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The effectiveness of ice application on pain response prior to intravenous procedures among children

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Abstract
Pain is referred as the fifth vital sign. Children often experience unpredictable and severe procedure-related pain in hospitals that can be associated with negative emotional and psychological implications. Venipuncture is one of the most commonly experienced procedures by children. Ice pack application is one of the simplest, safest, effective and most widely used techniques for reducing pain.
Methods: A quasi experimental study was conducted to assess the effectiveness of 'ice pack' application at the site prior to venipuncture on intensity of pain. Total 100 subjects were selected by purposive sampling. Randomization was done by lottery method. 50 subjects each in experiment group and control group were assigned. One sister grade 11 was selected from Day care chemotherapy centre to do the venipuncture in both the groups. Ice pack (ice cube covered by flannel cloth over 5*5 cm area around the site of venipuncture) was applied at the site prior to venipuncture for 3 minutes. Null hypothesis for the study was that there is no significant difference in the intensity of pain with or without 'ice pack' application at the site prior to venipuncture at the 0.05 level of significance. Demographic and clinical data was collected. Data was collected by using demographic profile and clinical profile. Pain was assessed in both the groups by using Wong-Baker Faces Pain Rating Scale pain assessment scale. It measures pain by quantifying pain behavior with scores ranging from o (no pain) to 10 (severe pain). Pain score was compared in both the group. There was a positive correlation between pain score and child's past experience of venipuncture and child's reaction towards heath care professional in general.
Results: show statistically significant reduction in pain during venipuncture in experiment group. Hence null hypothesis was rejected.
Conclusion: It was concluded that ice pack application significantly decreases pain during venipuncture in 6-12 years old children. It is safe, cheap, easy and effective method to reduce pain among children.

Keywords: Intravenous procedures, pain, ice application

Introduction
Children often experience unpredictable and severe procedure related pain in hospitals. Maximum procedures that are performed to cure illness among children are traumatic, painful, upsetting and frightening to children. Unfortunately, attempts to minimize pain because of medical intervention, have not kept pace with technologic advances in pediatric care. In hospital children undergo multiple painful procedures; venipuncture, intravenous cannulation, capillary stick, and injections are most commonly performed. Venipuncture is one of the most commonly experienced procedures by hospitalized children. Disease and hospitalization can be the first crisis that a child encounters [1]. Hospitalization exposes children to unfamiliar and unpleasant feelings. Since children have little experience and comprehension of the pain and disease process, such negative feelings cause intimidation and anxiety for them. Children requiring needle sticks (injections, intravenous catheters, blood sampling) view this procedure as frightening and a significant source of pain [2]. Venipuncture is the process of puncturing a peripheral vein, with a flexible tube containing a needle, to gain access to the venous system for administering fluids and medications using aseptic technique. Although health care professionals and adults often view venipuncture or intravenous (IV) catheter insertion as quick, routine and relatively painless procedure. Data are unambiguous that children consider the pain associated with such procedures to be "clinically significant and distressing" [3]. Pain is referred as the fifth vital sign. The International Association for the Study of Pain (IASP) defined pain as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage". Pain is a complex perception that has profound affective & cognitive features. It is a physiological mechanism that protects the individual from a harmful stimulus. It serves as a warning to tissue damage [4].
Ice pack application is one of the simplest, safest, effective and most widely used techniques for reducing pain. Cold application prevents the perception of pain through its effect on

sensory nociceptors by decreasing the conduction time and synaptic activity in peripheral nerves [5].

In a study conducted by Lynn ON (1988) on the effect of ice massage on children's perception of pain during venipuncture. Eleven hospitalized children between the ages of 7 to 16 tested the two interventions that are routine venipuncture without ice massage and venipuncture with ice massaged contralaterally to the site, and venipuncture with ice massaged proximally to the site. Perception of pain was obtained utilizing a 1 a-centimeter pain scale. Results indicated that there was significantly less pain reported when ice was applied to the contralateral site, versus routine venipuncture without ice massage [6]. Relief of pain is a basic need and right of all children. Management of pain in the child must be individualized. Age, sex, birth order, cultural background, parents, caregiver's response and past experiences affect the child's response. The newborn baby, the infants, and the toddler are unable to localize and describe the severity of pain [7]. Personal values and belief of health care professionals about the meaning and value of pain in the development of the child and about the treatment of pain cannot stand in the way of the optimal recognition and treatment of pain for all the children [8]. Non-pharmacological techniques to reduce venipuncture related pain and avoid potential drug side effects are generally less costly and can be performed independently by nurses [9].

