

Received 2017-03-03  
Revised 2017-07-12  
Accepted 2017-07-18

# The Effect of Classic Chest Physiotherapy on Postoperative Pain Scores and Hospital Stay in Patients Undergoing Off-Pump Coronary Artery Bypass Graft Surgery: A Randomized Clinical Trial

Mohammad Zolfaghari<sup>1</sup>✉, Seyed Jalil Mirhosseini<sup>2</sup>, Maryam Baghbeheshti<sup>1</sup>, Brent A. Bauer<sup>3</sup>

<sup>1</sup>Student Research Committee, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>2</sup>Department of Cardiovascular Surgery, Afshar Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>3</sup>Complementary and Integrative Medicine, Division General Internal Medicine, Department of Medicine, Mayo Clinic, Rochester, Minnesota, USA

## Abstract

**Background:** Background: Chest physiotherapy (CPT) is a care that increases the mobilization of several structures from both muscle and subcutaneous tissue. We planned to investigate the effect of classic CPT on pain, fatigue, satisfaction, and hospital length of stay (LOS) in patients undergoing off-pump coronary artery bypass graft (CABG). **Materials and Methods:** This study was a randomized controlled trial that conducted on 50 patients undergoing elective off-pump CABG. The patients have been randomly divided into two groups; in the group A (n=25) patients received physiotherapy at a single session of classic CPT, 4 times during 2nd to 5th days for 15 minutes in every session, in the group B (n=25) patients had not protocol of this exercise therapy (control). **Results:** The average age of all participants was 62.08 ±9.08 years. Of the 50 patients, 33 (66%) was male. Classic CPT significantly decreased pain (P=0.04), hospital LOS (P=0.010) and could increase in patients' satisfaction (P<0.001). However, it had no considerable effect on fatigue (P=0.725). **Conclusion:** According to our findings, classic CPT could improve postoperative care after off-pump CABG surgery. [GMJ.2018;7:e838] DOI:10.22086/gmj.v0i0.838

**Keywords:** Randomized Controlled Trial; Pain; Coronary Artery Bypass; Length of Stay

GMJ

Copyright© 2018, Galen Medical Journal. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>)  
Tel/Fax: +98 71 36474502  
Email: info@gmj.ir



✉ Correspondence to:

Mohammad Zolfaghari, Student Research Committee, Shahid Sadoughi University of Medical Sciences, Yazd, Iran  
Telephone Number: +989132698582  
Email Address : amhmzolfaghari89@gmail.com

## Introduction

Coronary artery bypass graft (CABG) surgery is common cardiac surgery in the world that has both early and late surgical complications compares to other operations [1]. Sternal surgical complications following median sternotomy are one of the major problems after surgery. Pain, fatigue, and anxiety are common complications after surgery. All of these factors may compromise treatment and quality of life following surgery; therefore, decreasing of pain scales may improve outcomes after surgery [2-4]. Pain is one of the most significant undesirable complications associating open surgeries. Due to the higher pain scores, the higher levels of opioid requirements and hospital level of stay (LOS) would be more problematic [5]. Patients with chest pain cannot breath normally, also opioid-induced respiratory depression may occur during acute care setting [6]; these two outcomes lead to more hospital LOS and lower satisfaction. Currently, pain is a challenge for anesthesiologists, and the techniques focus on improving post-operative pain management [7,8]. Massage therapy (MT) is a technique that increases the mobilization of several

structures from both muscle and subcutaneous tissue. This mobilization improves movement of lymph and venous return. MT may be used to promote muscle relaxation and to decrease pain which helps patients enhance their rehabilitation [9]. Classic chest physiotherapy (CPT) is one of the types of MT and recently there has been more evidence on the role of CPT on reducing pain [10]. Although some specialists in physiotherapy believe that there are some limiting factors in conducting physiotherapy for post-operative patients or even it may lead to high-risk complications in some cases [11,12]. Nowadays, CPT is not applied routinely for the patients undergoing CABG; it is just recommended for patients who suffer from a lot of chest pain as a selective method. This study was designed to evaluate the efficacy of CPT with a standard protocol on pain, fatigue, satisfaction and hospital LOS in off-pump CABG surgery patients.

## Materials and Methods

### Design

A double-blind randomized clinical trial was conducted on 50 patients undergoing CABG. The procedure is shown in Figure-1.

