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Research Paper

The effect of slow deep breathing relaxation exercise on pain levels during and post chest tube removal after coronary artery bypass graft surgery

Mohamad I. Jarrah^a, Issa M. Hweidi^{b,*}, Sirin A. Al-Dolat^b, Hossam N. Alhawattmeh^b, Salwa M. Al-Obeisat^b, Lama I. Hweidi^a, Aysam I. Hweidi^a, Osama A. Alkouri^c^a Faculty of Medicine, Jordan University of Science & Technology, Irbid, Jordan^b Faculty of Nursing, Jordan University of Science & Technology, Irbid, Jordan^c Faculty of Nursing, Al-Ahliyya Amman University, Amman, Jordan

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ABSTRACT

Objectives: This study aimed to evaluate the effectiveness of slow deep breathing relaxation exercise (SDBRE) in reducing patients' pain levels during chest tube removal (CTR) post coronary artery bypass grafting (CABG) surgery.

Methods: In 2019, fifty post-CABG patients were conveniently selected from a cardiac intensive care unit in Jordan's major referral heart institute. The patients were randomly assigned to either an intervention group or a control group. A total of 25 patients were assigned into the experimental group who received slow deep breathing relaxation Exercise (SDBRE) alongside the conventional care before CTR. The remaining 25 patients constituted the control group (50%) that had CTR following conventional care. The Visual Analogue Scale (VAS) was used to measure the participants' pain levels during three phases: before CTR (Time 1), 5-min post CTR (Time 2), and 15-min post CTR (Time 2) to compare the intervention effect between the two groups.

Results: The data analysis findings for the control and intervention group of patients showed that there was a statistically significant decline in their pain level across time for both groups ($H = 32.71, P < 0.01$; $H = 47.23, P < 0.01$) respectively. The intervention group had significantly lower pain levels than the control group at Time 2 (3.50 [1.20, 5.30] vs. 7.90 [7.00, 9.00], $P < 0.01$) and Time 3 (0.00 [0.00, 1.30] vs. 3.60 [2.40, 4.10] $P < 0.01$).

Conclusions: Using SDBRE during CTR is an effective technique for reducing pain which can minimize the need for analgesics and their associated adverse effects.

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What is known?

- Pain management is considered a prime nursing role that could major impact patients' physical and psychological health outcomes.
- Pain during chest tube removal post coronary artery bypass grafting surgery is a common concern among patients.

- Slow deep breathing relaxation exercise (SDBRE) therapy is a potential technique that nurses could use in managing pain experienced by patients during chest tube removal post coronary artery bypass grafting surgery.

What is new?

- SDBRE effectively reduces pain levels during chest tube removal post coronary artery bypass grafting surgery.
- This technique is simple, non-invasive, inexpensive, time-saving, and risk-free.
- The use of SDBRE could minimize the complications associated with pain and hence increase patient satisfaction.

* Corresponding author.

E-mail addresses: mijarrah@just.edu.jo (M.I. Jarrah), hweidi@just.edu.jo (I.M. Hweidi), saaldolat15@nur.just.edu.jo (S.A. Al-Dolat), hnhawattmeh@just.edu.jo (H.N. Alhawattmeh), smobeisat@just.edu.jo (S.M. Al-Obeisat), lihweidi14@med.just.edu.jo (L.I. Hweidi), aihweidi15@gmail.com (A.I. Hweidi), o.alkoury@ammanu.edu.jo (O.A. Alkouri).

