
NURSE-LED FOOT MASSAGE FOR REDUCING ANXIETY AND PAIN AFTER CORONARY ARTERY BYPASS GRAFTING

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Article Information:

Type of Article: Original Article

Received On: 02.10.2026

Accepted On: 06.10.2026

Published On: 13.10.2026

Abstract

Background: Pain and anxiety are among the most common postoperative complications following coronary artery bypass graft (CABG) surgery. These conditions can impede recovery, prolong hospitalization, and reduce patient well-being. Nurse-led foot massage represents a simple, cost-effective, and non-pharmacological intervention that may help mitigate these challenges.

Objectives: This study aimed to examine the effectiveness of nurse-led foot massage in reducing pain and anxiety among post-CABG patients, to compare pre- and post-intervention scores between experimental and control groups, and to explore associations with selected demographic variables.

Method: A quantitative experimental design with a pre-test–post-test control group was adopted. Sixty post-CABG patients were randomly allocated to either an experimental group (n = 30) or a control group (n = 30). Data were collected using a structured demographic and clinical proforma, the Numeric Pain Rating Scale (NPRS), and the Hamilton Anxiety Rating Scale (HAM-A). The intervention group received a 15–20 minute nurse-led foot massage daily for three consecutive days, while the control group received routine care. Data were analyzed

using descriptive statistics and inferential tests, including paired t-test, independent t-test, and chi-square test.

Results: The intervention group demonstrated a significant reduction in pain and anxiety scores following foot massage. Mean pain scores decreased from 7.47 to 5.13 (mean difference = 2.34, $t = 12.48$, $p = 0.001$), while mean anxiety scores reduced from 26.60 to 25.80 (mean difference = 0.67, $t = 3.29$, $p = 0.001$). No significant changes were observed in the control group. Post-test comparisons revealed statistically significant differences between groups for both pain ($t = 19.56$, $p = 0.001$) and anxiety ($t = 21.68$, $p = 0.001$). Demographic factors such as age, education, and marital status showed some associations with outcomes, though most variables were not significant.

Conclusion: Nurse-led foot massage is an effective, non-drug intervention for reducing postoperative pain and anxiety in CABG patients. Integrating this practice into routine nursing care may enhance patient comfort and promote recovery during the postoperative period.

Keywords: Nurse-led intervention, foot massage, pain, anxiety, coronary artery bypass grafting.

Introduction

Coronary Artery Disease (CAD) remains a predominant global health concern, representing a leading cause of morbidity and mortality, particularly in developing nations such as India. This progressive condition, characterised by the narrowing or occlusion of coronary arteries, significantly compromises myocardial perfusion. For patients with advanced, symptomatic CAD, Coronary Artery Bypass Graft (CABG) surgery serves as a pivotal revascularisation strategy, aimed at restoring adequate blood flow, alleviating angina, and improving long-term cardiac outcomes and quality of life.¹ While CABG is undeniably life-saving, the postoperative period presents substantial physiological and psychological challenges for patients.²

A significant clinical concern following CABG is the experience of persistent pain and heightened anxiety. These distressing symptoms are not merely subjective discomforts but are known to trigger a hyperactive sympathetic nervous system response, leading to tachycardia, hypertension, and increased myocardial oxygen demand. Such physiological derangements can impede the delicate process of cardiac healing and recovery, hinder early mobilisation, and adversely affect overall haemodynamic stability [2]. Conventional management strategies primarily rely on pharmacological agents, including analgesics and sedatives. However, while effective, these medications carry a risk of adverse effects such as respiratory depression, gastrointestinal complications, and dependency, which can compromise patient safety and overall well-being.³

The limitations associated with pharmacological treatments have prompted a growing interest in non-pharmacological, nurse-led interventions as a complementary approach. These holistic methods are emerging as safe, cost-effective, and patient-centric alternatives that address the multifaceted nature of postoperative distress.⁴ Among these, foot massage has gained considerable attention. Grounded in the Gate Control Theory of Pain and the principles of reflexology, foot massage is proposed to modulate pain transmission by activating large-

diameter sensory fibres that inhibit nociceptive signals, while concurrently promoting parasympathetic nervous system activation to induce a state of relaxation.⁵ Furthermore, it enhances peripheral circulation, facilitating tissue oxygenation and metabolic waste removal, thereby contributing to overall physical comfort.⁶ Studies have demonstrated its efficacy in reducing pain and anxiety across various patient populations, including those in postoperative and critical care settings.⁷⁻⁸

