

Original Article

A randomized trial of acupressure on pain management after cardiac surgery

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Abstract: This randomized controlled study aimed to determine the effects of acupressure on pain management after cardiac surgery. The sample included 100 patients who underwent cardiac surgery, divided into two groups: the intervention group (n=50), who received acupressure and daily nursing care, and the control group (n=50), who only received daily nursing care. Randomization was done by assigning the patients in even-numbered rooms to the intervention group and assigning the patients in odd-numbered rooms to the control group. In the postoperative period, the severity of pain was evaluated using the Visual Analogue Scale (VAS) for 3 days starting from the day that the patients returned to the clinic. Acupressure application decreased the level of pain by 1.86 points in the intervention group in comparison to 0.38 points in the control group. It was found that the acupressure intervention had a significant effect on relieving postoperative pain after cardiac surgery in the intervention group ($P<0.001$), while the difference in the control group was not statistically significant ($P>0.05$). Moreover, in the intervention group, acupressure was found to be 59.2% effective for pain management ($P<0.001$).

Keywords: Acupressure, pain management, cardiac surgery, complementary and alternative medicine

Introduction

Coronary Artery Disease (CAD) is characterized by myocardial ischemia due to alterations in the lipid metabolism [1-3]. CAD is a common disease across the globe; it is also highly common in the Turkish population. Cardiovascular diseases are responsible for 45% of all deaths in Turkey [4]. The progressive investigation study, "Heart Diseases and Risk Factors among Turkish Adults", reported that between 1990-2014, coronary mortality was detected in 1110 out of 100,000 people between the ages of 45 and 74, and it was significantly more frequent among women [5].

Cardiac surgery is one of the most common methods for treating certain cardiac problems. However, following cardiac surgery, 50-80% of patients may experience pain. Medical treatment is widely used for pain management after cardiac surgery; nevertheless, when used alone, it may not be effective in relieving pain to the desired level. Accordingly, when the advantages and disadvantages of medical pain treat-

ment are considered, using complementary medicine in addition to the medical treatment plan may be a safe and effective alternative for pain management [6-10].

Acupressure is a non-invasive massage technique that has been used for symptom management since ancient times, and it is a complementary medicine method recognized by the World Health Organization (WHO). Nowadays, acupressure consists of using fingers, palms, elbows, or special bands to apply pressure to exact points on the body [11, 12]. Over 5000 years ago, Chinese scientists believed that they should develop alternative methods because the approaches commonly used to relieve physical pain were insufficient. Therefore, they started to use different massage techniques to balance the life energy (chi) in the human body to treat pain and other conditions. Consequently, the traditional objective of acupressure is to apply pressure to the special points along the body's meridians (energy canals) that carry the chi; this helps the energy flow through the body in a healthy way [11-14]. The scientific objective

of this method is to create a positive effect on the sympathetic and the parasympathetic nervous systems by applying pressure to the points along the meridians. The body points used when applying acupressure are the exact points where the blood and oxygen flow is lower; applying pressure to these points creates a slightly painful muscle spasm. Therefore, it aims to maintain homeostasis by increasing the blood and oxygen flow in the affected body area [11, 12, 15].

In parallel to the increase in the number of cardiovascular diseases and cardiac surgeries, the number of studies about the use of complementary medicine for patient care have increased as well [16]. In a narrative review that included 28 research studies, most of the studies documented the effects of complementary therapies on improving the postoperative outcomes of patients [17]. In a study that investigated the attitudes that patients undergoing cardiac surgery had about complementary medicine, 75% of the sample used a complementary medicine method [18]. It was also demonstrated that the participants had a positive attitude about complementary medicine unrelated to the study's variables, such as age, gender, and educational level [18]. Jones and Cheng reported that transcutaneous electrical nerve stimulation (TENS) application to the PC6 meridian point for symptom management after cardiac surgery had a positive effect on hemodynamic stability [19]. A study that investigated the effect of reflexology reported a statistically significant decrease in pain intensity [20]. In another study, electro-acupuncture that was used during the postoperative period provided significant pain relief [21].

Even though an increasing number of studies are investigating the use of complementary medicine on surgical populations, more evidence is needed [17]. Therefore, the present study was conducted using a randomized controlled study design to add more evidence to the current body of literature. The study consisted of an intervention group and a control group. In similar studies, because a sham-acupressure group was not found to have better outcomes than the acupressure group [15, 22] the present study did not include a sham-acupressure group.

In the present study, the following hypothesis was tested: H_1 : Application of acupressure dur-

ing the postoperative period decreases the level of pain experienced by cardiac surgery patients.

