Send Orders for Reprints to reprints@benthamscience.ae

BENTHAM OPEN

CrossMark

The Open Nursing Journal

Content list available at: www.benthamopen.com/TONURSJ/

DOI: 10.2174/1874434601812010264, 2018, *12*, 264-271

CLINICAL TRIAL STUDY

The Impact of Using Ice on Quality of Pain Associated with Chest Drain Removal in Postcardiac Surgery Patients: An Evidence-Based Care

Seyed Reza Mazloum[1], Fatemeh Gandomkar[2,*] and Mohammad Abbasi Tashnizi[3]

[1]*Department of Medical Surgical Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran*

[2]*Department of Public Health, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran*

[3]*Department of Cardiac Surgery, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran*

Received: September 29, 2018 Revised: November 26, 2018 Accepted: December 4, 2018

Abstract:

Background:

Patients undergoing cardiothoracic surgery require the placement of at least one chest drain. Chest Drain Removal (CDR) has been considered to be a painful event in patient's postoperative recuperation.

Objective:

This study aimed to evaluate the impact of using ice on quality of pain associated with CDR in adult patients undergoing cardiac surgery

Materials and Methods:

This randomized, observer-blind, crossover trial was done on 51 post-cardiac surgery patients who had two chest drains in the Mashhad Heart Center in Iran. The patients were assigned to ice, placebo, and control groups. Ice and placebo bags were used over the region around the chest drains for 20 minutes prior to CDR. The quality of pain was assessed *via* Short-Form McGill Pain Questionnaire (SF-MPQ) before and after CRT. The data were analyzed through the SPSS software using ANOVA, Kruskal-Wallis, and Chi-square tests.

Results:

The study findings revealed that the three groups were not significantly different regarding pain quality before CDR ($p=0.24$). However, the ice bag group (4.6±4.4) was significantly different from the placebo (8.1±6.9) and control groups (7.1±5.3) concerning the pain quality score immediately after CDR ($p<0.05$). The results of chi-square test also showed that the three groups were significantly different regarding "hot-burning" ($p=0.009$). However, no significant differences were observed with regard to other items of SF-MPQ.

Conclusion:

The results indicated that ice bag application could be used as an effective, safe, and inexpensive non-pharmacological intervention to reduce patients' pain and increase their comfort during CDR.

Keywords: Chest drain removal, Thoracostomy, Ice, Quality of pain, Postcardiac surgery, Cardiac surgery.

* Address correspondence to this author at the Department of Public Health, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran; Tel: 00989173397847; E-mail: f.gandomkar881@gmail.com

1. INTRODUCTION

The majority of patients experience much pain after cardiac surgery [1]. Postoperative pain is a multi-dimensional phenomenon in patients undergoing cardiac surgery. Generally, surgical incisions and pulling and cutting the tissues cause pain in all surgeries [2]. In patients undergoing cardiac surgery, at least one chest drain is placed for taking out fluid and lung re-expansion, which causes more stimulation of pain receptors [2 - 6]. The chest drain is usually removed 1-2 days after surgery [7 - 9] if the fluid volume is < 100-150 cc and breath sounds are normal for 24 hours [10]. When chest drains remain in the location of surgery, layers of endothelial tissues in the chest cavity attach to them. Therefore, removal of the drains leads to adhesion rupture and stimulation of the parietal pleura and pectoral muscles followed by the release of neurotransmitters and stimulation of pain receptors, eventually resulting in an acute pain [7, 8].

Chest Drain Removal (CDR) is a painful event described by patients to be among the most unpleasant feelings in critical care units [7 - 9, 11]. Unrelieved pain not only causes psychological suffering but also results in respiratory dysfunction and hypoxia [1, 12].

To date, no international standards exist for the management of CDR pain [4]. Since inserting and removing the chest drain are essential in thoracic surgery, pain management is of particular importance for patients' welfare [7]. In this context, nurses are responsible for preparing the patients for painful techniques as well as doing them sporadically [6, 12].

