# Effectiveness of Intermittent Normal Saline Flush to Maintain the Patency of Intravenous Cannula among Children Admitted in Pediatric Wards of Tertiary Center of Eastern Nepal

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## ABSTRACT

**Introduction:** Insertion of peripheral intravenous cannula in children is a stressful experience. Nurses caring for neonates and infants spend a significant amount of time starting and managing intravenous (IV) cannula. It is therefore desirable to maintain the patency as long as possible once cannula is inserted. To achieve this cannula can be infused with fluid at a low rate or flushed intermittently. This study was done to assess effectiveness of intermittent normal saline flush to maintain the patency of intravenous cannula among children of pediatric ward.

**Methods:** An Experimental study was conducted on 60 samples, 30 in each in control and experimental group. Study was conducted among children of age group 5-14 years undergoing Intravenous cannulation during the time of data collection was 3 months. Consecutive sampling technique was used and random allocation of two groups i.e. control group and experimental group was done by lottery method. The data was collected by assessing the patency of intravenous cannula twice a day, before giving medication for three consecutive days.

**Results:** More than half 56.7% and 43.3% of children in the experimental group were 5-9 years and 10-14 years respectively whereas 60% and 40% of the children in the control group were 5-9 years and 10-15 years respectively. In experimental group patency was maintained in all cannula till day 2 and 56.7% cannula remained patent up to the day 3 evening. While in control group, patency decreased from day 2 morning (73.3%) and only 3.3% cannula were patent in day 3 evening. The difference in patency was highly significant ($p<0.001$) between two groups.

**Conclusion:** Intermittent normal saline flush was found to be highly effective for maintaining patency of intravenous cannula. Size of cannula was not homogenous in both groups but it does not show any statistical significance in patency of cannula. Age, sex, medicine, diagnosis and site of the cannula were not associated with patency of intravenous cannula.

**Key words: Patency; Intravenous cannula; Intermittent normal saline flush.**

## INTRODUCTION

Nurses caring for neonates and infants spend a significant amount of time starting and managing intravenous (IV) cannula. A variety of management strategies are employed to prolong cannula duration thereby decreasing the frequency with which IV cannula need to be restarted.[1] Inserting an IV cannula can be stressful to the child, the nurse, and the parents. Infants and children may experience the physical burden of pain and cold stress, and emotionally, they experience fear.[2] Peripheral intravenous device (PIV)/ cannula are the most commonly used intravenous device in hospitalized patients.[3] PIV's are usually considered a low risk; however it can be

associated with complications such as hematoma, phlebitis, pain and infections.[4,5] The introduction of plastic cannula as compared to stainless cannula provided a route for prolonged Intravenous therapy and was welcomed so enthusiastically that the subtle occurrence of an increasing rate of sepsis and phlebitis was over looked.[6]

Cannula occlusion can be caused by drug precipitates and several mechanical issues. Although intraluminal thrombosis is thought to be the most common factor, many factors cause blood to move into the catheter lumen from many sources.[7] Each cannula should last as long as possible and for any given period of treatment and minimum number of cannula should be used. To achieve this, the cannula can be infused continuously with fluid at a low rate or flushed intermittently (usually every 4-8 hours). [8,9,10]

The use of sodium chloride (0.9%) for Intravenous lock was recommended by American Society of Health System Pharmacists and Infusion Nurses Society to reduce the incidences of phlebitis, infiltration and blockage of I.V cannula.[11,12,13] Studies have shown those 82% cannulas are found patent when saline locks were used 8 hourly.[14] Intermittent flushing would decrease nursing time and equipment and allow greater access of the mother to her infant, but may decrease cannula life by blockage due to clotting. Currently there is little uniformity between neonatal nurseries as to which method is used and evidence is required to decide which method, if any, best maintains intravenous access.[15] This study was conducted to assess effectiveness of intermittent normal saline flush to maintain the patency of intravenous cannula among children of pediatric wards.

## METHODS

This was an experimental study conducted in pediatric ward of BPKIHS, a tertiary center of eastern region of Nepal. Study was conducted among children of age group 5-14 years undergoing Intravenous cannulation during the time of data collection (20th December, 2015 to 20th February, 2016). Consecutive sampling technique was used and random allocation of two groups i.e. control group and experimental group was done by lottery method.

Sample size calculation was done by considering 95% confidence interval and 90% power. A study done by Kaur, M was found to be 97% of cannula patent in experimental group while 57% patency was seen in control group. Therefore the sample size was calculated as;

Sample size to compare proportions

$$n = \frac{C\,(Pc\,Qc) + (PeQe)}{d^2} + 2/d + 2$$

Pc= proportion from control group, Qc = 1-Pc

Pe = proportion from experimental group, Qe = 1- Pe

d= difference between two groups

C = constant (11.68)

Here, Pc= 0.57 (patency of intravenous cannula seen in control group on third day),

Pe= 0.97 (patency of intravenous cannula seen in experimental group on third day).

