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Review

Reducing Patient's Pain with Post Coronary Artery Bypass Graft (CABG) by Performing Foot Massage: A Systematic Review

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Abstract

Introduction: Pain is one of the typical symptoms experienced after a Coronary Artery Bypass Graft (CABG) procedure. It may cause alteration on patient's physical function, professional life, relationship and family, social life, sleep pattern, and mood. Foot massage is a complementary therapy performed by pressing the reflective area in the foot to release endorphins that could alleviate pain levels. This study aimed to review the effect of foot massage on pain levels among postoperative CABG patients.
Methods: A systematic review was conducted using five journal databases: ProQuest, ScienceDirect, Google Scholar, ClinicalKey Nursing, and Sage Journal. Several inclusion criteria were set to obtain eligible articles: published within the range of 2018 to 2022, written in English or Bahasa Indonesia, and enrolled patients in the first phase. These articles were subsequently evaluated using the JBI. Five eligible articles were finally included in the analysis.
Results: Findings revealed that the total number of respondents in this study was 331, with the majority of male patients (64.35%). Five articles demonstrated a significant effect of the foot massage intervention on pain management outcome in postoperative CABG patients, with a p-value ($p < 0.05$).
Conclusion: Foot massage can improve the hemodynamic status and alleviate pain among postoperative CABG patients. The feelings of relaxation and lower stress levels induced by the foot massage intervention are associated with the hemodynamic stability and lower pain level.

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INTRODUCTION

Coronary Artery Bypass Surgery (CABG) is an interventional procedure performed to restore coronary perfusion by constructing a bypass on blocked coronary arteries [1], [2]. CABG is considered a compelling procedure to improve the quality of life among patients with cardiovascular issues, both for their physical and mental wellness [3]. CABG surgery is generally suggested due to failure in the previous PCI procedure, impracticability to utilize the coronary arteries in the PCI procedure due to its anatomical structures, or immediate need to do surgical repair [4]. CABG has been widely performed in the clinical practice area, and it has been confirmed by the high incidence rate.

The high incidence of CABG procedure is reported worldwide and also in Indonesia. CABG procedures are performed at an average of 44 per 100,000 individuals globally [5]. In Indonesia, CABG is the highest number of cardiac surgery, with 516 cases in 2020 based on the annual report of the Harapan Kita Heart Hospital and Blood Vessel Center Hospital [6]. Unfortunately, this high incidence of CABG is not the only issue that requires further attention.

Pain is a typical issue undergone by the majority of patients after the CABG procedure [7]. Postoperative CABG pain occurs in the majority of patients, whereas 75% of patients have reported postoperative pain [8]. On the fourth day after the CABG procedure, 7% and 67% of patients experienced severe and mild to moderate pain, respectively. Only 26% of patients reported no pain symptoms after the surgery [9]. Pain among patients who undergone CABG surgery can persist for one year after the procedure [10]. This symptom of pain may cause varied physiological responses.

The response that appeared among postoperative CABG patients could manifest in varied ranges. It may arise as changes in breathing pattern, pulse rate, blood pressure, myocardial oxygen consumption, and cardiac output [8]. Pain also alters their physical function, professional life, relationships and family, social life, sleep patterns, and mood [11]. This situation signifies the essential role of pain management efforts among postoperative CABG patients.

Pain management is broadly established as one indicator of the high quality of nursing services, especially today [12]. A recent popular pain management modality is a complementary alternative therapy. Complementary and Alternative Therapy (CAT) is one of the alternative interventions that can be applied by nurses to alleviate pain and discomfort [13]. Roughly, around 32%-41% and 60%-75% of patients with chronic illness, respectively, have employed complementary medicine to manage their diseases [14]. In Indonesia, 32% of the community are still unaware of complementary therapies, only 2% integrated these practices into their life [15]. This situation shows the need to explore, introduce, and use complementary therapy practice in Indonesia.

