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The effect of nature-based sound therapy on shortening length of mechanical ventilation in Coronary Artery Bypass Graft surgery patients during the weaning from mechanical ventilation

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ABSTRACT

Aims: Weaning from mechanical ventilation is a frequent nursing activity in Intensive Care Unit (ICU). The aim of this study was to determine the effect of nature-based sound on shortening length of weaning from mechanical ventilation time in patients undergoing Coronary Artery Bypass Graft (CABG) surgery.

Methods: This is a quasi-experimental study in which 120 patients undergoing CABG surgery had participated. These patients were undergoing weaning from mechanical ventilator; they were randomly divided into two intervention and control groups of 60 subjects. The study was done in 2013. The intervention group listened to nature-based sounds through headphones, immediately after the first trigger, they listened to the sound at 20 min intervals until extubation. Data collection tools included a demographic- medical questionnaire and a researcher-made data recording sheet. Data analysis was done through descriptive and inferential statistical methods including independent t-test, chi-square and Fisher's exact test by using SPSS 16 software.

Results: Findings showed that the intervention group had significantly lower length of mechanical ventilation time than the control group ($p<0.001$).

Conclusions: The results showed that nature-based sound as a non-pharmacological treatment can be effective in shortening length of weaning from mechanical ventilation time and it can be helpful in this process.

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1. Introduction

Nowadays, cardiovascular diseases are the most common diseases in the human societies and the number of these patients is increasing in the recent decades [1]. Cardiovascular diseases are the main cause of death in the whole world; about 16 million deaths happen in the world annually because of coronary artery disease and 82 percent of them are happening in developing countries [2].

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One of the common treatments of cardiovascular diseases is CABG surgery [3]. Patients are hospitalized in ICUs about 5 to 7 days [4]. These patients suffer from many emotional and psychological traumas in the ICU. As the result, physiologic responses to stress increase epinephrine and norepinephrine hormones, which increases heartbeat rate and muscle blood flow and usually patient's other vital signs are increased too.

These increases are along with some risks for the patient such as increased myocardial oxygen demand due to increased heart activity. Also hypertension due to the above procedure may lead to rupture or leakage of the stitches and increased postoperative bleeding and even rupture of the grafts anastomosis [5, 6].

More than 90 percent of the patients in ICU need respiratory protection by mechanical ventilator [7]. The advent of mechanical ventilators for supporting oxygenation and ventilation in patients that cannot continue natural breathing could save many patients' life [8]. Although mechanical ventilation is mostly lifesaving, it can have some life threatening complications too [9].The important stage in ICU procedure is patient's weaning from mechanical ventilator; it can take forty percent of the mechanical ventilation duration [10].

Therefore it is necessary to cut mechanical ventilation in the shortest possible length of time [11].

Longer mechanical ventilation duration has inappropriate effect on duration of patient's weaning from mechanical ventilator, therefore shorter length of time of mechanical ventilation should be considered specifically for patient's weaning from mechanical ventilator. Effort for decreasing duration of using mechanical ventilation can have appropriate clinical outcomes for the patients [12].

If the patient's conditions help, weaning should be done very soon.Although cost of hospital stay in ICU in Iran is lower than other countries, it is high in compare with the average of Iranians' monthly earnings and the severe shortage of ICUs beds indicates the importance of this issue clearly [13-14]. Stress and agitation of the patients undergoing mechanical ventilation increases oxygen demand by cardiac, increased sympathetic system activity, emergence of tachypnea, tachycardia, neural and hormonal responses and hypertension and the above factors make weaning from mechanical ventilation more difficult [15].

Anxiety and stress cause problem in weaning from mechanical ventilation [16]. If weaning from mechanical ventilator is not managed well, this psycho-physical process may interfere with patient's recovery and hinder weaning from mechanical ventilation [15]; so that finding correct ways for shortening duration of hospitalization and patient's weaning from mechanical ventilator can be very helpful in decreasing healthcare costs and better planning for optimal use of available resources [17]. Patients talk about mechanical ventilator as a stressful, unpleasant and inhuman device; anxiety and agitation, which is one of the barriers in weaning from mechanical ventilator, suffers these patients frequently [18].

Among common non-pharmacological treatments, it can be pointed out to music therapy, praying, aromatherapy, guided visualization, muscle relaxation, meditation, massage therapy, cognitive therapy and doing exercise, which are used for relieving patient's anxiety. There has been great emphasis on non-pharmacological methods that decrease anxiety and stress since they are very appropriate and affordable, do not have any complications for the users and do not need skilled personnel [19]. Using complementary treatments are developing. There are many studies regarding music therapy and other relaxation methods and it has been cleared that decreasing anxiety is their most important effect. Many writers suggest that the selected music should be instrumental music that do not have any words to let the patients to concentrate on the music not the meaning of the words [20].