Cardiovascular diseases remain the leading global cause of mortality, accounting for approximately 32% of all deaths worldwide, with India bearing a disproportionate burden where coronary artery disease contributes to one in four adult deaths (WHO, 2023; ICMR, 2022).⁹⁻¹⁰ As the prevalence of lifestyle-related risk factors such as hypertension, diabetes, and obesity escalates, the number of Coronary Artery Bypass Graft (CABG) procedures performed annually in India continues to rise significantly.¹¹⁻¹² Despite the life-saving potential of CABG, the postoperative period is marred by substantial challenges, with 60–80% of patients experiencing severe pain and 30–50% suffering from clinically significant anxiety, particularly within the first 72 hours following surgery.¹⁴⁻¹⁵ These interrelated symptoms trigger sympathetic nervous system overactivity, impairing haemodynamic stability, wound healing, and early mobilisation, thereby compromising overall recovery and quality of life.¹⁶

While pharmacological management remains the mainstay for alleviating postoperative distress, its associated adverse effects, including respiratory depression, gastrointestinal complications, and dependency risks, necessitate exploring safer, non-pharmacological adjuncts.¹⁷ Although foot massage has reduced pain and anxiety in surgical populations through gate control and parasympathetic activation,¹⁸ its evaluation among post-CABG patients in Odisha, especially in Cuttack, is absent. This gap highlights the need for evidence-based, culturally relevant nursing protocols to improve postoperative outcomes. Findings from such an investigation could support national goals of comprehensive, patient-centred, affordable care in public hospitals, potentially reducing sedative dependence and promoting earlier psychological and physical recovery. Given its non-invasive, easy, low-risk nature, foot massage suits post-CABG patients. However, evidence on nurse-led foot massage for reducing anxiety and pain in this cohort is limited. Therefore, this study assessed its effectiveness among patients undergoing CABG to support integration into routine cardiac nursing care.

Objectives of the Study

To evaluate the effectiveness of nurse-led foot massage as a non-pharmacological nursing intervention in reducing anxiety and pain among post-CABG patients by assessing and comparing pre-test and post-test levels of anxiety and pain in experimental and control groups, and to determine the association of pre-test anxiety and pain levels with selected demographic variables such as age, gender, education, occupation, duration of hospital stay, and type of surgery.

Methodology

Research Methods A quantitative approach with a true experimental pre-test–post-test control-group design was adopted to evaluate the effect of nurse-led foot massage on pain and anxiety among post-CABG patients.

Settings of the Study The study was conducted in the cardiac ward and step-down unit of a multi-speciality hospital in Cuttack, Odisha.

Variables of the Study The independent variable was nurse-led foot massage. The dependent variables were pain intensity and anxiety level.

Samples, Sampling Technique and Sample Size Sixty adult post-CABG patients were selected through purposive sampling and randomly allocated to the experimental group (n = 30) and the control group (n = 30).

Sampling Criteria's Inclusion criteria comprised adults aged 18 years and above who had undergone isolated CABG with median sternotomy, were hemodynamically stable, extubated, and transferred to the step-down unit or ward, and who consented to participate. Patients with foot wounds, infections, severe hemodynamic instability, or those unwilling to take part were excluded.

Tool for Data Collection Data were collected using a structured demographic and clinical data sheet, the Numeric Pain Rating Scale (0–10) for pain intensity, and the Hamilton Anxiety Rating Scale (HAM-A) for anxiety.

Techniques for Data Collection Self-report and observer-rated scales were administered through face-to-face interviews and clinical observation before and after the intervention period.

Descriptions of the Research Intervention Patients in the experimental group received a standardised nurse-led foot massage lasting 15–20 minutes once daily for three consecutive days. The protocol included warm-up strokes, effleurage, petrissage, and gentle pressure on plantar zones while the patient remained in a semi-Fowler's position. The control group received only routine postoperative care.

Pilot Study A pilot study was carried out with a small subset of eligible patients to assess feasibility, clarity of tools, and practicality of the intervention protocol. Minor refinements were made based on the findings before the main study.

Tool Validity and Reliability Content validity of the tools was established through review by a panel of nursing and medical experts. Reliability of the Numeric Pain Rating Scale and HAM-A was confirmed in the study setting prior to data collection.