A study was conducted by Richman PB *et al*. on 28 adult volunteers for pain assessment. An ice pack was placed over one arm for 10 minutes, followed by insertion of an 18-gauge Angio catheter in both arms. Patients recorded their pain assessment after each venipuncture on a previously validated 100-mm visual analog scale (VAS) and identified their preferred method for the procedure (pretreatment with ice or no pretreatment). The mean pain score for catheter placement on arms pretreated with ice was shorter than the mean pain score for the control arms though statistically it was not significant. During clinical experience, the researcher felt that children are often exposed to painful procedures on admission, during hospitalization and during follow up visits to hospital. One such common procedure is venipuncture procedure which is very painful to children and done very frequently during hospitalization. Above review of literature emphasized that ice pack application is effective in reducing procedural pain. With this intention, the investigator has taken steps to find the effectiveness of ice pack application at the site prior to venipuncture on intensity of pain during venipuncture procedures.

Objectives

To assess the effectiveness of 'ice pack' application at the site prior to venipuncture on intensity of pain.

Material & methods

Evaluatory research approach and Post -test only control group design was used for the study. The study was conducted in Tertiary care hospital Karad. 60 children aged 6 -12 years were selected, 30 children in experimental and 30 in control group were the sample selected by Non probability purposive sampling technique.

The purpose and procedure of the study were explained to the children and their parents. Formal consent was obtained from the parents. The ice cubes covered in gauze piece was applied on the site of venipuncture prior to intravenous procedures for 3 minutes. After 3 minutes of ice, application pain was assessed by using Wong-Baker Faces Pain Rating Scale.

Hypothesis

- **H_0**: There will be no significant difference in the intensity of pain with or without 'ice pack' application at the site prior to venipuncture.
- **H_1**: The pain score of experimental group after ice application will be significantly lower than the pain score of the control group.
- **H2:** There will be a significant association between pain score of children with selected demographic variables.

Variables

Independent variables: Ice application on the site of venipuncture.

Dependant variables: Pain during venipuncture.

Results: The present study was conducted to assess the effectiveness of ice application on pain response prior to intravenous procedures among children. The study aimed to evaluate the effectiveness of ice application in reducing pain. The result shows the mean pain score of the experimental group was 0.66 and control group was 8.93.

The data presented in Table no. 1 reveals the distribution of according to demographic variables.

- In control group out of 30 children maximum 13(43%) were in age group of 7-8 years, 9(30%) were in age group of 11-12 years, 6(20%) were in age group of <=6 years and 2(7%) belongs to age group of 9-10 years.
- On the other hand in the Experimental group out of 30 children 10(33%) were in age group of 7-8 years, 9(30%) in age group <=6 years, 6(20%) in age group of 11-12 years and 5(17%) were in age group 9-10 years.
- In control group out of 30(100%) children maximum 19(63%) were boys and 11(37%) were girls.
- In Experimental group out of 30(100%) children maximum 18(60%) were boys and 12(40%) were girls.
- In control group out of 30(100%) children according to their weight 17(57%) were less than or equal to eighteen Kg while 13(43%) were greater than eighteen Kg.
- In Experimental group out of 30(100%) children according to their weight 17(57%) were less than or equal to eighteen Kg and 13(43%) were greater than eighteen Kg.
- Only two religions were found while conducting this study in the Pediatric ward.
- In control group out of 30(100%) children according to religion 27(90%) were Hindu and 3(10%) were Muslims.
- In Experimental group out of 30(100%) children according to religion 26(87%) were Hindu and 4(13%) were Muslim.
- In control group out of 30(100%) children according to their residence 20(67%) lived in rural area, 10(33%) lived in urban area.
- In Experimental group out of 30(100%) children according to their residence 23(77%) lived in rural area, 7(23%) lived in the urban area.
- In control group out of 30(100%) children according to their type of family 18(60%) lived in nuclear while 12(40%) lived in joint.
- In Experimental group out of 30(100%) children according to their type of family 19(63%) lived in nuclear while 11(37%) lived in joint mean percentage of the nuclear family was higher side in both the groups.