Complementary therapy comprises a broad range of practices. The well-known pain management therapies are deep breathing, yoga, meditation, guided imagery, and foot massage [16]. Massage is deemed to

be a popular complementary therapy in Indonesia. Almost 70% of Indonesian have been exposed to massage therapy. Foot massage is one variety of massage in Indonesia [15].

Foot massage is performed and developed to reduce pain by pressing certain reflective areas on the foot according to various organs, glands, and other parts of the body to release natural analgesics, namely endorphins [17]. Foot massages have been demonstrating numerous health benefits in alleviating the pain levels. However, the exact point of the massage and physiological pathways in the human body remains unclear [18]. Further studies are necessary to obtain a shred of stronger scientific evidence to support foot massage interventions and enrich knowledge in this field [19]. Hence, this study was conducted to explore the effect of foot massage on pain levels among postoperative CABG patients.

METHODS

Eligibility Criteria

This study employed a systematic review method that discussed the effect of foot massage intervention on pain levels among postoperative CABG patients. The following inclusion criteria were used to acquire eligible articles in this study: (1) published in 2018-2022; (2) written in English or Bahasa Indonesia; (3) used intervention-based study design; (4) discussed the effectiveness or effect of foot massage on the pain level of postoperative CABG patients; and (5) enrolled participants who were acquiring care in inpatient units.

Information Source

Articles were systematically discovered through five journal databases, including ProQuest, ScienceDirect, Google Scholar, ClinicalKey Nursing, and Sage Journal.

Searching Strategy

The literature search was performed using the boolean operators (AND, OR, NOT) and was formulated based on clinical questions. Boolean operators in this literature search were written as "foot massage OR foot reflexology AND Pain Level AND CABG".

Article Screening

PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) was employed as a protocol to create a systematic, transparent, and complete analysis. Initially, 11,578 articles were discovered from the journal databases. Five eligible articles filtered by the screening and assessment process were eventually included in the final analysis. The article selection and screening process using PRISMA is shown in Figure 1.

Data Extraction and Critical Appraisal

The authors extracted the required information and determined the quality of the studies using the JBI (Joanna Briggs Institute) instrument. Five articles were finally obtained after an assessment of article eligibility. Data extraction was performed and presented in tabular form that represented the author, year of publication, method, intervention, and

outcome.

RESULTS

All articles included in the analysis were using intervention-based designs. Four articles employed the Randomized Control Trial (RCT), while one article used a quasi-experimental design. All studies aimed to assess or evaluate the effect of foot massage on pain levels among postoperative CABG patients.

The majority of articles used VAS (Visual Analog Scale) as the study instrument to assess the pain outcome. VAS comprises of 0 to 10 scale, in which 0 signifies no pain and 10 represents the worst pain. The reliability of the scale trials on the first and second postoperative days was 0.73 to 0.82 [20]–[23]. Only one article used BPS (Behavioral Pain Rating Scale) to assess the pain level. BPS had an internal consistency and reliability of Cronbach's alpha (r= 85)[[24].

Four studies only performed foot massage intervention, with no additional intervention added during the study. However, a study combined foot massage modality with educational sessions about self-management. The average duration of foot massage was 10-30 minutes. It was performed by using effleurage, petrissage, and friction techniques.

The total number of respondents obtained from all articles was 331. All respondents recruited were still requiring care in the inpatient units. The majority of them were adults or aged more than 18 years. Respondents were also dominated by male patients (213;64.35%). Only 118 female respondents (35.65%) were involved in the study. All studies revealed a significant effect of foot massage intervention on pain outcome after the CABG procedure ($p< 0.05$). The results of the article search are described in Table 1.

A recent review discovered two different methods to perform foot massage intervention. Four studies performed foot massages on both feet [20], [21], [23], [24]. However, one study conducted foot massage only on the left foot [22]. The frequency of foot massage intervention was also relatively different. One study delivered foot massage intervention only once on the second day after surgery [22]. Another study performed foot massages twice, on the second and fifth day after the surgery [21]. Further, a study explained that foot massages were given in three consecutive days after the surgery, without mentioning which day specifically [24]. A study conducted foot massage intervention in two sessions per day between morning and night [20]. Additionally, a study gave foot massage in three sessions: on the second, third, and fourth day after the surgery [23].

