

Effect of tactile and auditory stimulation on physiological parameters and sternal pain in post coronary artery bypass graft patients

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Abstract

Background: Cardiovascular disease is the most leading cause of increased morbidity and mortality. Coronary artery bypass graft surgery (CABG) has been known as an effective treatment for coronary artery disease that does not respond to pharmacological treatment. After CABG surgery, the patients experience moderate to severe postoperative sternal pain and hemodynamic instability. These may lead to subsequent complications that increase the length of hospital stay, cost, morbidity, and mortality rate. Tactile and auditory stimulation encompasses different techniques to control sternal pain and decrease physiological parameter alterations for post CABG patients. **Objective:** the current study is carried out to determine the effect of tactile and auditory stimulation on physiological parameters and the sternal pain among post CABG patients. **Design:** a quasi- experimental research design was used to fulfill the aim of the current study. **Setting:** The current study was carried out in the Open-Heart Critical Care Unit at Alexandria Main University Hospital which includes ten beds. **Subjects:** A convenient sample of 60 post CABG adult patients included in this study, they were conscious, able to communicate, and able to report their pain intensity verbally or nonverbally; 30 patients in each the intervention and control group. **Tools:** Two tools were used for data collection. Tool one: Socio-Demographic and Clinical Data Assessment, it was developed by the researcher, it consists of two parts. Tool two: Physiological Parameters and pain Assessment: It was used to assess the effect of the tactile and auditory stimulation on the physiological parameters and sternal pain, it consists of two parts. Part I was developed by the researcher, and part II was adopted from ([Lazaridou et al., 2018](#)). **Results:** The majority of the studied patients were males; their age were ranging from 50 to 60 years. Results of the study showed that there was a significant decrease in the sternal pain intensity and improvement in the mean scores of respiratory rates, spo₂, heart rate post tactile and auditory stimulation. **Conclusion:** Tactile and auditory stimulations were effective as non-pharmacological measures in reducing the sternal pain and improving the physiological parameters in the patients post CABG.

Keywords: Tactile stimulation, auditory stimulation, coronary artery bypass graft, sternal pain, physiological parameters.

Introduction

Cardiovascular disease is the leading cause of death worldwide. According to the WHO's World Health Statistics Report 2018, about 17.9 million people died from cardiovascular disease globally. Acute coronary syndrome is an atherosclerosis affecting the coronary arteries that are characterized by clinical symptoms such as chest tightness or pain,

shortness of breath, and fatigue ([Sanchis et al., 2016](#)).

Coronary artery bypass graft (CABG) surgery remains the gold standard intervention for patients with complex multi-vessels coronary artery disease. More than 800,000 patients undergo CABG each year over the world. After cardiac surgery, 86% of patients experienced acute severe pain, and 33%-75% of the patients suffer from

moderate to severe acute postoperative pain. Unrelieved postoperative pain can hinder patients' ability to cough and mobilize effectively, which leads to postoperative complications (Jin et al.,2020)

Opioids are routinely provided for severe postoperative pain, opioids are high-risk medications that can put the patients at risk for respiratory depression, and this leads to increased length of stay on the mechanical ventilator. The use of complementary non-pharmacologic intervention decreases the need for opioids and enhances analgesic effects. Non pharmacological interventions are mainly the role of the nursing staff to relieve sternal pain that helps to promote comfort and decrease physiological parameters alteration. Literature suggests that a combination of non-pharmacological intervention can reduce the sternal pain post CABG surgery (Priyasanthi et al., 2020).

Non-pharmacological interventions include massage which is considered one of the tactile stimulations that induces relaxation. Currently, it is used to control pain, stress, and anxiety. Massage therapy is an extended form of touch method that has been used for thousands of years to reestablish metabolic balance in soft body tissue. The massage components included petrissage, and friction ([Alimohammad et al., 2018](#)).

The second non-pharmacological intervention is auditory stimulation by listening to soft music. This intervention is an inexpensive and easily applicable that has no harmful side effects. Previous studies in surgical patients have found statistically significant useful effects of using perioperative recorded soft music on patients' anxiety, physiological parameters, and pain. However , these effects did not directly applied to patients undergoing open heart surgeries (Chandrababu et al., 2021).

Hence, the current study was conducted to determine the effect of tactile and auditory stimulation on physiological parameters and sternal pain among post CABG patients. Critical care nurses will be encouraged to use a combination of non-pharmacological interventions to control sternal pain post CABG and to decrease the harmful side effects that may result from using opioids analgesics.

