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EFFECTIVENESS OF COLD APPLICATION ON INTRAVENOUS CANNULATION PAIN RESPONSE AMONG HOSPITALIZED CHILDREN

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ABSTRACT

Background: Intravenous cannulation is one of the most common painful procedure performed in hospitalized children. Cold application is considered as simple and effective non-pharmacological method for reducing procedural pain. The objective of the study was to assess the effectiveness of cold application on intravenous cannulation pain response among hospitalized children. **Methods**: An experimental (Post test only) study was conducted among children of age group 4-14 years admitted in pediatric emergency and pediatric wards of BPKIHS. Total 86 participants undergoing intravenous cannulation were selected by consecutive sampling technique and allocated randomly to control group and experimental group. Ice cubes covered by 0.4mm thick plastic and wrapped in cotton cloth of 0.6mm thickness was applied over 5x5cm^2 area proximal to site of cannulation for 3 minutes prior to intravenous cannulation in experimental group only. Children's pain response was assessed in both experimental and control group via self report using Faces Pain Scale- Revised. Mann Whitney test was used to compare means of pain score between experimental and control group. **Results**: The mean pain score among experimental group was 3.24 and in control group 6.98. Experimental group showed significantly lower pain ($p<0.001$) compared to the control group. Application of cold did not cause a significant difference in the success of Intravenous cannulation. There was no association between socio-demographic variables, background variables and pain response in children. **Conclusion:** Cold application prior to intravenous cannulation is effective in reducing pain in children.

KEYWORDS: Cold application; Intravenous cannulation; Pain.

INTRODUCTION

Illness and hospitalization is a major stressful event especially to children. Children are exposed to many painful procedures during hospitalization. Intravenous cannulation is one of the most common and distressing procedures performed on pediatric patients in the inpatient setting.[1] The pain associated with Intravenous Cannula insertion can cause much fear and anxiety in children and their parents.[2]

Many non-pharmacological techniques, such as distraction, relaxation, guided imagery, and cutaneous stimulation provide coping strategies that may help reduce pain perception.[3] Ice pack application is one of the simplest, safest, effective, non-invasive and inexpensive technique for pain management.[4],[5] An application of cold is considered to slow the ability of pain fibres to transmit pain impulses.[6]

The study was conducted with the objective to assess the effectiveness of cold application on Intravenous cannulation pain response among hospitalized children and to find out the association between selected variables and pain response.

MATERIALS AND METHODS

An experimental (Post test only) study design was conducted in pediatric emergency and pediatric wards of B.P. Koirala Institute of Health Sciences between a period of two months from 20th December, 2015 to 20th February, 2016. Ethical approval was taken from Institutional Review Committee BPKIHS. Informed consent was obtained from the parents and verbal assent was taken from each child admitted in emergency and wards. Children of age group 4-14 years admitted in Pediatric Emergency and Pediatric Wards of BPKIHS undergoing Intravenous cannulation were included

whereas children admitted with symptom of pain, receiving an analgesic within the last 6 hours, having altered sensorium, neuromuscular disorder and neuro developmental delays were excluded from the study. Pain response was taken as dependent variable whereas cold application and socio demographic characteristics and background variables were taken as independent variables.

Consecutive sampling technique was adopted and a total of 86 participants (43 in each group) were selected and allocated randomly to control group and experimental group by lottery method. For sample size calculation, power analysis was done anticipating pain level of difference in mean between two groups as at least 1.0 unit (based on previous research where Standard deviation was 1.65 and Mean of control group was 6.56)[2], power of 80% and an acceptable Type I error of 0.05.

$$n = \frac{2\sigma^2(Z^{\alpha}/_2 + Z\beta)^2}{(X_1 - X_2)^2}$$

= 42.68 =43 (approximately) in each group

Ice cubes covered by 0.4mm thick plastic and wrapped in cotton cloth of 0.6 mm thickness was applied over 5x5cm2 area proximal to site of cannulation for 3 minutes prior to intravenous cannulation in experimental group only. In control group, to minimize placebo effect, pieces of Thermocol size similar to ice cubes covered by 0.4 mm thick plastic and wrapped in cotton cloth of 0.6 mm thickness was applied over 5x5 cm2 area prior to Intravenous cannulation for 3 minutes. Children's pain level was assessed in both experimental and control group via self report using semi-structured questionnaire and standard tool i.e., Faces Pain Scale- Revised (FPS-R) immediately after 5 minutes of fixing the cannula and before administering medication.