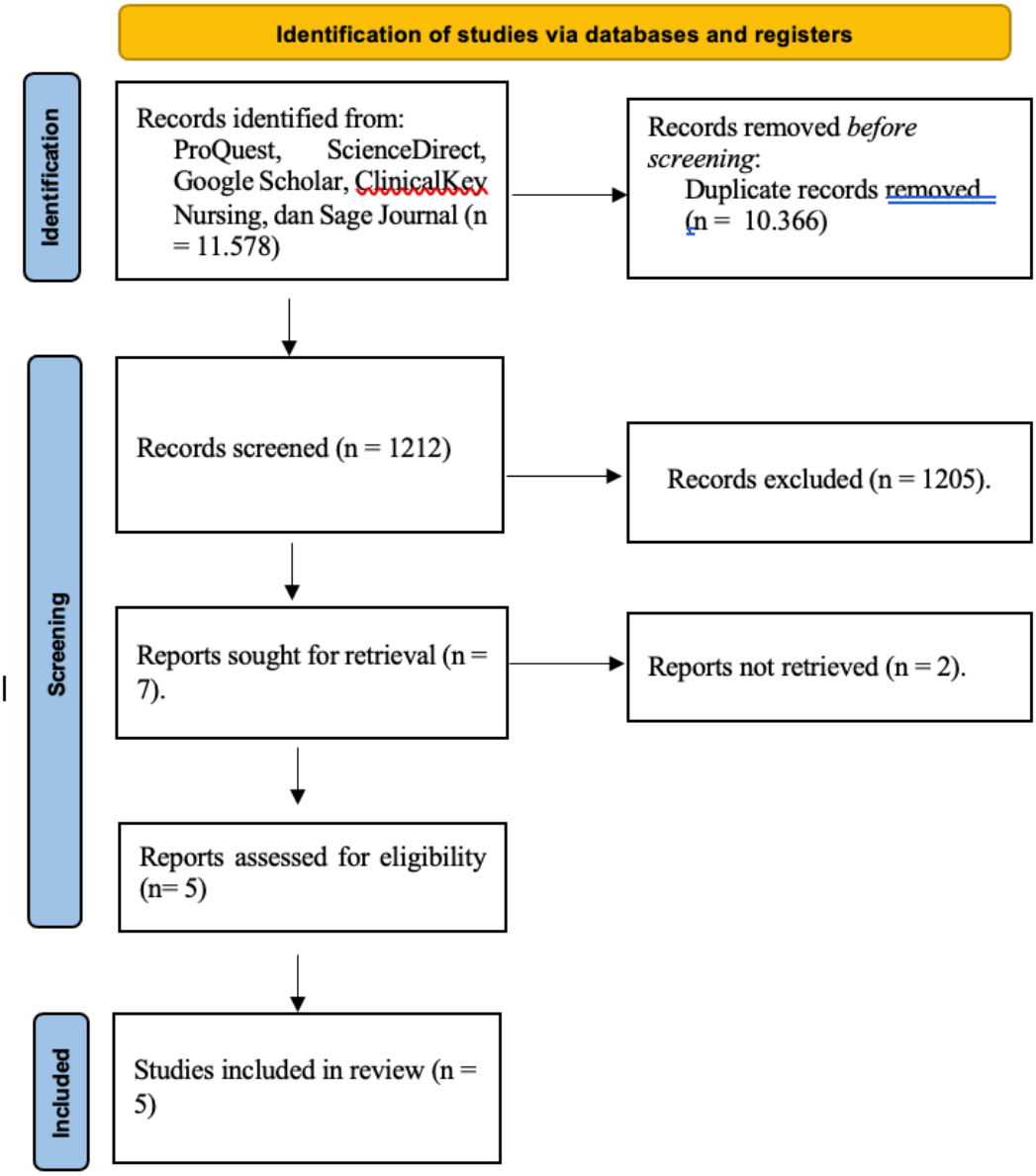

Figure 1. Article Selection and Screening Process using PRISMA

Table 1

Summary of Studies Included in the Analysis

Author, Place, and Year of Publication	Method	Intervention	Result
Hashemzadeh, Marjah Dehdilani, Mehdi Khanbabayi Gol Iran. 2019.	This study was conducted to investigate the effect of foot reflexology on post-sternotomy pain and physiological parameters in patients undergoing CABG. The research design used was RCT. The study was conducted in Shahid Madani Hospital from January 30th to May 10th, 2019. The inclusion criteria included: 1. Women aged 40-80 years; 2. Fully conscious; 3. Had healthy feet. While the exclusion criteria set were: 1. Suffering from peripheral arterial disease in the legs; 2. Having blood disorders and thrombocytopenia; 3. Experiencing severe complications from surgery procedure, such as: a. Severe bleeding (more than 400 mL in one hour or more than 200 mL/hour for four consecutive hours); b. History of diabetes for more than 10 years; c. Insertion of an artificial pacemaker; d. Bradycardia (less than 50 beats per minute) or low blood pressure (lower than 90.35 mm Hg); e. Use of sedatives or analgesics three hours prior to the intervention; f. Addiction to drugs, tranquilizers, or alcohol;	The massage was performed using the thumb tip with a clockwise rotational motion. It began from the toes, the solar plexus reflex point, and ended at the center of the foot sole. The massage pressure was adjusted to the patient's tolerance level. The massage was only performed on the left foot, with a total duration of 20 minutes.	Findings revealed that the intervention significantly reduced the systolic (P= 0.001) and diastolic (P= 0.005) blood pressure, along with heart (P= 0.003) and respiratory rates (P=0.041). Furthermore, foot reflexology significantly decreased postoperative pain severity in the intervention group (P = 0.003). The exact mechanism of foot reflexology is unclear, but several theories explain how this technique functions, including pain gate control theory, nerve impulse theory, and the theory of increased secretion of endorphins and enkephalins (which control pain outcome). Finally, endorphin secretion may lead to morphine-like analgesic properties as well.

Author, Place, and Year of Publication	Method	Intervention	Result