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1. Introduction

Coronary artery bypass graft surgery (CABG) is a surgical procedure in which the patient's veins or arteries are used to bypass the coronary arteries' narrowing area to restore normal blood flow to the cardiac muscle [1]. Immediately following CABG surgery, the patient is transferred to the intensive care unit (ICU) and is monitored through various medical devices, including electrocardiogram monitors, arterial and central lines, ventilators, and chest tubes [1,2]. Chest tubes are inserted into the pleural or mediastinal spaces after CABG surgery to remove fluid, air, and pus from the chest cavity and prevent potential cardiopulmonary complications [3–5]. However, ICU patients have reported chest tube removal (CTR) as an extremely painful and stressful procedure [4–9]. Pain experienced during CTR can result in deleterious neurohormonal and physiologic responses [2]. In turn, this stimulates catecholamines release and the activation of the sympathetic nervous system, causing hypertension, tachycardia, tachypnea, and increased cardiac oxygen utilization [2]. As a result, these changes may lead to left ventricular dysfunction and myocardial ischemia [4]. Moreover, pain post CABG surgery can lead to poor inspiratory efforts, which may contribute to postoperative pulmonary complications and ultimately compensate the health outcomes [2,7].

Moreover, unrelieved pain can trigger the hormonal stress response. This involves glucagon and cortisol release, associated with insulin resistance and hyperglycemia [2,4]. These changes and reactions are considered early vital indicators of the need for a pain control regimen [8,10]. Studies have shown that most postoperative patients experience moderate to severe pain [11,12]. Therefore, more focus needs to be placed on providing adequate pain management and preventing undesired outcomes [3,5].

For nurses, pain management is a major concern. Researchers have explored the effects of different non-pharmacologic techniques in controlling pain during CTR, including techniques such as music therapy, quick relaxation [13], foot reflexology massage [3], cold therapy [4,5,8,10], hearing a beloved person's voice [14], and slow deep breathing relaxation Exercise (SDBRE) [5,10]. SDBRE is among the simplest relaxation techniques nurses use in managing pain experienced by patients during CTR. It is also a non-invasive, inexpensive, time-saving, risk-free [15,16], and pain-relieving 5 to 15-min technique that involves inhaling air through the nose and exhaling it slowly with the lips semi-closed (pursed-lip exercise) [5,10,17]. Furthermore, the use of SDBRE can enhance response to pain, decrease negative clinical and financial outcomes, and minimize the use of analgesics and their associated side effects [18]. Further, it targets multiple dimensions of pain, including cognitive, behavioral, and affective dimensions [15,17].

The reviewed literature demonstrated the positive effects of breathing relaxation therapy on pain levels during CTR. Gorji, Nesami [5] conducted a randomized control trial study that aimed to compare the effects of cold therapy and relaxation on pain levels during CTR among patients who had undergone CABG surgery. The findings indicated that both interventions (relaxation and cold therapy) had an equal effect and that patients in both intervention groups experienced significantly lower pain levels than patients in the control group ($P = 0.001$). Similarly, an experimental study was carried out to compare the impacts of cold applications and breathing relaxation therapy on pain levels during CTR among 120 patients aged between 19 and 65 years [10]. The study findings showed that patients in the intervention group experienced a statistically significant reduction in pain levels over the three-time points (immediately, 15 min, and 30 min after CTR) as compared to patients in the control group, with $P < 0.001$ [10].

Furthermore, another study investigated the impacts of cold application and respiratory exercise along with acetaminophen on

pain level among patients after cardiac surgery. The results demonstrated that both treatment methods could decrease pain associated with CTR ($P = 0.001$) [5]. A more recent experimental research study of sixty patients was conducted to assess the efficacy of deep breathing relaxation therapy on pain levels during CTR following CABG. The study found that the pain levels in experimental group patients were significantly lower than those in the control group [7].