Aims of the Study

This study aims to determine the effect of tactile and auditory stimulation on physiological parameters and sternal pain among post coronary artery bypass graft patients.

Research Hypotheses

- **H1:** Post coronary artery bypass graft surgery patients who receive foot and hand massage, and listen to soft music experience less sternal pain than those who do not receive foot and hand massage, and listen to soft music.
- **H2:** Post CABG patients who receive foot and hand massage, and listen to soft music exhibit stable physiological parameters than those who do not receive foot and hand massage, and listen to soft music.

Materials and Method

Materials

Design: quasi-experimental research design was used to conduct this study.

Settings: This study was conducted in the open-heart critical care unit at Alexandria Main University Hospital that includes ten beds. This unit receives the patients of postoperative coronary artery bypass graft surgery in the acute stage for direct care and supervision of the physiological parameters after the operation.

Subjects: A convenience sample of 60 post CABG adult patients who were conscious, able to communicate, and able to report their pain intensity verbally or nonverbally were included in this study. They were divided

into 30 patients in each of the intervention and the control group. The sample size was calculated by the power analysis using Epi Info program (expected frequency 50%, accepted error 10%, and confidence coefficient 95%).

Exclusion criteria:

- Patients with hands or feet amputation.
- Patients with hands or feet diseases such as arthritis, inflammation, phlebitis, edema, and burn.
- Patients with skin lesions on hands and feet such as actinic keratosis, allergic eczema, contact dermatitis, cellulitis, and blisters.
- Patients with hypersensitivity to hand and foot massage.
- Patients with hearing disorders

Tools: Two tools were used to collect data of the study:

Tool one: “Socio-demographic and clinical data assessment”

This tool was developed by the researcher after reviewing the related literature ([Asadizaker et al., 2011](#); [Rodrigues, 2018](#)). This tool was used to assess the patient socio-demographic and clinical data. It consists of two parts:

Part I: Demographic data that includes patients’ age, sex, marital status, occupation, and level of education.

Part II: Clinical data that includes patients’ medical and/or surgical history, history of hospitalization, postoperative analgesics, and supplemental oxygen used.

Tool two: “Physiological Parameters and pain Assessment”

This tool was used to assess the effect of the tactile and auditory stimulation on the physiological parameters and sternal pain in post CABG patients. it consists of two parts.

Part I: Physiological Parameters Assessment: It was developed by the researcher after reviewing the related literature ([Priyasanthi et al., 2020](#); [Mahmoudi](#)

[& Ebadi, 2019](#)). It includes assessment of physiological parameters as RR, SPO₂, HR, SBP, DBP, MAP, and GCS.

Part II: Visual Analogue Pain Scale: It was adopted from [Lazaridou et al., 2018](#). It was used to assess sternal pain of the patients with post CABG surgery. It is a horizontal ruler scale, the scoring system started from 0 to 10 to measure pain intensity, zero means that the patient has no pain, 1 to 3 mild pain, 4 to 6 moderate pain, and 7 to 10 severe pain.

Method

- Ethical approval from the ethical committee, at the Faculty of Nursing, Alexandria University was obtained. An official permission was obtained from the Faculty of Nursing Alexandria University to the administrative authorities of the Alexandria Main University Hospital to conduct the study. An official approval was obtained from the hospital administrative authorities to collect the necessary data from the selected setting after explaining the aim of the study. The developed tools were tested for content validity by five experts in the field of the study. The necessary modifications were done accordingly. Cronbach's coefficient Alpha statistical test was used to evaluate the internal consistency of the tool. The correlation coefficient was 0.859 for tool one and 0.872 for developed part of the tool two which was acceptable. The adopted part tested by the authors. A pilot study was carried out on six patients (10% of the sample) to assess the clarity and applicability of the tools. The necessary modifications were done prior to data collection .They were excluded from the study sample. Data were collected by the researcher during the period from October 2018 to August 2019. Post CABG patients were assigned randomly into two groups 30 patients in each the intervention and the control group.