Qc= 0.43, Qe= 0.03, d= 0.4 (14)

Therefore, n= 27

Considering 10% mortality of sample, 2.7 i.e. 3 sample added.

So, total of 60 children were selected for study, 30 each for experimental group and control group.

Children on continuous infusion, having thrombophlebitis, anasarca and nephrotic syndrome were not included in study. Informed consent was obtained from parents and verbal assent was taken from children. Ethical clearance was taken from Institutional Review Committee (Reference No. 550/ 072/ 073-IRC) of the Institute before conducting the research. Confidentiality was maintained throughout the study.

Data was collected by using interview schedule, observation checklist which included socio-demographic data, clinical diagnosis, size & site of cannula, and medication used. Intervention (2 ml normal saline flush after medication) was done 12 hourly after medication for 3 consecutive days.

The collected data was edited and then entered in Microsoft excel 2010 and converted into SPSS 11.5 version for statistical analysis. Descriptive statistics i.e. frequency, percentage were used to describe age, gender. For the inferential statistics Chi square test and Fisher's extract test was applied. Significance probability was be set at 5% level of significance.

## RESULTS

Table 1 show that, 56.7% and 43.3% of children in the experimental group were 5-9 years and 10-14 years respectively whereas 60% and 40% of the children in the control group were 5-9 years and 10-15 years respectively. Majority of the children (63.3% in experimental and 60% in control group) were males. Whereas 36.7% were female in experimental group while 40% were female in control group. Regarding disease, 30% and 33.3% were respiratory illness, 13.3% and 16.7% were blood disorder, 6.7% and 16.7% were gastro-intestinal disorder, 16.7% and 13.3% were neurological disorder and 33.3% and 20% were others in experimental and control group respectively. Majority (80%) of the experimental group children had 22 G cannula while 20% had 24 G cannula. Moving towards to the control group, 22G and 24G

cannula was used in equal percentage i.e. exactly half of children. More than half (60 %) of the children in the experimental group had peripheral intravenous cannula in the cephalic vein, whereas in the control group, 66.7 % of the children had peripheral intravenous cannula in cephalic vein. Nearly half (46.7 %) of the children of the experimental group received injection ceftriaxone while 43.3% of children received other drugs like cefixime, amikacin etc. and more than half (60%) received the ceftriaxone in the control group. Swelling was the major reason for cannula change i.e. 36.7% in experimental group and 60% in the control group. 3.3% and 23.3% cannula changed due to resistance felt in experimental and control group respectively. While pain response was reported by 6.7% and 16.7% in experimental and control group.

Table 2 shows all children in control and experimental group had 100% of patent intravenous cannula at day 1 morning and evening. At day 2 morning patency of intravenous cannula was 100% patent in experimental group whereas patency was decreased to 73.3% in control group. Similarly 100% of the patency of intravenous cannula was maintained till day 2 evening in the experimental group while patency of intravenous cannula in control group was reduced to less than half (46.7%). At Day 3 morning patency of intravenous cannula in experimental group was slightly decreased to 93.3% while in control group patency of intravenous cannula was found to be only 3.3%, P value <0.001 in morning and at Day 3 evening patency of intravenous cannula was more than half (56.7%) in experimental group whereas3.3% of cannula was found patent in control group. P value <0.001 was highly significant.