Despite the potential benefits of breathing relaxation therapy on pain during chest tube removal as demonstrated by previous studies, such studies have neither been employed in Jordan nor adequately addressed nurses' assessment and management of patients' responses [19]. Psychological and physical reactions, including pain, are underestimated and undertreated among critical care unit patients in Jordan [19]. Based on the available and accessible databases, it can be concluded that there are very few research studies that have investigated the effects of relaxation techniques on pain levels post CABG surgery among patients in Jordan. It is essential that nurses can identify pain levels among patients post-CABG surgery. It is also vital that nurses are aware of and able to use relaxation techniques and pharmacologic therapy to reduce the physical and psychological complications associated with pain [3]. Hence, there is a need to explore the importance of the role of nurses in using non-pharmacologic interventions to treat critically ill patients. Therefore, the present study aimed to examine the effect of relaxation therapy on reducing pain during CTR among post CABG surgery patients in Jordan. The study was guided by the following research questions: 1) Does SDBRE significantly affect patients' pain levels during CTR post-CABG surgery? 2) Are there significant differences in pain level based on patients' selected socio-demographic and other health characteristics during CTR post-CABG surgery?

2. Method

2.1. Research design

The current study is a quasi-experimental study with a repeated-measures design conducted over four months in 2019. Participants were conveniently selected from the targeted population and randomly divided into experimental and control groups to identify the differences in pain levels between the two groups.

2.2. Setting and sample

The study sample included fifty post-CABG surgery patients admitted to a cardiac ICU in a major referral cardiac center. This referral center is considered one of the region's most well-staffed and equipped heart institutes. Using G*power analysis, the minimum sample size required for this study was estimated to be 50 participants to avoid internal validity threats, particularly committing type I & type II errors. For the repeated-measures design, a medium effect size $f = 0.25$ provided a power of 0.95 to detect a difference at the 0.05 significance α level. A sample size of forty-two participants is needed, with an expected attrition rate of around 10%.

Consequently, an additional eight participants were recruited, resulting in a total sample of fifty participants who were then randomly assigned to the two independent groups. The potential participants included all patients at the targeted institute who met all the inclusion criteria to control for potential confounding variables. The inclusion criteria included being willing to participate; being of Jordanian nationality; being hemodynamically stable; being over 18 years of age; being fully conscious and oriented (as measured by the Glasgow Coma Scale), being able to

understand and follow commands, having no visual or auditory impairments, being a first-time CABG surgery patient, having had a chest tube for more than 24 h, and have not received opioids/analgesics within the 4 h preceding CTR. After obtaining the consent, the participants were randomly assigned to the two groups.

2.3. Ethical considerations

Before data collection, institutional review board (IRB) approval was obtained from Jordan University of Science and Technology (approval number 16/108/2017). Patients who met the inclusion criteria were invited to participate in the study, and written consent was obtained from each patient who agreed to participate. The researchers also provided verbal and written explanations of the study purposes, techniques, and possible benefits and harms for all potential participants. Moreover, all participants were assured that the collected data would be kept confidential and anonymous throughout the study.

2.4. Procedure

2.4.1. Intervention group

A total of 25 patients were assigned into the experimental group who received SDBRE alongside the conventional care (the same as the control group) before CTR. The breathing exercises included slow and deep inhaling air through the nose. Patients were also asked to put their hands on the abdomen, hold their breath for about 3 s, and then exhaling slowly through semi-closed pursed lips for at least 2 to 3 s, three times as long as inhalation. Breathing exercises consist of 10 deep breathing attempts with pursed lips exercises according to the American Lung Association guidelines issued in 2018 [25]. Patients in the intervention group initiated the technique 5 min before removing the chest tube. Then the patients were asked either to close their eyes or focus on an object inside the room. The patients were also instructed to focus on their breathing and relax simultaneously. While the patients continued with the relaxation technique, both the chest tube dressing and sutures were removed. Then the patient was instructed to hold their breath during CTR. Before receiving the SDBRE and after the patients' assignment, a physiotherapist who is an expert in relaxation techniques, specifically the deep breathing relaxation therapy, explained the purpose of the technique and the method of performance and then instructed the patients in the experimental group to sit down in a relaxed, straight back position supported by the bed, with their legs uncrossed [26]. The patients were then provided with verbal instructions and audiovisual materials explaining the method of performance of the technique by the physiotherapist. The participants were instructed to repeatedly carry out the breathing exercise for 15 min [5]. Training on how to perform the breathing exercise was provided to the participants at admission before CABG surgery. The physiotherapist had the participants repeat the interventional technique until they demonstrated that they could perform it correctly and effectively. The physiotherapist allowed the patients to ask questions during the teaching session of SDBRE.

