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Effect of Preferred Music Listening on Pain Reduction in Mechanically Ventilated Patients After Coronary Artery Bypass Graft Surgery

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Abstract

Background: Pain is a symptom of discomfort or tissue injury experienced by patients. Among patients in intensive care unit (ICU), pain is a common phenomenon.
Objectives: The purpose of this study was to evaluate the effect of preferred music listening on behavioral measures of pain, as an indicator of pain assessment, in patients undergoing coronary artery bypass graft surgery (CABG).
Patients and Methods: This blinded clinical trial was performed on 60 patients admitted to ICU following CABG. Patients intubated and those under mechanical ventilation were unable to report their pain. The study population was randomly divided into two groups of control and music intervention groups (preferred music listening). In the intervention group, preferred music (including classical, instrumental and traditional music as well as Quran recitation) was played via a headphone for 30 minutes. In the control group, patients were in bed at the same time and only mute headphones were used. The pain levels of patients were assessed at three time intervals; a) during rest, b) 10 minutes prior to receiving music, following a painful procedure (e.g., change of position for dressing change) and c) in the final 3 minutes of music following a painful procedure using the method of "critical care pain observation tools" (CPOT).
Results: The mean pain behavior scale score 10 minutes prior to receiving music, following a painful procedure, was 2.77 ± 1.04 in the music intervention group and 2.33 ± 1.12 in the control group. The score increased after a painful procedure compared to that before the procedure in the control group and reached 2.67 ± 1.124; this increase (0.34 unit) in the control group was statistically significant ($P = 0.008$). In contrast, the score in the music intervention group dropped to 2.20 ± 1.06 and statistical tests showed a significantly reduced pain behavior scale score in the music intervention group ($P < 0.001$).
Conclusions: The results of this study showed beneficial effect of preferred music listening on reducing pain sensation during painful procedures in intubated patients after CABG.

Keywords: Coronary Artery Bypass Graft Surgery, Pain, Music, Tracheal Intubation

1. Background

Despite the emphasis on prevention and modification of risk factors, cardiovascular diseases currently constitute the most common cause of universal deaths (1). According to the estimates of the world health organization (WHO), heart diseases would be the leading cause of death in 2020 worldwide (2).

Despite advances in new therapies such as thrombolytic therapy, angioplasty with balloons, laser and atherectomy, heart surgery is still the treatment of choice for many patients (1). Coronary artery bypass graft surgery (CABG) is a common treatment modality to relieve angina and augment the level of activity, quality of life and life expectancy in patients with coronary artery disease (3). Because of the nature of this type of open-heart surgery, patients usually experience postoperative pain caused by the incision of sternum, incision and extension of the tissue, extraction of veins, embedding of drains and chest tubes and multiple other surgical factors (4). Forty-six percent of patients report moderate-to-severe postoperative pain, mostly relating to dressing change (5). Indeed, despite the frequency of heart surgery and increased knowledge about pain and pain management, patients still have no significant pain reduction after surgery (6).

Untreated pain can have complications in multiple systems such as endocrine, cardiovascular, respiratory, neural and musculoskeletal systems (7). The complications

include sympathetic stimulation, hypertension, tachycardia, imbalance between supply and oxygen demand in the heart muscle, ischemia/infarction and ultimately increased mortality and morbidity (8). Moreover, uncontrolled postoperative pain leads to an increased need for mechanical ventilation, prolonged hospitalization period, agitation due to inability to communicate and ultimately increased health care costs for patient and society (9). It is therefore vitally important to identify and assess pain meticulously by health care providers (8).

Postoperative pain management encompasses efforts to lessen painful symptoms, improve the quality of recovery and ensure the continuation of normal everyday activities (10). Patients in intensive care unit (ICU) in critical condition are not able to communicate because of a variety of reasons including changes in consciousness level, mechanical ventilation and sedative drugs; all of which can result in inadequate pain management and intervention on the part of health care providers (8).

There are pharmacological and non-pharmacological methods for pain control. Since pain medications are expensive and have adverse effects on cardiovascular system, there has been an added interest in delving into non-pharmacological methods for pain control (11).

These non-pharmacological methods of pain relief comprise behavioral pain treatment methods, including relaxation techniques and music therapy (12). Listening to music is a low-priced noninvasive method with low complications that can be used successfully as a safe nursing intervention in the hospital (13). McCaffrey et al. (13) claimed that music can be used as a method to distract patients from pain by allowing them to focus on something other than pain, thereby making pain more tolerable. The authors suggested that this method is effective in short painful procedures (13).

