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Research Article

"Effectiveness of Cold Needle to Administer Intramuscular Injection on Pain Perception among Adult Patients"

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ABSTRACT

Background and Objectives. Injections are among the most commonly performed medical procedure in a hospital. The uncomfortable sensation caused by pain from intramuscular injection should not be trivialized, because a painful injection could create neurotic fear of the injection and may even delay a patient from seeking treatment. According to the WHO, around 16 billion injections administered globally each year. In India, prevalence of intramuscular injection range is between 0.9-8.5 injections per person per year. A community survey reported that 27.1% of the subject's received injections. A challenge for the nurse is to administer painless injection to help alleviate pain, particularly for patients who fear needles and injection. The "Cold needle" technique is one such method, which can be used to provide painless intramuscular injection.

The researcher aims to evaluate the effectiveness of cold needle to administer Intramuscular Injection on pain perception among adult patients at Dr. D.Y. Patil Medical College Hospital and Research Centre, Kolhapur. The study seeks to understand the Pain perception of adult patients receiving intramuscular injection and identify ways to support them.

Objectives: The present study is aimed that to evaluate the effectiveness of cold needle to administer intramuscular injection on pain perception among adult patients at Dr. D. Y. Patil Medical College Hospital and Medical Research centre, Kolhapur.

The objectives are as follows,

1. To evaluate the effectiveness of cold needle to administer intramuscular injection on pain perception among adult patients within experimental group.
2. To compare the mean post-test pain perception score of adult patients between experimental group and control group.
3. To find out an association between post-test pain perception score and selected socio-demographical variables in control group and experimental group.

Methods: A quantitative research approach was adopted for the study. A quasi-experimental post-test only control group design was chosen. By using non-probability purposive sampling technique 50 adult patients (aged 21-60 years) receiving IM injection was selected. The experimental group received IM injection with a needle cooled to 2-8 degree Celsius for 1 minute, while the control group received routine room-temperature injections. Pain was assessed using the Visual Analogue Scale (VAS). Data were analyzed with descriptive statistics Mean, Median, Mode, Range, Standard deviation, Unpaired t-test, and Chi-square test.

Result: The study finding revealed that in experimental group, 56% no pain, 36% had mild pain and 8% having moderate pain while receiving intramuscular injection. In control group, 60% reported mild pain, 32% had moderate pain and 8% had no pain. Mean pain score after intervention in experimental group is 1.04 ± 1.3 and the mean pain score without intervention in control group is 2.60 ±1.2 which was found to be significant at $p<0.05$ level with 't' value is 4.14. Hence cold needle is effective to reduce pain perception. There was significant association found between age and pain score in experimental group ($p<0.05$).

Interpretation and conclusion: The study concludes that the level of pain perception among adult patients receiving Intramuscular injection at Dr. D.Y. Patil medical college hospital and research centre, Kolhapur. In this study majority of respondents (56%) experienced no pain in experimental

group than in control group. The finding of this study suggests that using cold needle for intramuscular injection significantly reduces pain perception among adult patients compare to room temperature needle. This simple and cost-effective technique can be easily implemented in clinical settings to enhance patient comfort and reduce injection related anxiety.

Keywords: Effectiveness; Cold Needle; Intramuscular Injection; Pain Perception; Visual Analogue Scale; Adult Patients.

INTRODUCTION

Pain is never "just in the mind" or "just in the body" but it is a complex process which involving our whole being and how our brain interpretation the signals.[1] Everyone is enduring some type or degree of pain. Pain intensity is varied from person to person. A person in pain feels distress and seeks relief. A pain is subjective so it can also call as separate disease. Pain is always a personal experience that is influenced to varying degrees by biological, psychological and social factors through their life experiences.[2] According to The International Association for the Study of Pain (IASP) state that Pain as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage".[1]

According to the American Psychological Association (APA), 16 billion intramuscular injections (IMI) are given annually throughout the world in a range of healthcare settings, making it a common clinical procedure.[3] Injections are among the most commonly performed medical procedure in a hospital. One of the most common and safe routes of administration of medicine is the intramuscular route. Intramuscular injection pain should not be undervalued, as it can causes severe fear to the patients for receiving it. They conducted a study about pain intensity and duration after IM injection, reported that injection pain peaked at 0 second and lasted for 10 seconds.