2.4.2. Control group

Patients in the control group had CTR following conventional care that includes administration of moderate physician-prescribed NSAID analgesics following CTR as a medical protocol inside the target unit alongside the routine nursing activities that include patients' ongoing assessment (e.g., monitoring, reporting, and documenting vital signs and patients' physio-psychological

responses). The timings of the control group measurements and their tools were like those of the intervention group.

2.5. Data collection

The baseline pain measurement was taken on the day of CTR, and the intervention was initiated 5 min before CTR and throughout the subsequent two measurements. The second and third measurements were taken and immediately recorded 5 and 15 min after CTR.

The Visual Analogue Scale (VAS) was used to measure pain levels among the participating post-CABG surgery patients. The Pain VAS tool is a 100 mm horizontal line that indicates a continuum with "0 = no pain" at one end and "100 = greater pain" at the other. The VAS has proved valid and reliable in previous studies [20,21] and has been used in diverse studies to measure pain among patients who have undergone CABG surgery [5,10,22]. The scale has been shown to have good test-retest reliability which is higher among literate patients ($r = 0.94$, $P < 0.001$) than illiterate patients ($r = 0.71$, $P < 0.001$) [23]. The VAS is valid, simple, reliable, and sensitive [24].

Furthermore, physiological parameters, including heart rate (HR), blood pressure (BP), respiratory rate (RR), and oxygen saturation (SpO₂), were also measured at the time of data collection as additional measures of pain to establish homogeneity of the sample. These parameters were obtained from the cardiac monitors connected to the patients in both groups. As per hospital policy, the biomedical engineering department calibrates these monitors monthly to ensure data reliability and accuracy. Regarding SpO₂, the patients were connected to pulse oximeters, and the measurements were collected from the cardiac monitor screen.

2.6. Data analysis

The Statistical Package for the Social Sciences version 21 [27] was used to analyze the study data. The Shapiro-Wilk's test and the Histogram were used to examine the normality of the data. Descriptive statistics, including frequencies, means, standard deviations, median, and percentile 25 and 75, were used to describe the participants' demographic and clinical health characteristics. Bivariate analyses of chi-squared test of independence (χ^2), Fisher exact test, and independent groups *t*-test were also employed to identify any differences between the two groups based on the baseline measures. The Non-parametric Mann-Whitney *U* test was used to compare the patients' pain level between the patient groups at each time point due to distributional differences between the patient groups on their pain level. Also, the Kruskal-Wallis test was applied to the patients' pain level across time points for each group of patients separately, and comparison among time points in each group was achieved by pairwise comparison. Statistical significance level was considered at 0.05 level.

3. Results

3.1. The participants' demographic and clinical health characteristics

Most of the participants in both groups were male (62%), and 96% were married. The participants were aged between 39 and 83 years, with 36% aged between 60 and 69 years. As for educational level, 18% of the participants were educated to primary school level or below, 28% had either high school or college education, and 26% held undergraduate or postgraduate degrees. Regarding financial status, 20% of the participants had monthly household income of

below \$285, while 46% had monthly household income of between \$285–705. The results indicated that 84% ($n = 42$) of the patients had at least one or more comorbidities. Further, 52.4% of the participants had hypertension, 55% had diabetes, and 19% had confirmed diagnosis of heart failure. In addition, 60% of the participants were active smokers. Data analyses revealed no significant differences between the two groups at baseline measures (Table 1).