Using nature-based sound such as sound of birds, river and rain have been used since 1984 for treating anxiety, pain, patients undergoing

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mechanical ventilation and mood disorders [21]. Therefore, this study is done with the aim of determining the effect of sound therapy on the process of weaning (decreasing duration) from mechanical ventilator in patients undergoing CABG surgery.

2. Methods

The study population of this this semi-experimental is the patients undergoing CABG surgery that are hospitalized in Open Heart Intensive Care Units of Jamaran Heart Hospital in Tehran; it had been done from Novemebr 2012 to August 2013. Samples of this study were 120 patients undergoing CABG surgery; they have been randomly divided into two intervention and control groups. Samples of the study had been selected through purposive sampling via convenient samples. Inclusion criteria included: being under mechanical ventilation (both genders), being under elective CABG surgery, lack of drug and alcohol addiction, no hearing problem, no history of cardiac surgery, not suffering from a known mental illness, which is recorded in their medical records, being in the age range of 45 to 65 years old. Exclusion criteria included: serious hemodynamic disorder such as dependence on postoperative inotropic, active drainage and everything that hinders weaning process, emergency surgery or returning to the operating room because of any kind of reason, urgent need to relaxing and sedative drugs more than the common therapy protocol during intervention because of any kind of reason, changing in the mode of the device from the adaptive supportive ventilation mode to other available modes, high dependence on the positive inotropic after surgery and delay in the weaning process according to the physician's order.

There are some studies similar to this study, therefore the number of the required samples was achieved from one of the similar studies [25] by considering α=0.05,20%β , power = 80% and the counted standard deviation in the similar study that was 0.66 and by using Nomogram Altman, the required number was counted 60 people in every group.

The researcher took the permission from Medical Ethics Committee of the university one day before cardiac surgery and came to the study environment and took the written consent from the samples of the study after explaining the aims and the method of the study to them. Then the patients listened to the prepared album of the nature-based sounds and chose their favorite sounds. Samples randomization was done based on the last number of the file; so that even numbers were in the intervention group and odd numbers were in the control group. A researcher-made data recording sheet was used for collecting data; its validity was confirmed by five faculty members of nursing colleges of Tehran universities, demographic and clinical features of the patients such as; age, gender, marital status, education, occupation, history of diabetes, hypertension, high blood lipids and smoking, the number of grafts and left ventricular Ejection Fraction [EF], Fraction of Inspiratory oxygen (FIO2), extubation and weaning from mechanical ventilation. Monitoring of DATEX-OHMEDA S/5 model were used for recording the amount of vital signs at top of the patients' bed, and for recording mechanical ventilator settings, HAMILTON-RAPHEL XTC model was used in the two groups.

Data was recorded in the intervention group before the beginning of broadcasting nature-based sound and the intervention was started immediately after the beginning of the patient's first trigger and the patients listened to the nature-based sounds, which are according their personal interest by headphone and took a rest for twenty minutes, this procedure had been continued until the patients' extubation. Also data collection had been continued until twenty and then thirty minutes after extubation.

Broadcasting sounds in the intervention group was done by using MP3 player with leono brand through headphones and by considering the voice level between 25 to 50 decibels (calibration monitored by an audiologist). This

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process of intervention was done in the control group too, but after putting headphones on there was no sound broadcasting for the patients of this group.

Data analysis was done through SPSS 16 software and description of the variables of the study variables was done by using descriptive statistical methods and tables. Kolmogorov-Smirnov test was used for assessing distribution of quantitative variables in terms of being a normal distribution and determining appropriate test for doing analysis. Then by using independent t, chi-square and exact Fisher's tests demographic variables were compared and factors of the study were assessed. $p<0.05$ was statistically significant.

3. Results

The average age of the patients was 57.38±5.9 years old and there was no significant difference between the two groups in this regard ($p>0.19$); in terms of gender, 55 percent of the samples were male and 45 percent of them were female and there was no significant difference between the two groups in this regard too ($p>0.46$). Findings showed that 81.4 percent of the patients in the intervention group and 93.3 percent of the patients in the control group were nonsmokers ($p=0.09$).

There was no significant difference between the two groups in terms of clinical characteristics before intervention. Table 1 indicates that some cases such as the average left ventricular Ejection Fraction (EF), the average of Fraction of Inspiratory oxygen (FIO2), arterial blood pressure mean, the amount of peripheral blood oxygen saturation, heartbeat and respiratory rate were the same in the two groups [table 1].