- In control group out of 30(100%) children according to previous experience of ice application30 (100%) had lack of experience.
- In Experimental group out of 30(100%) children 1(3%) had previous experience of ice application and 29(97%) had no experience of ice application.

Table 1: Frequency and Percentage distribution of children according to demographic variables

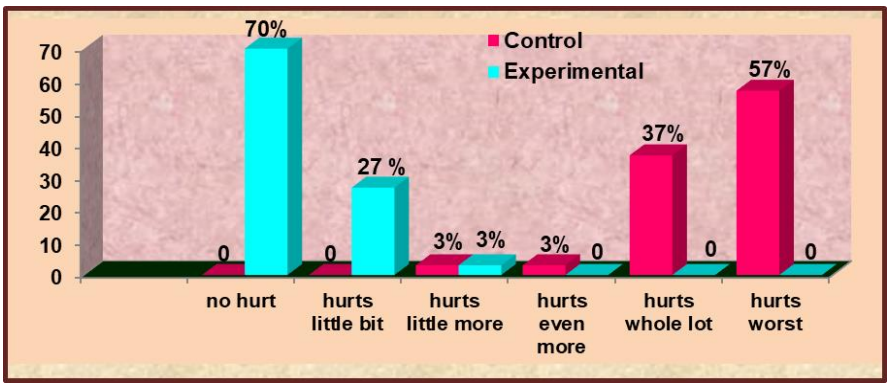
S. No.	Variables	Control (n=30)		Experimental (n=30)	
		Frequency	Percent	Frequency	Percent
1	**Age in years**				
	≤ 6	6	20	9	30
	7--8	13	43	10	33
	9--10	2	7	5	17
	11--12	9	30	6	20
2	**Sex**				
	Male	19	63	18	60
	Female	11	37	12	40
3	**Weight (in Kg)**				
	≤ 18 kg	17	57	17	57
	>18 kg	13	43	13	43
4	Religion				
	Hindu	27	90	26	87
	Muslim	3	10	4	13
	Others	0	0	0	0
5	**Residence**				
	Urban	10	33	7	23
	Rural	20	67	23	77
6	**Family Type**				
	Nuclear	18	60	19	63
	Joint	12	40	11	37
7	**Previous Experience of Ice Application**				
	No	30	100	29	97
	Yes	0	0	1	3

Section II

A. Pain responses of children during intravenous procedures as per Wong Bakers Faces Rating Scale in experimental & control group.

Table 2: Frequency and percentage distribution of pain score of pediatric children.

Pain Score	Control (n=30)		Experimental (n=30)	
	Frequency	Percent	Frequency	Percent
no hurt	0	0	21	70
hurts little bit	0	0	8	27
hurts little more	1	3	1	3
hurts even more	1	3	0	0
hurts whole lot	11	37	0	0
hurts worst	17	57	0	0
Total	30	100	30	100



Bar graph showing frequency and percentage distribution of pain score of pediatric children

Table 3: Distribution of children According to pain Scores during intravenous procedures in experimental group and control group. n=30

Pain Score	Control Group n(%)	Experimental Group n(%)
Mild Pain (0-2)	0	29 (97)
Moderate Pain (4-6)	2 (7%)	1 (3%)
Severe Pain (8-10)	28 (93%)	0

Table 3. Highlighted the distribution of subjects as per pain score i.e. mild pain, moderate pain and severe pain.

In the experimental group majority of subjects 29(97%) experienced mild pain,1(3%) experienced moderate pain and zero percentage of severe pain.

In control group 28(93%) experienced severe pain. 2(7%) experienced moderate pain and zero percentage of mild pain in control group.