Data collection:

For the control group:

- **First**, the data were collected from the control group.
- Patients' demographic data that included age, sex, marital status, occupation, and level of education were obtained from admission chart and recorded using part I of the tool one.
- Patients' clinical data that included patient's medical and/or surgical history, history of hospitalization, postoperative analgesics, and supplemental oxygen were obtained from admission chart and recorded using part II of the tool one.
- The control group received the routine nursing care by administering medications as opioids, verify the patient's oxygen saturation, check the ABG results, check the physiological parameters, educate patients how to perform deep breathing exercises, elevate the head of the bed, measure urine output to maintain renal function, daily dressing on sternal wound to prevent sternal wound infection, control hypothermia, control bleeding and repositioning.
- The researcher let the patients be rested in the bed for 20 minutes while she was bedside them (for emotional consideration).
- Then the researcher assessed the physiological parameters as RR, SPO₂, HR, MAP, and GCS using part I of tool two.
- After that the researcher assessed the sternal pain level by using the Visual Analogue Pain Scale using part II of tool two.
- Physiological parameters and the sternal pain intensity were assessed before and after twenty minutes from receiving the routine nursing care for the control group.

For the intervention group:

- The data were collected from the intervention group through three phases:

I- Preparation phase:

- **Patients' demographic data** including age, sex, marital status, occupation, and level of education were obtained from admission chart and recorded using part I of tool one.
- **The clinical data** including patient's medical and/or surgical history, history of hospitalization, history and postoperative analgesic used and supplemental oxygen were obtained from admission chart and from the patients and recorded using part II of tool one.
- Then the researcher washed her hands and prepared the environment. After that, the researcher put the patient in the semi-fowler position.

II- Intervention phase

1- Tactile Stimulation (Massage Session)

- The **petrissage** and **friction** massage were done.
- **Petrissage** was done by the researcher's balls of fingers and thumbs moved to perform **direct pressure** in a slow and rhythmic fashion to the soft tissue underlying the skin of the foot and hand, lift, roll, grasp, stretch, compress or squeeze the underlying tissue.
- **In friction**, researcher moved of the knuckles in an up-and-down motion to stroke the hand and foot.
- The above treatment repeated two times a day, with the interval of six hours and for two consecutive days for the same patients.

2- Auditory Stimulation (Music Session)

- Assessment was done by the researcher before application of the auditory intervention. The researcher asked the patient if he/she tried to listen to any type of music to relieve his/her pain, and which kind of music she/he preferred, if the answer was yes the researcher put on the device on the same type of the music that the patient used to relieve his pain with 60-80 beats per minute guidelines.
- Soft music was recommended to be used to relieve pain.
- This music recommended to be flowing and non-lyrical with 60- 80 beats per

minute (BPM), low tones, minimal brass percussion ([Jeffrey, 2017](#); [Citlik et al., 2018](#)).

- **If the patient did not use the music for relieving his/ her pain**, he/she was given a list of music that followed the 60-80 BPM guidelines.
- The patients were able to choose their preferred music from this list.
- Patient began to listen the music that she/he preferred for twenty minutes by using headphones which disinfected by the researcher before using.
- At the same time the researcher performed foot and hand massage for the same patient applying the foot and hand massage protocol. This step took twenty minutes, every extremity took five minutes.
- Both interventions were applied at the same time, twice a day for 20 min.

III- Evaluation phase:

- The physiological parameters assessed before and after the interventions, these data were recorded using part I of tool two.
- Visual Analogue Pain Scale was used to measure pain intensity before and after interventions using part II of tool two.

After that the researcher compared the results of the assessed values between the control and intervention group to determine the effect of the tactile and the auditory stimulation on the physiological parameters and sternal pain post CABG surgery for the intervention group.

Ethical considerations:

An informed written consent was obtained from the post CABG patients. It included the aim of the study, potential benefits, risks, and discomfort from participation in this study. The anonymity and privacy of the studied patients and confidentiality of the data were assured; voluntary participation and the right to withdraw from the study were emphasized before inclusion in the study.

Statistical Analysis

The raw data were coded and transformed into coding sheets, and entered into IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) using a personal computer. Categorical data were described using numbers and percentages. Chi-square test, Fisher's Exact, Monte Carlo correction, and paired t-test were used to analyze data of the current study. Finally, analysis and interpretation of data were conducted. The significance of the obtained results was judged at the 5% level.

Results

Table I: presents description of the intervention and control group according to their **demographic data**. It can be seen that 36.7 % of the patients in the **both** groups **aged** between 50- 60 years old with no statistically significant difference between the two studied groups ($\chi^2=3.920$, $^{MC}P=0.421$).