Researches have shown that despite using analgesic drugs (morphine and topical analgesics), CDR caused moderate to severe pain [5, 13, 14]. Therefore, using other pain management techniques is mandatory. Today, the emphasis has been put on non-pharmacological methods of pain relief [15, 16]. Ice is a non-pharmacological, easy, and inexpensive method of pain control [15 - 17], which increases the threshold of pain [7, 18 - 21]. This method has been widely used in orthopedic surgeries and sports injuries and has shown great effects on pain management [22, 23]. Nonetheless, few studies have used ice to relieve CDR pain and have reported different and somewhat opposing conclusions [6, 7].

Pain is a personal experience that is affected by various factors, such as culture, experiences, perceptions, educational opportunities, family, and psychological factors. These factors make an individual perception of pain [17, 24]. In the previous studies, ice was applied without paying attention to the painful presence of drains on the skin. Thus, the researcher decided to design a method of ice bag application with full coverage to reduce pain caused by movement of the drain that creates pain in the attached places. The intended ice bag covered 5 cm of the skin around the drain and did not exert force and pressure on the drain. It should be noted that the review of the literature revealed no reports on utilization of this method. Considering the researcher's observations, insufficiency of analgesics for management of CDR pain, and the necessity to take complementary measures for patients with chest drains, the present study aims to evaluate the effect of ice bag application on quality of CDR pain in adult patients undergoing cardiac surgery. We hypothesized that ice bag application would be effective on quality of pain during CDR.

2. MATERIALS AND METHODS

This randomized, observer-blind, crossover study was conducted in patients underwent cardiac surgery during March to July 2011 in the Department of cardiac Surgery of a tertiary teaching hospital of Mashhad-Iran. Based on a pilot study and the sample size formula, a 90-drain sample size was determined for the study (30 drains in each group). However, 34 drains were considered for each group in order to account for the potential dropouts. Therefore, 51 patients were selected *via* convenience sampling method and were randomly assigned to three groups (17 patients in each group). Inclusion criteria included: age above 18 years, orientation to time, place, and person, having the ability to read and write, speaking Persian, existence at least one mediastinal and one thoracic drain with an 8-cm distance from each other, and passage of at least 1 day from drains insertion. It should be mentioned that two drains were selected in patients with three drains. The exclusion criterion was the unwillingness to continue participation in the research. If the interval between ice bag removal and CDR was more than two minutes and the interval between the two drains removal was more than 30 minutes, the cases were excluded, as well. Modified Short-Form McGill Pain Questionnaire (SF-MPQ) was used to determine the pain quality. This questionnaire included 11 words divided into sensory (n=8) and affective (n=3) dimensions, which were rated from 0 (no pain) to 3 (severe pain). Furthermore, five words were allocated to describing the Present Pain Intensity (PPI) as follows: no pain (0), mild (1), discomforting (2), distressing (3), horrible (4), and excruciating (5). Three words; *i.e.*, brief, intermittent, and continuous, were also used to determine the pain pattern. Other data gathering instruments consisted of a questionnaire containing demographic information and clinical characteristics, the visual analogue scale to evaluate fatigue severity (VAS-F), and Depression, Anxiety, and

Stress Scale (DASS-21). The validity and reliability of the VAS-F and DASS-21 have been demonstrated by others [25 - 27].

The validity of the modified SF-MPQ and demographic information and clinical characteristics questionnaire was confirmed by 10 faculty members of Mashhad University of Medical Sciences. In order to determine the reliability of the modified SF-MPQ, a pilot study was conducted on 12 participants and the reliability of the questionnaire was assessed using a test-retest method. The reliability of the questionnaire was confirmed by r = 0.99 and Cronbach's alpha = 0.85. This study was approved by the Ethics Committee of the University. Indeed, all patients were informed about the study protocol and procedures and were required to sign written informed consents (IRCT201105146484N1). The data were gathered *via* interviews as well as reviewing the patients' medical records. Then, each patient's chest drain was placed in one study group. Therefore, due to having two chest drains, each patient was randomly assigned to one out of the three cods as follows: ice and placebo (code 1), ice and control (code 2), and placebo and control (code 3). The researcher's assistant who was not aware of the study groups asked the patients to express their pain quality before and immediately after drain removal based on the modified SF- MPQ.

