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Effect of Applying Cold Gel Pack to the Sternum Region on the Postoperative Pain after Open-Heart Surgery

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Öz

Amaç: Bu çalışma açık kalp ameliyatı sonrasında sternum bölgesine uygulanan soğuk uygulamanın, derin solunum ve öksürük uygulaması sırasında oluşan ağrı üzerine etkisini incelemek amacıyla yapıldı.

Gereç ve Yöntem: Çalışmanın örneklemini 46 kişi oluşturdu. Çalışma verileri toplanırken, araştırmacı tarafından ilgili literatür doğrultusunda hazırlanan hastalara ilişkin sosyodemografik özelliklerin yer aldığı “Hasta Tanıtım Formu”, hastanın ağrı şiddetini değerlendirmek için “Visüel Analog Skala-VAS”, derin solunum ve öksürük egzersizleri öncesinde ve sonrasında hastanın ağrı seviyelerini kaydetmek için “Ağrı İzlem Formu” kullanıldı. Derin solunum ve öksürük egzersizleri sonrasında ağrı seviyeleri ölçüldü. Girişim, kontrol ve plasebo grupları arasında karşılaştırıldı.

Bulgular: Gruplar arası analiz; girişim, kontrol ve plasebo grupları arasında işlem öncesi ve işlem sonrası elde edilen ortalama VAS skorları açısından istatistiksel olarak anlamlı bir fark olmadığını gösterdi. Ancak girişim grubunda; işlem öncesi ve işlem sonrası elde edilen ortalama VAS skorları açısından istatistiksel olarak anlamlı bir fark saptandı.

Sonuç: Bu çalışmanın sonucu, soğuk uygulamanın açık kalp ameliyatı olan hastalarda derin solunum ve öksürük ilişkili sternal insizyon ağrı yönetiminde etkili bir yöntem olduğunu gösterdi.

Anahtar Kelimeler: Postoperatif Ağrı, Nefes Egzersizleri, Kardiyak Cerrahi, Cerrahi Sonrası Hemşirelik.

Abstract

Aim: The present study was performed at investigating the effects of cold gel pack applied to the sternum on the pain associated with deep breathing and coughing after open-heart surgery.

Materials and Methods: The study sample included 46 participants. While the study data were collected, the “Patient Information Form” prepared by the researcher based on the pertinent literature was used to question the sociodemographic characteristics of the patients, the “Visual Analogue Scale-VAS” was used to assess the severity of the patient's pain, and the “Pain Monitoring Form” was used to record the patient's pain associated with deep breathing and coughing exercises before and after cold gel pack application. Pain scores after deep breathing and coughing were measured and compared warm (room temperature) (placebo) gel pack, with (intervention) and without (control) the gel pack.

Results: The intergroup analysis showed that the difference between the experimental, control and placebo groups in terms of their mean VAS scores obtained before the procedure and after the procedure was not statistically significant. But in the experimental group; in terms of their mean VAS scores obtained before the procedure and after the procedure was determined statistically significant.

Conclusions: The results of this study showed that cold therapy is an effective method for management of sternal incision pain associated with coughing and deep breathing in open heart surgery patients.

Key words: Postoperative Pain, Breathing Exercises, Cardiac Surgery, Post-Surgical Nursing.

1. Introduction

Every year millions of patients undergo surgical intervention and %80 of these patients experience postoperative pain [1]. Due to the opening of the sternum in open heart surgery, the soft tissues and nerves in the chest wall are severely damaged and may cause chest wall discomfort after the surgery [2]. In addition, patients who are stayed in the critical care unit for a period of postoperative 1 to 3 days participates in numerous procedures such as endotracheal suctioning, turning, coughing, breathing, and chest tube removal, activities which are perceived to be the most painful routine procedures and treatment interventions during this time [3-5].