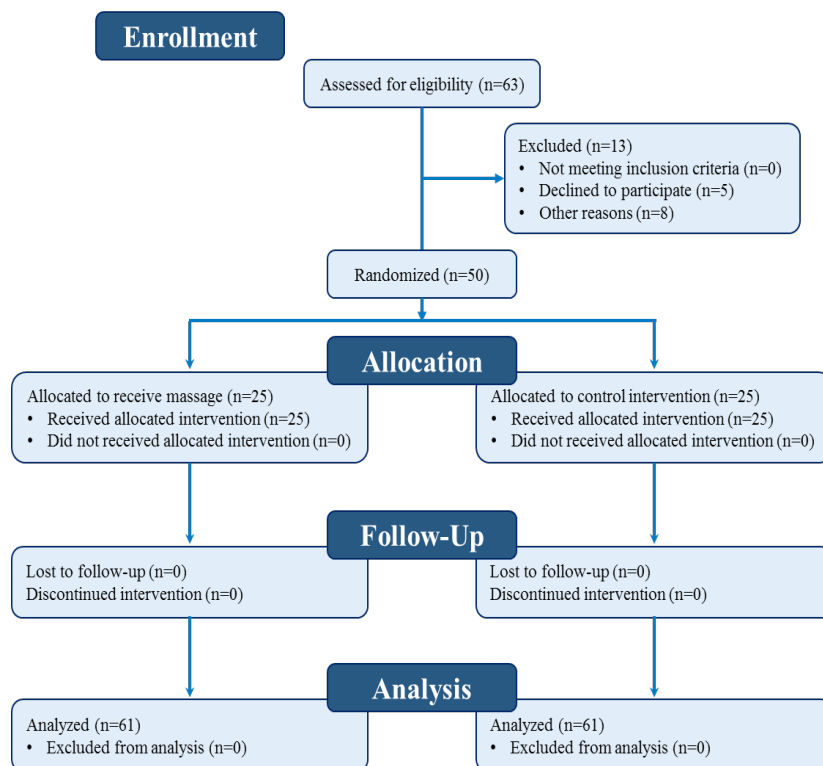


Figure-1. CONSORT Flow Diagram

### Participants

After receiving the written informed consent from patients, they participated voluntarily for off-pump CABG, at Afshar Cardiovascular Surgery Center of Yazd, Iran. Certain cardiothoracic surgeon performed all of the operations. Table-1 shows the characteristics of the participants.

### Inclusion and Exclusion Criteria

We included only those who gave written informed consent and were medically able to participate in MT postoperatively from March 5, 2016, through April 3, 2016. Patients post off-pump CABG were similar in the inclusion criteria. Patients were excluded from the study if they met the criteria as follow: (a) history of cardiac and thoracic surgery; (b) chronic pain syndrome; (c) prolonged

bleeding during hospital stay (more than 200 cc per hour); (d) psychiatric disorders; (e) history of chest trauma and deformity.

### Random Allocation

Eligible participants (n=50) were randomly allocated to the CPT or control group. The participants were divided into two groups; Patients in the group A (n=25) received physiotherapy at a single session of classic CPT 4 times during second to the fifth day for 15 minutes in every session. In the group B (n=25) patients had not protocol of this exercise therapy (control). To perform random allocation, a block of four was applied. Each patient in a block assigned to letters A, B, C, and D. The possible groups that could assign to CPT group were AB, AC, AD, BC, BD, and DC.

**Table-1.** Demographic Information of the Participants

Characteristics	Control (N=25) n(%)	CPT (N=25) n(%)	Total (N=50) n(%)	P-Value
<b>Age (y, Mean±SD)</b>	64.56±10.07	59.60±7.35	62.08±9.08	0.053
<b>Sex</b>				
Female	10 (40.0)	7 (28.0)	17 (34.0)	0.370
Male	15 (60.0)	18 (72.0)	33 (66.0)	
<b>HTN</b>				
Yes	16 (64.0)	14 (56.0)	30 (60.0)	0.564
No	9 (36.0)	11 (44.0)	20 (40.0)	
<b>DM</b>				
Yes	10 (40.0)	5 (20.0)	15 (30.0)	0.123
No	15 (60.0)	20 (80.0)	35 (70.0)	
<b>HLP</b>				
Yes	10 (40.0)	14 (56.0)	24 (48.0)	0.258
No	15 (60.0)	11 (44.0)	26 (52.0)	
<b>CS</b>				
Yes	7 (28.0)	8 (32.0)	15 (30.0)	0.758
No	18 (72.0)	17 (68.0)	35 (70.0)	
<b>Involved Vessels</b>				
<b>SVD (%)</b>	0 (0.0)	3 (12.0)	3 (6.0)	0.184
<b>2VD (%)</b>	8 (32.0)	9 (36.0)	17 (34.0)	
<b>3VD (%)</b>	17 (68.0)	13 (52.0)	30 (60.0)	

