

# The Use of Ice Pack for Pain Associated with Arterial Punctures

MOHAMMADREZA BASTAMI<sup>1</sup>, ARMAN AZADI<sup>2</sup>, MASOUD MAYEL<sup>3</sup>

## ABSTRACT

**Background:** Arterial punctures for monitoring respiratory problems are one of the most painful procedures in hospitalized patients. The knowledge regarding non-pharmacologic methods of pain management, including cold application is limited.

**Objective:** This aim of this study was to determine if the application of ice pack before the procedure would decrease the pain perception of patients during the arterial puncture.

**Materials and Methods:** This experimental study was undertaken among patients admitted to emergency ward in a public educational center affiliated to Ilam University of Medical Sciences, Ilam/Iran. Sixty-one eligible subjects were randomly assigned to two groups. The treatment group (n=31) received ice pack before arterial puncture, whereas the control group (n=30) received no intervention for pain management. Pain immediately

and 5 minute after the arterial puncture were scored on a visual analog scale (VAS) from 0 to 10.

**Results:** The mean of pain score immediately after the arterial puncture were 3.12 (1.68) and 4.6 (1.56) for treatment and control group, respectively ( $p < 0.001$ ). The mean pain score 5 minute after the punctures were 1.9 (1.51) for treatment group and 2.53 (1.85) for control group. This difference was not statistically significant. The mean of heart rate during the procedure were 75.45 (9.76) beats/min for the treatment subjects and 75.46 (9.36) beats/min for the control group ( $p > 0.05$ ). Patients with previous arterial puncture reported higher pain intensity.

**Conclusion:** Cold pack is a simple, non-invasive and inexpensive technique for pain management before the arterial puncture. However, there is a need for further research regarding this topic.

## INTRODUCTION

Arterial puncture for arterial blood gases (ABGs) analysis is one the most common laboratory procedure used in hospitalized patients with respiratory disease [1]. Although this invasive procedure is associated with moderately to severely pain and discomfort, are frequently performed by clinicians without any pain management [2]. Pain at the injection site and its associated discomfort and stress involved for some patients may cause them to avoid the medical care [3-5].

Researchers examined various methods for relief of procedural pain including arterial punctures. Local/ topical analgesia is one of those methods that frequently addressed in the literature [1,3, 6-8]. However, nurses and physicians remain hesitant to use such interventions due to their concerns regarding the pain from injection of anaesthetic drugs, probability of allergic reactions and the time that needed for administering and onset of action of these anaesthetics [1,3].

Furthermore, clinicians underutilize non-pharmacologic/non-invasive techniques such as cold application for relief of pain caused by procedural interventions [9-11]. Cold application has been used for decades as an effective non-pharmacologic method for pain management [11-13]. Ice application decreases nerve conduction velocity, increases the pain threshold and provides analgesia [11]. Relief musculoskeletal and postoperative pain, prevention of edema and control discomfort of local anaesthetic injection are most common application of ice which have documented by several authors [11-14]. To the best of our knowledge, there are inadequate studies that examined non-pharmacological interventions to alleviate arterial puncture pain. To date, there have been no studies assessing the effectiveness of cold application for pain relief in arterial puncture. Accordingly, the aim of this study was to determine if the application of ice pack would decrease pain perception of patients during and after the arterial puncture.

**Keywords:** Arterial puncture, Cold, Pain

## MATERIALS AND METHODS

### Design

This quasi-experimental study was undertaken among patients admitted to a public educational center affiliated to Ilam University of Medical Sciences, Ilam/Iran. Patients who had orders for ABG draws as a part of their routine clinical assessment were recruited from the emergency ward during the period of July 1, 2014, to July 30, 2014. A lack of previous studies to establish effect size limited the ability to establish a specific sample size for the study. Therefore, the sample size (n=55) was calculated based on a pilot study. Considering sample attrition, a convenience sample of 75 patients was invited to participate in the study. Overall, 66 subjects accepted to be enrolled (response rate=92%) and were randomly assigned to two groups. However, a total of five patients were ultimately excluded from the study, as their arterial access was not successful at the first attempt. Inclusion criteria were that they had to be adults, able to verbally report their pain, a score of 15 on Glasgow coma scale (GCS) and willing to participate in the study. Exclusion criteria included arterial puncture not from the radial artery, diagnosis of Raynaud's syndrome, failure to palpate radial pulse, infection or burn/scar over the puncture site, ulnar circulatory impairment (positive Allen test), using opiate or sedative over the past 8 hours, more than one attempt to access the artery, and AV fistula for dialysis. The study proposal was approved by the Ilam Medical University Ethical Committee.