Methods

Study design

The study was conducted using a pre-test/post-test study design with an intervention group and a control group. A simple random sampling method was used to assign the participants into the two study groups. By using a "Random Number Table", the intervention group consisted of patients in even-numbered rooms and the control group consisted of patients in odd-numbered rooms. Thanks to this randomization, the patients in each group were unable to observe each other. The pre-test was done with patients in both groups to evaluate the patients' base pain scores. The homogeneity of the groups, in terms of socio-demographic characteristics and pain scores, was evaluated; it was found that the groups were distributed homogeneously. The intervention group received acupressure and the standard daily nursing care while the control group only received the standard care. One researcher applied the acupressure and evaluated the patients' pain levels to avoid interpersonal inconsistency, especially in terms of the acupressure application. The patients in the intervention group were informed that they would receive acupressure at specific points; however, they were not informed about the effect of acupressure on pain in order to avoid creating placebo expectancy.

Study setting and participants

The study was conducted in a university hospital in Istanbul, Turkey between January and April, 2016. Ethical Committee Approval was obtained from the university's Ethical Committee of Clinical Researches on 6th of October 2015. The data collection process started following the ethical committee approval. Sampling criteria were not having any condition (e.g. *incision, catheter*) on the wrist and on the inner surface of the forearm that avoids massage application, having cardiac surgery for the first time, being over the age of 18, not having any neurological diseases (e.g. *multiple sclerosis*), not having any problem which may lead to misunderstandings (e.g. *hearing loss*), and being able to communicate in Turkish. The sample

Acupressure on pain management after cardiac surgery

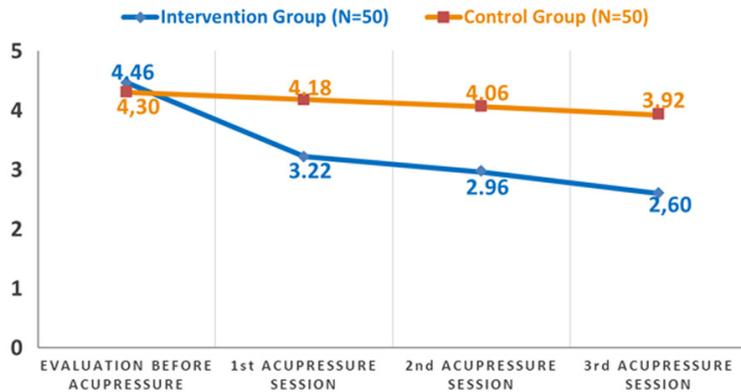


Figure 1. Changes in the average pain scores during repetitive acupressure sessions ($F=31,757$, $P=0.000$).

included 100 patients who underwent cardiac surgery, divided into two groups which were *Intervention Group* ($n=50$) who received acupressure and daily nursing care, and *Control Group* ($n=50$) who only received daily nursing care. As there wasn't any study in the literature that is similar to our sample and methodology, intervention group ($n=50$) and the control group ($n=50$) were selected as the sample of the study for being able to do comparisons under parametric conditions. Post-hoc Power analysis was done after finishing the data collection and it was found that the current data had 99.7% power rate. Power Analysis was calculated with PASS statistical software (PASS 13, NCSS, LLC. Kaysville, Utah, USA). Sample size was calculated by power analysis by using the ratio of cardiovascular surgery to all surgical interventions in the selected hospital setting. According to the Power Analysis, it was deemed appropriate to have 50 patients in each study group. The sample included 100 patients who underwent cardiac surgery, divided into two groups which were *Intervention Group* ($n=50$) who received acupressure and daily nursing care, and *Control Group* ($n=50$) who only received daily nursing care. The study workflow is summarized in **Figure 3**.

Data collection

Descriptive data were collected by Patient Information Form which was created by the researchers and included 14 questions about socio-demographic characteristics, medical and surgical history of the patient. Evaluation of the pain level after surgery was done by using 0 to 10 vertical Visual Analogue Scale (VAS).

Severity of pain was evaluated after each acupressure session.

Acupressure application procedure

Informed Consent: The purpose of the study was explained to the patients who were eligible to participate in the study and they were asked for their voluntary participation. The patients who agreed to participate in the study signed a written informed consent form.

Acupressure Application: The patients were transferred from the intensive care unit to the clinic on the 3rd postoperative day in average. The intervention group received acupressure application once a day for 3 days and continued receiving the daily nursing care in the clinic. The control group only received the daily nursing care. After each acupressure session, the severity of pain was evaluated. The mean pain score of these 3 days were considered as the final pain score.