**CPT:**chest physiotherapy; **HTN:**hypertension; **DM:**diabetes mellitus; **HLP:**hyperlipidemia; **CS:**cigarette smoking, **SVD:**single vessel disease; **2VD:**two-vessel coronary artery disease; **3VD:** three-vessel coronary artery disease

Then one number from 1-6 was selected at random, for assigning to CPT group; for instance, if number 5 was selected, number 2 would be allocated to the control group.

#### Blinding

The study was a double-blind trial; so, the participants were unaware of the intervention they had received. The two groups were in separate rooms to avoid possible cross-talking between them. After collecting the data, the secondary blinded researcher measured outcomes. The blinded researcher was not aware of the group of patients whether they were in the control group or CPT group.

#### Measurements

The data collected using a two-part questionnaire. The first part included items about the demographic information of the participants (e.g. age, sex, cigarette smoking (CS), and the presence of hypertension (HTN), diabetes mellitus (DM), and hyperlipidemia (HLP)). Also, pre-operation data such as the number of vessels which were involved before the surgery that were single vessel disease (SVD), two-vessel (2VD), and three-vessel (3VD) coronary artery disease were recorded. Part two included a self-report Questionnaire to evaluate the patients' quality and degree of pain, fatigue and satisfaction.

The patients were asked to fill in a questionnaire and rate their pain, fatigue and satisfaction from 0 to 10 (0=minimum, 10=maximum). On the fifth day and before discharge, the questionnaire was filled again to determine the patients' score finally. Pain, fatigue, and satisfaction were measured at the baseline and the end of the intervention period.

#### Intervention

Patients were received follow-up care and stabled for one day in intensive care unit (ICU) after surgery. After the first postoperative day, they were transferred to the heart ward. Thus CPT sessions must be started from the second postoperative day and only after transfer of the patients to the ward. In order to homogenize the two groups, four 15-minute sessions were determined as quiet time in days 2-5 after surgery. To preventing entering confounding factors, all of the processes of intervention was performed by a just one physiotherapist familiar with methods of physiotherapy in cardiac surgery patients. Selection of the methods of physiotherapy was on a patient-oriented basis; individualized to each patient (selected according to the psychological and physical states of the patients and other underlying conditions. Each session consisted of three parts. In the first part which lasts for 1-5 minutes,

**Table-2.** The Effect of CPT On Pain, Fatigue, and Hospital LOS in Comparison with Control Group

	Initial Level (Mean±SD)		Terminal Level (Mean±SD)		Change in Amount (after-before) (Mean±SD)		P-value
	Ctrl	CPT	Ctrl	CPT	Ctrl	CPT	
<b>Pain</b>	6.84 (1.37)	6.32 (1.74)	3.04 (1.02)	1.56 (0.76)	3.80 (1.08)	4.76 (1.16)	0.004
<b>Fatigue</b>	2.76 (0.66)	2.60 (0.70)	1.84 (0.68)	1.28 (0.67)	0.92 (0.81)	1.32 (0.98)	0.725
<b>LOS</b>	—	—	7.16 (1.40)	6.20 (1.11)	—	—	0.010
<b>Satisfaction</b>	2.08 (0.49)	2.16 (0.68)	2.52 (0.65)	3.60 (0.50)	-0.44 (0.71)	-1.44 (0.76)	<0.000