The use of cold therapy to lessen pain during invasive procedures such as intramuscular injections, has also been extensively studies. Despite the potential clinical significance, the researcher finds that there was limited research conducted on cold needles or cold substances to reduce pain perception during IM injections. Therefore, this study is urgently needed to examine how cold needles affect, how painful intramuscular injections are, as well as to help develop strategies to reduce pain and injection anxiety and enhance the overall patient experience during this common medical procedure.[4]

MATERIAL AND METHODS

A quasi-experimental post-test only control group study was conducted at Dr. D. Y. Patil Medical College Hospital and Research centre, Kolhapur. Fifty adult patients (aged 21-60 years) were selected via non-probability purposive sampling (25 experimental, 25 control). The sample size was calculated by using G*Power software targeting 80% power and a 0.05 significance level, assuming a medium effect size (Cohen's d = 0.5). The experimental group received IM injections with a 22-gauge sterile disposable needle which was cooled at 2–8°C for 1 minute. While the control group received room-temperature needle injections. Pain was assessed immediately post-injection using the Visual Analogue Scale (VAS, 0–10). Data were analyzed with descriptive statistics (mean, median, mode, SD, frequency, percentage), unpaired t-test, and chi-square test ($p < 0.05$). Ethical approval and informed consent were obtained.

RESULTS

Table 1: Frequency and Percentage Distribution of Subjects According To Socio - Demographic Variables. N =50

S.NO.	Socio-demographic variable	Experimental group *f*(%)	Control Group *f*(%)
1.	Gender a. Male	12(48)	15(60)
	b. Female	13(52)	10(40)
	c. Transgender	-	-
2.	Age (in years) a. 21-30 b. 31-40 c. 41-50	08(32) 05(20) 08(32) 04(16)	06(24) 07(28) 06(24) 06(24)

	d. 51-60		
3.	History of any chronic illness? a. Rheumatic arthritis b. Thrombocytopenia c. Diabetic mellitus d. No any	- - 08(32) 17(38)	02(8) - 02(8) 21(84)
4.	History of any psychological disturbance. a. Anxiety b. Depression c. Phobia d. No any	02(8) 01(4) - 22(88)	01(4) - - 23(92)
5.	Having any kind of bad habits if? a. Smoking b. Alcohol c. Drug addiction d. No any	06(24) 02(8) - 17(68)	02(8) 03(12) - 17(68)
6.	History of abscess during previous IM injection? a. Yes b. No	03(12) 22(88)	06(24) 19(76)
7.	Have you taken IM injection before 1 year? a. Yes b. No	19(76) 06(24)	19(76) 06(24)

The **primary outcome-** In the experimental group, 13 (52%) were female, 12 (48%) males; in the control group, 15 (60%) were male, 10 (40%) females, with no transgender participants. Age distribution showed 8 (32%) in the experimental group aged 21–30 and 41–50, while the control group had 7 (28%) aged 31–40 and 6 (24%) each in 21–30, 41–50, and 51–60. Chronic illness was absent in 17 (68%) experimental and 21 (84%) control participants; 8 (32%) experimental and 2 (8%) control had diabetes mellitus, with 2 (8%) control reporting other conditions. In experimental group majority of subjects that is 22(88%) having no any history of psychological disturbance and minority 01(4%) having history of depression, whereas in control group majority of subjects that is 23(92%) having no any history of psychological disturbance and minority 01(4%) having history of anxiety and phobia. Bad habits (smoking/alcohol) were reported by 8 (32%) experimental (6 smoking, 2 alcohol) and 5 (20%) control (2 smoking, 2 alcohol). Abscess history was noted in 3 (12%) experimental and 6 (24%) control; 22 (88%) and 19 (76%) had none, respectively. 19(76%) having previous history of IM injection in both group and 06(24%) had no previous history of IM.