It should be noted that the chest drains were inserted by a group of surgeons using the same technique and were removed by a team of experienced nurses *via* the same method during two minutes after removal of the bags. According to the ward rules, first mediastinal and then thoracic drains were removed in the morning shift. In this study, ice and placebo bags made of cotton were designed. The bags were shaped in form of two half-circles with 5 cm radius and 2 cm height. The half-circles were attached together on one side but were open on the other side. In addition, a small hole existed in the middle of the bags whose size was close to that of the diameter of the chest drain. These bags were designed such a way that they covered the whole region surrounding the drains. Ice bags were full of ice, while placebo bags were full of the same size plastic pieces at room temperature. The bags were placed around the drains for 20 minutes and the two chest drains were taken out with a 30-minute interval. After all, the study data were analyzed through the SPSS 14.0 software *via* Chi-square, Fisher's exact test, and McNemar's test. The study groups were compared using one-way ANOVA and LSD post-hoc test for normally distributed data and Kruskal-Wallis and Mann-Whitney tests for non-normally distributed ones. $P<0.05$ was considered to be statistically significant.

3. RESULTS

The study subjects consisted of 36 males (70.6%) and 15 females (29.4%) with the mean age of 55.4±11.1 years (range: 29-75 years). Moreover, 50% of the drains were pericardial and 50% were pleural. The three groups were not significantly different regarding the demographic and clinical variables ($p>0.05$). The main demographic and clinical variables included age, education level, pain tolerance level, worst pain experienced, pain description, received sedatives, fatigue, sleep hours, hemoglobin level, ambient temperature, body temperature, DASS-21 score, Body Mass Index (BMI), having had a chest drain in the past, duration of having the chest drain, distance between the pleural and pericardial drains and the incision site, lengths of pleural and pericardial drains, interval between removing the ice bag and removing the pleural or pericardial drain, and quality of pain (Table **1**).

Table 1. The frequency distribution of some demographic variables in the three groups

Variable		Group								Chi-square test
		Ice		Placebo		Control		Total		
		n	%	n	%	n	%	n	%	
Gender	Female	9	26.5	12	35.3	9	26.5	30	29.4	**p=0.654**
	Male	25	73.5	22	64.7	25	73.5	72	72.6	
Education	Illiterate	27	79.4	29	85.3	28	82.4	84	82.4	**Fisher exact p=0.823**
	Under Diploma	1	2.9	3	8.8	2	5.9	6	5.9	
	Diploma	4	11.8	1	2.9	3	8.8	8	7.8	
	University	2	5.9	1	2.9	1	2.9	4	3.9	
Pain tolerance	Very high	7	20	3	8.8	6	17.6	16	15.7	**Fisher exact p=0.355**
	high	20	58.8	17	50	15	44.1	52	51	
	Moderate	3	8.8	9	26.5	10	29.4	22	21.6	
	low	3	8.8	2	5.9	1	2.9	6	5.9	
	Very low	1	2.9	3	8.8	2	5.9	6	5.9	
Worst pain	Angina	16	47.1	21	61.8	23	67.6	60	58.8	**p=0.206**
	Others	18	52.9	13	38.2	11	32.4	42	41.2	

(Table 1) contd.....