For the first pain score, the patients were asked the most severe postoperative pain score before starting the acupressure session. And then the most severe pain levels were questioned between the first and the last acupressure sessions. Acupressure practice was performed by a single researcher (*first author*) to prevent the risk of inconsistency between practitioners.

Application Points: Heart 7 (H7), Pericardia 6 (MC6=PC6), Gallbladder 20 (GB20), Stomach 6 (ST6) (**Figure 2**). These acupressure points were selected according to WHO's standard report for acupressure application and limited to the points distant from the incision area [23].

Application Technique: The pressure was done manually with fingertips of thumb, index and/or middle finger depends on the position of the patient and/or the researcher. Pressure was applied for 2 minutes to each acupressure point. The pressure was done gently without giving disturbance and pain. The pressure point was confirmed by asking the patients if they have a sensation of slight pain and burning on

Acupressure on pain management after cardiac surgery

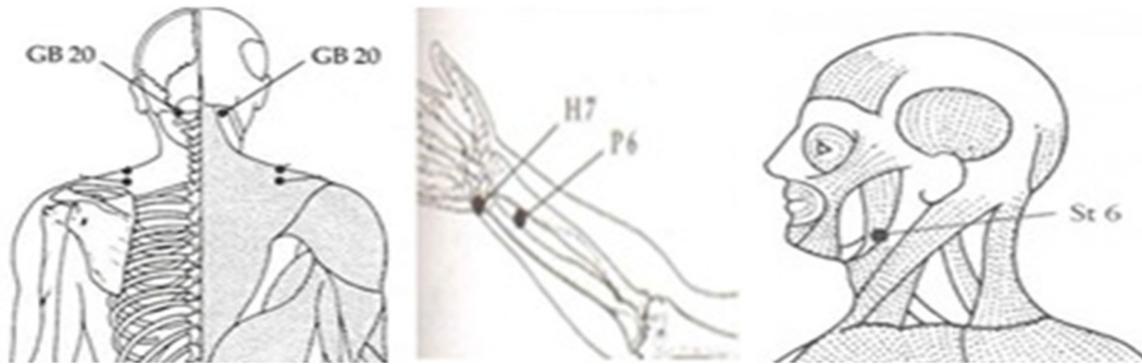


Figure 2. ST6, GB20, H7, P6 acupoints 28.