Table 2: Post-Test Pain Perception Score in both Experimental Group and Control Group. N=50

Group	Mean± SD	Median	Mode	Range
Experimental group(n=25)	1.04 ±1.3	0	0	4
Control group(n=25)	2.60 ±1.2	3	2	4
Difference	1.5 ± 0.1	3	2	0

The secondary outcome - In experimental group Post-test Mean ± SD (1.04 ± 1.3) and Control group the Post-test Mean ± SD (2.60 ± 1.2). Mean difference of group is 1.5 ± 0.1.

Table 3: Frequency and percentage distribution of subjects according to their pain scores in control group and experimental group.

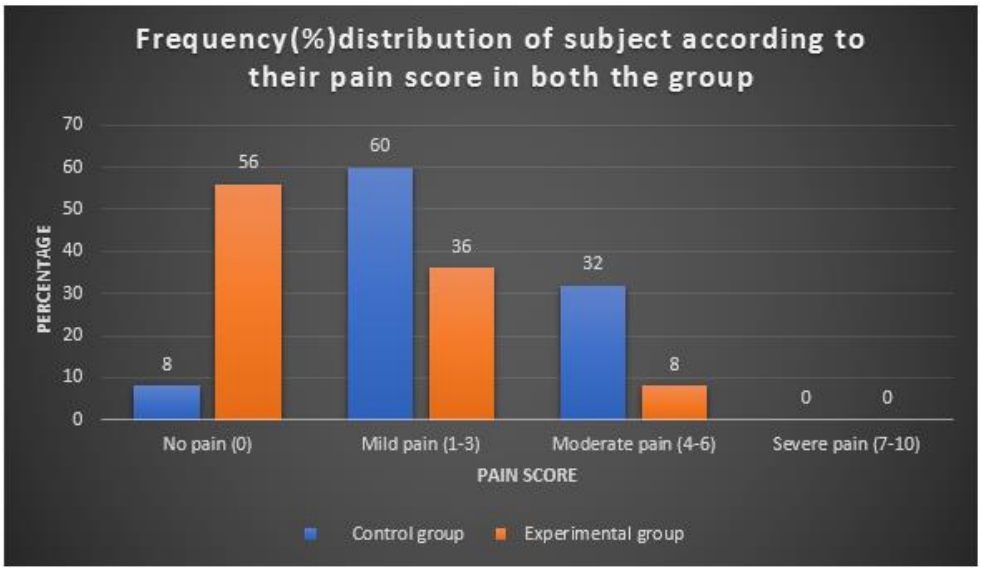

Table 4: Effectiveness of Cold Needle to Give Intramuscular Injection on Pain Perception.
n = 50

Mean ± SD	Mean difference	't' value	P value
Experimental group 1.04 ±1.3 Control group 2.60 ±1.2	1.5	4.14	0.0001*

$df_{(48)}$ =2.0 *Significance p<0.05.

Table 4 reveals that,

'p' value (0.001) is less than 0.05 level of significance. Findings revealed that the Cold needle for IM injection is effective to reduce pain perception among adult patients.

Table 5: Association between Pain score of subjects with their socio-demographic variables.

The result of chi-square values indicates a significant association between the post-test pain score with age (p<0.005) in experimental group.

DISCUSSION

Injections are among the most commonly performed medical procedure in a hospital. One of the most common and safe routes of administration of medicine is the intramuscular route, as the muscles are easily accessible, ensures immediate and consistent uptake of the drug due to the rich blood supply of the muscles, improved bioavailability, and better systemic effect of the drug compared to oral and other parenteral routes.[3]