It is believed that music strengthens the immune system, increases comfort and improves vital signs (11). Research shows that pain is alleviated by music in patients with cancer and those after surgery (14-16). A study by Stratton and Zalanowski (12) showed a significant correlation between the degree of relaxation and willingness to listen to music. The success of music intervention may be largely enhanced by selecting music based on patient's preference, previous familiarity and cultural backgrounds. In addition, favorite music confers a sense of control over an environment that is unfamiliar to patients. Characteristics, traditions, language, culture, geographical location, economic status, religious belief and education affect an individual's response to music. Factors affecting the choice of music include culture, previous familiarity and experience with music and music structure (12).

2. Objectives

In the present study, the effect of preferred music listening on pain reduction in mechanically ventilated patients following CABG was investigated.

3. Patients and Methods

This clinical trial was performed in 2014 on 60 patients admitted to the cardiac surgery ICU in a referral hospital. The inclusion criteria consisted of age over 18 years, intubation, inability to communicate verbally, nonemergency CABG through sternotomy, lack of facial injuries, first-time admission to the cardiac surgery ICU, signs of stable hemodynamics (systolic blood pressure > 90 mmHg, heart rate between 60 and 120 bpm, absence of any dangerous dysrhythmias), ability to follow verbal orders, recovery from anesthesia (about 3 to 5 hours after admission to the ICU), no hearing problems, no quadriplegia and no ear bandage. The exclusion criteria were constant use of sedative or analgesic drugs or muscle relaxant drugs during the study period, cardiac arrest and cardiopulmonary resuscitation in the operating room, chronic pain and unwillingness to continue cooperation.

Data collected via interviews, self-report and medical records. Additionally, information was obtained by recording patients' data and using a demographic questionnaire (personal characteristics of patients and their disease), the Richmond agitation-sedation scale (RASS) and a pain checklist (using the critical care observation tool (CPOT) with a score of 0 to 8). The pain scale form for CPOT incudes 4 items of facial movement, body movement, muscle tune and acceptance of mechanical ventilation in tracheal intubated patients and sound making of non-intubated patients and has two points for each item, 8 points in total. Zero for no pain and eight for the maximum amount of pain.

The study protocol was approved by the institutional ethics committee. The patients fulfilling the study criteria completed an informed consent form after having received comprehensive information on the research methods and music therapy protocol. The samples were randomly divided into two groups of music intervention and control. All patients received morphine sulfate 0.1 mg/kg for pain severity > 4 in CPOT score in the first postoperative day.

The day before surgery, patients' demographic data were recorded through interviews and medical records (Table 1). On the day of operation, 4 to 5 hours after transferring patients to the cardiac surgery ICU, it was first ascertained that the effects of sedative and anesthetic medications had decreased and that the patients were able to

perform verbal commands; thereafter, patients' pain was evaluated once at rest and once immediately after a painful procedure in the both groups by means of pain behavior scale. The patients in the music intervention group had their selected music played for 30 minutes and the painful procedure was performed in the final 3 minutes of music, while the control group rested in their beds without any intervention before the painful procedure during this time (with headphones in their ears with no sound). The patients' pain following the painful procedure was evaluated in the both groups using the pain behavior scale. Other information relating to the patients' surgery was recorded by visiting patients and their medical records (Table 2). The data entered statistical package for the social sciences (SPSS), version 21 and analyzed using descriptive and inferential statistics. Kolmogorov-Smirnov test was used to check normal distribution of variables; Mann–Whitney U test, chi-square test and Friedman test were used to analyze nonparametric variables and independent samples t-test and paired t-test to compare continuous variables between the groups and before/after the painful procedure. The statistical significance was considered as a P value $\leq$ 0.05.

4. Results

Seventy-one patients were enrolled in the study. All patients underwent CABG and were conscious but intubated and not able to report their pain. Of total 71 patients, 11 patients (4 patients in the control group and 7 patients in the music intervention group) were excluded due to an increase in the dose of sedative drugs during the study. Thus, the study was performed on 60 patients. The samples were randomly divided into two groups of intervention and control. Of total 60 patients, 47 (77.1%) patients were male and 13 (22.9%) female. The mean age of subjects in the two groups were 60.63 $\pm$ 7.38 in the control group and 59.80 $\pm$ 8.24 in the music intervention group. According to patients' statements, mother language of most participants was Persian and most occasionally listened to music. Also, 53.3% of patients in the music intervention group chose to listen to Quran recitation. All demographic data and risk factors of the study population as well as surgical information are mentioned in Tables 1 and 2.