**Table 1: Frequency Distribution of Various Categorical Variables in Experimental and Control Group.**

| Variables | Experimental (n=30) | | Control (n=30) | | Combined (n=60) | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| **Age group** | | | | | | |
| 5-9 | 17 | 56.7% | 18 | 60% | 35 | 58.3% |
| 10-14 | 13 | 43.3% | 12 | 40% | 25 | 41.7% |
| **Gender** | | | | | | |
| Male | 19 | 63.3% | 18 | 60% | 37 | 61.7% |
| Female | 11 | 36.7% | 12 | 40% | 23 | 38.3% |
| **Diagnosis** | | | | | | |
| Respiratory illness | 9 | 30% | 10 | 33.3% | 19 | 31.7% |
| Blood disorder | 4 | 13.3% | 5 | 16.7% | 9 | 15.0% |
| GI disorder | 2 | 6.7% | 5 | 16.7% | 7 | 11.7% |
| Neurological disorder | 5 | 16.7% | 4 | 13.3% | 9 | 15.0% |
| Others | 10 | 33.3% | 6 | 20% | 16 | 26.7% |
| **Size of cannula** | | | | | | |
| 22 gauze | 24 | 24 | 15 | 50% | 39 | 65% |
| 24 gauze | 6 | 6 | 15 | 50% | 21 | 36% |
| **Site of cannula** | | | | | | |
| Basilic | 2 | 6.7% | 6.7% | 16.7% | 7 | 11.7% |
| Brachial | 1 | 3.3% | 3.3% | 0% | 1 | 1.7% |
| Cephalic | 18 | 60% | 60% | 66.7% | 38 | 63.3% |
| Dorsal metacarpal | 9 | 30% | 30% | 13.3% | 13 | 21.7% |
| Great saphenous | 0 | 0% | 0% | 3.3% | 1 | 1.7% |
| **Medication** | | | | | | |
| Ceftriaxone | 14 | 14 | 18 | 60% | 32 | 53.3% |
| Ceftriaxone +Vancomycin | 3 | 3 | 2 | 6.7% | 5 | 8.3% |
| Other | 13 | 13 | 10 | 33.3% | 22 | 38.3% |
| **Reason for cannula changed** | | | | | | |
| Resistant felt | 1 | 1 | 1 | 1 | 1 | 13.3% |
| Pain response | 2 | 2 | 2 | 2 | 2 | 11.7% |
| Swelling | 11 | 11 | 11 | 11 | 11 | 48.3% |

**Table 2: Comparison of Frequency of Patency in Morning and Evening of Day 1, 2 and 3 between Experimental and Control Groups.**

| Days and variables | Morning | | | Evening | | |
|---|---|---|---|---|---|---|
| | Control group n=30 | Experimental group n=30 | P value | Control group n=30 | Experimental group n=30 | P value |
| **Day 1 Patent** | 30(100%) | 30 (100%) | NA | 30 (100%) | 30 (100%) | NA |
| **Not patent** | 0 (0%) | 0 (0%) | | 0 (0%) | 0 (0%) | |
| **Day 2 Patent** | 22(73.3%) | 30 (100%) | NA | 14 (46.7%) | 30 (100%) | NA |
| **Not patent** | 8 (26.7%) | 0 (0%) | | 16 (53.3%) | 0 (0%) | |
| **Day 3 Patent** | 1 (3.3%) | 28 (93.3%) | <0.001* | 1 (3.3%) | 17 (56.7%) | <0.001* |
| **Not patent** | 29(96.7%) | 2 (6.7%) | | 29(100%) | 13 (43.3%) | |

NA: not applicable

Figure 1 shows how the level of patency of intravenous cannula differ in experimental and control group over a time period.