Most of the patients (48%) had left-side chest tubes inserted after their cardiac bypass surgery, 22% had right-side chest tubes, and 30% had pericardial chest tubes. On average, the participants' mean arterial BP, based on mean systolic BP 133.8 ± 15.0 mmHg and diastolic BP 74.1 ± 12.5 mmHg, was 93.98 ± 11.3 mmHg. The participants had a mean HR of 88.9 ± 13.6 beats/min and a mean respiratory rate of 24.1 ± 7.0 breaths/minute. Further, the mean oxygen

saturation was 97.4%, and the mean pain level score, as measured by the VAS, was 6.68 ± 2.6 out of 10. Measures of heart rate, respiratory rate, oxygen saturation, blood pressure (systolic, diastolic, and mean arterial BP) were taken at three-time points similar to pain level measurements. To identify any differences between the two groups based on clinical and demographic characteristics and medical history, the patients were assessed for any statistically significant differences in their characteristics and baseline measures, including pre-intervention pain.

3.2. Pain level

The data showed that the patients in the two groups did not differ significantly on their perceived pain level at Time 1 ($P = 0.148$).

Table 1
Bivariate statistical comparison of patient's demographic and past medical history and baseline measured physiological parameters between the two groups.

Variables	Intervention group ($n = 25$)	Control group ($n = 25$)	Test statistic	P
Sex				
Female	11	8	0.80	0.38 ^a
Male	14	17		
Age (years)	63.6 ± 9.5	61.1 ± 13.6	0.76	0.45 ^b
39–49	1	6	8.34	0.40 ^a
50–59	6	6		
60–69	13	5		
≥70	5	8		
Marital state				
Never married	0	2	–	0.47 ^c
Ever married	25	23		
Educational level				
Primary	4	5	4.63	0.20 ^a
High school	4	10		
College degree	9	5		
University degree or higher	9	5		
Monthly households' income (USD)				
<285	3	7	3.11	0.21 ^a
286–705	11	12		
706–1400	11	6		
Past medical history				
Hypertension				
No	13	15	0.33	0.57 ^a
Yes	12	10		
Diabetes mellitus				
No	11	16	2.01	0.16 ^a
Yes	14	9		
Heart Failure				
No	23	19	1.34	0.25 ^a
Yes	2	6		
Other comorbidities				
No	24	24	0.72	1.00 ^a
Yes	1	1		
Previous surgeries				
No	17	17	0.47	1.00 ^a
Yes	8	8		
Active smoker				
No	11	9	0.33	0.56 ^a
Yes	14	16		
Ex-smoker				
No	6	8	0.40	0.53 ^a
Yes	19	17		
Ex smoking years	23.3 ± 13.7	25.1 ± 9.4	0.30	0.78 ^b
Chest tube site				
Left	13	11	0.32	0.85 ^a
Right	5	6		
Pericardial	7	8		
RR, breath/min	24.4 ± 5.7	23.8 ± 8.3	0.32	0.85 ^b
HR, beat/min	93.6 ± 14.8	84.1 ± 10.5	2.61	0.12 ^b
Systolic BP, mmHg	136.1 ± 16.1	131.6 ± 13.8	1.10	0.30 ^b
Diastolic BP, mmHg	73.8 ± 11.4	74.3 ± 13.7	0.15	0.88 ^b
Arterial pressure, mmHg	94.6 ± 12.1	93.4 ± 10.7	0.36	0.72 ^b
SpO ₂	98.6 ± 1.5	96.1 ± 3.8	3.10	0.06 ^b

Note: Data are n or $Mean \pm SD$. ^a chi-squared test of independence; ^b t -test value. ^c Fisher exact test. 1 mmHg = 0.133 kPa. RR = respiratory rate. HR = heart rate. BP = blood pressure.