Acute postoperative pain was severe in the majority of patients after cardiac surgery [6,7]. Untreated postoperative pain can cause chronic pain problems. After open-heart surgery, chronic post sternotomy pain incidence is reported varies from 21 to 60% at 1-3 years according to various studies [2,7-12]. Chronic post-surgical pain affecting the quality of life and has serious economic results [13,14]. It is vital that the patient maintain postoperative pain management at optimal level in order to increase patient satisfaction, reduce the postoperative complications and duration of hospitalization in open heart surgery [2,3,15]. Insufficient pain management bring about patients to complications such as hypoxemia, atelectasis, pneumonia and deep vein thrombosis because of mucous plugging and their insufficiency to cough, mobilize effectively [3,6,15-18]. Furthermore, unrelieved postoperative pain may have a negative psychological effect and impede postoperative recovery [3]. Incisional pain can be managed with both pharmacologic and nonpharmacologic methods [19]. Nonpharmacological methods are advantageous because no chemical agents are given to the body and they can be applied by the nurses [20]. Cold therapy is an effective, simple, cheap and safe one of the nonpharmacologic methods to reduce pain with few complications or no side effects [15]. Cold may result in enhanced activation of supraspinal mechanisms, raising the body's overall pain threshold [21,22].

This study was aimed at investigating the effects of cold gel pack applied to the sternum on the pain caused by deep breathing and coughing after open-heart surgery.

2. Materials and Methods

This study was a randomized controlled trial which was conducted in the cardiac surgery intensive care unit (ICU) at a university hospital in Turkey between July 2015 to September 2016. In order to reduce variability among patients, only patients with coronary artery bypass grafts (CABG) surgery were taken and cold gel package was performed on the first postoperative day.

2.1. Participants

The following inclusion criteria were applied: aged over 18 years, patients scheduled to coronary artery bypass graft (CABG) surgery with median sternotomy, able to

understand and speak Turkish, hadnot received mechanical ventilation support, oriented to place and time, able to report pain, patients undergoing their first open heart surgery and willing to give written informed consent. Patients who had mechanically ventilated patients, contraindication to cold therapy use (Raynaud's disease), diabetic patients, could not understand the use of a pain scale, postoperative complications such as infection, bleeding, uncontrolled atrial fibrillation were excluded from the study.

2.2. Ethical consideration

Before commencing the research, written permission was obtained from Ethics Committee (consent no 06/2014). Verbal and written informed consent was obtained from each of the patients for the present study.

2.3. Data Collection

While the study data were collected, the "patient information form" prepared by the researcher based on the pertinent literature was used to question the sociodemographic characteristics of the patients, the "Visual Analogue Scale-VAS" was used to assess the severity of the patient's pain, and the "Pain Monitoring Form" was used to record the patient's pain associated with deep breathing and coughing exercises before and after cold gel pack application.

2.4. Procedures

A simple randomization method was used to select patients for groups for the study to prevent conscious or unconscious manipulation in selection. The same postoperative analgesic method was used for all patients, and they all received the same type of analgesics. But we also applied cold gel pack to the experimental group. Patients who conformed to the rules for admission to the study were assigned to one of three groups:

Intervention Group: Cold application group.

Control Group: Group without application.

Placebo Group: Warm application (room temperature) group.

2.5. Cold Gel Pack Application

The use of cold packs in the form of silica gel packs is the most commonly used method of cold application in clinics. The special silica gel soaked in water in a soft rubber envelope can be stored in various sizes and shapes special tanks [23-25]. We were used weighed 110 grams and measured 13x13 cm, flexible cold gel pack. They were kept in the freezer on the patient service unit. The gel packs need approximately two hour of freezing before the temperature is low enough to be suitable for use and then were removed from the freezer and placed in a cotton bag. Placebo pack were kept at room temperature at 18-22 °C. The steps in the applications to patients included in the study were as follows:

Intervention Group/ Cold Application Group:

After deep breathing and coughing exercise, VAS was used before cold application to measure and record the patient's starting pain intensity (VAS-1). After the measurement, the cold gel pack placed in a cotton bag. The timer was activated for 15 min and gel pack was used over the sternal wound dressing. At the end of 15 minutes, the researcher was made deep breathing and coughing exercises. After the exercises, VAS was used to measure and record the patient's pain intensity (VAS-2).