The FPS-R is a self report measure having 0 to 10 scale consisting of six cartoon faces that range from a neutral expression (0-no pain) to a screaming face (10-severe pain).[7] The tool is freely accessible[7] and has been recommended to obtain self-report of pain intensity in children on the basis of utility and psychometric features.[8] The FPS-R demonstrate strong psychometric properties in children ages 4 to 17 years, and between subgroups based on age, sex, and ethnicity.[9]

The flow diagram of the study is shown in figure (Figure 1).

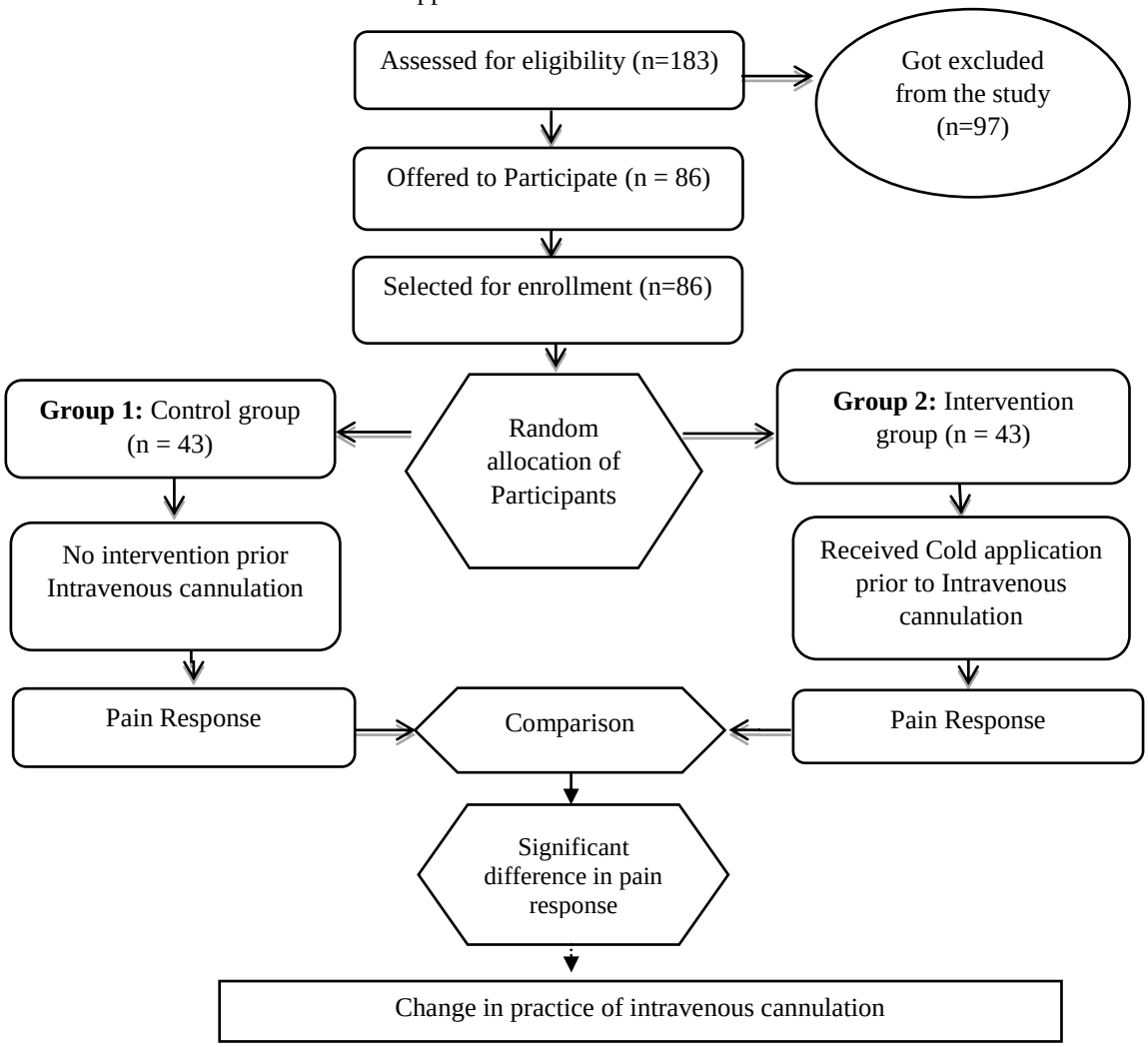

Figure 1: Flow diagram of the study.