However, the control group of patients measured significantly higher pain level at Time 2 (7.90 [7.00, 9.00]) compared to the patients in the intervention group who performed the SDBRE (3.50 [1.20, 5.30]) ($P < 0.01$). Also, the patients in the control group measured significantly higher pain levels at Time 3 (3.60 [2.40, 4.10]) than the patients of the intervention group (0.00 [0.00, 1.30]) ($P < 0.01$). The test showed that there had been a statistically significant difference in the intervention group of patients' perceived pain level across the three-time point ($H = 47.23, P < 0.001$), and the pairwise comparison between each time points on the perceived pain level for the patients measured significantly higher pain level at Time 1 than at Time 2 ($P < 0.01$), also those patients had measured significantly lower pain level at Time 3 compared to Time 1 ($P < 0.01$), but also the patients had experienced significantly lower pain level at Time 3 compared to Time 2 ($P < 0.01$). The resulting data analysis findings for the control group of patients showed a statistically significant decline in their pain level across time ($H = 32.71, P < 0.001$). Pairwise comparison between each time points on the perceived pain level for the patients of control groups at Time 1 & Time 2 did not differ significantly ($P > 0.05$), but the pain level at Time 1 was found to be significantly higher compared to Time 3 ($P < 0.01$); also the pain level at Time 2 was found to be significantly higher than at Time 3 ($P < 0.01$). (Table 2).

4. Discussion

This study aimed to evaluate the effectiveness of the SDBRE in reducing patients' pain levels during CTR post-CABG surgery. A marked reduction in pain levels was present on the 2nd and 3rd-time measures after CTR post-intervention, which was the same extent as found in other similar investigations after CABG [5,7,10]. The analysis results showed that while patients in both groups experienced a significant decline in pain level, patients who received SDBRE experienced significantly faster pain relief than patients in the control group. The patients in the control group experienced a sharp rise followed by a decline in pain level immediately following CTR. Meanwhile, the patients in the intervention group experienced a fast decline in pain level from before CTR (Time 1) to the third point in time post CTR (Time 3).

In a similar vein, a quasi-experimental study showed that patients receiving breathing relaxation therapy experienced a statistically significant reduction in pain level over the three-time points (immediately, 15 min, and 30 min after CTR) as compared to patients in the control group, with $P < 0.001$ [10]. Gorji, Nesami [5] also reported similar findings in their randomized control trial study, which aimed to compare the effects of cold therapy and relaxation on pain levels during CTR among patients who had undergone CABG surgery. The findings indicated that both interventions (relaxation and cold therapy) had an equal effect. Patients in both intervention groups experienced significantly lower pain 15 min following CTR than patients in the control group ($P = 0.001$). However, the results indicated no significant differences between the intervention and control groups or between the two different groups (relaxation and cold therapy groups)

Table 2
Mann-Whitney U non-parametric test comparing the pain levels of patients' groups across the three time points.

Group	n	Time 1	Time 2	Time 3	H
Intervention group	25	8.00 (5.60, 9.05)	3.50 (1.20, 5.30)	0.00 (0.00, 1.30)	47.23
Control group	25	7.20 (4.50, 8.00)	7.90 (7.00, 9.00)	3.60 (2.40, 4.10)	32.71
Z		-1.33	5.22	5.18	
P		0.180	0.001	0.001	<0.001

Note: Data are Median (P_{25}, P_{75}). Time 1 = before chest tube removal. Time 2 = 5-min post chest tube removal. Time 3 = 15-min post chest tube removal. Intervention group: Time 1 vs. Time 2, $P < 0.01$; Time 1 vs. Time 3, $P < 0.01$; Time 2 vs. Time 3, $P < 0.01$. Control group: Time 1 vs. Time 2, $P > 0.05$; Time 1 vs. Time 3, $P < 0.01$; Time 2 vs. Time 3, $P < 0.01$.

immediately and 30 min after CTR [5].

