analysis

Age: 50% of children in the experimental group were preschoolers whereas 40% of the children in the control group were preschoolers.

Sex: Majority of the children (60% in experimental and 55% in control group) were males.

Site of cannula: 85 % of the children in the experimental group had peripheral intravenous cannulation in the dorsum of hand, whereas in the control group, 75 % of the children had peripheral intravenous cannula in the dorsum of hand.

Antibiotics: 50 % of the children of the experimental group received Inj Augmentin from the pencillin group of drugs and in the control group, only 40 % of the children received Inj Augmentin from the pencillin group of drugs.

Size of cannula: 24G cannula was used in 50% of the children of experimental group whereas in the control group, 24G cannula was used in 55% of the children.

An analysis of research variables revealed that the randomization of samples had succeeded in providing relatively homogenous groups in respect of the age groups, gender, size of cannula, choice of antibiotics and site of cannulation. There was no significant difference between both the groups for these variables as evident by $p > 0.05$.

Table 1: Patency of peripheral intravenous cannula after intermittent saline flushing in experimental group

Variable	Day 1 NS flushing				Day 2 NS flushing				Day 3 NS flushing			
	f(obs 1)	%	f(obs 2)	%	f(obs 1)	%	f(obs 2)	%	f(obs 1)	%	f(obs 2)	%
Patent	20	100	20	100	18	90	17	85	14	70	09	45
Not patent	0	-	0	-	02	10	03	15	06	30	11	55

3.2 Patency in Experimental Group

After intermittent saline flushing, all children had patent peripheral intravenous cannula at the end of Day1 of the study i.e. 24 hours from the time of insertion of cannula, 85% of children had patent intravenous cannula at the end of Day 2 of the study i.e. 48 hours from the time of insertion of cannula and at the end of Day 3 of the study i.e. 72 hours from the time of insertion of cannula, 45% of the children had patent intravenous cannula.

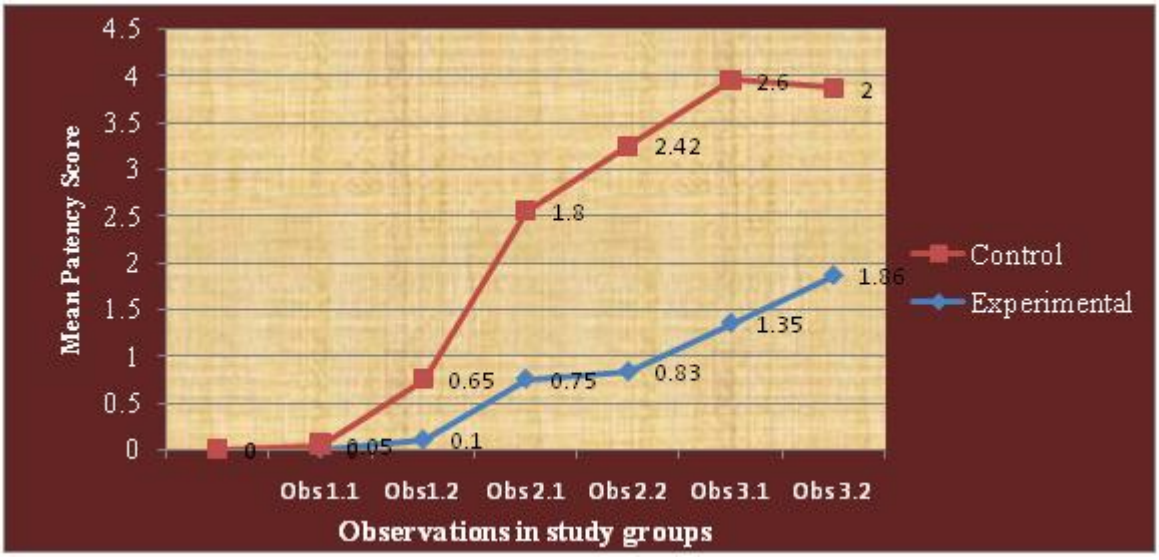

Figure 1: Comparison of mean patency score of intravenous cannula among the experimental and control group