	g. Development of postoperative cognitive or neurological disorders such as stroke. Forty participants were equally distributed into the control and intervention group, with 20 patients each. A purposive sampling technique was employed in the initial selection of eligible participants. Participants were then randomly assigned to the intervention and control group.		
Ramesh Chandrababu, Baby S. Nayak, Vasudev Baburaya Pai, Ravishankar N, Linu Sara George, Elsa Sanatombi Devi, Anice George. India 2020	This study was conducted to evaluate the effect of foot massage and education on anxiety, fatigue, pain, self-efficacy, and quality of life of CABG patients. This was a randomized controlled trial (RCT) study, involving 130 participants. Participants were assigned to experimental (n= 65) and control (n= 65) group. The experimental group received a combination of foot massage and patient educational sessions, while the control group received standard hospital care. The inclusion criteria were patients who were undergoing CABG for the first time, undergoing elective CABG, aged between 35-70 years in both genders and had been weaned from mechanical ventilators within 48 hours in the day of study commencement. Patients who were unable to follow instructions, experienced a cardiac arrest in the	The foot massage was provided between the second and fifth postoperative day for 10 minutes on each foot in a total duration of 20 minutes. The foot massage was performed in the following steps: (1) lubricating the sole with light oil, (2) creating friction of the sole with the help of the palm by grasping the foot with one hand at the ankle, (3) stretching of the knuckles with the right hand over the sole, (4) giving pressure on the reflex area with the tips of the thumbs of both hands over the entire sole of the foot, (5) creating friction on the instep and side of the foot and from the toes to the heel, (6) pressing the thumb near the heel with the fingertips and finally, (7) pressing the foot inward, grasping the foot between the heels, and pressing the center of the sole.	The experimental group experienced significant decreases in anxiety (p= 0.001), fatigue (p= 0.001), pain (p= 0.001), and increases in self-efficacy (p= 0.001) and also quality of life (p= 0.001).