Variable		Group								Chi-square test
		Ice		Placebo		Control		Total		
		n	%	n	%	n	%	n	%	
Smoking	No	28	82.4	30	88.2	30	88.2	88	86.3	**Fisher exact p=0.819**
	Yes	6	17.6	4	11.8	4	11.8	14	13.7	
Drug abuse	No	28	82.4	27	79.4	29	85.3	84	82.4	**p=0.946**
	Yes	6	17.6	7	20.6	5	14.7	18	17.6	
Type of drain	Thoracic	16	47.1	19	55.9	16	47.1	51	50	**p=0.703**
	Mediastinal	18	52.9	15	44.1	18	52.9	51	50	

Based on the results of one-way ANOVA, the three groups were not significantly different regarding the mean number of words chosen on the modified SF-MPQ before CDR. The results of Kruskal-Wallis test also indicated that the three groups were not significantly different concerning the mean number of words chosen on the modified SF-MPQ during CDR (Table **2**).

Table 2. The mean number of words chosen on the modified SF-MPQ before and after CDR in in the three groups.

The mean number of selected words on the questionnaire	Group						Test
	Ice		Placebo		Control		
	Mean ± SD	n	Mean ± SD	n	Mean ± SD	n	
Before CDR	2.9±2.3	34	3.7±2.6	34	3.6±2.4	34	**ANOVA** p=0.349
During CDR	2.8±2.1	34	4.2±2.6	34	4.0±2.5	34	**Kruskal-Wallis test** p=0.093
Wilcoxon test	p=0.981		p=0.276		p=0.475		

According to the results of Kruskal-Wallis test, the three groups were not significantly different regarding sensory, effective, and total pain quality scores before CDR. The results also revealed that the three groups were not statistically different with respect to the mean scores of sensory and affective dimensions during CDR. However, the results of repeated measures ANOVA showed that the three groups' pain quality scores were significantly different during CDR (p=0.021, f=4.04, DF=2.99). According to the LSD post-hoc test results, no significant difference was found between the placebo and the control group (p=0.530), but significant differences were observed between the ice and placebo groups as well as between the ice and control groups (p=0.008 and p=0.040, respectively) (Table **3**).

Table 3. The sensory, affective, and total mean scores of the modified SF-MPQ before and during CDR in the three groups.

Variable		Group						Test	
		Ice		Placebo		Control			
		Mean ± SD	n	Mean ± SD	n	Mean ± SD	n		
Sensory dimension	Before CDR	2.8±2.7	34	4.0±4.0	34	3.8±3.2	34	p=0.288	**Kruskal-Wallis test**
	During CDR	3.5±3.2	34	5.5±4.6	34	5.0±3.2	34	p=0.088	
Affective dimension	Before CDR	1.7±2.1	34	2.5±2.8	34	2.1±2.5	34	p=0.437	
	During CDR	1.1±1.6	34	2.6±2.7	34	2.1±2.6	34	p=0.059	
Total score	Before CDR	4.4±4.2	34	6.4±6.2	34	5.9±4.7	34	p=0.246	
	During CDR	4.6±4.4	34	8.1±6.9	34	7.1±5.3	34	p=0.021	**ANOVA**
The results of Wilcoxon test	Sensory dimension	p=0.249		p=0.081		p=0.063			
	Affective dimension	p=0.121		p=0.902		p=0.955			
	Total score	p=0.793		p=0.198		p=0.312			

According to Fisher's exact test and Chi-square test results, the three groups were not significantly different concerning the selected words, pain pattern, and PPI based on the modified SF-MPQ before CDR. Also, the three groups were not significantly different with respect to the pain pattern and PPI based on the modified SF-MPQ during CDR. However, the results of the Chi-square test showed that the three groups were significantly different regarding the word "hot-burning" during CDR (p=0.009). The three groups were not significantly different regarding the other words on the modified SF-MPQ during CDR. The most commonly used pain quality descriptors reported by the participants were shooting (47.1%), hot-burning (41.2%), aching (29.4%), and fearful (29.4%) in the ice group, shooting (70.6%), fearful (61.8%), hot-burning (55.9%), and sharp (44.1%) in the placebo group, and shooting (50.0%), hot-burning, heavy (44.1%), aching (44.1%), and fearful (41.2%) in the control group. The results of McNemar's test showed a

significant difference in the quality of pain in the three study groups (using words shooting, sharp, hot-burning, and painful when fatigued and touched) before and during CDR.