Ctrl: Control; CPT: chest physiotherapy; LOS: level of stay

the best conventional position was evaluated for the patients. Indeed, every patient knows the best position according to the medical condition (such as sitting on the edge of bed, lying down with supine position, lying down with lateral decubitus position, etc.). The position could be affected by many factors such as the ability to move, tubing and medical equipment connected to the patient and the patient's preference. After being in the right situation, in the second part, physiotherapist tries to perform gentle and relaxant exercises to reduce anxiety and tensions of the patient. Movements of the shoulder joint (manual techniques for the shoulder) an example of the relaxant movements. This movement is beneficial after heart surgery specially in patients with a long time motionless on the bed. In the third part of each session, the physiotherapist tries to apply MT methods to help patients. These methods are according to the physiotherapist's knowledge and opinion and due to the patient's medical condition, the patient's signs and symptoms as well as the patient's tolerance. Hence, deep tissue

massage, trigger point therapy, neuromuscular techniques, myofascial release, acupressure, some Swedish massage techniques, manual lymphatic drainage, and reflexology were selected. The physiotherapist would attempt not to push, pull or hit the regions which were very close or on the surgical incisions, and they avoid inflicting of physical forces on the patient's sternum region (due to the mid-sternotomy during operation). All techniques could be performed in other parts of the body such as the head, neck, shoulders, arms, hands, back, and legs based on the patient's request. During the second to fourth days after surgery, to unify intervention in intervention and control groups, three 15-minute sessions entitled (silence time) for patients in the control group was considered that the patient was lying on the bed no physical activity. Also, after discharge and at follow-up period, the patients will benefit from standard medical care (such as drugs, clinical trials, and a periodic visit by a physician), it was recommended that patients should comfort on a bed in a low-light environment, every week for thirty minutes.

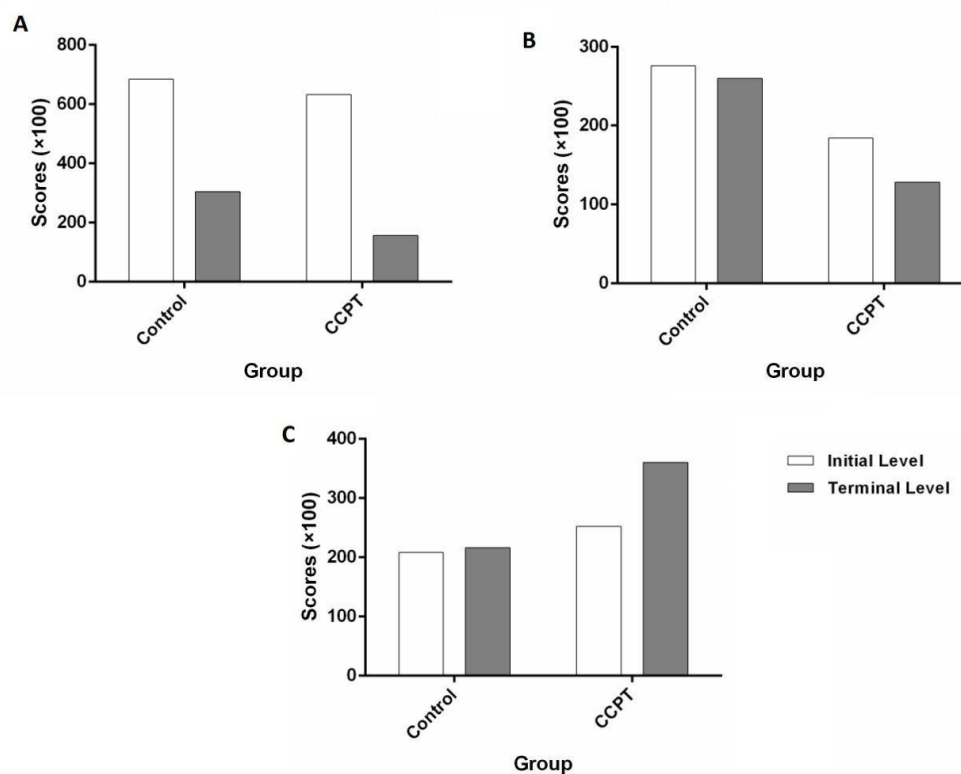


Figure-2. Level of pain (A), fatigue (B), and satisfaction (C) before and after CPT

### *Ethical Issues*

Local Medical Ethics Committee of Shahid Sadoughi University of Medical Sciences (SSU) approved the study proposal with the ID number: 746/G/T. Moreover, this clinical trial registered in the Iranian Registry of Clinical Trials (IRCT) and allocated a unique code IRCT2016010925913N1. All of the participants signed the written informed consent.

