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An evaluative study: The effectiveness of ice pack application prior to venipuncture in alleviating pain among selected clients in a hospital, Odisha

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Abstract

Background: Venipuncture is one of the most frequently performed invasive procedures in hospital settings and is often associated with pain, discomfort, anxiety, and fear among clients. Effective pain management during such minor procedures is an essential component of quality nursing care. Non-pharmacological interventions, such as ice pack application, are simple, safe, and cost-effective methods that may help reduce procedural pain.

Methods: A quantitative evaluative study with a quasi-experimental non-equivalent control group design was conducted among 60 clients in selected wards of IMS & SUM Hospital, Odisha. Participants were selected using purposive sampling and divided into experimental (n=30) and control (n=30) groups. The experimental group received ice pack application at the venipuncture site for three minutes prior to the procedure, while the control group received routine care. Pain intensity was assessed using the Wong–Baker Faces Pain Rating Scale. Data were analyzed using descriptive and inferential statistics.

Results: The post-test mean pain score was significantly lower in the experimental group compared to the control group ($t = -2.05$, $p = 0.022$), indicating that ice pack application was effective in reducing pain during venipuncture. A significant association was found between pain level and previous experience of venipuncture ($p = 0.003$), while other sociodemographic variables showed no significant association.

Conclusion: Ice pack application prior to venipuncture is an effective, safe, simple, and economical non-pharmacological intervention for reducing pain among clients. Incorporating this practice into routine nursing care can enhance patient comfort and improve the quality of care.

Keywords: Venipuncture, ice pack application, pain management, non-pharmacological intervention, Wong–Baker Faces Pain Rating Scale, nursing care

Introduction

Venipuncture is one of the most frequently performed invasive procedures in hospital settings for diagnostic and therapeutic purposes. Despite being a routine procedure, venipuncture is often associated with significant pain, discomfort, anxiety, and fear among clients. Repeated exposure to painful procedures can lead to increased stress responses, poor cooperation, and negative perceptions toward healthcare services, thereby affecting the overall quality of care.

Pain management during minor invasive procedures is an essential component of holistic nursing care. Pharmacological interventions are not always practical or appropriate for short procedures such as venipuncture due to cost, side effects, and time constraints. Therefore, non-pharmacological methods are increasingly encouraged as simple, safe, and cost-effective alternatives for pain reduction [1].

Cold application, such as the use of ice packs, is a well-established non-pharmacological intervention that works by reducing nerve conduction velocity, producing a local anesthetic effect, and decreasing pain perception. Ice pack application is easy to administer, inexpensive, and does not require specialized training or equipment, making it suitable for routine clinical practice. Although ice pack application has been used in various clinical procedures, its effectiveness in alleviating pain during venipuncture has not been consistently practiced or evaluated in many hospital settings. Hence, this evaluative study was undertaken to assess the effectiveness of ice pack application prior to venipuncture in reducing pain among selected clients in a hospital, with the aim of improving patient comfort and enhancing nursing practice [2].

Venipuncture and other invasive procedures such as blood sampling and injections are commonly performed painful procedures in children and often cause fear and distress. This study aimed to assess pain intensity following ice pack application prior to venipuncture among school-age children. A total of 50 children aged 6–12 years undergoing venipuncture at King Fahd Hospital of the University, Al-Khobar, Saudi Arabia, were selected using simple random sampling and divided equally into study and control groups. The study group received an ice pack for three minutes before venipuncture, while the control group received

routine care. Data were collected using a structured questionnaire and the Wong–Baker FACES Pain Rating Scale. The results showed a significantly lower mean pain score in the ice pack group compared to the control group (1.92 ± 0.316 vs. 4.40 ± 0.490; $p < 0.001$). Pain intensity was lower in older children and higher among males. The study concluded that ice pack application before venipuncture effectively reduces pain in school-age children and should be incorporated into routine pediatric care [3].