Also, an RCT showed that deep breathing relaxation therapy significantly decreased pain levels during CTR following CABG compared to the regular treatment regimen utilized in the ICU. It was recommended that clinical institutions follow deep breathing relaxation therapy and pharmacological therapy guidelines during CTR to improve patient satisfaction and clinical outcomes [7]. A recent study supporting our study's findings showed that SDBRE might be an effective CTR pain management technique when used along with acetaminophen among cardiac surgery patients. Adopting this technique could minimize the need for analgesics to treat pain during CTR, therefore preventing the adverse effects associated with the use of analgesics, minimizing the potential pulmonary complication related to cardiac surgery, decreasing hospital costs, and decreasing hospital length of stay for patients [22,26,28].

The main theme underlying the current study findings, alongside other similar studies, supports the theoretical foundation that breathing relaxation therapy oxygenates body cells and tissues, promotes energy production, eliminates toxins, and increases feelings of calmness and relaxation through mental distraction [17,26,28]. This therapy subsequently leads to a decrease in the feelings of pain [26,28]. Thus, using this simple, non-invasive technique as a non-pharmacological nursing intervention would have several advantages and benefits inside clinical settings. Moreover, the results of the present study can be used to guide the development of nursing educational programs related to non-pharmacologic pain management, which would increase the effectiveness of care provided by nurses. Educating nurses and nursing students about pain, pain management techniques, and the advantages and disadvantages of different pharmacologic and non-pharmacologic treatment options. Increasing nurses' awareness of the various pain management techniques available increases their knowledge in the clinical field and allows them to better cooperate with other health team members in providing care. Also, our results may encourage nursing administrators and hospital policymakers to implement SDBRE as an effective pain management technique. Subsequently, our results may guide health policymakers in developing evidence-based practice guidelines for CTR pain management. In terms of research, this study has provided baseline data that can conduct future research related to non-pharmacologic pain management techniques among post-CABG surgery patients in Jordan.

5. Limitations

However, despite the significant findings, this study has several limitations. First, although the cardiac center in which this study was conducted serves patients from all regions in Jordan, a single setting limits the generalizability of the results. Second, convenience sampling was used to recruit participants from the total population, limiting the external validity of the results. Accordingly, it is highly recommended that the study be replicated using probability sampling techniques with case-control cross-match design to control for potential confounders and be conducted in

multi-center settings to improve the external validity of the findings.

6. Conclusion

The present study results have supported the use of SDBRE for managing pain during CTR. Healthcare providers must be aware of the importance of pain management and the advantages of adopting this intervention in their clinical practice. For patients, these advantages include reducing pain during CTR, maintaining the stability of vital signs, and ensuring better health outcomes and faster rehabilitation progress. Furthermore, SDBRE could minimize pain-associated complications, including potential pulmonary complications related to cardiac surgery, decreased mobility, sleep deprivation, depression, and fatigue, increasing patient satisfaction and quality of life. For nurses, the use of this technique could lead to the enhancement of their pain management abilities and their awareness of evidence-based practice in critical care units. This could ultimately lead to improving pain management practice protocols in hospitals. Further, this technique is a timesaving, cost-effective, and easy-to-learn pain management technique for nurses to adopt. In summary, the current study has provided evidence that SDBRE may be used in addition to pharmacologic therapy as an effective, inexpensive, time-saving, and risk-free non-pharmacological technique for pain management during CTR post-CABG surgery.

CRedit authorship contribution statement

Mohammad I. Jarrah: Conceptualization, Methodology, Funding acquisition, Writing-reviewing and editing. **Issa M. Hweidi:** Conceptualization, Methodology, Project administration, Writing-reviewing and editing. **Sirin Dolat:** Methodology, Investigation, Resources, Writing-original draft, Visualization. **Hossam Alhawwatmeh:** Conceptualization, Investigation, Formal analysis, Validation, Methodology, Data curation. **Salwa Al Obeisat:** Methodology, Writing-original draft, Resources, Data curation, Visualization. **Lama Hweidi:** Writing-original draft, Resources, Software, Validation. **Aysam Hweidi:** Software, Investigation, Validation, Formal analysis. **Osama Alkouri:** Software, Validation, Formal analysis.

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Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest

The authors have declared no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2022.03.001>.

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