Table 4: Effectiveness of ice application on pain response during intravenous procedures among children

Parameters	Groups	Mean	SD	t statistic	p value
Pain level	Control	8.93	1.461	24.817	<0.01*
	Experimental	0.66	1.093		

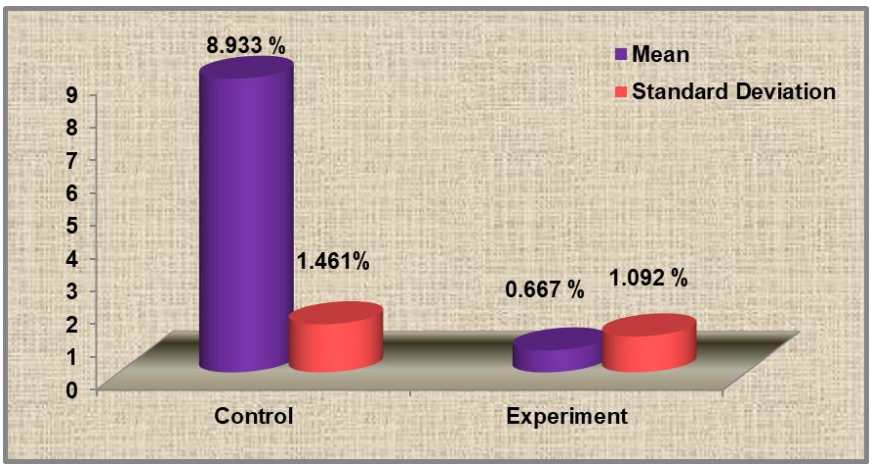


Table 5: Association between pain scores with demographic variables of control group

(n= 30)

Demographic Variables		Control Group			Chi-square	P-value	Inference
	n	Mild	Moderate	Severe			
Age (in yrs.)							
≤6	6	0	0	6	2.802	0.4231	NS
7—8	13	0	2	11			
9—10	2	0	0	2			
11—12	9	0	0	9			
Sex							
Male	19	0	1	18	0.1968	0.6573	NS
Female	11	0	1	10			
Weight							
≤18	17	0	2	15	1.353	0.2448	NS
≥18	13	0	0	13			
Religion							
Hindu	27	0	2	25	0.2381	0.6256	NS
Muslim	3	0	0	3			
Others	0	0	0	0			
Residence							
Urban	10	0	1	9	0.2679	0.6048	NS
Rural	20	0	1	19			
Family Type							
Nuclear	18	0	2	16	1.429	0.232	NS
Joint	12	0	0	12			
Previous experience of ice application							
Yes	0	0	0	0	1.352	0.411	NS
No	30	0	2	28			

Table 5. Reveals association between pain score and demographic variables in control group

According to age, chi-square value was 2.802 and P-value was 0.4231, sex chi-square value 0.1968 and P-value was 0.6573, weight chi-square value was 1.353 and P-value 0.2448, religion chi-square value 0.2381 and P-value was 0.6256, residence chi-square value 0.2679 and P-value 0.6048, family type chi-square value 1.429 and P-value 0.232, in experience chi-square value was 1.352 and P-value was 0.411. There was no significant association between pain score and demographic variables in control group.

Table 6: Association between pain scores with demographic variables of experimental group.

(n=30)

Demographic Variables		Experimental Group			Chi-square	P-value	Inference
	n	Mild	Moderate	Severe			
Age (in yrs.)							
≤6	9	9	0	0	8.816	0.0318	S
7—8	10	10	0	0			
9—10	5	5	0	0			
11—12	6	5	1	0			
Sex							
Male	18	17	1	0	5	0.0253	S
Female	12	12	0	0			
Weight in kg							
≤18	17	17	0	0	0.7938	0.0267	**S**
≥18	13	13	1	0			
Religion							
Hindu	26	26	1	0	0.1149	0.7346	**NS**
Muslim	4	3	0	0			
Others	0	0	0	0			
Residence							
Urban	7	7	0	0	0.6536	0.4188	**NS**
Rural	23	22	1	0			
Family Type							
Nuclear	19	18	1	0	0.5489	0.439	**NS**
Joint	11	11	0	0			
Previous experience of ice application							
Yes	1	0	1	0	30.000	0.0001	**NS**
No	29	29	0	0			

Table 6. Reveals association between demographic variables and experimental group

- According to age, chi-square value was 8.816 and P-value was 0.0318, sex chi-square value was 5 and P-value was 0.0253, weight chi-square value was 0.7938 and P-value was 0.0267, There was a significant association between pain score and demographic variables such as age, sex and weight of children in experimental group as $P<0.05$.
- According to religion chi-square value was 0.1149 and P-value was 0.7346, residence chi-square value was 0.6536 and P-value was 0.4188, family type chi-square value was 0.5489 and P-value was 0.439, experience chi-square value was 30.000 and P-value was 0.0001, there was no significant association between pain score and demographic variables such as religion, residence, family type and experience of experimental group as $P>0.05$.