In relation to patients' **sex**, 60% of the studied patients were males in the intervention group, while it was 66.7% in the control group with no statistically significant difference between the two groups ($\chi^2=0.287$, $P=0.592$). concerning the **marital status**, it was found that **more than half** of the patients in the intervention (63.3%) and the control group (60%) were married with no statistically significant difference between the two groups ($\chi^2=0.607$, $^{MC}P=1.000$).

Regarding the **occupation**, the same table indicates that half of the patients in the intervention group (50%) and slightly more than half of the control group (53.3%) were working with no statistically significant difference between the two groups ($\chi^2=0.099$, $P=0.952$ Chi square). In relation to the **level of education**, it can be noted that 26.7% of patients in the intervention group graduated from the university, while 30% of patients in the control group graduated from secondary school with no statistical

significance difference between the two groups ($\chi^2=1.321$, $^{MC}P = 0.969$).

Table II: reveals description of the intervention and control group according to their **clinical data**. All the patients in the two studied groups (intervention and control) had history of **cardiovascular** diseases, while 20% of the intervention and 16.7% of the control group had history of **gastrointestinal** diseases with no statistically significant difference between the two groups ($\chi^2=0.111$, $^{FE}P= 0.739$). The same table presents that half of the patients in the intervention group (50%) had **pervious hospitalization**, and 43.3 % of the patients in the control group had pervious hospitalization with no statistically significant difference between the both groups ($\chi^2=0.268$, $P= 0.605$).

Table III: illustrates comparison between the intervention and control group by the mean values of the **physiological parameters** before and after application of the tactile and auditory stimulation to the intervention group post CABG. Statistical significant changes were found between the intervention and control group in the following parameters: respiratory rate, saturation of peripheral oxygen (SPO₂), and heart rate {(t= 4.684, P= <0.001), (t= 2.480, P= 0.016), (t= 4.664, P= <0.001) respectively}.

The mean respiratory rate was changed from 23.96 ± 2.51 to 21.14 ± 2.18 in the intervention group and from 24.26 ± 2.29 to 23.92 ± 2.40 in the control group, the SPO₂ was changed from 93.20 ± 1.47 to 95.33 ± 0.94 in the intervention group and from 93.74 ± 1.03 to 94.69 ± 1.04 in the control group, while the heart rate was changed from 85.96 ± 7.56 to 71.98 ± 5.99 in the intervention group and from 82.23 ± 10.13 to 82.01 ± 10.14 in the control group.

Table IV: shows comparison between the intervention and control group in relation to the **sternal pain** post CBAG before and after tactile and auditory stimulation to the intervention group. This was done by the mean values of the sternal pain intensity score. Statistical significant changes were

observed (t= 4.696, P= <0.001). The mean values of the sternal pain levels were changed from 7.76 ± 0.54 to 5.15 ± 1.68 in the intervention group and from 7.76 ± 0.92 to 7.02 ± 1.38 in the control group.

Discussion

Coronary artery bypass graft (CABG) surgery can cause moderate to severe postoperative sternal pain, and may lead to alteration of the physiological parameters. Moreover, if the pain and the physiological alteration are not treated properly, the patient may experience increased morbidity, longer hospitalization stay, and higher overall costs. It was documented that nurses play a vital role in controlling postoperative pain ([Lakshmi, 2021](#)).

The current study findings revealed significant decreased in the sternal pain intensity in the intervention group compared to the control group post CABG. The intervention group received a combination of non-pharmacological measures of tactile stimulation which included hand and foot massage, and auditory stimulation of listening to soft music. The control group received only the routine nursing care by administering medications as opioids, verify the patient's oxygen saturation, check the ABG results, and change patients 'position.

Foot and hand massage arouses the nerve fibers to produce pain-relieving endorphins. Since, feet and hands are complex surface areas of the body, with 7000 nerve endings in each foot and hand. Foot and hand massage may promote the unblocking of a terminal nerve by increasing pain modulation ([Málek et al., 2017](#)). Peripheral receptors on the body are stimulated with massage and stimulants reach the brain through the spinal cord. Foot and hand massage and neurons' stimulation may be a good technique for decreasing pain and increasing pain threshold ([Sayari et al., 2021](#)).

The current study results are in line with Sayari, et al (2021) who used foot massage to decrease chest pain and anxiety in

patients with acute myocardial infarction. The results of this study revealed that the severity of chest pain in the intervention group was significantly lower than the control group. In contrast, a study was done by Erzincanli and Kasar (2021) reported that there was no significant difference in the pain level of the intervention and control groups in venipuncture procedure pain by using hand massage.