Control Group/ Group Without Application:

After deep breathing and coughing exercise, VAS was used to measure and record the patient's starting pain intensity (VAS-1). About 15 minutes after the measurement, the researcher was made deep breathing and coughing exercises. After the exercises, VAS was used to measure and record the patient's pain intensity (VAS-2).

Placebo Group/ Warm Application Group:

After deep breathing and coughing exercise, VAS was used before warm gel pack application to measure and record the patient's starting pain intensity (VAS-1). After the measurement, the warm gel packs, which was at room temperature, placed in a cotton bag. The timer was activated for 15 min and gel pack was used over the sternal wound dressing. At the end of 15 minutes, the researcher was made deep breathing and coughing exercises. After the exercises, VAS was used to measure and record the patient's pain intensity (VAS-2).

2.6. Statistical Analysis

The data obtained from the study were analysed on a computer using the Wilcoxon test, Chi-square test and Kruskal-Wallis variance analysis in the Statistical Package for Social Science.

3. Results

Table 1. Demographic characteristics of patients

There were 46 patients recruited for this study from after cardiac surgery ICU, and no side effects or complications due to the cold therapy via gel pack were reported. The results showed that there were no statistically significant differences in the demographic characteristics of the patients in the three groups ($p > 0.05$, Table 1). The mean age of the patients was 60.73 ± 1.08 (min. 39, max. 81). Of them, 58.7% were male, 91.3% were married and 60.9% were primary school graduates, 82.6% had two chest tubes (Table 1).

Table 2. Comparison of mean pain scores before and after cold gel pack application in three groups

The mean VAS scores before and after the cold gel pack applications were 6.93 ± 2.40 and 4.26 ± 2.63 in the experimental group, 5.68 ± 2.52 and 4.86 ± 2.52 in the control group and 5.06 ± 2.12 and 4.86 ± 2.58 in the placebo group, respectively. The intergroup analysis showed that the difference between the experimental, control and placebo groups in terms of their mean VAS scores obtained before the procedure ($p = .102$) and after the procedure ($p = .378$) was not statistically significant ($p > 0.05$). But in the experimental group; in terms of their mean VAS scores obtained before the procedure and after the procedure was statistically significant ($p = .001$, Table 2).

Table 1. Demographic Characteristics of Patients

	Intervention (n=15)		Control (n=16)		Placebo (n=15)		Total (n=46)		Test
	n	(%)	n	(%)	n	(%)	n	(%)	
Gender									
Female	8	53.3	7	43.8	4	26.7	19	41.3	$X^2=2.260$ $p=0.323$
Male	7	46.7	9	56.2	11	73.3	27	58.7	
Mean age	63.40±12.06		59.75±9.34		59.13±11.33		60.73±1.08		
Age									
39-49	2	28.6	2	28.6	3	42.9	7	15.2	$X^2=5.260$ $p=0.511$
50-60	3	17.6	8	47.1	6	35.3	17	37.0	
61-70	6	50.0	2	16.7	4	33.3	12	26.1	
71-81	4	40.0	4	40.0	2	20.0	10	21.7	
Marital status									
Married	12	80.0	16	100	14	93.3	19	91.3	$X^2=4.016$ $p=0.134$
Single	3	20.0	-	-	1	6.7	27	8.7	
Educational status									
Illiterate	3	20.0	2	12.5	3	20.0	8	17.4	$X^2=8.182$ $p=0.225$
Primary school	6	40.0	12	75.0	10	66.7	28	60.9	
High school	4	26.7	-	-	2	13.3	6	13.0	
License	2	13.3	2	12.5	-	-	4	8.7	
Number of chest tube									
1	2	13.3	1	6.2	-	-	3	6.5	$X^2=2.258$ $p=0.323$
2	11	73.3	13	81.2	14	93.3	38	82.6	
3	2	13.3	2	12.5	1	6.7	5	10.9	

Table 2. VAS Score Comparisons of the Patients from the Experimental, Control and Placebo Groups

