

ORIGINAL ARTICLE

Effectiveness of Cold Pack Application in Reducing Pain During Intramuscular Injection Among Adult Patients: A Quasi-Experimental Study

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ABSTRACT

Context: Intramuscular (IM) injection is a common clinical procedure associated with short-term pain. Cold application is a simple, low-cost non-pharmacological method proposed to reduce this discomfort, but rigorous evidence specific to the cold-pack method remains limited.

Aims: To evaluate the effectiveness of cold pack application in reducing pain during IM injection among adult outpatients, and to examine associations between pain level and selected demographic and clinical variables.

Settings and Design: Quantitative, quasi-experimental, post-test-only control-group design conducted in the outpatient department of a hospital in Coimbatore, Tamil Nadu, India.

Methods and Material: Sixty adults receiving IM injection were allocated by non-probability convenience sampling to an experimental group (cold pack applied at the injection site, n=30) or a control group (routine IM injection, n=30). Pain was assessed immediately after injection using a structured pain-assessment instrument. As the original participant-level dataset is no longer available, this report presents the historically recorded group-level results rather than newly generated data.

Statistical analysis used: Descriptive statistics, unpaired t test, and chi-square test, as recorded in the original study record; these inferential values could not be independently recalculated.

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Results: The reported post-test mean pain score was 1.68 in the experimental group and 4.34 in the control group (mean difference 2.66; unpaired $t = 4.02$, $p < 0.01$). Age was reportedly associated with pain level in the experimental group; no variable examined was significantly associated with pain in the control group.

Conclusions: The historical results suggest cold pack application may lower pain during IM injection, consistent in direction with published evidence on local cold interventions. Because participant-level data and some methodological details are unavailable, findings should be treated as historical and confirmed by adequately powered, prospectively documented trials.

KEYWORDS:

• Cold pack • Intramuscular injection • Injection pain • Non-pharmacological intervention • Nursing

INTRODUCTION

Pain is a multidimensional sensory and emotional experience central to patient-centred care, defined by the International Association for the Study of Pain as an unpleasant sensory and emotional experience linked to actual or potential tissue damage¹. Intramuscular injection is a routine method of drug administration that can nonetheless cause transient procedural pain, and reducing such discomfort without compromising safe administration remains relevant to nursing practice².

Non-pharmacological methods, particularly local cold application, are attractive because they are inexpensive and easy to incorporate into routine care. A 2025 systematic review of nine studies in adults receiving IM injections reported that cold application reduced injection-related pain, while calling for larger, methodologically stronger trials³. Randomised trials using cold spray have similarly reported lower pain scores than routine injection^{4,5}. Although cold spray and cold-pack methods are not identical, these findings support further investigation of local cooling.

This report re-examines a quasi-experimental study of cold pack application among adults receiving IM injections in an outpatient department in Coimbatore, Tamil Nadu, presenting the surviving group-level results with transparent reporting of the study's data limitations.

MATERIALS AND METHODS

Design and setting: A quantitative evaluative approach with a quasi-experimental, post-test-only control-group design was used in the outpatient department of a hospital in

Coimbatore, Tamil Nadu, India. Ludwig von Bertalanffy's General Systems Theory was adopted as the conceptual framework, treating patient, intervention, and response as interacting system components.

Sample: Sixty adult patients receiving IM injection were enrolled by non-probability convenience sampling, 30 to an experimental group and 30 to a control group. Inclusion criteria were age above 20 years, willingness to participate, and comprehension of Tamil or English; patients with neurological disorder or leprosy, or who had consumed alcohol, were excluded. The surviving record does not establish random allocation, so the design is described as quasi-experimental rather than randomised.

Intervention: The experimental group received IM injection with a square plastic device containing an ice pack applied at the injection site; the control group received routine IM injection. Exact temperature, duration, and pressure of cold application were not documented in the surviving record and have not been reconstructed.

Instrument and variables: A structured interview schedule recorded demographic and clinical variables (age, sex, religion, marital status, education, occupation, body build, presence of illness, injection frequency, medication type and volume, injection site, needle size, and position), and a pain-assessment instrument recorded post-injection pain. The original record refers to a visual analogue scale in one section and a 0–10 scoring framework in another; as the original form is unavailable, the precise instrument cannot be verified and is described neutrally as a "pain-assessment instrument."

Procedure: Data were reported to have been collected over one week after institutional permission was obtained, with pain assessed immediately after injection in both groups.

Statistical analysis: The original study applied descriptive statistics, an unpaired t test for the primary outcome, and chi-square tests for associations with demographic and clinical variables. Because the participant-level dataset is no longer available, these inferential results are reported as originally recorded and have not been independently recalculated.

Ethical considerations: The surviving record states that institutional permission was obtained but does not specify an ethics committee name, approval number, or date; these details cannot be reconstructed and should be confirmed and documented by the authors before submission.

RESULTS

Sixty participants were included, 30 per group; demographic and clinical characteristics are summarised in Table 1. The groups were broadly comparable, though the control group included more participants aged 31–40 years and fewer aged 21–30 years than the experimental group.