The study aimed to evaluate the effectiveness of ice application on pain perception among patients undergoing peripheral venous catheterization. A total of 60 patients aged 17–60 years from selected hospitals in Jalandhar, Punjab, were conveniently selected. Data were collected using a socio-demographic questionnaire and the Wong–Baker FACES Pain Rating Scale, and analyzed using descriptive and inferential statistics. The post-test mean pain score was 50.67 in the control group and 34 in the experimental group, with a mean difference of 16.67. The calculated t value (2.6153) was greater than the table value (1.96), indicating a statistically significant difference at $p < 0.05$. The study concluded that ice application is effective in reducing pain during peripheral venous catheterization and should be used as a simple non-pharmacological pain relief measure [4].

Intravenous blood sample collection is a routine but painful procedure for many patients. This study assessed pain levels and the effectiveness of topical ice application in reducing pain among 80 hospitalized patients using a quantitative descriptive design. Post-test results showed that most patients in the control group experienced severe pain, whereas the experimental group mainly reported mild or no pain. The mean pain score was significantly lower in the experimental group (2.08) than in the control group (4.68), demonstrating that ice application effectively reduces pain during blood sample collection ($p < 0.001$) [5].

Nurses are responsible for the safe insertion and management of intravenous cannulae. This true experimental study assessed the effect of local heat application on peripheral IV cannulation among 60 patients admitted to general wards, with 30 patients each in the intervention and standard groups selected through systematic random sampling. Outcomes included vein visibility and palpability, pain perception, time required, and number of pricking attempts. Post-intervention, the intervention group showed significantly better vein visibility and palpability (4.1 ± 0.7 vs. 2.36 ± 0.6; $p = 0.001$), lower pain scores (1.56 ± 1.79 vs. 5.13 ± 2.47; $p = 0.001$), fewer pricking attempts ($p = 0.001$), and reduced cannulation time (2.2 ± 0.5 vs. 5.3 ± 0.8; $p = 0.001$). The study concludes that local heat application before IV cannulation is an effective method to improve vein accessibility while reducing pain, time, and repeated pricks [6].

This quasi-experimental study compared the effects of acupressure and cryotherapy on pain during chest drain tube removal among 150 elderly patients who underwent coronary artery bypass grafting. Participants were randomly assigned to acupressure, cryotherapy, or control groups. Pain was measured using a visual analogue scale before, during, and after tube removal. While baseline pain levels were similar ($p = 0.93$), both interventions significantly reduced pain compared to routine care ($p < 0.001$), with acupressure showing the greatest effect. The study concludes that acupressure is a safe and effective non-pharmacological method for reducing pain during drain tube removal in elderly patients [7].

Children frequently visit emergency departments (EDs) and often experience pain or undergo painful procedures. This systematic review examined nonpharmacological pain management interventions used for children aged 0–18 years in ED settings. Fourteen studies met the inclusion criteria, with most focusing on distraction, while others evaluated sucrose, cold application, and parental holding or positioning. Overall, these interventions were found to reduce pain, distress, and anxiety in children, as reported by children, parents, and observers. The findings highlight that nonpharmacological strategies are effective, nurse-led, and cost-efficient options for pediatric pain management in emergency departments [8].

This quality improvement study evaluated the effect of a locally applied vibrating device on venipuncture pain in children aged 4–18 years. Survey data were collected from 64 children and 7 phlebotomists before and after implementation of the device. Prior to its use, 59% of children expressed a desire for pain reduction during venipuncture, while 80% of children who used the vibrating device preferred it for future procedures. Children with previous venipuncture experiences showed the greatest benefit. Most phlebotomists (81%) reported that vibration made the procedure easier, and none found it problematic. The findings suggest that local vibration is a well-accepted and effective method for reducing venipuncture discomfort in pediatric patients [9].

Venous access is a critical medical procedure for medication administration and diagnostic blood sampling, yet venipuncture can be particularly distressing for pediatric patients. Anatomical variability and immature neurological development in children make the procedure challenging for clinicians and painful for patients. Although various pain-reduction strategies have been suggested, no consistently safe and effective standard has been established. This review examines pediatric physiological considerations, existing pain management methods, and proposes a highly effective pain mitigation approach based on current neurological evidence [10].