4. DISCUSSION

This study aimed to determine whether the application of ice bags would be followed by a significant decrease in pain quality and use of fewer pain quality descriptors. The study findings showed that the three groups were not significantly different with respect to sensory, affective, and total pain scores of the modified SF-MPQ before CDR. The ice group obtained lower mean scores of the sensory and affective dimensions during CDR in comparison to the other two groups, but the difference was not statistically significant (p=0.088 and p=0.059, respectively). However, the three groups were significantly different concerning the total mean score of the modified SF-MPQ during CDR. Accordingly, using ice bags reduced the total mean score of pain quality. These findings are supported by the Gate Control Theory proposed by Melzack and Wall. Based on this theory, pain has physical, affective, and cognitive components. Application of coldness is believed to influence the affective component of pain. This may lead to a reduction or reversal of the pain impulse by activating descending inhibitory neurons that block ascending nociceptive nerves originating from the substantia gelatinosa. Thus, blocking of ascending nerve impulses "closes the gate" to pain, causing the brain not to interpret the impulses as painful [7]. The proper use of skin irritation, such as coldness, also reduces the pain [16].

The results of the study by Buyukyılmaz and Asti (2009) demonstrated the effects of music and relaxation techniques on the reduction of pain quality score [28]. Cognitive-behavioral therapy could change individuals' perception of pain and their behavior towards it. It could also lead to better tolerance of pain, reduction of anxiety, and an increase in the effectiveness of analgesics [4, 29, 30].

The current study findings were in contrast to those obtained by Demir *et al*. (2010) [7]. They used the Long-Form McGill Pain Questionnaire to investigate the effect of coldness on pain quality 15 minutes after CDR. They found that although coldness was effective in the intensity of CDR pain, it had no effects on the total score of pain quality. The difference between the results can be related to the use of the Long-Form McGill Pain Questionnaire and differences in the time of evaluating the pain.

According to the current study findings, the used pain quality descriptors were similar in the three groups before CDR. In line with the previous studies [31, 32], the most widely used words in the sensory dimension were tender (39.2%), heavy (38.2%), aching (38.2%), and shooting (30.4%), which might be due to the visceral nature and deep somatic pain. The most widely used word in the affective dimension was tiring-exhausting (48%). This is consistent with the results of Fox's study [31], which revealed the rate of tiring-exhausting to be 46.6%. Such fatigue could be attributed to the drains remained in the patients' chests for a long time (at least 38 hours). Before CDR, the majority of the patients in the current study described the PPI as mild (41.2%) and the pain pattern due to the chest drain as intermittent (43.1%). Breathing, coughing, and moving might displace the drain, which could justify the periodical pain experienced by the patients [33].

The most widely used sensory words to describe pain during CDR were shooting (55.9%), hot- burning (47.1%), aching (36.3%), heavy (34.3%), and sharp (34.3%). The most widely used word in the affective dimension was fearful (44.1%). Compared to before CDR, using the words aching (2%) and heavy (4%) reduced, but shooting (25.5%), sharp (14.7%), and hot-burning (17.7%) increased significantly during CDR. The word aching is associated with a vague sensation, whereas the word sharp is associated with an incisive type of sensation. This difference in the qualitative nature of background and procedural pain may have a physiological explanation. Cutaneous afferent noxious impulses are transmitted from the periphery to the central nervous system through small-diameter myelinated A delta-fibers and smaller diameter unmyelinated C fibers. Pain thought to be transmitted through A-delta fibers is sharp and fast. In contrast, pain thought to be transmitted through C fibers is diffuse, dull, and delayed. C fibers activity may be dominant during immobility, causing background pain as a response to biochemical mediators released from the inflamed tissue. On the other hand, mechanical stimulation may lead to a more dominant activation of A-delta fibers with a more rapid transmission of the stimulus. This difference could lead to a predominant perception of more incisive sensations, such as sharp, stabbing, and shooting, as a result of a procedure [34].