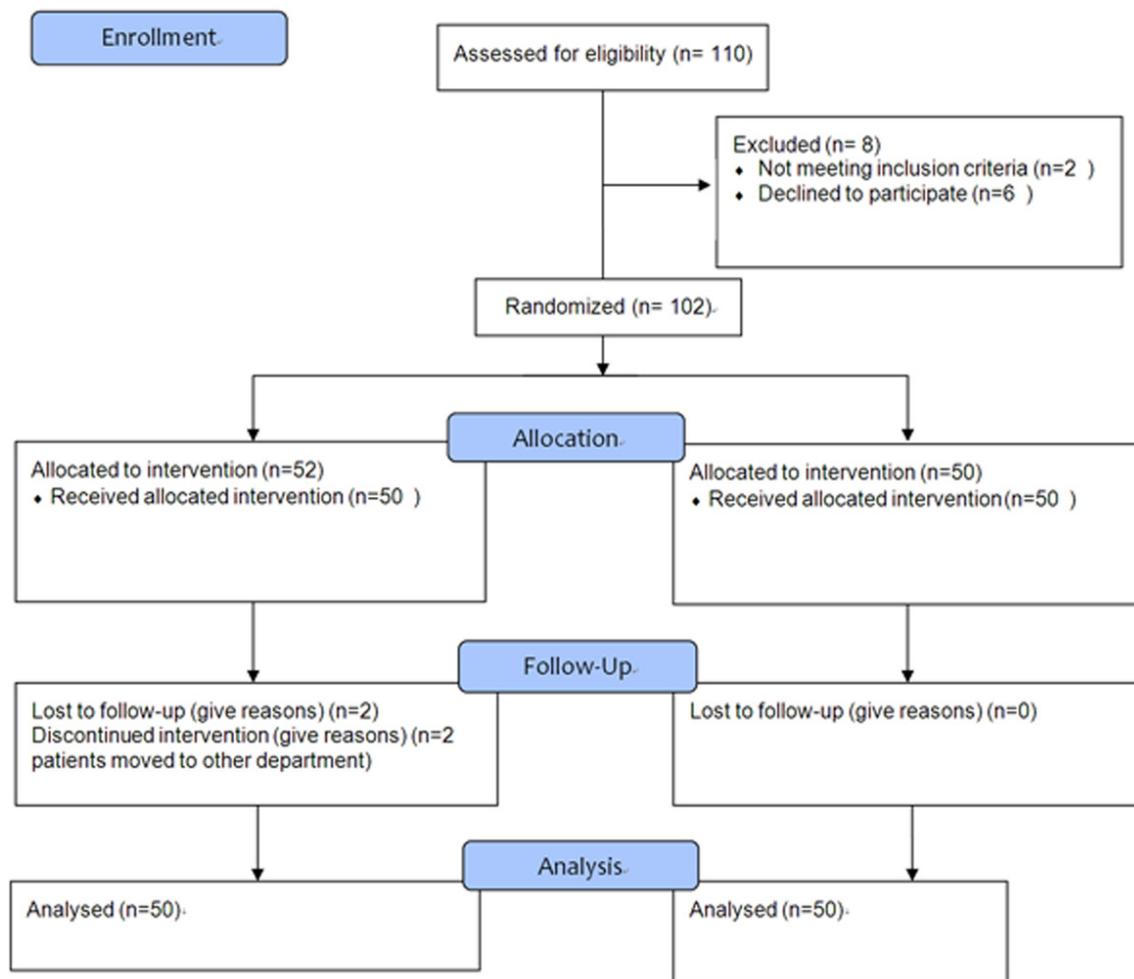


Figure 3. Flow Diagram (CONSORT).

the application area. Hand hygiene and disinfection were done before and after the application for preventing the risk of cross infections.

Application Number & Frequency: Acupressure sessions were applied as one session in a day

and for 3 days starting from the day that the patients came back to the clinic. All patients received the acupressure application to the selected points in this order: H7, P6, GB20, ST6 and application time was 16 minutes for each patient.

Acupressure on pain management after cardiac surgery

Table 1. Patient characteristics

Patient Characteristics		Intervention Group (N=50)		Control Group (N=50)		Total (N=100)		Homogeneity of Variances
		n	%	n	%	n	%	
Gender	Female	26	52	18	36	44	44	$\chi^2=2.59$ P=0.580
	Male	24	48	32	64	56	56	
	Total	50	100	50	100	100	100	
Age (Mean±Standard Deviation)		60.62±8.29		58.24±9.27		59.43±8.83		t=1.35
		Min: 39		Min: 31		Min: 31		P=0.158
		Max: 82		Max: 78		Max: 87		F=0.038
Marital Status	Single	4	8	5	10	9	9	$\chi^2=0.122$ P=1.000
	Married	46	92	45	90	91	91	
	Total	50	100	50	100	100	100	
Educational Level	Elementary school & lower	35	70	42	84	77	77	$\chi^2=2.767$ P=0.153
	High school & higher	15	30	8	16	23	23	
	Total	50	100	50	100	100	100	
Surgery Type	CABG	16	32	14	28	30	30	$\chi^2=1.224$ P=0.747
	Valve Surgery	16	32	13	26	29	29	
	CABG & Valve Surgery	9	18	13	26	22	22	
	Aorta Surgery	9	18	10	20	19	19	
	Total	0	100	50	100	100	100	
Body Mass Index (BMI)		28.59±4.29		27.74±3.42		28.16±3.88		t=1.088
		Min: 17.63		Min: 16.42		Min: 16.42		P=0.279
		Max: 42.61		Max: 34.38		Max: 42.61		F=1.371
Regularly Smoking	Yes	34	68	39	78	73	73	$\chi^2=1.268$ P=0.368
	No	16	32	11	22	27	27	
	Total	50	100	50	100	100	100	

Application Position: Acupressure sessions were done while the patients were comfortably laid down or sitting in their bed.

Limitations of the study

According to the regulations of the ethical committee, the researchers didn't interfere to the routine analgesic treatment policy of the clinic.

Data analysis

Data were analyzed by using SPSS 21 package programme. Homogeneity of the data was tested by using homogeneity of variance test (ANOVA and Levene Tests) and the significance of the data evaluated in 0.05 level. Depends on the homogeneity of related data, parametric and non-parametric tests were used. Relation of the data was tested by using chi-square test, independent sample t-test. Changes in the average pain scores during repetitive acupressure sessions were evaluated by using multiple

variance analysis. Effectiveness of acupressure on pain management was tested by using linear regression analysis.