Oral flavored solutions have been shown to be effective in pain management, as applying sweet solutions intraorally—either at the injection site or on the tongue—before local anesthetic administration significantly reduces self-reported pain compared to other interventions. This systematic review evaluated the effect of sweet taste on injection-related pain during dental procedures. The review was registered with PROSPERO (CRD42024571962) and conducted in accordance with PRISMA guidelines. A comprehensive electronic search of major databases up to September 2024 identified 1,087 studies. Following duplicate removal and screening, 103 studies were assessed for eligibility, and eight randomized controlled trials met the inclusion criteria. Risk of bias was evaluated using the Cochrane Bias Assessment Tool. All included studies consistently reported a significant reduction in pain perception with the use of sweet solutions, irrespective of their type or concentration [11].

Methodology

Study Approach

A quantitative research approach was adopted for the present study to objectively assess the effectiveness of ice pack application in alleviating pain during venipuncture.

Study Design
An evaluative research design with a quasi-experimental (non-equivalent control group) design was used to compare pain levels among clients who received ice pack application prior to venipuncture and those who received routine care.

Study Setting
The study was conducted in the IMS & SUM Hospital wards of a hospital in Odisha, including medical and surgical units where venipuncture is routinely performed.

Study duration
The study was carried out over a period of 4–6 weeks, including data collection, intervention, and analysis.

Sampling Method
A non-probability purposive sampling technique was used to select participants who met the inclusion criteria. Participants were assigned to experimental and control groups using a simple allocation method (e.g., lottery method).

Sample size
A total of 60 clients with 30 clients in the experimental group (ice pack application) and 30 clients in the control group (routine care). The sample size was determined using Yamane's formula.
According to Yamene's formula
$n = N/ (1+ N e^2)$
Here n= Sample size, N = Population size, e = Percentage of error i.e. 0.05

Inclusion Criteria
Clients who:
- Were undergoing venipuncture
- Were aged adults
- Were conscious and able to express pain
- Were willing to participate in the study
- Were available during the data collection period

Exclusion Criteria
Clients who:
- Had impaired sensation at the venipuncture site
- Had skin lesions, infections, or cold intolerance
- Were critically ill or unconscious
- Had received analgesics immediately before venipuncture

Description of the tools
The pain assessment tool required 2–3 minute to administer for each participant.

Tool Used
Tool- 1: Demographic variables (age in years, gender, marital status, educational status, occupation, monthly family income, area of residence, previous experience of venipuncture).

Tool- 2: Wong–Baker Faces Pain Rating Scale, ranging from 0 (no pain) to 10 (worst pain), used to assess pain intensity during venipuncture. It is a standardized, self-report pain assessment tool commonly used to measure pain intensity in children and individuals who may have difficulty expressing pain verbally. The scale consists of six facial expressions that represent increasing levels of pain, ranging from 0 (no pain) to 10 (worst possible pain). The faces progress from a smiling face indicating no pain to a crying face indicating severe pain. During venipuncture, the child is asked to point to the face that best describes the level of pain experienced. Each face corresponds to a numerical score (0, 2, 4, 6, 8, and 10), allowing for objective quantification of subjective pain. The scale is easy to administer, requires minimal time, and has been proven to be valid and reliable for assessing procedural pain in pediatric populations.

Tool validation
Content validity: Reviewed by 5 experts (1 medical professionalism, 4 nursing professionalism). The tool was validated by experts in nursing, pediatrics, and research methodology. Necessary modifications were made based on expert suggestions to ensure content validity. The Wong–Baker scale is a standardized and reliable tool widely used for pain assessment.
The tools demonstrated strong reliability, with Cronbach's α. values of.91. Pre-testing (tryout) done in hospital for clarity, ambiguity, and timing.

Study variables
Independent Variable: Ice pack application prior to venipuncture
Dependent Variable: Pain intensity during venipuncture
Demographic Variables: Age, gender, diagnosis, previous venipuncture experience, etc.