### Instrument

The baseline data was collected for each subject included age, gender, primary diagnosis, previous arterial puncture, success of the procedure and any possible adverse effects. Also, participants in both groups were asked to report their pain intensity using 0 (no pain) to 10 (most severe pain) visual analog scale (VAS) immediately and 5 minute after arterial puncture. The researcher who administered

the arterial puncture and drawn the ABG was not present when this rating was recorded. This instrument has been used successfully in other studies. The reliability co-efficient using cronbach-Alpha coefficient value for VAS was 0.9 in Tran et al., study [7]. The pulse rate was recorded using pulse-oximeter before and immediately after the procedure.

**Procedure**

Patients who had orders for ABG were approached before the procedure to inquire if they would be willing to participate in the study. The investigator obtained informed consent before the procedure. The ice intervention was provided for the treatment group subjects. The control group participants received no pain management techniques before the arterial puncture. An ice pack was applied over the radial artery before the puncture and was secured with a loose bandage for 5 minute. A 10-minute application of ice recommended for tissue cooling and analgesia in previous studies [12,14]. But due to possibility of arterial spasm and failure to access the radial artery we decreased the duration of cold pack application. Arterial puncture were performed by one researcher experienced with the procedure to maintain the consistency. The puncture site was cleaned using aseptic technique. All ABG samples were drawn using 25-gauge needles and 2-mL blood syringes.

**STATISTICS ANALYSIS**

Data were analysed using SPSS version 13. Descriptive statistics such as the mean and standard deviation were used to describe demographic data, pain score and heart rate. Chi-square and Fisher Exact tests were used to analyse categorical variables, while independent and paired t-tests were used for the analysis of means.  $p < .05$  was considered significant.

**RESULT**

In 5 out of 66 patients from both groups the arterial access was not successful at the first attempt. So, these subjects were excluded from the study. They were excluded because the second attempt may affect their perception of pain intensity compared to patients in whom arterial access was successful in first attempt. Finally, the data obtained from 31 patients in treatment group and 30 patients in control group were analysed. The mean and standard deviations of ages for the treatment and control groups were 61.25 (12.6) and 62.2 (14.9) years, respectively. The baseline characteristics of patients are summarized in [Table/Fig-1]. There were no significant differences between treatment and control groups regarding age, gender, previous arterial puncture, previous hospitalization, failure to access radial artery at first attempt, discomfort associated with previous arterial punctures and previous pain management during arterial puncture.

As shown in [Table/Fig-2], the mean and standard deviations of pain score immediately after the arterial puncture for treatment and control groups were 3.12 (1.68) and 4.6 (1.56), respectively. This difference was statistically significant ( $p < 0.001$ ). Also, the mean and standard deviations of pain score 5 min after the puncture were 1.9 (1.51) and 2.53 (1.85) in two groups. The mean and standard deviations of heart rates before and during the procedure were 76.19 (10.27) beats/min and 75.45 (9.76) beats/min in the treatment group and 75.63 (9.89) beats/min and 75.46 (9.36) beats/min in control group, respectively. Also, the mean of pain score immediately after the procedure was higher among female than male patients in both groups. These differences were not statically significant. Overall, the mean and standard deviations of pain immediately after the procedure in patients with and without previous arterial puncture were 4.27 (1.94) and 3.35 (1.44), respectively ( $p < 0.05$ ). Also, all patients in the treatment group who had previous arterial punctures declared that the use of cold packs were effective in reducing the pain of arterial puncture. Although the mean of pain score was lower

Variables	Treatment group	Control group
Patients, NO.	31	30
Gender (M/F)	18/13	16/14
Age, mean (SD)	61.25 (12.61)	62.20(14.99)
previous arterial puncture %	18 (58.1%)	16 (55.2)

[Table/Fig-1]: Baseline characteristics of the patients in both groups.