Author, Place, and Year of Publication	Method	Intervention	Result
	postoperative period, and were taken for reoperation/operation during the postoperative period were excluded from the study.		
Fayza Abdou, Ismael Abd El-Hafez 2018 Egypt	The study was conducted to evaluate the effect of foot reflexology on pain and anxiety among postoperative cardiac patients. This was a quasi-experimental study enrolling 60 participants that equally distributed into the intervention and control group. Participants involved in this study were adult patients who received at least one day of postoperative care in the ICU before the commencement of the study, had stable vital signs, had no health related-problems in the foot area, fully conscious, had no mental issues, and reported no chronic pain complaints.	The study intervention was delivered in three days with three intervention sessions. Each session consisted of a preparation and a reflection phase. The preparation phase was performed by maintaining privacy, designating a comfy position, and reviewing the patient's pain and anxiety as the baseline data before delivering the massage intervention. The second stage was delivered by massaging the area under the toes, the ball, the upper arch, the inside, above the toes, and the top of the foot.	
Rana Alameri, Grace Dean, Jessica Castner, Ellen Volpe, Yasser Elghoneimy, Carla Jungquist. 2018 Saudi Arabia	This study was conducted to evaluate the effectiveness of integrated foot massage therapy in managing pain among patients following cardiac surgery. A randomized placebo-controlled single-blinded trial comparing foot massage with placebo intervention was conducted in a large hospital situated in Saudi Arabia. Thirty-one patients who had undergone heart surgery (16 patients in the	Foot massage therapy was delivered twice a day (morning and evening) by a nurse researcher. The foot massage therapy (five minutes for each foot) was performed in a supine position using lavender topical cream. The massage session used effleurage, thumb gliding, wringing, and foot spreading techniques, and terminated with a range of motion exercise, then	There was a statistically significant interaction between group and time (pretest-posttest) on pain intensity (F [1, 29] 1/4 23.19, p < .001, partial h2 1/4 .444;). Post-CABG patients involved in the mobilization exercise program showed better cardiac autonomic modulation at discharge compared to the control group. The results encourage further investigation in the area of in-hospital exercise

Author, Place, and Year of Publication	Method	Intervention	Result
	experimental and 15 patients in the placebo group) participated in the study. A ten-minute foot massage was given to the experimental group by a nurse researcher, twice in a day, within 30 minutes after receiving opioid painkillers.	followed by 30 minutes of rest.	rehabilitation dosing on cardiac autonomic modulation in a more comprehensive sample to strengthen the findings.
Ceyda Uzun Sahin, Dilek Cilingir 2022 Turkey	An interventional study was conducted to analyze the effects of foot reflexology on the pain, anxiety, and satisfaction levels of patients undergoing open-heart surgery. The study was conducted between March 1, 2016, and August 31, 2016, in the cardiovascular surgery clinic of a university hospital in Turkey. The random sample method was used to recruit 70 eligible patients (35 in the test group and 35 in the control group). To avoid patients influencing each other, the study started with the control group and continued with the test group. A total of 73 patients were approached, but three patients were excluded from the study because one patient was transferred for a second surgery and two patients had diabetes.	A 20-minute session of foot reflexology therapy was administered, 10 minutes for each foot in each patient. At the end of the procedure, VAS was used to reassess the pain level. On the third postoperative day, before the reflexology procedure, the VAS for foot reflexology was used to measure the pain outcome. On the fourth postoperative day, a VAS examination was performed before the foot reflexology intervention. At the end of the procedure, evaluation was conducted using VAS, STAI, and VASPS.	There were statistically significant differences in VAS mean scores on the second, third, and fourth postoperative days ($p<0.001$) from both the test (before and after foot reflexology intervention) and the control group. Also, statistically significant differences in pain levels were discovered among postoperative patients in the test and control group on the second ($p=0.002$), third ($p=0.001$), and fourth day ($p=0.001$).