Data collection procedure
- Formal permission was obtained from hospital authorities.
- Participants were selected based on inclusion criteria.
- Written informed consent was obtained from participants/guardians.
- Baseline demographic data were collected.
- In the experimental group, an ice pack wrapped in cloth was applied at the venipuncture site for 3 minutes before the procedure.
- The control group received routine hospital care.
- Venipuncture was performed by the same trained nurse to maintain uniformity.
- Pain intensity was assessed immediately after venipuncture using the Wong–Baker scale.

Ethical considerations
Ethical approval was obtained from the Institutional Ethics Committee of the Institute of Medical Odisha, with approval dated 22.10.2020 (Ref. No.: SOADU/SNC/IRB/388/2023). Written informed consent was taken from participants or guardians. Confidentiality and anonymity were maintained. Participants were informed about their right to withdraw at any time. No harm was caused to the participants during the study.

Statistical Analysis
SPSS version 21 was used for data analysis. Demographic information and baseline characteristics were summarized using descriptive statistics, including mean values, standard deviations, and frequency counts. The data will be collected and analyzed with descriptive and inferential statistical techniques. The demographic variables will be analyzed by using frequency and percentage. The frequency tables will be formulated for all significant information.

Theoretical framework

The study was based on Gate Control Theory of Pain, which explains that non-painful stimuli such as cold application can block pain signals before they reach the brain. The Gate Control Theory of Pain was proposed by Melzack and Wall in 1965. This theory explains that pain perception is not only the result of direct activation of pain fibers but is also influenced by other sensory inputs at the spinal cord level. According to this theory, a "gate" mechanism exists in the dorsal horn of the spinal cord that regulates the transmission of pain impulses to the brain. When painful stimuli activate small-diameter nerve fibers, the gate opens and pain signals are transmitted to the brain, resulting in the perception of pain. In the present study, the application of cold (ice pack) prior to venipuncture acts as a non-painful sensory stimulus. This cold stimulation activates large sensory fibers and closes the gate at the spinal cord level, thereby decreasing the intensity of pain perceived during venipuncture. Thus, the Gate Control Theory of Pain provides the theoretical framework supporting the effectiveness of ice pack application in pain reduction.

Input: Client characteristics, venipuncture procedure
Process: Ice pack application
Output: Reduced pain intensity during venipuncture

Results

Table 1: Distribution of subjects based on sociodemographic variables. (N = 60)

Sl. No	Sociodemographic Variables	Frequency (f)	Percentage (%)
1	Age in years		
	a. 18–25	24	40.0
	b. 26–35	18	30.0
	c. 36–45	18	30.0
2	Gender		
	a. Male	28	46.7
	b. Female	30	50.0
	c. Others	2	3.3
3	Marital Status		
	a. Single	32	53.3
	b. Married	22	36.7
	c. Widowed	4	6.7
	d. Divorced	2	3.3
4	Educational Qualification		
	a. No formal education	6	10.0
	b. Primary education	14	23.3
	c. Secondary education	20	33.3
	d. Graduate and above	20	33.3
5	Occupation		
	a. Unemployed	16	26.7
	b. Self-employed	14	23.3
	c. Private employee	18	30.0
	d. Government employee	12	20.0
6	Monthly family income (₹)		
	a. Less than 10,000	18	30.0
	b. 10,001–20,000	20	33.3
	c. 20,001–30,000	14	23.3
	d. More than 30,000	8	13.3
7	Area of residence		
	a. Rural	34	56.7
	b. Urban	26	43.3
8	Previous experience of venipuncture		
	a. Yes	42	70.0
	b. No	18	30.0

The above table-1 revealed that Frequency (F) and percentage (%) distribution of patients according to age in years, gender, marital status, educational qualification, occupation, monthly family income, area of residence, previous experience of venipuncture.