The primary outcome demonstrates that in experimental group majority of subjects that is 13 (52%) were females and minority 12(48%) were males, whereas in control group majority of subjects that is 15 (60%) were male and minority 10(40%) were females, none of them belong to category which is transgender. In experimental group majority of subjects that is 08(32%) belong to 21-30 and 41-50 years of age, whereas in control group majority of subjects that is 07(28%) belong to 31-40 years of age and minority 06(24%) was in 21-60, 41-50 and 51-60 years of age. In experimental group majority of subjects that is 17(68%) having no history of any chronic illness and minority 08(32%) having history of Diabetic mellitus, whereas in control group majority of subjects that is 21(84%) having no history of any chronic illness and minority 02(8%) having history of Diabetic mellitus and Rheumatic arthritis. In experimental group majority of subjects that is 22(88%) having no any history of psychological disturbance and minority 01(4%) having history of depression, whereas in control group majority of subjects that is 23(92%) having no any history of psychological disturbance and minority 01(4%) having history of anxiety and phobia. In experimental group majority of subjects that is 17(68%) having no any bad habits and minority of 06 (13%) do smoking and 02(8%) habit of drinking alcohol, whereas in control group majority of subjects that is 20(80%) having no any bad habits and

minority of 02(8%) having habit of drinking alcohol, 02(8%) having habit of smoking. In experimental group majority of subjects that is 22 (88%) had no history of abscess during IM injection and minority of 03 (12%) having history of abscess during IM, where as in control group majority of subjects that is 19 (76 %) had no history of abscess and minority of 06(24%) having history of abscess during IM injection. 19(76%) having previous history of IM injection in both group and 06(24%) had no previous history of IM.

Similar finding was noted, the study conducted to evaluate the effectiveness of Cold Application before administering intramuscular injection on the reduction of needle stick pain among patients in a selected Primary Health Centre. result of study most of the samples 8(40%) patients were between the age group of 36-40 years. The many of the 15(75%) patients were male. The majority of the 11(55%) patients were educated at up to school level. Most of the 14(70%) patients was Unmarried. The majority of the 9(45%) patient's occupation was professionals. The most of the 11(55%) patients taken intramuscular injection before at Primary Health Centre. The majority of the 16(80%) patients taken intramuscular injection at site of deltoid muscle. Most of 13(65%) patients taken intramuscular injection in Tetanus type of medications. The majority of 6(30%) patients were ante-natal mother. The majority of 10(50%) patients had developed the symptoms of pain.[6]

2. Finding related to frequency & percentage distribution of subjects according to their pain score in experimental and control group.

In present study, in experimental group majority (56%) having no pain, were as (36%) had mild pain and (8%) having moderate pain. In control group majority (60%) having mild pain, were as (32%) had moderate pain and 02(8%) had no pain.

A study with similar finding was conducted, to evaluate the efficacy of using cold needle for giving intramuscular injection to minimize the pain intensity among patients admitted at selected tertiary care hospital Belgaum. The difference between the Experimental and Control group was ruled out, the Mean pain score after intervention in Case group is 1.73 ± 1.08 and the Mean pain score without intervention in Control Group is 7.17 ± 1.05. The post-test mean values of pain among the experimental and control group were obtained at $p < 0.001$. Which proposes that reduced levels of pain in experimental group at the time of IM inoculation was because of using cold needle as an intervention and not accidental or by luck. A significantly high difference was detected.[7]

3. Findings related to effectiveness of cold needle for IM injection on pain perception among adult patients.

In the present study, result confirm that, the calculated Unpaired 't' value (t_{cal}=4.14) and 'p' value (0.001) is less than 0.05 level of significance. Hence H_1 is accepted. This indicates that the pain score is statistically significant at $p<0.05$ level. Therefore, finding of study revealed that mean post-test pain perception score of subjects within control group is higher than the mean post-test pain Perception score of subjects within experimental group. Hence cold needle is effective to reduce pain perception.

Similar study aimed at to assess effectiveness of Helfer skin tap technique on the level of pain during intramuscular injection among the adults in selected hospitals at Sangali, Miraj, Kupwad corporation area. The unpaired' test was used. The null hypothesis was rejected because the p value is less than 0.05. because the degree of pain varies significantly. According to the study, using the Helfer skin tap technique during intramuscular injections lower the amount of pain and this technique works very well to distract patients from their pain and lessen its severity.[8]

4. Finding related to association between post-assessment pain score of subjects with their selected socio-demographic variables between experimental and control group.