Results of the current study for controlling postoperative pain indicated lower pain when listening to soft music combined with foot and hand massage. Previous studies reported that effective results can be accomplished with a combination of multiple measures in pain management by using pharmacological intervention with more than one measure of non-pharmacological interventions (Ay, 2018). Music listening acts as a distracter, directing the patient's attention away from negative stimuli (Gramaglia et al., 2019).

The positive effect of the soft music on pain relieve may be related to the music stimulation that have biological effects on the individual behavior from its effect on the brain functions involved in the memory, learning, and multiple motivational and emotional states. This effect is seen in the right hemisphere of the brain; also, the left hemisphere may play a main role in the analytical aspects of cerebral interpretation of the music. Auditory stimulation of music happens in the auditory center of the temporal lobe of the brain, which then signals the thalamus, midbrain, pons, amygdala, medulla, and hypothalamus. A study done by Yaman Aktaş, et al (2019) indicated that music therapy could be used as a non-drug therapy to reduce pain in patients with mechanical ventilation.

The present study revealed significant reduction in the respiratory rate, and heart rate. Moreover, significant improvement was observed in the SPO₂ in the intervention group when comparing these values with the control group before and after auditory and tactile stimulation. However, no significant

change in GCS and MAP in the intervention group in comparison with the control group after auditory and tactile stimulation. The researcher did not find studies that have investigated the effect of hand and foot massage on the physiological parameters for post CABG patients.

The current study is in line with the study done by Khaledifar et al (2017) which presented improvement in the diastolic blood pressure, heart rate, and respiratory rate in the intervention group, after massage before coronary angiography. In contrast a study done by Abbaszadeh, et al (2018) showed that there was no significant difference in the heart rate between the intervention and control group post foot massage in patient undergoing CABG surgery.

Opposite to the current study, a study conducted by Nilsson, 2009; in a [cardio-thoracic](#) intermediary unit, documented that there was no difference in the heart rate, respiratory rate, mean arterial pressure, arterial oxygen tension, arterial oxygen saturation, and subjective pain between the experimental and control group after listening music.

Although, the present study results revealed that there was a significant reduction in the respiratory rate, heart rate, and significant improvement in the SPO₂; no change was found in the GCS and MAP in the intervention group in comparison with the control group after listening to soft music as auditory stimulation for the intervention group post CABG.

These findings may be attributed to that soft music can have a direct influence on the brain edge and the brainstem reticular structure of the nervous system, decreasing sympathetic nervous system activity and increasing parasympathetic neural activity, decreasing the body's physiological response to stress, and decreasing cortisol level in the patient's body, thus stabilizing the patient's physiological parameters (Dai et al., 2020).

In line with the current study, Chlan and Halm (2013) pointed out that music therapy

would lower the heart rate by making comfortable feeling and relaxation for the patients. This effect is related to the Adrenalin level of blood. Another study supported the present study done by Karakul and Bolışık (2018) who reported that listening to music during the post-operative recovery period showed a positive effect on the pulse rate, and respiratory rate without any side effects.

Results of the current study revealed that the tactile and auditory stimulation are effective as non-pharmacological measures in decreasing sternal pain and decreasing physiological parameters except improvement of the GCS and MAP among post CABG patients. The tactile and auditory stimulation are safe and inexpensive non-pharmacological methods. Therefore, it is mandatory to update the critical care nurses' knowledge and improve their practice based on the evidence to improve the patients' clinical outcomes and safety and prevent the adverse effects of the pain and unstable physiological parameters.

- Provide the new guidelines about the techniques of the tactile and auditory stimulation to the health care providers.
- Conduct other research on a larger sample and in multi-centers for generalization.

Conclusion

Based upon the findings of the current study, it could be concluded that the use of tactile stimulation as foot and hand massage in combination with auditory stimulation as listening to soft music in the early days of postoperative CABG surgery, twice a day for 20 min was associated with positive results in the reduction of the sternal pain and improvement of the physiological parameters among CABG patients.

Recommendations

In line with the findings of the study, the following recommendations are made:

- Provide in-service training programs for the critical care nurses on how to use auditory and tactile stimulation for post CABG patients.

Table I: Description of the intervention and control group according to their demographic data.