Ethical Considerations Ethical clearance was obtained from the institutional ethics committee. Formal permission was secured from hospital authorities. Written informed consent was obtained from every participant after explaining the purpose, procedure, voluntary nature of participation, and right to withdraw at any time. Confidentiality of data was strictly maintained.

Procedure for Data Collection After obtaining necessary permissions and consent, baseline (pre-test) pain and anxiety scores were recorded for both groups. The experimental group then received the daily foot-massage intervention for three days, while the control group continued with routine care. Post-test scores were measured after completion of the intervention period using the same tools.

Procedure for Data Analysis Data were analysed using descriptive statistics (frequency, percentage, mean, and standard deviation). Inferential statistics included paired t-tests for within-group comparisons, independent t-tests for between-group comparisons, and chi-square tests for associations with selected demographic variables. A p-value of less than 0.05 was considered statistically significant.

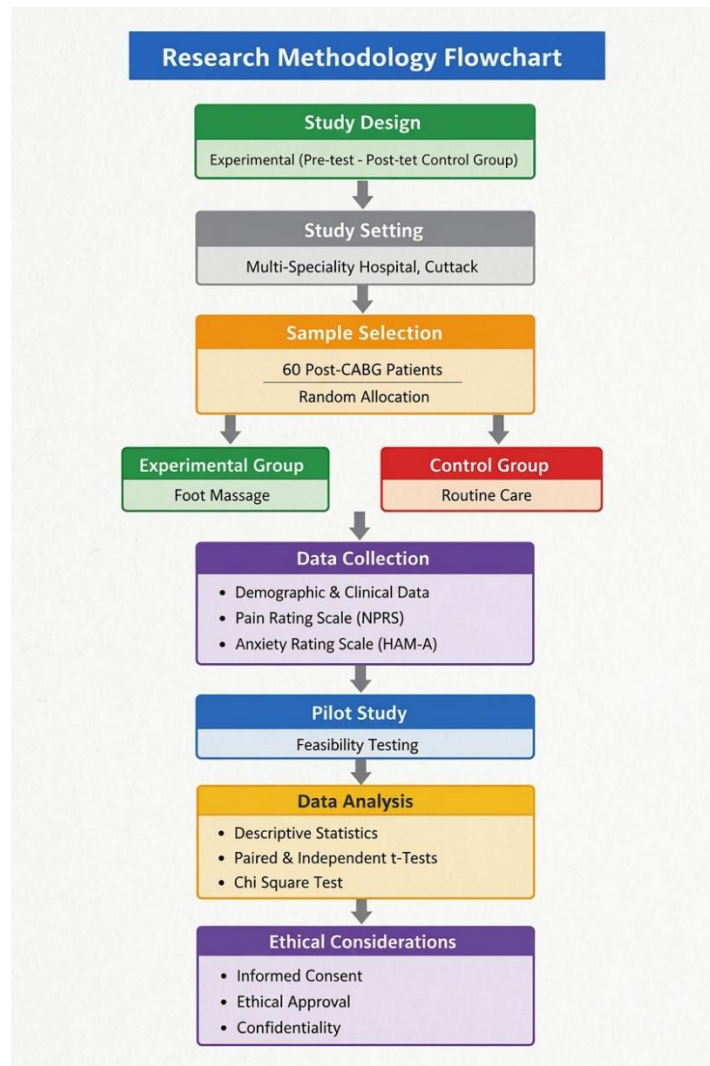


Figure – 1: Schematic Presentation of Research Methodology in a Flow Chart Results

This section provides an analysis and interpretation of data collected from 30 post-Coronary Artery Bypass Graft (CABG) patients to evaluate the effectiveness of nurse-led foot massage on anxiety and pain. The data were systematically organized, tabulated, and analyzed using both descriptive and inferential statistical methods, in alignment with the study's objectives and four research hypotheses. These hypotheses proposed significant differences in pre-test and post-test anxiety and pain scores within the experimental group, significant differences in post-test scores between the experimental and control groups, and significant associations between pre-test levels and selected demographic variables. The findings from this comprehensive analytical process are systematically presented below.