DISCUSSION

Findings from the five studies demonstrated the significant effect of foot massage on pain outcomes in postoperative CABG patients. The mechanism of pain in postoperative patients has been widely discussed by various experts. Postoperative pain generally emerges after the cessation of intraoperative-analgesic agents. Tissue damages due to the surgery procedures induce neurogenic inflammation at the site of trauma. This site is usually swollen, red, and painful, which is caused by the release of potassium ions, bradykinin, prostanoids, and many inflammatory cell mediators, such as the substance P, serotonin, histamine, cytokines, and leukotrienes. This situation could lead to changes in the nature and sensitivity of primary afferent nerve terminals (peripheral sensitization)[25]. Pain management interventions, such as foot massages, are performed to alleviate these issues.

The foot massage was selected as a pain management intervention because of its effect in alleviating postoperative CABG pain. Foot massage usually applies techniques such as effleurage, petrissage, and friction [24]. Effleurage is a gliding movement on the superficial area done by providing lubrication to create a smooth rhythm of relaxation [26]. The second technique is petrissage and friction by applying strong circular pressure [24]. The movements in the foot massage technique stimulate the nerve fibers (A-beta fibers) in the foot and dermatome layer that contain touch and pressure receptors. The receptors then transmit nerve impulses to the central nervous system. The gate control system is activated through inhibitory interneurons while excitatory interneurons are inhibited, resulting in inhibition of T-cell function and thus closing the gate. Pain stimuli are not forwarded to the central nervous system, so the brain does not receive pain stimulation [27].

Foot massage can promote relaxation, facilitate body balance capacity, reduce stress symptoms, and stimulate a good mood in a group of postoperative cardiovascular surgery patients. Reflexology theory is organized based on the principle of energy that flows through vertical zones throughout the body from the organs toward the head. Massage and nerve stimulation promote relaxation, reduce tension, and restore balance to the body [20], [24]. This finding is parallel with a study conducted by Momeni [28]. They discovered that foot massage reduced pain complaints in patients who were receiving treatment in the Intensive Care Unit (ICU). Foot massage may offer a relaxation effect and reduce uneasiness by increasing endorphin secretion, stimulating parasympathetic system activity, and lowering stress hormone production. However, it is required to be delivered with the proper techniques.

The procedure of foot massage was relatively different in every study. Based on the pain scale indicator, the provision of massage on both feet provided a more effective pain-alleviating effect compared to the massage procedure on the left foot only. Massage procedure on both feet delivered a more comprehensive stimulation through parasympathetic nervous system inducement and a higher release of chemical mediators,

generating a state of balance and relaxation, thereby reducing pain [20], [21], [23], [24]. The foot massage performed on one side of the foot aimed to stimulate the left foot or left-hand reflex that is closely associated with the heart, which is also located on the left side of the body.

The most significant reduction in pain level was discovered in a study that performed two-foot massage sessions, on the second and fifth day after surgery. However, it is necessary to note that this study did not only use foot massage as an intervention in reducing pain outcomes. This study also provided educational sessions related to self-management after surgery [21]. If only referring to the foot massage intervention, the most significant pain reduction outcomes were found in a study that performed three-foot massage sessions, on the second, third, and fourth days after surgery [23].

Foot massage performed on both feet on the second, third, and fourth days after surgery for 10-30 minutes is suggested to alleviate pain outcomes among postoperative CABG patients. However, a combination of interventions may offer a better pain-alleviating effect, as an article applied a combination of pain management and educational session intervention to improve pain outcomes and provide more comprehensive nursing care. However, this type of intervention combination also demands further studies to uncover its effect on pain management.

CONCLUSION AND RECOMMENDATION

This review confirmed the effect of foot massage in reducing pain among post-CABG patients. Thus, this intervention could be suggested as an independent nursing modality in improving postoperative CABG patient pain outcomes.

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CONFLICT OF INTEREST

Authors disclose no conflicts of interest related to the work in this manuscript.

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