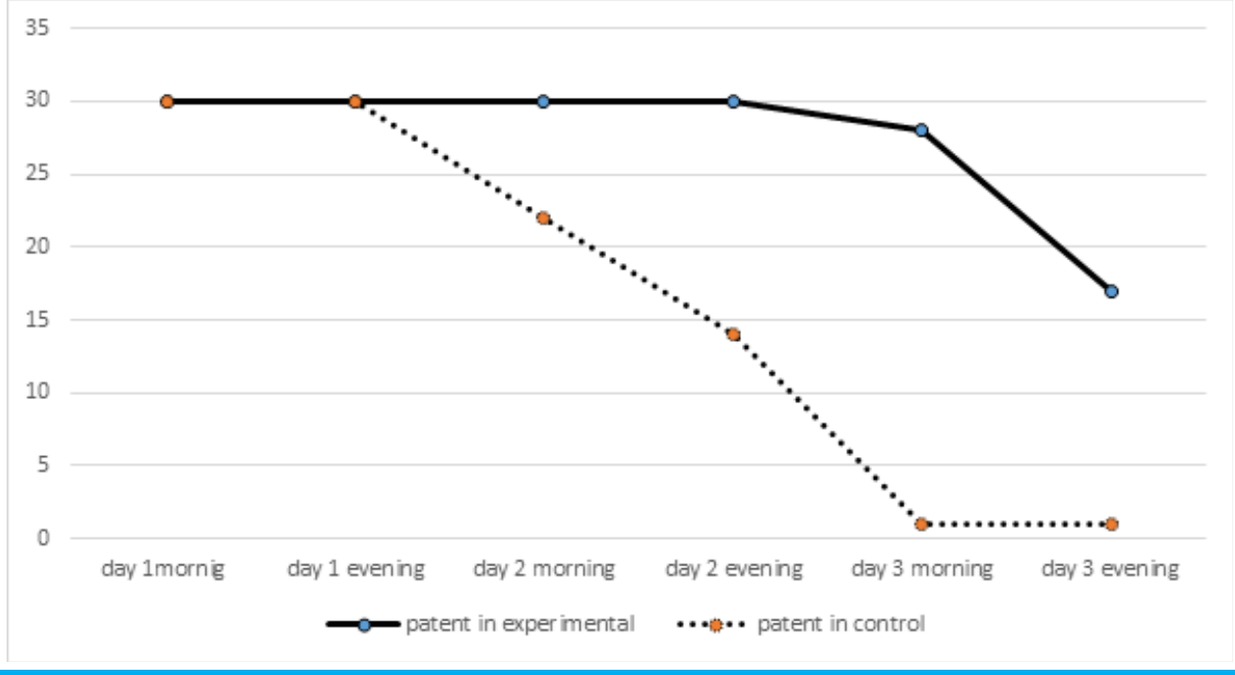


**Figure 1: Line Chart Showing Comparison of Patency of Intravenous Cannula in Two Groups with Time. period.**

## DISCUSSION

This study focused on normal saline flush twice a day which is supported by Eghbali-Babadi M study done in Iran, in which 12 hourly flush was done.[16] The percentage of phlebitis incidence in the control group was 88.6% and in the intervention group was 43.2%. Study concluded for flushing to prevent from the phlebitis.

In contradictory the study done by Schreiber S who conducted study 'Normal saline flushes performed once daily maintain peripheral intravenous catheter patency: a randomized controlled trial which concluded occlusion occurred in 15 children (7.6%) in group 12 hourly flush group versus 9 (4.5%) in 24 hourly flush

group (p=0.21). The difference in catheter patency was +3.1% in favor of the 24 h group (95% CI -1.6% to 7.7%), showing the non-inferiority of the 24 hourly procedure. Catheter-related complications were not different between the two groups [(12.1% in group A versus 9.5% in group B); p=0.42].[17]

This study showed the patency of the cannula in both group on day I morning and evening was 100% which is supported by Kaur M and Patidar AB findings and patency of intravenous cannula in experimental group on day II morning and evening was 100% patent which is supported by Kaur M study but the finding is contradictory to Patidar AB where patency was 88 Percent.[14,18]

In this study patency of intravenous cannula patency in control group on day II morning and evening was 73.3% and 46.7% respectively supported by Kaur M study where patency of intravenous cannula were 96.7% and 76.7%, in the morning and evening respectively. P value <0.05 in morning while <0.001 in evening. In this study control group had 32% non-patent cannula which was almost similar to Patidar AB finding i.e. 26.7% of non-patent cannula.[14,18]

On the third day morning, 93.3% cannula in the experimental group were patent in the morning which is supported by Kaur M findings in which the 100% of experimental group and the patency of intravenous cannula in experimental group in day 3 evening was 56.7% which is supported by Patidar AB which had similar patency 76% and the findings are contradictory to Kaur M finding i.e. 96.7% cannula was patent in evening on day three. In addition, this study patency of cannula in day 3 was 3.3% i.e only one cannula was found patent in morning and evening in control group which is contradictory to Kaur M and Patidar AB. In Kaur M, control group had 60% patency in the morning and 56.7% patency in the evening whereas in Patidar AB patency of control group cannula was 48%. P value 0.001 showed the highly significance of study depicting intermittent flushing with normal saline effective than no flushing of peripheral IV lines.

This study showed significant difference P value <0.001 in patency of peripheral intravenous cannula in the experimental group with intermittent saline flushing as compared to the control group which is supported by Samuel study where p value is <0.05. This finding denotes that the intermittent saline flushing was effective in maintaining patency of peripheral intravenous cannula. In addition this study is supported by Mok, E et al which concluded that using heparinized saline flushes of 1 unit/mL or 10 units/mL was not superior to flushing with normal saline. Findings support the change in practice to the use of saline flushes on pediatric units in this hospital. Costs and 420 hours of nursing hours were saved in preparing the flush solution.[19]

Likewise, this study is also supported by the study conducted by Perez A in 2012, intermittent flushing improves cannula patency compared to continuous infusion for peripherally inserted venous catheters in newborn which result showed patency was found higher in intermittent flushing group.[20] The cannula patency was significantly longer in the intermittent flushing group (mean 62.1 vs. 92.8 h, P=0.01). Similar patency of intravenous cannula by saline flush is showed by meta-analysis was done to estimate the effects of heparin flush and saline flush solutions on maintaining patency, preventing phlebitis, and increasing duration in peripheral heparin locks. It concluded that saline is as effective as heparin in maintaining patency, preventing phlebitis, and increasing duration in peripheral intravenous locks. Quality of care can be enhanced by using saline as the flush solution, thereby eliminating problems associated with anticoagulant effects and drug incompatibilities.

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## CONCLUSION

This study concluded that intermittent normal saline flush is highly effective in maintaining the patency of intravenous flush evidence by p value <0.001. Size of cannula was not homogenous in both groups but it does not show any statistical significance in patency of cannula. Age, sex, medicine, diagnosis and site of the cannula were not associated with patency of intravenous cannula.

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