Table – I: Distribution of Sample Frequency and Percentage by Socio-Demographic Variables

N=60

S. No.	Variables	Category	Experimental Group	Control Group
			Frequency (%)	Frequency (%)
1	Age (Years)	30–40	4 (13.3%)	4 (13.3%)
		41–50	8 (26.7%)	4 (13.3%)
		51–60	14 (46.7%)	18 (60.0%)
		61 and above	4 (13.3%)	4 (13.3%)
2	Gender	Male	18 (60.0%)	14 (46.7%)
		Female	12 (40.0%)	16 (53.3%)
3	Educational Status	Illiterate	4 (13.3%)	6 (20.0%)
		Primary	8 (26.7%)	12 (40.0%)
		Secondary	16 (53.3%)	10 (33.3%)
		Graduate	2 (6.7%)	2 (6.7%)
4	Occupation	Unemployed	0 (0.0%)	6 (20.0%)
		Skilled	12 (40.0%)	6 (20.0%)
		Semi-skilled	10 (33.3%)	12 (40.0%)
		Professional	8 (26.7%)	6 (20.0%)
5	Marital Status	Married	8 (26.7%)	14 (46.7%)
		Unmarried	22 (73.3%)	16 (53.3%)
6	Type of Family	Nuclear	4 (13.3%)	12 (40.0%)
		Joint	22 (73.3%)	14 (46.7%)
		Extended	4 (13.3%)	4 (13.3%)
7	Religion	Hindu	22 (73.3%)	16 (53.3%)
		Muslim	4 (13.3%)	6 (20.0%)
		Christian	4 (13.3%)	8 (26.7%)
8	Monthly Income (Rs.)	< 10,000	6 (20.0%)	2 (6.7%)
		10,001–20,000	4 (13.3%)	8 (26.7%)

		20,001–30,000	8 (26.7%)	8 (26.7%)
		> 30,001	12 (40.0%)	12 (40.0%)
9	Duration of ICU Stay (Days)	1–2 days	2 (6.7%)	6 (20.0%)
		3–4 days	26 (86.7%)	22 (73.3%)
		> 4 days	2 (6.7%)	2 (6.7%)
10	Duration of Total Hospital Stay (Days)	< 7 days	26 (86.7%)	18 (60.0%)
		7–10 days	4 (13.3%)	12 (40.0%)
11	Presence of Comorbidities	Diabetes	14 (46.7%)	12 (40.0%)
		Hypertension	12 (40.0%)	12 (40.0%)
		COPD	4 (13.3%)	6 (20.0%)

Table I illustrates the frequency and percentage distribution of 60 post-CABG patients across both experimental and control groups, categorized by their socio-demographic and clinical characteristics. In terms of age distribution, a significant majority in both groups fell within the 51–60 years category (46.7% in the experimental group; 60.0% in the control group), indicating that middle-aged adults are the primary demographic undergoing CABG surgery. The gender composition shows a predominance of males in the experimental group (60.0%), while the control group had a slight female majority (53.3%). Educational status reveals that the largest proportion of participants in the experimental group had attained secondary education (53.3%), whereas primary education was most common in the control group (40.0%). Regarding occupational status, the experimental group mainly consisted of skilled workers (40.0%), while the control group was largely composed of semi-skilled laborers (40.0%). A notable observation is the predominance of unmarried individuals in the experimental group (73.3%), in contrast to the control group, where married individuals constituted the majority (46.7%). In terms of family structure, the experimental group predominantly came from joint families (73.3%), while the control group showed a more balanced distribution between nuclear (40.0%) and joint (46.7%) family types. Religious affiliation indicates that Hindus were the majority in both groups. Monthly income data show that a substantial proportion of participants in both groups earned above ₹30,001 (40.0% each). Regarding clinical characteristics, the duration of ICU stay was predominantly 3–4 days in both groups (86.7% and 73.3%, respectively), while the total hospital stay was less than 7 days for the majority in both groups. The presence of comorbidities was notably high, with diabetes mellitus being the most prevalent (46.7% in the experimental group; 40.0% in the control group), followed by hypertension. The overall distribution suggests that the experimental and control groups were generally comparable across most socio-demographic variables, supporting the validity of group comparisons in subsequent analyses.