Demographic data	Intervention (n = 30)		Control(n = 30)		Test of Sig.	P
	No.	%	No.	%		
Age (years)						
<30	1	3.3	3	10.0	$\chi^2=$ 3.920	^{MC} p= 0.421
30-<40	3	10.0	5	16.7		
40-<50	3	10.0	5	16.7		
50-<60	11	36.7	11	36.7		
≥60	12	40.0	6	20.0		
Min. – Max.	26.0 – 65.0		18.0 – 65.0		t=1.917	0.061
Mean ± SD.	53.87 ± 9.80		47.97 ± 13.72			
Sex					$\chi^2=$ 0.287	0.592
Male	18	60.0	20	66.7		
Female	12	40.0	10	33.3		
Marital status					$\chi^2=$ 0.607	^{MC} p= 1.000
Single	4	13.3	5	16.7		
Married	19	63.3	18	60.0		
Widow	4	13.3	5	16.7		
Divorced	3	10.0	2	6.7		
Occupation					$\chi^2=$ 0.099	0.952
Housewife	8	26.7	7	23.3		
Not working	7	23.3	7	23.3		
Working	15	50.0	16	53.3		
Level of education					$\chi^2=$ 1.321	^{MC} p= 0.969
Illiterate	4	13.3	4	13.3		
Read and write	4	13.3	4	13.3		
Primary	5	16.7	6	20.0		
Preparatory	2	6.7	2	6.7		
Secondary	7	23.3	9	30.0		
University and post graduate	8	26.7	5	16.7		

χ^2 : Chi square test, MC: Monte Carlo, t: Student test, *: Statistically significant at $p \leq 0.05$.

Table II: Description of the intervention and control group according to their clinical data.

Clinical data	Intervention (n = 30)		Control (n = 30)		χ^2	P
	No.	%	No.	%		
Patient's medical or surgical history	30	100.0	30	100.0	–	–
Cardiovascular disease						
Respiratory disease	3	10.0	3	10.0	0.0	^{FE} p=1.000
Renal disease	1	3.3	3	10.0	1.071	^{FE} p=0.612
Neurological disease	4	13.3	3	10.0	0.162	^{FE} p=1.000
Gastrointestinal disease	6	20.0	5	16.7	0.111	^{FE} p 0.739
Surgery	8	26.7	1	3.3	6.405*	^{FE} p=0.026*
Trauma/ Burn	4	13.3	0	0.0	4.286	^{FE} p=0.112
Others	0	0.0	2	6.7	2.069	^{FE} p=0.492
History of hospitalization						
Yes	15	50.0	13	43.3	0.268	0.605
No	15	50.0	17	56.7		

χ^2 : Chi square test MC: Monte Carlo FE: Fisher Exact t: Student test $p \leq 0.05$

Table III: Comparison between the intervention and control group by the mean values of the physiological parameters before and after application of the tactile and auditory stimulation

Physiological parameters assessment	Intervention (n = 30)	Control (n = 30)	T	P
	Mean \pm SD.	Mean \pm SD.		
Respiratory system				
Respiratory rate				
Before	23.96 \pm 2.51	24.26 \pm 2.29	0.484	0.630
After	21.14 \pm 2.18	23.92 \pm 2.40	4.684*	<0.001*
SPO₂				
Before	93.20 \pm 1.47	93.74 \pm 1.03	1.652	0.104
After	95.33 \pm 0.94	94.69 \pm 1.04	2.480*	0.016*
Cardiovascular system				
Heart rate				
Before	85.96 \pm 7.56	82.23 \pm 10.13	1.617	0.111
After	71.98 \pm 5.99	82.01 \pm 10.14	4.664*	<0.001*
Mean arterial blood pressure				
Before	110.53 \pm 8.36	107.67 \pm 7.37	1.405	0.165
After	102.38 \pm 6.90	105.59 \pm 9.87	1.463	0.149
Neurological system				
GCS				
Before	14.69 \pm 0.38	14.83 \pm 0.32	1.565	0.123
After	14.82 \pm 0.25	14.90 \pm 0.22	1.350	0.182

t: Student test, * Statistically significant at $p \leq 0.05$

Table IV: Comparison between intervention and control group by the mean values of the sternal pain intensity score before and after tactile and auditory stimulation

Pain score	intervention (n = 30)	Control (n = 30)	T	P
	Mean ± SD.	Mean ± SD.		
Before	7.76 ± 0.54	7.76 ± 0.92	0.000	1.000
After	5.15 ± 1.68	7.02 ± 1.38	4.696*	<0.001*

t: Student test,

* Statistically significant at $p \leq 0.05$

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