Discussion

Using the cold therapy to reduce pain of an acute injury is ages old. The pain threshold can be elevated by a direct effect of cooling on the pain receptors and fibers. The effect of cold on pain suggests that it may act like sensory stimuli on the pain gate mechanism. Since cold stimuli are quite intense they may lead to the release of endorphins and encephalin by the same mechanism. The fact that cold will effectively relieve pain, at least temporarily, has been supported by many studles. Following this principle this present study was conducted to assess the effectiveness of ice pack application at the site prior to venipuncture among 60 children of 6 to 12 years of age at Tertiary care Hospital, Karad. They are divided into two groups by using purposive sampling technique (30 in each group).

In present study ice pack at the site prior to venipuncture was applied for three minutes in experimental group. This study is also supported by a quasi experimental study which was conducted by Ali FM9 et al. in which they studied the effect of local refrigeration (using an ice bag) prior to venipuncture on pain related responses in school age children. In the test group, the injection site was refrigerated for three minutes using an ice bag. Similar study conducted by Bugaj (1975) [10]

A similar Quasi-experimental study was conducted in Iran to determine the effect of local refrigeration prior to venipuncture on pain-related responses in 80 school age children of 6 to 12 years age selected by purposive sampling, in a pediatric emergency ward of a pediatric center. Results showed no significant difference between the two groups for physiological responses. However behavioural responses during and after the procedure ($p=0.0011$), and subjective responses after the procedure ($p=0.0097$) were significantly lower. The study concludes that the use of local refrigeration prior to venipuncture can be considered an easy and effective intervention of reducing venipuncture-related pain [11].

A study was conducted in Canada on use of a topical refrigerant anesthetic to reduce injection pain in children. The double-blind placebo-controlled study was conducted in community health clinics in conjunction with ongoing immunization programs. Randomly90 subjects, aged 4–5.5 years, were assigned. The purpose of this study was to assess the efficacy of a refrigerant topical anesthetic in reducing injection pain in preschool children experiencing routine diphtheria-pertussis-tetanus (DPT) immunizations. Age was found to be an important factor influencing pain response in this study. The results of the study support the use of an intervention, such as refrigerant topical anesthetic, as a practical, simple, and effective treatment strategy for reduction of short-term painful procedures like injections [12].

A study was conducted to evaluate the effect of local cold therapy and distraction in pain relief using penicillin intramuscular injection in randomly choosed 90 children of 5 to 12 years of age who had penicillin injection intramuscularly in a health center. Results Average pain intensity in local cold therapy, distraction, and control groups was 26.3, 34.3, and

83.3, respectively. The findings indicate that pain intensity was significantly higher in the control group than the experimental groups. Also, pain intensity among children was inversely proportional to their age. Conclusion- This study supports the efficacy of non-pharmacologic pain management methods in children. Nurses are recommended to use local cold therapy and distraction to decrease pain intensity of penicillin intramuscular injection in 5–12-year-old children [13].

In a study conducted by Lynn ON (1988) on the effect of ice massage on children's perception of pain during venipuncture. Eleven hospitalized children between the ages of 7 to 16 tested the two interventions that are routine venipuncture without ice massage and venipuncture with ice massaged contralaterally to the site, and venipuncture with ice massaged proximally to the site. Perception of pain was obtained utilizing a 1 a-centimeter pain scale. Results indicated that there was significantly less pain reported when ice was applied to the contralateral site, versus routine venipuncture without ice massage [14].

A Prospective, Randomized, Single-81 ind Controlled Trial was done by Sarifakioglu, N and Sarifakioglu E on Evaluating the Effects of Ice Application on the Pain Felt During Botulinum Toxin Type-A Injections shows that pain is significantly reduced on the side where ice is applied [15]

Conclusion: Ice pack application significantly decreases pain during venipuncture in 6 -12 years old children. It is safe, cheap, easy and effective method to reduce pain among Children.

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