The collected data was edited and then entered in Microsoft excel 2010 and converted into Statistical Package for Social Sciences (SPSS) version 11.5. Descriptive statistics were used to describe socio-demographic and background characteristics. Mann Whitney test was used to compare means of pain score between experimental and control group. Non-parametric test (Spearman correlation, Mann Whitney test and Kruskal Wallis test) were used to show the association of pain and selected variables. The probability (p-value) of <0.05 was considered statistically significant at 95% confidence level.

RESULT

The demographic characteristics are presented in Table 1. In this study, 86 children of age group 4 to 14 years old and their parents agreed to participate. Study groups i.e. experimental and control group did not differ significantly by age, gender, ethnicity, educational status, frequency of previous hospitalization, previous exposure to any painful procedure, child's reaction towards health personnel in general, frequency of previous intravenous cannulation, site and size of intravenous cannula.

Table 1: Comparison of groups on socio-demographic and background variables.

Characteristics	Category	Experimental Group (n=43)		Control Group (n=43)		p value
Age (years)*	Mean ± SD	9.02 ± 3.23		8.65 ± 2.85		0.573
Weight (Kg)*	Mean ± SD	23.70 ± 9.39		24.35 ± 9.92		0.755
Number of days of hospitalization ##	Mean ± SD	2.28 ± 5.06		1.58 ± 1.62		0.261
		N	%	N	%	p value
Gender #	Male	22	51.2	28	65.1	0.190
	Female	21	48.8	15	34.9	
Ethnicity #	Brahmin/ Chhetri	13	30.2	6	14	0.132
	Janajati	23	53.5	25	58.1	
	Others	7	16.3	12	27.9	
Educational status #	Pre-Primary	14	32.6	12	27.9	0.081
	Primary	17	39.5	26	60.5	
	Lower Secondary and above	12	27.9	5	11.6	
Frequency of previous hospitalization #	No previous hospitalization	23	53.5	23	53.5	0.411
	1-3 times	15	34.9	11	25.6	
	> 3 times	5	11.6	9	20.9	
Previous exposure to any painful procedure #	Yes	27	62.8	23	53.5	0.382
	No	16	37.2	20	46.5	
Frequency of previous IV cannulation #	No previous IV cannulation	13	30.2	13	30.2	0.967
	1-3 times	15	34.9	14	32.6	
	> 3 times	15	34.9	9	20.9	
Past experience of IV cannulation #	Calm and quiet	7	23.3	5	16.7	0.705
	Minimal resistance	13	43.4	16	53.3	
	Rebellious and high resistance	10	33.3	9	30.0	
Size of IV cannula #	22 Gauge	19	44.2	15	34.9	0.378
	24 gauge	24	55.8	28	65.1	

N= Number, %= Percentage, *= Independent t test, # = Chi-Square test, ## = Mann Whitney test

The mean pain score of children in the cold application group was 3.24 ± 1.807 (mean rank 26.44) whereas in the control group mean pain score was 6.98 ± 2.110 (mean rank 60.56) which was statistically significant (Table 2).

Table 2: Comparison of pain score between experimental and control group.

Characteristic	Experimental Group (n=43)		Control Group (n=43)		p value
	Mean ± SD	Mean Rank	Mean ± SD	Mean Rank	
Pain score##	3.24 ± 1.807	26.44	6.98 ± 2.110	60.56	<0.001

= Mann Whitney test

Application of cold during intravenous cannulation did not cause a significant difference in the success of intravenous cannulation (Table 3).

Table 3: Variation of success of intravenous cannulation among experimental and control group.

Characteristics	Category	Experimental Group (n=43)		Control Group (n=43)		χ^2	p value
		N	%	N	%		
Success of Intravenous cannulation #	Yes	38	88.4	37	86.0	0.104	0.747
	No	5	11.6	6	14.0		

= Chi-Square test

There was no correlation between age and pain of both experimental and control group at p value <0.05 (Table 4).

Table 4: Correlation of age and pain.

Characteristics	Experimental Group (n=43)			Control Group (n=43)		
Age (years) ***	Mean ± SD	Correlation (r)	p value	Mean ± SD	Correlation (r)	p value
	9.02 ± 3.23	0.143	0.361	8.65 ± 2.85	- 0.238	1.125

*** = Spearman Rank Correlation

There was no significant association between socio-demographic variables and pain in both experimental and control group at p value <0.05 (Table 5).

Table 5: Association of child's socio-demographic variables with pain.