The mean pain CPOT score before the study at rest was 0.77 $\pm$ 0.74 in the control group and 0.60 $\pm$ 0.55 in the music intervention group. In the music intervention group, the mean pain behavior scale score 10 minutes before receiving music and following a painful procedure (e.g., dressing change) was 2.77 $\pm$ 1.04, while the mean score in the final 3 minutes of music following the same painful procedure was 2.20 $\pm$ 1.064 in this group. Friedman test showed a significant reduction in the mean pain behavior scale score in this group (P $<$ 0.0001). However, in the control group, the mean pain behavior scale score 10 minutes prior to the study following painful procedure of dressing change was 2.33 $\pm$ 1.124; whereas, the mean score in the final 3 minutes of having headphones without music following the painful procedure (i.e., dressing change) was 2.67 $\pm$ 1.124 in this group. Additionally, Friedman test showed a significant increase in the mean pain behavior scale score in this group (P = 0.008) (Table 3).

5. Discussion

Pain is an unpleasant sensory and emotional experience, which is still widely experienced by patients after surgery despite high frequency of heart surgery and increased knowledge about pain and its management. In most cases, pain is controlled by medication, which can have many disadvantages. In contrast, application of non-pharmacological pain management can prevent complications and create higher satisfaction in patients. The findings of the present study showed that preferred music listening reduced pain in our patients undergoing CABG, which further underscores the success of non-pharmacological methods of pain relief.

Comparing mean pain behavior scale score between the control group (0.77) and the music intervention group (0.60) before the study and during rest demonstrated that subjects in the two groups did not differ at baseline for pain behavior scale score (P = 0.274), which chimes in with the results of a study by Allred et al. (17) who reported a mean pain intensity score before the study of 52.4 $\pm$ 25.2 in the music intervention group and 56.4 $\pm$ 25.7 in the control group. In addition, the authors reported that their two groups were similar regarding pain intensity before the study. Their study showed a decrease in the mean pain intensity 20 minutes after the intervention by comparison with that before the intervention; a reduction of 11.2 scores in the intervention group and 1.3 in the control group.

Also in our study, the mean pain behavior scale score 10 minutes prior to receiving music following a painful procedure was 2.77 in the music intervention group and 2.33 in the control group. The pain behavior scale score increased after the painful procedure by comparison to that before the study in the control group and reached 2.67; this 0.34 rise in the mean pain behavior scale score in the control group was statistically significant. Nonetheless, this score in the music intervention group dropped to 2.20 and statistical tests revealed a reduced mean pain behavior scale score in the music intervention group (P $<$ 0.0001).

Table 1. Demographic Characteristics of Patients in Control and Intervention Groups[a]

Group/Specifications	Control	Experience	P Value (Chi-Square)
Gender			0.754
Female	6 (20)	7 (23.3)	
Male	24 (80)	23 (76.7)	
Marital Status			0.389
Single	0	0	
Married	28 (93.3)	26 (86.7)	
Widow	2 (6.7)	4 (13.3)	
Occupation			0.432
Employed	16 (53.3)	19 (63.3)	
Unemployed	0	0	
Retired	14 (46.7)	11(36.7)	
Education			0.945
Illiterate	4 (13.3)	8 (26.7)	
Elementary school	4 (13.3)	1 (3.3)	
Below high school diploma	13 (43.3)	10 (33.3)	
High school diploma	7 (23.3)	7 (23.3)	
College education	2 (6.7)	4 (13.3)	
Opium Use			0.371
Yes	9 (30)	6 (20)	
No	21 (70)	24 (80)	
Smoking			0.118
Yes	16 (53.3)	10 (33.3)	
No	14 (46.7)	20 (66.7)	
Music Listening Frequency			0.639
Everyday	0	3 (10)	
Sometimes	15 (50)	12 (40)	
Occasionally	10 (33.3)	11 (36.7)	
Rarely	4 (13.3)	3 (10)	
Never	1 (3.3)	1 (3.3)	

[a] Values are expressed as No. (%).