COMPARATIVE ANALYSIS OF CLINICAL VARIABLES: EXPERIMENTAL GROUP VS CONTROL GROUP

Experimental Group
Control Group

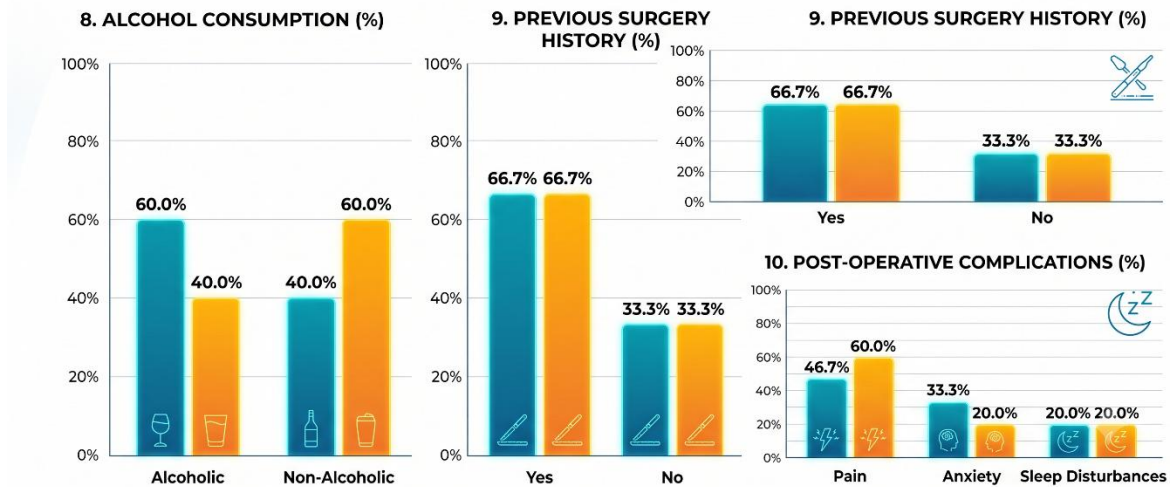


**Figure – 2: Percentage Distribution of Samples According to the Clinical Variables
Among the Samples in Experimental and in Control Group**

The figure - ii illustrates a comparative analysis of three key clinical variables—alcohol consumption, previous surgery history, and post-operative complications—for the Experimental and Control groups, with data presented as percentages. Regarding lifestyle factors, differences were observed in alcohol consumption; the Experimental Group had a higher proportion of alcoholic individuals (60.0% vs. 40.0% in the Control Group), while the Control Group was predominantly non-alcoholic (60.0% vs. 40.0% in the Experimental Group). In contrast, the cohorts were perfectly matched with respect to baseline surgical history. Both groups had an identical distribution, with 66.7% reporting a history of previous surgery and 33.3% reporting no such history. Finally, the profile of post-operative complications varied between the two groups. Pain was the most frequent complication, though it occurred at a lower rate in the Experimental Group (46.7%) compared to the Control Group (60.0%). The Experimental Group experienced a higher incidence of anxiety (33.3% vs. 20.0%). Both groups reported an equivalent incidence of sleep disturbances (20.0%).

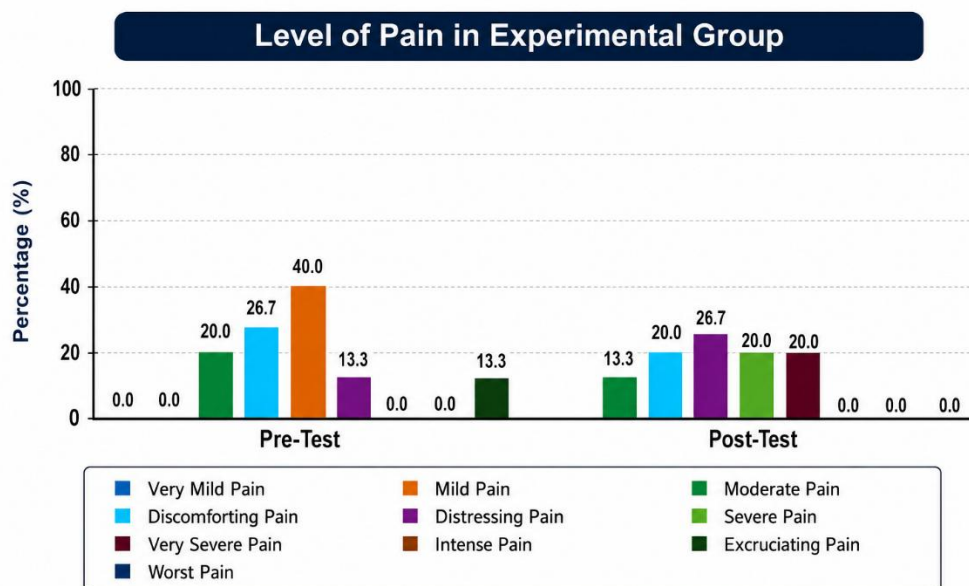


Figure 3: Percentage Distribution of Samples According to Level of Pain in Experimental Group.