The result of the present study indicates a significant association between post-test pain scores of subjects with age group in experimental group as calculated, except this other p value are greater than 0.05. Hence, H_2 was accepted. In control group there is no significant association between post-test Pain scores of subjects with socio-demographic variables as calculated, all 'p' values are greater than 0.05. Hence, H_{03} is accepted and H_3 is rejected.

Similar study was conducted at Manglor, impact of routine injection versus cold needle injection on the degree of pain and discomfort experienced by adult in a particular hospital. The degree of pain and discomfort experienced by 60 adult patients receiving tramadol injection during intramuscular injection was

compared between the routine injection technique and the cold needle injection technique using a quasi-experimental posttest cross over design. Purposive sampling was used to select the participant and the lottery method was used to divide them into two group: one for routine injection and the other for cold needle injection. According to the study, every computed p value was higher than 0.05. Therefore, the degree of pain and discomfort does not significantly correlate with certain demographic factors. [9]

CONCLUSION:

This quasi-experimental study confirmed that cold needle administration significantly reduces pain perception during intramuscular (IM) injections, with the experimental group showing a lower mean VAS score (1.04 ± 1.3) compared to the control group (2.60 ± 1.2, $t = 4.14$, $p < 0.001$). The findings support the use of cold needles as a simple, cost-effective, non-pharmacological intervention to enhance patient comfort and reduce injection-related anxiety. The significant association between age and pain reduction in the experimental group suggests younger patients may benefit more. Integrating cold needle techniques into clinical practice can improve patient experiences, with future research needed to explore broader applications across diverse populations and settings.

IMPLICATION OF THE STUDY:

The findings of the research have number of ramifications in various field, which are covered in the sections that follow,

Nursing practice

The study demonstrates that cold needle administration significantly reduces pain during intramuscular (IM) injections ($t = 4.14$, $p < 0.001$), offering nurses a non-pharmacological strategy for pain management. Nurses should adopt cold needle techniques (22-gauge needle cooled to 2–8°C) in daily practice to enhance patient comfort and reduce injection-related anxiety, particularly in younger patients ($\chi^2 = 12.45$, $p = 0.029$). This cost-effective method can be integrated into preventive, promotive, curative, and rehabilitative care in hospitals and community settings, serving as an adjunct therapy to improve patient outcomes and satisfaction during IM injections.

Nursing Education

According to the study's findings, cold needles can effectively lessen adult patients' perception of pain. It proves that people in pain require immediate medical attention and that treating pain is essential to lowering people's anxiety about intramuscular injections. Therefore, the value of a cold needle should be incorporated into the nursing curriculum as treatment for intramuscular injection. Alternative therapies should be emphasized in nursing curricula.

Nursing Administration

The nurse administrator may use the study's findings to improve nursing care. In addition to providing staff with in-service training, nurse administrators were given guidelines were given guidelines and procedures for assessing pain during intramuscular injection administration. Utilize various techniques and therapies to control the level of pain during intramuscular injections and administering care can lessen the discomfort.

Nursing Research

Nursing research provides a crucial avenue for further nursing studies. The study's conclusions demonstrated that cold needles were useful in lowering adult patients pain scores. The study will encourage other researchers to carry out a large-scale investigation using the same variables. Staff nurse and student nurse can be encouraged to work on project and theses that focus on different non-pharmacological interventions for people who use digital devices.

LIMITATIONS

1. The study finding cannot be generalized because of small number of participants.
2. The study is limited only to Dr. D. Y. Patil Medical College Hospital and Research Center, Kolhapur.

RECOMMENDATIONS

The following suggestions were put forth in light of the study's findings-

1. Conduct similar studies in pediatric and elderly populations to assess cold needle efficacy.
2. Replicate the study with a large, multi-center sample to enhance generalizability.
3. Perform descriptive studies to evaluate knowledge and practices of cold therapy in nursing.
4. Conduct comparative studies of non-pharmacological pain reduction techniques for IM injection to identify optimal methods.
5. A study can be carried out in a variety of settings and designs.

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