In a study by Jafari et al. (11) no significant difference was observed between initial pain score between the two groups, but repeated measurements by NRS tool showed that music significantly reduced pain (F, 16.31; $P < 0.0001$). This finding is consistent with the results of the current study.

In another study by Huang et al. (18) the intervention group had a lower score of pain than the control group and the score obtained from the VAS tool after the intervention was 1.5 scores less in the experimental group than that of the control group.

In a study by Mangoulia and Ouzounidou (19) about the role of music in promoting relaxation in patients in the ICU, a significant reduction in behavioral measures of pain was observed in the intervention group ($P = 0.000$) compared to the control group, which is in line with the present study.

Based on the findings of the current study and other similar studies, non-pharmacological methods of pain relief such as music therapy are relatively effective in reducing pain in patients undergoing CABG. Given that nurses play an important role in the diagnosis and management of patients' pain and spend more time with patients than other health team members, they should consider using this method.

5.1. Limitations

Our study population included only patients undergoing CABG at one center. Consequently, the results can be generalized only to this category of patients. Some of the behaviors in our patients may have been associated with anxiety and stress, but we considered them as indications of pain in evaluation of pain with tools. Taking into account that culture and pain threshold are different among people, these factors may have affected the results of the current study. On the other hand, our patients received

Table 2. Surgical Features of Patients Undergoing Coronary Artery Bypass Graft Surgery in the Control and Intervention Groups[a]

Group/Specifications	Control	Experience	P Value
Vein Harvest from Foot			0.601[b]
One side	27 (90)	26 (86.7)	
Two sides	3 (10)	3 (10)	
Neither	0	1 (3.3)	
Vein Harvest Site			0.077[b]
Above the knee	1 (3.3)	1 (3.3)	
Below the knee	26 (86.7)	19 (63.3)	
Above and below the knee	3 (10)	10 (33.3)	
Richmond Agitation-Sedation Scale Score			0.108[b]
+2	1 (3.3)	1 (3.3)	
+1	4 (13.3)	6 (20)	
0	1 (3.3)	6 (20)	
-1	3 (10)	4 (13.3)	
-2	8 (26.7)	4 (13.3)	
-3	13 (43.3)	9 (30)	
Drug Use Sedation			0.228[b]
History	5 (16.7)	2 (6.7)	
No history	25 (83.3)	28 (93.3)	
Pain Relief Medication			0.389[b]
History	2 (6.7)	4 (13.3)	
No history	28 (93.3)	26 (86.7)	
Surgical Information			
Surgery time, h	4.25 ± 0.58	4.26 ± 0.73	0.988[c]
Aortic clamp time, h	0.45 ± 0.19	0.55 ± 0.36	0.865[c]
Cardiopulmonary pomp time	1.13 ± 0.35	1.28 ± 0.46	0.209[c]
Ejection fraction, %	43.67 ± 8.60	41.67 ± 8.64	0.348[c]
Chest tube, N	2 (2 - 3)	2 (2 - 3)	0.76[c]
Grafts, N	3 (3 - 4)	4 (3 - 4)	0.02[c]

[a] Values are expressed as No. (%), mean ± SD, or mean (IQR).
[b] Chi-Square test.
[c] Mann-Whitney U test.

Table 3. Comparing the Mean Pain Behavior Scale Score Between the Two Study Groups Before and After Playing Music[a]

Group	Control	Experience	P Value (Comparing the Two Groups)
Pain Assessment Time			
Ten minutes before hearing music	2.33 ± 1.124	2.77 ± 1.04	0.084
Three minutes into music playing time (following a painful procedure)	2.67 ± 1.124	2.20 ± 1.06	0.087
Freidman test (comparison of time intervals)	0.008	< 0.0001	-

[a] Values are expressed as mean ± SD

standard analgesic (morphine sulphate) for pain scores more than 4 of CPOT tool, so all patients' pain scores were lower than 4 and close to each other, relatively.

5.2. Conclusions

The results of the present study can provide evidence for pain alleviation during painful procedures in intubated patients after heart surgery as a result of preferred music listening. Preferred music listening can reduce pain in patients through a diversion from pain and conversion of negative experiences into more enjoyable ones. The use of complementary nursing interventions such as music therapy plays an important role in pain relief. Given the importance of postoperative care and care in the ICU and due to the increasing need to improve the quality

of nursing care, application of this non-pharmacological, low-priced and effective approach is recommended with a view to reduce pain and ultimately improve the recovery process in these patients.

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