Comparison of patency of peripheral intravenous cannula in both the groups

The patency score was 0.10 ± 0.31 SD in the experimental group, whereas in the control group, the mean patency score was 0.65 ± 0.74SD from the 2nd observation. The computed p value varied from < 0.05 to < 0.0001, which indicates that there is significant association of patency of intravenous cannula with intermittent saline flushing. As the mean score increases, the patency of the peripheral intravenous cannula decreases. On day 3 of study, from 60 hours of insertion of IV cannula , the mean patent score in experimental group was 1.35 ± 1.12 SD and in the control group, the score was 2.60 ± 0.89 SD. The computed Z value was 2.08, which was more than the critical value as evident by p value <0.05 denotes that the intermittent saline flushing was effective in maintaining patency of peripheral intravenous cannula.

Association of patency of peripheral intravenous cannula with research variables

In the present study, findings reveal that there is no significant relationship of patency of peripheral intravenous cannula among the study groups in terms of age group, size of cannula and site of cannula as evident by p value > 0.05 up to 72 hours from the insertion of cannula.

4. Discussion

The present study findings supported that there is a significant association of intermittent saline flushing with the patency of peripherally inserted intravenous cannula. The cannula should be flushed at established intervals to promote and maintain patency and to prevent the mixing of incompatible medications and/or solutions. Following research studies support the above study findings.

Lynn Hadway in an educational program on infection control and patient safety, concluded that flushing is used to clear the catheter lumen of any medication that was previously infused.[4]Medication incompatibility produces drug precipitates that can occlude the catheter lumen. Flushing with normal saline between each medication can prevent contact between incompatible drugs and prevents the formation of the occluding precipitate. Moss in 1996 suggested that peripheral intravenous cannula should be flushed on first sitting to confirm patency and before, between and after intravenous drug injections. If a cannula is in situ, but not actively used, studies suggest routine 8 hourly, 0.9 percent saline flushes will maintain cannula patency.[5]

A study conducted by Perez A,et al concluded that intermittent cannula flushing is associated with improved cannula patency for peripherally inserted venous catheters in newborns.[6] It is important to note that twisting the infusion set, or wrapping it around the scissors to force fluid through the cannula should be avoided. This results in an increase of intravascular pressure up to 300 mm Hg as cited by Hecker in 1988, resulting in vasospasm and eventual collapse of the vein. [5] If there is any resistant pressure, do not force the flush and discontinue use of the cannula. Flushing with 0.9 percent sodium chloride solution to ensure and maintaining patency, should be performed between and administration of incompatible medications and solutions. (INS 2000; NICE 2003).[7]

A study published in Journal of Paediatric Nursing by Gupta P et al revealed that birth weight, gestation, application of splint, fluid and glucose infusion rate, site of cannulation, administration of gentamicin, amikacin and other drugs did not influence the median life span of intravenous cannulas. Cefotaxime use led to decreased survival of intravenous cannula; though this effect appeared to be related to the mode of administration rather to the drug per se.[8]A study published in Pediatric Nursing Journal by Paisley MK et al concluded that gestational age and site of insertion were the only predictor variables related to the duration of patency for intravenous catheters .[9]

Almost similar type of findings were reported by Dunn and Lenihan in 1987 that when saline lock is used 8 hourly, 82 % cannulas were patent.[16] Ashton and Gibson in 1990 conducted a study on patency of intravenous cannula and found that patency was successfully maintained with a flush of 1 ml of saline solution every 12 hourly.[16]The present study is also supported by the study conducted by Anna, et al which suggested that intermittent cannula flushing is associated with improved cannula patency.[17]

5. Conclusion

It is imperative that the nurse makes a periodical assessment of the site of cannulation to detect preventable hazards of phlebitis early and the cannula should be reinserted soon Flushing and locking of all peripheral intravenous cannula should be established in organisational policies, procedure and practice guidelines.

Nurses and other health care professionals need to be re-educated on the importance of intermittent normal saline flushing to improve the patency of peripheral intravenous cannula and thereby, provide the best possible care to the child. Accurate records of peripheral intravenous access and management should be maintained. Frequent inspection of the site will prevent complications like infiltration, extravasations and will show unequivocal effectiveness in reducing the incidence of catheter related infections and associated complications and costs.

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