### *Data Analysis*

The data were analyzed by SPSS16 software. Regarding demographic information of participants, descriptive statistics (mean, standard deviation, frequency, percentage) were calculated. The ANOVA and Chi-square tests were used for analyzed variables and to evaluate the difference between groups. A  $P$ -value  $< 0.05$  was considered as significant.

### **Results**

In this study, 50 patients who underwent elective off-pump CABG were enrolled. The average age of all participants was  $62.08 \pm 9.08$  years. In the control group, 40% (10) were female, and 60% (15) were male, and 28% (7) were female, and 72% (18) were male in the CPT group. Totally, 33 patients (66%) were male and 17 patients (34) were female. Of all the participants who were studied in this survey, 30% had DM, and 60% suffered from hypertension (HTN). In addition, 48% of them had hyperlipidemia (HLP), and 30% of them were cigarette smokers (CS). From all the participants, 6% were SVD, 34% with 2VD, and 60% with 3VD coronary artery disease (Table-1). According to the ANOVA and Chi-square results, there was a significant statistical relationship between the CPT and reducing pain ( $P=0.004$ ). On the other hand, patients who were massaged for 15 minutes complained of less pain in the 2-5 days after surgery. The mean score of pain was 1.56 in the CPT group at the final level, and it was lower in comparison with the control group (3.04). Although, CPT had no considerable effect on fatigue. The mean score of fatigue was 1.28 in the CPT group, and it was approximately

close to the score in the control group (1.84). There was no statistical relationship between the CPT and fatigue ( $P=0.725$ ) (Table-2). According to the statistical outcomes, classicCPT could decrease hospital LOS; the mean score in the CPT group (6.20) was lower than the control group (7.16) ( $P=0.01$ ). As mentioned above, pain and LOS make patients feel unsatisfied; in this research, pain and LOS were lower in the CPT group. Therefore, satisfaction was increased among patients in the CPT group (Figure-2).

### **Discussion**

The aim of this study was to deal with the effect of CPT on pain, satisfaction, fatigue and hospitalization in post-CABG patients. In this clinical trial, CPT had considerable positive effects on pain relief after CABG. Satisfaction was another important factor that could be used as an indicator of quality of life, which has been much considered in patients following major surgeries these days. At last, shorter duration of bed rest in hospital after CABG was a better way to reduce hospital costs and common complications of surgery (e.g. thromboembolism); moreover, patients often had more emotional supports and better remission when they were discharged as soon as possible. Pain, fatigue, and anxiety are common complications after surgery. All of these factors may compromise treatment and quality of life following surgery; therefore, decreasing pain scales may improve outcomes after surgery. According to our hypothesis, performing physiotherapy on an area could increase its circulation. Therefore, there would be more oxygen provided for the tissue by increasing the red blood cell count. It also increases the immune system function in the area by providing more immune factors. These two can remove pathogenic factors and relatively heal wounds and alleviate pain [13-16]. Ucuza M *et al.* carried out research on 70 patients undergoing breast surgery to determine the effect of foot massage on post-operative pain and found that this therapeutic method in breast surgery patients was effective in postoperative pain management [17]. Jane and Chen reflected the benefits of mas-

sage therapy on reducing pain in patients with metastatic bone and ameliorating anxiety in CHF patients, respectively [18, 19]. Also, Tarja claimed that, there was a negative relationship between massage therapy and pain in patients who were admitted in ICU [20]. Interestingly, CPT could be a multi aspect method when it is utilized in low mood. Mirmohammad sadeghi *et al.* 2013 reported better mood in 72 patients post CABG after 4 sessions of massage therapy per day. These patients were 18-75 years old [21]. Also, Streit RS studied the effectiveness of MT for the treatment of neurogenic thoracic outlet syndrome (NTOS). They used MT for treatment and found improvement in range of motion at the glenohumeral joint. Therefore, it can be useful as part of a broad approach to managing of this syndrome [22]. Castro AA *et al.* showed that CPT can minimize hospital LOS in patients hospitalized in the ICU [23]. Nowadays, physiotherapy is used to decrease hospital LOS [24,25], pain in osteoporosis [26], chronic low back pain [27], knee osteoarthritis [28], musculoskeletal disorders [29], open-abdominal surgery [30] and increase satisfaction. The results of this clinical trial showed a decrease in chest pain and hospital LOS and also an increase in patient satisfaction. However, since the post-operative cares after cardiac surgery are so sensitive and some of them can cause complications in healing wounds and immune system function, any intervention including physiotherapy even though having some pain-relieving effects, should be considered as stressful and

with adverse effects. Physiotherapy, when performed by a specialized physiotherapist, has much fewer side-effects compared with using drugs, and it can also be a less stressful substitution. Furthermore, in this study choosing the right time for performing the physiotherapy, its repetition and selecting an appropriate method based on patient's state, were of high importance. We tried to completely inform the patients before enrolling in the study to avoid any negative outcome resulting from their dissatisfaction. Finally, we conclude that physiotherapy can diminish chest pain and hospital LOS and increase patient's satisfaction.