Studies surveying pain during CDR have reported various rates of using words on long- and short-form McGill Pain Questionnaire and other instruments [4, 11, 32]. Patients' different responses to painful events might result from variations in the tools used to describe pain as well as the concept of pain as a multidimensional phenomenon. The

multidimensional model of procedural pain helps recognize that choosing words to describe the quality of pain is a cognitive process. In other words, patients use their judgments to report the quality of pain experienced during CDR. These findings reinforce the long-held belief that pain is not a sensation that varies only in intensity; rather, it has qualitative describable characteristics. This indicates the extent of the language of pain [33, 34].

The present study results revealed a significant correlation between groups and using the word "hot-burning" to describe the pain during CDR. Accordingly, the patients in the ice group used this word less compared to those in the two other groups. Consistently, the study by Kol *et al*. (2010) showed the effectiveness of ice bag application in the quality of pain resulting from chest drain irritation [35].

In the current study, all words of SF-MPQ were not used by all patients before and during CDR, which is in agreement with the results obtained by Puntillo and Ley (2004) [4]. This indicates that the researcher's suggestions did not influence the selection of the words.

This study had some strengths and limitations. One of the strong points of the study was designed a bag, which fully covered the area surrounding drain and induced little pressure on the drain insertion site. However, the limitation of the study was its single-blind, randomized, crossover design. Since the patients knew whether they belonged to the ice, placebo, or control groups, a double-blind design could not be employed. Moreover, the distance between the two chest drains was at least 8 centimeters, the bag had a radius of 5 cm, and the time interval between removing the two drains was 30 minutes. However, the probable partial effect of the ice bag on the other drain was not controllable. Future researches could assess the effects of length and type of chest drains on pain associated with CDR.

CONCLUSION

The present study findings revealed that ice bag was an efficient, inexpensive, and harmless intervention to reduce pain resulted from CDR. In general, non-pharmacological pain relief techniques like using ice bags are acceptable for patients and can be done by nurses. Additionally, such methods do not have the complications and adverse effects associated with pharmacological interventions. The findings of this study can be used in clinical, nursing education, and management services and other researches.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Ethical Committee of Mashhad University of Medical Sciences.

HUMAN AND ANIMAL RIGHTS

All human research procedures were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national) and with the Helsinki Declaration of 1975 as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent have been obtained from all the participants.

CONFLICT OF INTEREST

This study was extracted from a Master's thesis (grant No. 89359) and financially supported by the University's Vice-chancellor of Research affairs. The author declares no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

The authors would like to thank the personnel of the cardiac ICU and post ICU of the tertiary teaching hospital, Mashhad University and the patients for the participation in the survey.

REFERENCES

[1] Milgrom LB, Brooks JA, Qi R, Bunnell K, Wuestfeld S, Beckman D. Pain levels experienced with activities after cardiac surgery. Am J Crit Care 2004; 13(2): 116-25.
[PMID: 15043239]

[2] Mueller XM, Tinguely F, Tevaearai HT, Ravussin P, Stumpe F, von Segesser LK. Impact of duration of chest tube drainage on pain after

cardiac surgery. Eur J Cardiothorac Surg 2000; 18(5): 570-4.
[http://dx.doi.org/10.1016/S1010-7940(00)00515-7] [PMID: 11053819]

[3] Abramov D, Yeshayahu M, Tsodikov V, *et al.* Timing of chest tube removal after coronary artery bypass surgery. J Card Surg 2005; 20(2): 142-6.
[http://dx.doi.org/10.1111/j.0886-0440.2005.200347.x] [PMID: 15725138]

[4] Puntillo K, Ley SJ. Appropriately timed analgesics control pain due to chest tube removal. Am J Crit Care 2004; 13(4): 292-301.
[PMID: 15293581]