Variables	Control group Mean (SD)	Treatment group Mean (SD)	p
Pain score immediately after the puncture	4.6 (1.56)	3.12 (1.68)	.001
Pain score 5 min after the puncture	2.53 (1.85)	1.9 (1.51)	.15
Heart rate before the puncture	75.63 (9.89)	76.19 (10.27)	.82
Heart rate during the puncture	75.46 (9.36)	75.45 (9.76)	.99

[Table/Fig-2]: Results of pain score and heart rate in both rous

in older patients than other age groups, these differences were not statically significant.

**DISCUSSION**

Although the study finding showed patients had moderate to high levels of pain during the arterial puncture, the knowledge regarding non-pharmacologic techniques for pain management during this procedure is limited. According to extensive literature review, this is one of the first studies which assessed the effectiveness of a non-invasive/pharmacologic technique on arterial puncture pain. The study findings showed ice pack was effective in reducing the pain associated the arterial puncture.

Interestingly, the degree of pain experienced by our participants in treatment group was similar to that experienced by the group of patients in Matheson et al., study who received buffered lidocaine before the arterial puncture [1]. Several studies support the theory that application of cold decreases nerve conduction, so providing analgesia [13,15,16]. Despite lack of related studies, In a study of 22 patients underwent local lid anaesthetic infiltration, local ice application prior to local anaesthetic injection significantly reduced the pain and discomfort of the injection [17]. Yoon et al., also reported that pretreatment use of ice cubes was effective in reducing pain and discomfort related to intra-dermal skin injection [13]. This is also supported by Watkins et al., who examined the effect of Ice Packs on postoperative Middle Incision pain and found narcotic use and pain was decreased significantly in cryotherapy patients [15]. However, other findings are controversial. For example Sauls examined the application of ice to manage pain associated with chest tube removal. He found no evidence for any differences in pain intensity/distress between the treatment and control groups were not significant [12].

Although the mean of pain score was lower in older patients than other age groups but this differences were not significant which is consistent with the finds other studies [1,7]. Contrary to our expectations, we did not found any significant differences in the heart rates during the procedure between the two groups. Also, the use of ice pack had no adverse effect on locating the radial artery and the numbers of first attempt successes were practically the same for both groups. Incongruent with the Tran et al., findings, patients with previous arterial puncture reported more pain than the patients who did not had such experience. However, all patients in the treatment group who had previous arterial punctures declared that the use of cold packs were effective in reducing the pain of arterial puncture.

Application of ice in the form of cold pack as a simple, available, inexpensive and non-invasive nursing intervention has been less explored. The current study provides a foundation for future research with the potential to change pain management techniques for the

arterial puncture. Although the study findings showed that cold pack was an effective way to manage pain during arterial puncture, the need for further investigation is evident.

The findings of this study have implications for both clinicians and nursing research. Pain is one of the most frequently used nursing diagnoses. Looking for and test applicable pain management techniques are serious responsibility of nurses. Precise assessment is crucial in determining the usefulness of the therapies that are used for pain control. In order to provide holistic care, it is the responsibility of the nurses, as patient advocates, to optimally manage all aspects of the pain experience.

## LIMITATIONS OF THE STUDY

Despite the strength of this study, it also has some limitations. First, a convenience sample of patients admitted to emergency ward in one public educational center not represent variation of all kind of patients in different settings. In relation to future research, replicating such studies in different settings such as Intensive care unit with diverse patient populations in terms of age, ethnicity, gender, GCS score and different situations (emergent versus non-emergent) are required. Also, using a longer period of ice application would provide useful information for better pain management. Small sample size and using one treatment group were other limitations of this study. Then, future studies should also compare the efficacy of pharmacological (local/topical anaesthetics) and non-pharmacological interventions such as ice application for arterial pain management.

## CONCLUSION

The research results showed that cold pack as a simple, non-invasive and inexpensive technique could be effective for pain management before arterial puncture. Hence, it can be said that cold pack can be used as an intervention to reduce arterial puncture pain. However, additional research is needed to evaluate and compare such interventions for pain associated with arterial puncture.