Results

The experimental and control groups were distributed homogeneously according to their socio-demographic characteristics, surgery type, body mass index, and smoking habits (Table 1). Most of the patients were middle aged, over weighted, married and had low education levels. Many participants stated that they were smoking regularly before the surgery. Coronary Artery By-pass Graft (CABG) and valve surgeries were found as the most common cardiac surgeries (Table 1). Among the patients in the intervention group, the level of pain before the acupressure application (4.46 ± 1.19) decreased significantly (2.60 ± 0.85) following the last acupressure application on the 3rd day ($P < 0.001$) (Figure 1); additionally, in relation to the linear regression analysis the effectiveness

of acupressure on pain management was found 59.2% ($P < 0.001$, $F = 30.386$, $B = 1.422$, $R = 0.782$). Meanwhile in the control group, the level of pain on the 1st postoperative day in the clinic (4.30 ± 1.19) decreased slightly (3.92 ± 1.08) on the 3rd postoperative day in the clinic ($P > 0.05$) (**Figure 1**).

Discussion

In this study, acupressure application decreased the level of pain significantly after cardiac surgery. Therefore, the authors call the attention to the usage of acupressure as a safe method for the management of pain after cardiac surgery. Positive attitude and beliefs of the patients may increase the success of this procedure. On the other hand, when the advantages and disadvantages of medical treatment for symptom management and its economic cost are considered together, methods related to complementary medicine gain more importance [18]. Until today, the positive effect of acupressure on physical health was explained both traditionally and scientifically. Increase in the number of studies in this area will increase the number of scientific justifications. In this study, the authors aim to bring new information to the literature about the relationship between acupressure and pain management, and to contribute positively to the healing process of cardiac surgery patients by increasing the success of pain management after cardiac surgery.

Acupressure application was done to H7, PC6, GB20, and ST6 points and the researchers didn't interfere to the routine analgesic treatment policy of the clinic. When compared to the control group, pain scores given by the patients before the acupressure application were decreased significantly in the intervention group (**Figure 1**). According to the linear regression analysis, acupressure application had a significantly effectiveness (59.2%) on the management of pain after cardiac surgery. The effect of acupressure on pain management is explained by the transmission of the pressure stimulus to the central nervous system and activation of the pain control system. According to the gate-control pain theory, the mechanical effect over the fascial tissue stimulates alfa-beta (α - β) fibers and stops nociceptive transmission. The increase in the levels of certain neurotransmit-

ters (e.g. beta-endorphin, enkephalin, serotonin, and noradrenaline) in central nervous system and in blood plasma shows analgesic, sedative and, anxiolytic effects [24-29].

This seems to be the first study which investigated the effect of acupressure on pain management among cardiac surgery patients. Therefore, there aren't any literature findings that can be compared with our findings. However, in the related literature, Wang and Keck demonstrated that after 2 minutes of bilateral hand and feet massage (*reflexology*) during postoperative period, pain score decreased from 4.65 ± 1.93 to 2.35 ± 1.87 [20]. Coura et al. Applied electro-acupuncture to LI4, LI11, LR3, ST36, PC6, TE5 points before the cardiac surgery, and found that postoperative pain decreased significantly [21]. Even if these studies worked on reflexology and electro-acupuncture, each technique has similar basis with acupressure. Therefore, it can be said that these findings were parallel to the findings of this study.

However; Ai et al. Reported that the patients who had cardiac by-pass surgery had better psychological recovery with complementary methods such as praying, massage etc [30]. Also; Bauer et al. Investigated the effect of massage on pain and anxiety levels after cardiac surgery and reported a -1.5 ± 1.7 points of decrease among the intervention group while the decrease in the control group was only -0.4 ± 1.4 points [31]. In a similar study of Cutshall et al. The effect of body massage was investigated after cardiac surgery and pain scores of the intervention group was decreased 2.3 ± 2.44 after body massage in the intervention group, while this change was only -0.4 ± 1.45 in the control group [32].

Before any conclusion we should declare our limitation; as the researchers couldn't interfere to the routine analgesic treatment policy of the clinic in order to follow the regulation of hospital's ethical committee, all the results of the study were assessed under this circumstance. Even if this makes the effectiveness of the application questionable, the significantly positive decrease in the moderately high pain scores after acupressure application should be considered as an effective outcome.

Implications for clinical practice

Consequently, the study showed that acupressure application done to H7, PC6, GB20, and ST6 points significantly decreased pain after cardiac surgery. As acupressure is an easy, safe and effective method, it can be used independently by health professionals [34]. On the other hand, in parallel with the national and international literature research, it can be said that this study was the first to show the effect of acupressure on pain management after cardiac surgery. Therefore, for the future studies in this subject, well-designed large-scale studies should be conducted to enrich the related literature and influence the health professionals working in clinical settings.

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Disclosure of conflict of interest

None.

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Acupressure on pain management after cardiac surgery

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