### Conclusion

Since close monitoring is necessary for patients after CABG operation, CPT could be helpful to reduce their chest pain in the department of cardiovascular surgery in Iran. However, patients often want to stay in hospital as short time as possible; therefore, postoperative CPT may partly meet their needs.

### Acknowledgments

This research was performed at Afshar Hospital in Yazd, Iran. We sincerely appreciate the patients who participated in our study. Special thanks to Mr. Rahimianfar for his assistance.

### Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this article.

### References

1. Sá MP, Ferraz PE, Escobar RR, Martins WN, Lustosa PC, Nunes Ede O, et al. Off-pump versus on-pump coronary artery bypass surgery: meta-analysis and meta-regression of 13,524 patients from randomized trials. *Rev Bras Cir Cardiovasc.* 2012; 27(4): 631-41.
2. Ambrosino N, Gabbrielli L. Physiotherapy in the perioperative period. *Best Pract Res Clin Anaesthesiol.* 2010; 24(2): 283-9.
3. Paras I, Bakhsh A, Hussain G, Khan Y, Moeen M. Early outcome of coronary artery bypass grafting in patients with unstable angina. *J Ayub Med Coll Abbottabad.* 2014; 26(3): 283-5.
4. Mark DB, Knight JD, Velazquez EJ, Wasilewski J, Howlett JG, Smith PK, et al. Quality-of-life outcomes with coronary artery bypass graft surgery in ischemic left ventricular dysfunction: a randomized trial. *Ann Intern Med.* 2014; 161(6): 392-9.