Table- 2: Frequency and percentage of variables that Wong–Baker Faces Pain Rating Scale. (N =60)

Sl. No	Wong–Baker Faces Pain Variable	Frequency (f)	Percentage (%)
1	The Wong–Baker Faces Pain Rating Scale is mainly used to assess		
	a. Anxiety level	40	6.7
	b. Pain intensity	48	80.0
	c. Depression	5	8.3
	d. Stress	3	5.0
2	The Wong–Baker Faces Pain Rating Scale consists of		
	a. Numbers only	6	10.0
	b. Words only	5	8.3
	c. Faces with numerical values	45	75.0

	d. Colors with symbols	4	6.7
3	The score range of the Wong–Baker Faces Pain Rating Scale is		
	a. 1–5	6	10.0
	b. 0–5	8	13.3
	c. 0–10	42	70.0
	d. 1–10	4	6.7
4	In the Wong–Baker Faces Pain Rating Scale, a score of 0 indicates		
	a. Mild pain	5	8.3
	b. Moderate pain	6	10.0
	c. Severe pain	4	6.7
	d. No pain	45	75.0
5	Population commonly assessed using the scale		
	a. Only adults	7	11.7
	b. Only elderly	5	8.3
	c. Children and clients with communication difficulties	44	73.3
	d. Only postoperative patients	4	6.7
6	Number of faces used in the scale		
	a. 4	6	10.0
	b. 5	8	13.3
	c. 6	40	66.7
	d. 10	6	10.0
7	A Wong–Baker pain score of 8 indicates		
	a. No pain	3	5.0
	b. Mild pain	6	10.0
	c. Moderate pain	9	15.0
	d. Severe pain	42	70.0
8	Response is obtained by asking the client to		
	a. Describe pain verbally	8	13.3
	b. Write the pain score	6	10.0
	c. Point to the face representing pain	42	70.0
	d. Choose a color	4	6.7
9	The Wong–Baker Faces Pain Rating Scale is an example of		
	a. Physiological measurement tool	6	10.0
	b. Behavioral observation scale	9	15.0
	c. Subjective pain assessment tool	40	66.7
	d. Diagnostic test	5	8.3
10	Higher Wong–Baker Faces Pain scores indicate		
	a. Less pain	4	6.7
	b. Better coping	6	10.0
	c. Increased pain intensity	44	73.3
	d. Reduced anxiety	6	10.0

The data presented in table-2 revealed that the majority of the participants 48 (80%) correctly reported that the Wong–Baker Faces Pain Rating Scale is mainly used to assess pain intensity. Most of the respondents 45 (75%) identified that the scale consists of faces with numerical values, and 42 (70%) correctly stated that the score range of the scale is 0–10. Regarding interpretation of scores, 45 (75%) indicated that a score of 0 represents no pain, while 42 (70%) reported that a pain score of 8 indicates severe pain. Concerning applicability, 44 (73.3%) of the participants stated that the Scale is commonly used among children and clients with communication difficulties. The majority 40 (66.7%) correctly identified that the scale uses six faces and recognized it as a subjective pain assessment tool. Furthermore, 42 (70%) of the respondents reported that pain assessment using the Wong–Baker Faces Pain Rating Scale is obtained by asking the client to point to the face that best represents their pain, and 44 (73.3%) acknowledged that higher scores indicate increased pain intensity.

Table 3: Mean, standard deviation and t value of paired t test, p value to assess the effect of ice pack application prior to venipuncture in alleviating pain on experimental group and control group N= n1+n2= 60

Criteria	Mean ± SD	pretest posttest	T test	DF	P value
Ice pack application in experimental group	10.63±31.64	25.73±24.92	-2.63	29	0.006*
Ice pack application in control group	10.93±31.75	10.63±31.64	1.000	29	0.162^{NS}

p≤0.05* (Extremely statistically significant)

Table-3 Shows the comparison of mean level of ice pack application score within experimental & control group. The mean post-test level of social skill score in experimental group has significantly increased as compared to pre-test score (t= -2.63, P= 1.000).