Characteristics	Category	Experimental Group (n=43)		Control Group (n=43)	
		Mean ± SD	p value	Mean ± SD	p value
Gender ##	Male	3.27 ± 2.097	0.877	7.14 ± 2.068	0.427
	Female	3.14 ± 1.496		6.67 ± 2.225	
Ethnicity ###	Dalit	4.00 ± 1.633	0.517	6.00 ± 2.191	0.371
	Janajati	2.96 ± 1.796		6.80 ± 2.236	
	Madhesi	4.00 ± 2.00		8.00 ± 1.789	
	Brahmin/ Chhetri	3.23 ± 1.922		7.67 ± 1.506	
Educational status ###	Pre-primary level	3.14 ± 1.875	0.574	8.00 ± 1.706	0.036
	Primary level	2.82 ± 1.741		6.38 ± 2.118	
	Lower secondary level	3.78 ± 1.856		8.67 ± 1.155	
	Secondary level	4.00 ± 2.00		6.00 ± 2.828	

=Mann Whitney test, ### = Kruskal-Wallis test

There was no significant association between background variables and pain in both experimental and control group at p value <0.05 (Table 6).

Table 6: Association of child's background variables with pain.

Characteristics	Category	Experimental Group (n=43)		Control Group (n=43)	
		Mean ± SD	p value	Mean ± SD	p value
Frequency of previous hospitalization ###	No previous hospitalization	3.13 ± 1.890	0.854	6.87 ± 1.984	0.755
	1-3 times	3.33 ± 1.952		7.45 ± 1.809	
	> 3 times	3.20 ± 1.095		6.67 ± 2.828	
Previous exposure to any painful procedure beside IV cannulation ##	Yes	2.88 ± 1.784	0.357	7.00 ± 1.777	0.321
	No	3.41 ± 1.824		6.96 ± 2.402	
Frequency of previous IV cannulation ###	No previous IV cannulation	3.38 ± 1.261	0.860	7.38 ± 2.063	0.427
	1-3 times	3.20 ± 2.242		7.14 ± 2.033	
	> 3 times	3.07 ± 1.831		6.50 ± 2.251	
Past experience of IV cannulation ###	Calm and quiet	3.43 ± 2.507	0.672	5.20 ± 2.280	0.099
	Minimal resistance	2.77 ± 1.922		6.75 ± 2.295	
	Rebellious and high resistance	3.40 ± 1.897		7.78 ± 1.202	
Size of IV cannula ##	22 Gauge	3.47 ± 1.867	0.483	7.20 ± 1.474	0.819
	24 gauge	3.00 ± 1.769		6.86 ± 2.399	

=Mann Whitney test, ### = Kruskal-Wallis test

DISCUSSION

Cutaneous stimulation like cold is a non-pharmacological technique that relieves pain and promote healing.[10] An application of cold is considered to slow the ability of pain fibers to transmit, pain impulses.[6] Mean pain score among experimental group was less in comparison to control group with significant difference in mean pain score among groups (p=<0.001). The finding is consistent with the quasi experimental study in India where mean pain score during venipuncture in experimental group was significantly lesser as compared to control group.[4]

The finding is supported by various other studies in different circumstances.[11],[12] In a randomized control trial, external cold and vibration stimulation were found to be more effective than Vapocoolant spray for pain relief in children during IV access.[13] Similar findings were found studies where external cold and vibration stimulation was found to be an effective method for pain and anxiety relief in children.[2],[14] However, contradictory findings have also been quoted in a quasi-experimental study which showed that Ice was not significant in reducing procedural pain.[15] The findings were in contrast to an experimental study where vapocoolant spray was more effective than ice as an analgesic for IV insertion.[16]

In the study, there was no significant difference of success of intravenous cannulation between experimental and control group. Application of cold does not alter the success rate of intravenous cannulation. The finding is similar to various studies that have shown that use of external cold did not cause a significant difference in the success of blood specimen collection.[2],[13]

Study finding revelaed no correlation between age and pain of both experimental and control group. On the contrary, these findings are inconsistent with Baxter and Afolayan which revealed that age was a significant predictor of self reported pain and influences perception of pain.[13],[17]

There was no significant association between socio-demographic variables and background variables with pain in both experimental and control group. Findings were collateral with the findings by Al-Hashimi in which neither post-operative pain nor pain management were influenced significantly by ethnicity.[18] In contrast, a study conducted by Sakai revealed Nepalese males had significantly higher scores for bodily pain.[19] In contrast, inadequate relief of infant pain and distress during tissue-damaging procedures were found to permanently decrease an individual's pain tolerance, and increase pain responses in future.[8]

CONCLUSION

The study concluded that cold application prior to intravenous cannulation is effective in reducing pain in children. Pain response was not associated with socio-demographic variables, background variables and child's experience of intravenous cannulation.

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