[5] Puntillo KA. Effects of interpleural bupivacaine on pleural chest tube removal pain: A randomized controlled trial. Am J Crit Care 1996; 5(2): 102-8.
[PMID: 8653161]

[6] Sauls J. The use of ice for pain associated with chest tube removal. Pain Manag Nurs 2002; 3(2): 44-52.
[http://dx.doi.org/10.1053/jpmn.2002.123017] [PMID: 12050835]

[7] Demir Y, Khorshid L. The effect of cold application in combination with standard analgesic administration on pain and anxiety during chest tube removal: A single-blinded, randomized, double-controlled study. Pain Manag Nurs 2010; 11(3): 186-96.
[http://dx.doi.org/10.1016/j.pmn.2009.09.002] [PMID: 20728068]

[8] Friesner SA, Curry DM, Moddeman GR. Comparison of two pain-management strategies during chest tube removal: Relaxation exercise with opioids and opioids alone. Heart Lung 2006; 35(4): 269-76.
[http://dx.doi.org/10.1016/j.hrtlng.2005.10.005] [PMID: 16863899]

[9] Singh M, Gopinath R. Topical analgesia for chest tube removal in cardiac patients. J Cardiothorac Vasc Anesth 2005; 19(6): 719-22.
[http://dx.doi.org/10.1053/j.jvca.2005.07.024] [PMID: 16326294]

[10] Hunter J. Chest drain removal. Nurs Stand 2008; 22(45): 35-8.
[http://dx.doi.org/10.7748/ns2008.07.22.45.35.c6590] [PMID: 18686692]

[11] Puntillo KA. Dimensions of procedural pain and its analgesic management in critically ill surgical patients. Am J Crit Care 1994; 3(2): 116-22.
[PMID: 7513228]

[12] Houston S, Jesurum J. The quick relaxation technique: Effect on pain associated with chest tube removal. Appl Nurs Res 1999; 12(4): 196-205.
[http://dx.doi.org/10.1016/S0897-1897(99)80261-4] [PMID: 10589108]

[13] Carson M, Barton DM, Morrison CC, Tribble CG. Managing pain during mediastinal chest tube removal. Heart & lung: The journal of critical care 1994; 23(6): 500-5.

[14] Rosen DA, Morris JL, Rosen KR, *et al.* Analgesia for pediatric thoracostomy tube removal. Anesth Analg 2000; 90(5): 1025-8.
[http://dx.doi.org/10.1097/00000539-200005000-00005] [PMID: 10781447]

[15] Potter PA, Perry AG. Fundamentals of nursing. 5th ed. St. Louis: Mosby 2001.

[16] Taylor C, Lemone P, Lillis C, Lynn P. Fundamentals of nursing: the art and science of nursing care. 6th ed. Philadelphia: Lippincott Williams& Wilkins 2008.

[17] Bruce EA, Howard RF, Franck LS. Chest drain removal pain and its management: A literature review. J Clin Nurs 2006; 15(2): 145-54.
[http://dx.doi.org/10.1111/j.1365-2702.2006.01273.x] [PMID: 16422731]

[18] Akan M, Misirlioğlu A, Yildirim S, Çakir B, Taylan G, Aköz T. Ice application to minimize pain in the split-thickness skin graft donor site. Aesthetic Plast Surg 2003; 27(4): 305-7.
[http://dx.doi.org/10.1007/s00266-003-3014-1] [PMID: 15058555]

[19] Ernst E, Fialka V. Ice freezes pain? A review of the clinical effectiveness of analgesic cold therapy. J Pain Symptom Manage 1994; 9(1): 56-9.
[http://dx.doi.org/10.1016/0885-3924(94)90150-3] [PMID: 8169463]

[20] 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. Int J Nurs Stud 2001; 38(1): 51-9.
[http://dx.doi.org/10.1016/S0020-7489(00)00061-4] [PMID: 11137723]