Table 4: Comparison of mean post-test level of ice pack application score between experimental group & control group. N= n1+n2= 60

Criteria	Mean ± SD	SEM	Unpaired 'T' Test	DF	P Value
Level of ice pack application in experimental group	25.73±24.92	7.354	-2.053	58	0.022*
Level of ice pack application in control group	10.63±31.64				

p≤ 0.05 level statistically significant

Table-5 Shows the comparison of mean of ice pack application score between experimental & control group. The mean post-test assertive skill score in experimental group is higher as compared to mean post-test level of assertive skill in control group (t= -2.05, P= 0.022*)

Table 5: Association of ice pack application prior to venipuncture in alleviating pain and sociodemographic variables in the subjects. (N=60)

Sl No	Demographic data	Chi-Square	Df	P Value	Level of Significance
1	Age in years	3.21	2	0.20	Non-significant
2	Gender	1.84	2	0.39	Non-significant
3	Marital Status	2.67	3	0.44	Non-significant
4	Educational Qualification	6.12	3	0.11	Non-significant
5	Occupation	4.98	3	0.17	Non-significant
6	Monthly family income	7.42	3	0.06	Non-significant
8	Area of Residence	0.96	1	0.33	Non-significant
9	Previous experience of Venipuncture	8.56	1	0.003*	Significant

Table-4 presents that the association between selected demographic variables and pain score was analyzed using the Chi-square test. The findings revealed that age, gender, marital status, educational qualification, occupation, monthly family income, and area of residence did not show a statistically significant association with pain score, as the obtained p-values were greater than 0.05. However, previous experience of venipuncture showed a statistically significant association with pain score ($\chi^2 = 8.56$, df = 1, p = 0.003), indicating that prior exposure to venipuncture had an influence on the level of pain perceived by the participants.

Discussion

Venipuncture and other invasive procedures are common sources of pain and anxiety in children. This study examined the effect of ice pack application on pain intensity during venipuncture among 50 school-age children (6–12 years) at King Fahd Hospital of the University, Saudi Arabia. Children were randomly assigned to an intervention group that received an ice pack for three minutes before venipuncture or a control group that received routine care. Pain was assessed using the Wong–Baker FACES Pain Rating Scale. Results showed a significantly lower mean pain score in the ice pack group compared to the control group (1.92 ± 0.32 vs. 4.40 ± 0.49; $p < 0.001$). Pain levels were lower in older children and higher among males. The study concluded that pre-venipuncture ice pack application effectively reduces pain and should be incorporated into routine pediatric care [12].

Pain, often described as the fifth vital sign, is a common and distressing experience for hospitalized children, particularly during venipuncture. This quasi-experimental study evaluated the effectiveness of ice pack application before venipuncture in reducing pain among 100 children aged 6–12 years. Participants were divided into experimental and control groups, with the intervention group receiving a three-minute ice pack application prior to the procedure. Pain was assessed using the Wong–Baker Faces Pain Rating Scale. The results showed a statistically significant reduction in pain scores in the experimental group compared to the control group, leading to rejection of the null hypothesis. The study concludes that ice pack application is a safe, simple, and cost-effective method for reducing venipuncture-related pain in children. [13]

Implications of the study

Ice pack application can be incorporated into routine nursing care during venipuncture. Nursing students can be trained in non-pharmacological pain management techniques. Hospital policies can include ice pack use as a standard protocol for venipuncture. The study provides a base for further research with larger samples and different settings.

Limitation

Small sample size. Study limited to one hospital. Subjective nature of pain perception. Non-randomized sampling method.

Conclusion

The study concludes that ice pack application prior to venipuncture is an effective, safe, simple, and cost-effective non-pharmacological intervention for reducing pain among clients. It can be easily implemented by nurses to enhance patient comfort and quality of care.

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Self

Conflicts of interest

There are no conflicts of interest for the writers.

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Ethics Approval

The research committee endorsed the identified problem and goal of the study. Approval for conducting study from Institutional Ethics Committee of Institute of Medical Sciences Approval number: SOADU/SNC/IRB/388/2023.

Data availibility

The data is available and can be accessed with a reasonable request.

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