5. Vu V, Baker WL, Tencza EM, Rochon C, Sheiner PA, Martin ST. Intravenous Acetaminophen for Postoperative Pain Management in Patients Undergoing Living Laparoscopic Living-Donor Nephrectomy. *Ann Pharmacother.* 2016; 51(1): 21-6.
6. Overdyk F, Dahan A, Roozkrans M, van der Schrier R, Aarts L, Niesters M. Opioid-induced respiratory depression in the acute care setting: a compendium of case reports. *Pain Manag.* 2014; 4(4): 317-25.
7. Fontaine M, Latarjet J, Payre J, Poupelin JC, Ravat F. Feasibility of monomodal analgesia with IV alfentanil during burn dressing changes at bedside (in spontaneously breathing non-intubated patients). *Burns.* 2017; 43(2): 337-42.
8. Kurosaka K, Tsukada S, Seino D, Morooka T, Nakayama H, Yoshiya S. Local Infiltration Analgesia Versus Continuous Femoral Nerve Block in Pain Relief After Total Knee Arthroplasty: A Randomized Controlled Trial. *J Arthroplasty.* 2016; 31(4): 913-7.
9. Rasmussen MU, Amris K, Rydahl-Hansen S, Danneskiold-Samsøe B, Mortensen EL, Christensen R, et al. Are the changes in observed functioning after multi-disciplinary rehabilitation of patients with fibromyalgia associated with changes in pain self-efficacy? *Disabil Rehabil.* 2017; 39(17): 1744-52.
10. Brummitt J. The role of massage in sports performance and rehabilitation: current evidence and future direction. *N Am J Sports Phys Ther.* 2008; 3(1): 7-21.
11. Bagheri-Nesami M, Shorofi SA, Zargar N, Sohrabi M, Gholipour-Baradari A, Khalilian A. The effects of foot reflexology massage on anxiety in patients following coronary artery bypass graft surgery: a randomized controlled trial. *Complement Ther Clin Pract.* 2014; 20(1): 42-7.
12. Bauer BA, Cutshall SM, Wentworth LJ, Engen D, Messner PK, Wood CM, et al. Effect of massage therapy on pain, anxiety, and tension after cardiac surgery: a randomized study. *Complement Ther Clin Pract.* 2010; 16(2): 70-5.
13. Pehlivan E, Turna A, Gurses A, Gurses HN. The effects of preoperative short-term intense physical therapy in lung cancer patients: a randomized controlled trial. *Ann Thorac Cardiovasc Surg.* 2011; 17(5): 461-8.
14. Egito JG, Abboud CS, Oliveira AP, Máximo CA, Montenegro CM, Amato VL, et al. Clinical evolution of mediastinitis in patients undergoing adjuvant hyperbaric oxygen therapy after coronary artery bypass surgery. *Einstein (Sao Paulo).* 2013; 11(3): 345-9.
15. Yogaratnam JZ, Laden G, Guvendik L, Cowen M, Cale A, Griffin S. Hyperbaric oxygen preconditioning improves myocardial function, reduces length of intensive care stay, and limits complications post coronary artery bypass graft surgery. *Cardiovasc Revasc Med.* 2010; 11(1): 8-19.
16. Zhou YY, Liu W, Yang YJ, Lu GD. Use of hyperbaric oxygen on flaps and grafts in China: analysis of studies in the past 20 years. *Undersea Hyperb Med.* 2014; 41(3): 209-16.
17. Ucuzal M, Kanan N. Foot massage: effectiveness on postoperative pain in breast surgery patients. *Pain Manag Nurs.* 2014; 15(2): 458-65.
18. Chen WL, Liu GJ, Yeh SH, Chiarnig MC, Fu MY, Hsieh YK. Effect of back massage intervention on anxiety, comfort, and physiologic responses in patients with congestive heart failure. *J Altern Complement Med.* 2013; 19(5): 464-70.
19. Jane SW, Wilkie DJ, Gallucci BB, Beaton RD, Huang HY. Effects of a full-body massage on pain intensity, anxiety, and physiological relaxation in Taiwanese patients with metastatic bone pain: a pilot study. *J Pain Symptom Manage.* 2009; 37(4): 754-63.
20. Vainiola T, Roine RP, Suojaranta-Ylinen R, Vento A, Sintonen H. Can factors related to mortality be used to predict the follow-up health-related quality of life (HRQoL) in cardiac surgery patients? *Intensive Crit Care Nurs.* 2013; 29(6): 337-43.
21. Babae S, Shafiei Z, Sadeghi MM, Nik AY, Valiani M. Effectiveness of massage therapy on the mood of patients after open-heart surgery. *Iran J Nurs Midwifery Res.* 2012; 17(2 Suppl 1): S120-4.
22. Streit RS. NTOS symptoms and mobility: a case study on neurogenic thoracic outlet syndrome involving massage therapy. *J Bodyw Mov Ther.* 2014; 18(1): 42-8.



23. Castro AA, Calil SR, Freitas SA, Oliveira AB, Porto EF. Chest physiotherapy effectiveness to reduce hospitalization and mechanical ventilation length of stay, pulmonary infection rate and mortality in ICU patients. *Respir Med.* 2013; 107(1): 68-74.
24. Panteli M, Habeeb S, McRoberts J, Porteous MJ. Enhanced care for primary hip arthroplasty: factors affecting length of hospital stay. *Eur J Orthop Surg Traumatol.* 2014; 24(3): 353-8.
25. Ahn KY, Hur H, Kim DH, Min J, Jeong DH, Chu SH, et al. The effects of inpatient exercise therapy on the length of hospital stay in stages I-III colon cancer patients: randomized controlled trial. *Int J Colorectal Dis.* 2013; 28(5): 643-51.
26. Paolucci T, Morone G, Iosa M, Grasso MR, Buzi E, Zangrando F, et al. Efficacy of group-adapted physical exercises in reducing back pain in women with postmenopausal osteoporosis. *Aging Clin Exp Res.* 2014; 26(4): 395-402.
27. Carneiro KA, Rittenberg JD. The role of exercise and alternative treatments for low back pain. *Phys Med Rehabil Clin N Am.* 2010; 21(4): 777-92.
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.
29. Delextrat A, Hippocrate A, Leddington-Wright S, Clarke ND. Including stretches to a massage routine improves recovery from official matches in basketball players. *J Strength Cond Res.* 2014; 28(3): 716-27.
30. Chapelle SL, Bove GM. Visceral massage reduces postoperative ileus in a rat model. *J Bodyw Mov Ther.* 2013; 17(1): 83-8