Table 1: Demographic and clinical characteristics of participants (N=60)

Variable	Experimental n (%)	Control n (%)
Age		
21–30 years	7 (23)	3 (10)
31–40 years	9 (30)	12 (40)
41–50 years	10 (34)	7 (23)
51–60 years	4 (13)	8 (27)
Sex		
Male	11 (37)	14 (47)
Female	19 (63)	16 (53)
Religion		
Hindu	22 (73)	23 (77)
Christian	5 (17)	3 (10)
Muslim	3 (10)	4 (13)
Marital status		
Married	24 (80)	23 (77)
Unmarried	5 (17)	5 (17)
Widow	1 (3)	2 (7)
Education		
Illiterate	4 (13)	4 (13)
Primary	12 (40)	15 (50)
Graduate	14 (47)	11 (37)

Occupation		
Employed	18 (60)	17 (57)
Unemployed	12 (40)	13 (43)
Body build		
Thin	9 (30)	6 (20)
Moderate	15 (50)	17 (57)
Obese	6 (20)	7 (23)
Pre-existing illness		
Yes	19 (63)	20 (67)
No	11 (37)	10 (33)
Frequency of IM injection		
Often	5 (17)	5 (17)
Sometimes	14 (46)	19 (63)
Rarely	11 (37)	6 (20)
Medication type		
Oil-based	6 (20)	12 (40)
Water-based	24 (80)	18 (60)
Injection site		
Deltoid	2 (7)	4 (13)
Gluteal	28 (93)	26 (87)
Needle size		
24 gauge	30 (100)	30 (100)
Position		
Prone	9 (30)	5 (17)
Left lateral	19 (63)	21 (70)
Sitting	2 (7)	4 (13)
Medication volume		
5 mL	8 (27)	7 (23)
3 mL	5 (17)	3 (10)
2 mL	13 (43)	13 (44)
1 mL	4 (13)	7 (23)

Abbreviations: IM, intramuscular; SD, standard deviation. Percentages are reproduced from the original study record and rounded to whole numbers.

The reported post-test mean pain score was 1.68 (SD 6.08) in the experimental group and 4.34 (SD 2.54) in the control group, a mean difference of 2.66 points, with a reported unpaired t value of 4.02 ($p < 0.01$) (Table 2). These values are reproduced from the archived study record and have not been independently recalculated.

Chi-square analysis reported a significant association between pain level and age in the experimental group; associations with body build, medication type, injection site, position, and medication volume were not significant in either group (Table 3). Values marked with an

asterisk in the archived control-group record appeared internally inconsistent in the source document and are reproduced as transcribed

pending verification against the original statistical output.

Table 2: Post-test pain scores in the experimental and control groups

Group	n	Mean	SD	Mean difference	Unpaired t (p)
Experimental	30	1.68	6.08	2.66	4.02 (p<0.01)
Control	30	4.34	2.54	—	—

Abbreviations: SD, standard deviation. Values are reproduced from the archived study record; the participant-level dataset is unavailable for independent recalculation

Table 3: Chi-square statistics for selected demographic and clinical variables by pain level

Variable	Exp. df	Exp. χ^2	Exp. table value	Ctrl. df	Ctrl. χ^2	Ctrl. table value
Age	12	2.93	21.03	12	27.67	21.03
Body build	8	2.99	15.51	8	3.17	15.51
Medication type	4	8.89	9.49	4	0.97	9.49
Injection site	4	0.42	9.49	4	1.15	0.42*
Position	8	1.58	15.51	8	2.41	1.58*
Medication volume	12	5.36	21.03	12	11.53	5.36*

Abbreviations: df, degrees of freedom; χ^2 , chi-square statistic. *Values in the archived source record for these control-group entries appeared internally inconsistent and are reproduced as transcribed; they should be verified against the original statistical output before further use.

DISCUSSION

The historically reported results indicate lower post-test pain in the experimental group receiving cold pack application than in the control group receiving routine IM injection, a direction consistent with contemporary evidence on local cold interventions.³⁻⁵ A 2025 systematic review of cold application for IM injection pain in adults similarly reported a beneficial effect while urging larger, higher-quality trials.³ Randomised trials of cold spray have reported comparable reductions in injection-related pain,^{4,5} though cold spray and cold-pack methods should not be treated as interchangeable.

The reported association between pain and age in the experimental group warrants cautious interpretation given the small, convenience-sampled cohort and the number of associations tested; it may reflect sampling variation rather than a causal relationship.

Several limitations constrain interpretation. The participant-level dataset underlying this study is no longer available, so the reported inferential statistics could not be independently recalculated; no missing data, ethics details, or intervention parameters have been invented to fill these gaps. The precise pain-assessment instrument cannot be confirmed, as the surviving record refers ambiguously to both a visual analogue scale and a 0–10 framework.^{6,7} The cold-pack protocol itself — temperature,

duration, and pressure — was not documented. The post-test-only, non-randomised design and small sample further limit generalisability, and institutional ethics approval could not be verified from the surviving record.

Despite these constraints, the study reflects a practical nursing question of clinical relevance: a simple, low-cost cooling method applied at the point of injection. Future research should prospectively define the cold-pack protocol, use a validated and clearly named pain instrument, employ random allocation with an a priori sample-size calculation, and transparently report ethics approval, consent, and funding.

CONCLUSION

The historical record suggests that cold pack application was associated with lower pain during IM injection than routine injection, consistent in direction with published evidence on local cold interventions. Because the participant-level dataset and some methodological documentation are no longer available, these findings should be regarded as historical reported results rather than independently verified evidence. Adequately powered, randomised trials using a standardised cold-pack protocol and a validated, clearly identified pain instrument are needed before the intervention can be recommended for routine practice.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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