[21] Ross S, Soltes D. Heparin and haematoma: Does ice make a difference? J Adv Nurs 1995; 21(3): 434-9.
[http://dx.doi.org/10.1111/j.1365-2648.1995.tb02724.x] [PMID: 7745195]

[22] Kullenberg B, Ylipää S, Söderlund K, Resch S. Postoperative cryotherapy after total knee arthroplasty: A prospective study of 86 patients. J Arthroplasty 2006; 21(8): 1175-9.
[http://dx.doi.org/10.1016/j.arth.2006.02.159] [PMID: 17162178]

[23] Singh H, Osbahr DC, Holovacs TF, Cawley PW, Speer KP. The efficacy of continuous cryotherapy on the postoperative shoulder: A prospective, randomized investigation. J Shoulder Elbow Surg 2001; 10(6): 522-5.
[http://dx.doi.org/10.1067/mse.2001.118415] [PMID: 11743529]

[24] Ebrahiminezhad G, Ebrahiminezhad A, Kohan S, Bahrampour A. The evaluation of pain in neurosurgical patients before and after operation in Kerman Shahid Bahonar Hospital according to the McGill pain questionnaire. Persian 2004.

[25] Gift AG. Visual analogue scales: Measurement of subjective phenomena. Nurs Res 1989; 38(5): 286-8.
[http://dx.doi.org/10.1097/00006199-198909000-00006] [PMID: 2678015]

[26] Lee KA, Hicks G, Nino-Murcia G. Validity and reliability of a scale to assess fatigue. Psychiatry Res 1991; 36(3): 291-8.
[http://dx.doi.org/10.1016/0165-1781(91)90027-M] [PMID: 2062970]

[27] Sahebi A, Asghari MJ, Salari RS. Validation of depression anxiety and stress scale (DASS-21) for an Iranian population. Iranian Psychologists 2005; 4(1): 299-313. [Persian].

[28] Büyükyılmaz F, Aştı T. The effect of relaxation techniques and back massage on pain and anxiety in Turkish total hip or knee arthroplasty patients. Pain Manag Nurs 2013; 14(3): 143-54.
[http://dx.doi.org/10.1016/j.pmn.2010.11.001] [PMID: 23972865]

[29] Movahedi AF, Rostami S, Salsali M, Keikhaee B, Moradi A. Effect of local refrigeration prior to venipuncture on pain related responses in school age children. Aust J Adv Nurs 2006; 24(2): 51-5.
[PMID: 17285837]

[30] Van Wormer GA. Quantitative evaluation of hypnotically suggested analgesia: A nonpharmacological nursing pain management intervention. 2002.

[31] Fox V, Gould D, Davies N, Owen S. Patients' experiences of having an underwater seal chest drain: A replication study. J Clin Nurs 1999; 8(6): 684-92.
[http://dx.doi.org/10.1046/j.1365-2702.1999.00307.x] [PMID: 10827615]

[32] Owen S, Gould D. Underwater seal chest drains: The patient's experience. J Clin Nurs 1997; 6(3): 215-25.
[http://dx.doi.org/10.1111/j.1365-2702.1997.tb00307.x] [PMID: 9188339]

[33] Aslan FE, Badir A, Arli SK, Cakmakci H. Patients' experience of pain after cardiac surgery. Contemp Nurse 2009; 34(1): 48-54.
[http://dx.doi.org/10.5172/conu.2009.34.1.048] [PMID: 20230171]

[34] Puntillo KA, White C, Morris AB, *et al.* Patients' perceptions and responses to procedural pain: Results from Thunder Project II. Am J Crit Care 2001; 10(4): 238-51.
[PMID: 11432212]

[35] Kol E, Erdogan A, Karslı B, Erbil N. Evaluation of the outcomes of ice application for the control of pain associated with chest tube irritation. Pain Manag Nurs 2013; 14(1): 29-35.
[http://dx.doi.org/10.1016/j.pmn.2010.05.001] [PMID: 23452524]