	Before (VAS-1) X ± SD	After (VAS-2) X±SD	Test
The group started with gel pack	6.93±2.40	4.26±2.63	Z=-3.192, p= 0.001*
The group started without gel pack	5.68±2.52	4.86±2.52	Z= 0.000, p= 1.000
The group started with warm gel pack	5.06±2.12	4.86±2.58	Z=-0.535, p= 0.593
KW	4.572	1.948	
p	0.102	0.378	

SD: Standart Deviation, Z: Wilcoxon 2 Related Samples *p<0.05, KW: Kruskal-Wallis Variance Analysis

4. Discussion

Sternal incision pain is the most common complaint after these surgeries [15,19]. Patients who underwent open heart surgeries report having most severe pain during deep breathing and coughing then pain at rest [6,26]. Especially deep breathing and coughing exercise is one of the most painful activities. Deep breathing and coughing exercise are important in the prevention of respiratory complications such as hypoxemia, atelectasis, pneumonia. But, patient sare not likely to do this exercise if they are uncomfortable, or do not have strategies to control the break through pain [19]. We used cold gel pack in order to relieve pain.

In this study, pain was significantly decreased with the use of cold gel packs. Pain scores after cold application were lower with gel pack compared to before cold application. Our study showed that the cold gel pack application is an effective method for management of sternal incision pain associated with deep breathing and coughing in open heart surgery patients. Four studies previously investigated the effect of cold application for reducing the pain related to deep breathing and coughing. In a randomized crossover design, Chailier et al. (2010) evaluated the level of sternal pain after deep breathing and coughing in four stages [19]. A significant reduction in pain scores between pre- and post-application of the gel pack was found. Khalkhali et al. (2014) and Pishkar Mofrad et al. (2016) was performed on 50 patients undergoing CABG, reporting similar results regarding the reduction of sternal pain after cold therapy [15, 28]. Another study by Ebrahimi-Rigi et al. (2016) reported that cold therapy reduced pain relating to deep breathing and coughing in patient undergoing coronary artery bypass grafting. The findings of the present study are similar to the results of aforementioned studies [27]. Thus, the cold therapy may be an effective approach that can be used for relieving pain associated with coughing and deep breathing in postsurgical patients.

Similar results were obtained with cold therapy in various conditions such as chest tube removal, soft tissue injuries and postoperative [20, 25, 29-33]. In another research, Hasanzadeh et al. (2016) investigated the effects of cold therapy and inhalation of lavender oil on the level of pain and anxiety during the removal of chest tube in patients

in the cardiac intensive care unit undergoing CABG. According to the results, cold application and aromatherapy helped to the significant reduction of pain and anxiety in the patients [34].

As a limitation, this study was performed on 46 individuals due to the small number of cases in the hospital and was limited to patients who underwent CABG surgery. While these inclusion criteria increased the homogeneity of the study population, it made the generalizability of the findings difficult.

5. Conclusions

Cold gel pack application was effective for decreasing incisional pain associated with deep breathing and coughing after open heart surgery. It is very important to emphasize that cold application is an independent nursing intervention in the control of pain. Another important point is; it should be noted that pain management depends on effective communication and collaboration of the multidisciplinary health care professionals. In this respect, it is considered that studies are need involving multidisciplinary approaches. Other non-pharmacological methods such as cold application are recommended as complementary therapy with pharmacological methods and investigate for more information about the effects of different post-surgical periods, and ways of cold application with a broader sampling base. Future studies could also perform the same design, but after removing the chest tube to increase its reliability. Because pain may also depend on the chest tube.

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Conflicts of Interest

The authors declare that there is no conflict of interest.

The present study has several limitations. The major limitation is that we did not exclude the patients who had also a co-diagnosis of depression which might have biased the results. One might argue that schizophrenic patients may be more sensitive towards criticism, and depressed patients may be more sensitive towards emotional overinvolvement, or respectively, that key relatives of schizophrenic patients behave in a more critical manner, while those of depressed patients are more emotionally overinvolved. Any psychotropic medications and dosages were not controlled for the caregivers. Also, we did not measure the severity of depression in caregivers, since we excluded the relatives with a current diagnosis of major depression and any anxiety disorder.

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