## ACKNOWLEDGEMENT

The authors would like to thank the authorities of Shahid Mostafa Khomini Hospitals, the staff, nurses and also all the patients who sincerely assisted the researchers all through the study.

## REFERENCES

- [1] Matheson L, Stephenson M, Huber B. Reducing Pain Associated with Arterial Punctures for Blood Gas Analysis. *Pain Management Nursing*, 2014.
- [2] Malley W. *Arterial blood gases*: Unnecessary cost, discomfort and delay of care or vital lifesaving information. *American Association for Respiratory Care Times*. 2010;34(1):25-27.
- [3] Hudson TL, Dukes SF, Reilly K. Use of local anaesthesia for arterial punctures. *American Journal of Critical Care*. 2006;15(6):595-99.
- [4] Pourghaznein T., Azimi AV, Jafarabadi MA. The effect of injection duration and injection site on pain and bruising of subcutaneous injection of heparin. *Journal of clinical nursing*. 2014;23(7-8):1105-13.
- [5] Sawyer J, et al. Heated lidocaine/tetracaine patch (SyneraTM, RapydanTM) compared with lidocaine/prilocaine cream (EMLAw) for topical anaesthesia before vascular access. *British Journal of Anaesthesia*. 2009;102(2):210-15.
- [6] Kuivalainen AM, Ebeling F, Rosenberg P. Warmed and buffered lidocaine for pain relief during bone marrow aspiration and biopsy. A randomized and controlled trial. *Scandinavian Journal of Pain*, 2014;5(1):43-47.
- [7] Tran NQ, Pretto JJ, CJ Worsnop. A randomized controlled trial of the effectiveness of topical amethocaine in reducing pain during arterial puncture. *Chest*. 2002;122(4):1357-60.
- [8] Giner J. Pain During Arterial Puncture. *Chest*. 1996;110(6):1443-45.
- [9] Hogan M, et al. A Systematic Review of Vapocoolants for Reducing Pain from Venipuncture and Venous Cannulation in Children and Adults. *The Journal of emergency medicine*. 2014;47(6):736-49.
- [10] Kuzu N, Ucar H. The effect of cold on the occurrence of bruising, haematoma and pain at the injection site in subcutaneous low molecular weight heparin. *International journal of nursing studies*. 2001;38(1):51-59.
- [11] Sauls J. Efficacy of Cold for Pain: Fact or Fallacy? *The Online Journal of Knowledge Synthesis for Nursing*. 1999;6:103-11.
- [12] Sauls J. The use of ice for pain associated with chest tube removal. *Pain Management Nursing*. 2002;3(2):44-52.
- [13] Yoon WY, et al. Analgesic pretreatment for antibiotic skin test: vapocoolant spray vs ice cube. *Am J Emerg Med*. 2008;26(1):59-61.
- [14] Bleakley C, McDonough S. The use of ice in the treatment of acute soft-tissue injury: a systematic review of randomized controlled trials. *Am J Sports Med*. 2004;32(1):251-61.
- [15] Watkins AA, et al. Ice Packs Reduce Postoperative Midline Incision Pain and Narcotic Use: A Randomized Controlled Trial. *Journal of the American College of Surgeons*, 2014;219(3):511-17.
- [16] Miller CR, Weber RL. The effects of ice massage on an individual's pain tolerance level to electrical stimulation. *The Journal of Orthopaedic and Sports Physical Therapy*, 1990;12(3):105-10.
- [17] Goel S, et al. "Cryoanalgesic preparation" before local anaesthetic injection for lid surgery. *Orbit*. 2006;25(2):107-10.

### PARTICULARS OF CONTRIBUTORS:

1. Faculty, Nursing Department, Ilam University of Medical Sciences, Ilam, Iran.
2. Faculty, Nursing Department, Ilam University of Medical Sciences, Ilam, Iran.
3. Faculty, Emergency Medicine Department, Kerman University of Medical Science, Kerman, Iran.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Arman Azadi,  
Faculty, Nursing Department, Ilam University of Medical Sciences, Ilam, Iran.  
E-mail: azadi.arman@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Dec 26, 2014**

Date of Peer Review: **May 29, 2015**

Date of Acceptance: **Jun 07, 2015**

Date of Publishing: **Aug 01, 2015**