15.7 percent of the samples of the control group were suffering from diabetes, but the average of suffering and not suffering from diabetes was the same in the intervention group ($p=0.085$). Most of the samples in both intervention: 58.30 percent and control: 51.70 percent groups were healthy in terms of suffering from HDL ($p=0.46$).Respectively 61.7 percent and 51.7 percent of the samples of the intervention and control groups were suffering from hypertension ($p=0.35$); there was no significant statistical difference in none of the above variables. None of the samples had the history of drug addiction and alcoholism. Most of the samples in the both groups were not suffering from dangerous cardiac dysrhythmia (PVC, AF), ($p=0.64$, $p=0.24$).

There was no statistical significant difference between the two groups in terms of drainage ($p=0.39$). The average of surgery duration in the intervention and control groups was respectively 2.56±61.34 and 2.47±55.78 hours,

Table1: Comparison of frequency distribution, mean clinical characteristics of the two groups before intervention

	Intervention group (n=60)	Control group (n=60)	Statistic and significant level
Weaning length of time (hour)	1.053±45.425	1.390±39.152	t= -4.349, df=118, p=0.00

Table2: Comparing weaning length of time in intervention and control group after intervention

	Intervention group (n=60)	Control group (n=60)	Statistic and significant level
Left ventricular Ejection Fraction	49.28±6.22	4.75±6.67	t=1.51, df=118, p=0.13
FIO2	42.28±4.39	43.18±7.99	t=-0.76, df=118, p=0.44
The level of TNG drug (Mg per minute)	19.18±7.91	20.30±14.51	t=-0.37, df=118, p=0.70
Mean arterial blood pressure	89.79±10.72	90.83±9.45	t=-0.56, df=118, p=0.57
Peripheral blood oxygen saturation	96.90±2.33	96.70±2.003	t=0.33, df=118, p=0.73
Heartbeat	100.37±13.07	103.70±8.82	t=1.63, df=118, p=0.10
Respiratory rate	17.63±4.42	17.70±3.50	t=-.0.09, df=118, p=0.92

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the average length of time that the patient is connected to cardiopulmonary bypass machine in the intervention and control groups was respectively 68.85±18.47 and 67.43±16.70 minutes. The duration average of aortic artery clamping in the intervention and control groups was respectively 44.61±16.50 and 45.46±15.10 minutes. The average of duration of patient's entry into the ward until the beginning of the intervention in the intervention and control groups was respectively 32.43±1.29 and 42.50±1.30 hours. The average of patient's stay in the open heart intensive care unit in the intervention and control groups was respectively 42.42±11.13 and 48.05±38.62 hours. There was no significant statistical difference in the two groups regarding the above variables.

Results of the independent t-test showed that duration of weaning from mechanical ventilator was reduced in the intervention group in compare with control group and it was statistically significant (p=0.001) (table 2).

4. Discussion

In this study we assessed the effect of sound therapy on the process (duration) of the patients' weaning from mechanical ventilator. The results showed that sound therapy has a positive effect on the criteria of weaning process; so that nature-based sound causes stability and normality of heart rate, respiratory rate, systolic and diastolic blood pressure, mid arterial pressure, increase of arterial oxygen saturation during weaning duration, and all of them are important in facilitating and certainty of successful weaning, since instability of every one of them is a barrier in weaning process and causes delay in this process. Also Zeidi et.al that assessed the effect of music on the vital signs and the percentage of hemoglobin oxygen saturation of the patients after open heart surgery achieved similar results that indicated decreased systolic blood pressure, heartbeat rate and mid arterial pressure and increased SPo2 level, but it didn't influence diastolic blood pressure and respiratory rate. Results of the study of Rouhi et.al also showed that music decreased mid arterial blood pressure in the patients before abdominal surgery, but it did not influence heartbeat and respiratory rate [22]. Also Maleki et.al, who assessed the effect of music therapy on physiologic indicators of the patients with brain injuries achieved that music therapy as an intervention increased arterial oxygen saturation and decreased pulse rate, respiratory rate, systolic and diastolic blood pressure in the intervention group in compare with control group (p<0.001) [23].

In this regard, nature-based sound could decease weaning duration in the intervention group in compare with control group through stabilizing weaning criteria and preparing required conditions for weaning. Brian et.al had conducted a study in 2010 about music therapy as an adjunctive therapy in managing patients' stress at during weaning from mechanical ventilator. Results indicated statistical significant decrease of anxiety physiologic symptoms (pulse and respiratory rate) (p<0.001, p<0.05) and increased patients and nurses' satisfaction, but music therapy did not influence in decreasing weaning days [16].

5. Conclusions

Results of this study indicated that by considering the benefits of decreasing mechanical ventilation duration and the importance of preparing the required conditions for the patients' earlier weaning from mechanical ventilator; safe and complementary therapies such as sound therapy can be used besides other therapies for earlier preparation of the patients for this process. It is hoped to decrease earlier weaning of the patients and speed up this process through getting help from complementary therapies. The study was along with limited number of the samples; it is recommended to conduct a study with more sample size.

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