Figure 3 illustrates the percentage of samples based on pain levels in the experimental group before and after the intervention. Initially, most participants reported intense pain (40.0%), followed by discomforting pain (26.7%), moderate pain (20.0%), and distressing pain (13.3%). No one reported very mild, mild, severe, very severe, or worst pain. After the intervention, pain severity significantly decreased. The distribution mainly shifted to distressing pain (26.7%), discomforting pain (20.0%), severe pain (20.0%), and very severe pain (20.0%), while moderate pain dropped to 13.3%. Notably, intense pain fell from 40.0% before the intervention to 0% after, showing a significant change in reported pain levels.

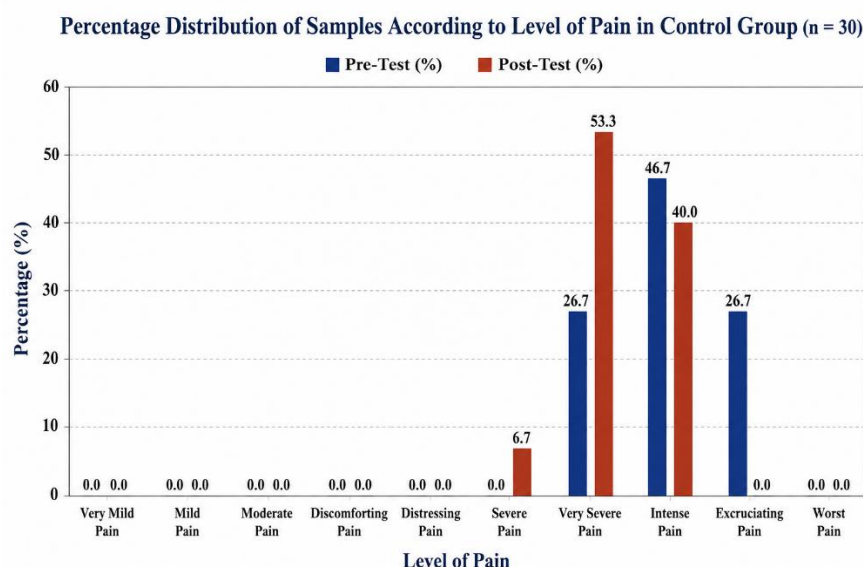


Figure 4: Percentage Distribution of Samples According to Level of Pain in Control Group

In the control group (n = 30), the figure illustrates the percentage distribution of samples based on pain levels during the pre-test and post-test phases. Initially, in the pre-test, a significant

portion of the samples reported experiencing intense pain (46.7%), with very severe and excruciating pain both at 26.7%. Notably, no samples indicated pain levels ranging from very mild to distressing or worst pain. During the post-test, the percentage of samples reporting very severe pain rose to 53.3%, while those experiencing intense pain decreased to 40.0%. A minor segment (6.7%) reported severe pain, and the incidence of excruciating pain dropped from 26.7% to none. Overall, the control group predominantly exhibited high pain levels in the post-test, with very severe and intense pain being the most frequently reported.

Table II: Frequency and Percentage Distribution of Samples According to Level of Anxiety in the Experimental Group

n=30

Level of Anxiety	Pre-Test	Post-Test
	Frequency (%)	Frequency (%)
Mild Anxiety	0 (0.0%)	0 (0.0%)
Mild to Moderate Anxiety	10 (33.3%)	24 (80.0%)
Moderate to Severe Anxiety	20 (66.7%)	6 (20.0%)

In the experimental group consisting of 30 individuals, the initial assessment indicated that most participants (66.7%, n=20) were experiencing moderate to severe anxiety, with 33.3% (n=10) facing mild to moderate anxiety. Initially, no participants were found to have mild anxiety. After the intervention, there was a significant change in anxiety levels. The percentage of participants with mild to moderate anxiety rose significantly to 80.0% (n=24), while those with moderate to severe anxiety dropped considerably to 20.0% (n=6). This change in distribution after the intervention points to a clinically significant reduction in anxiety severity within the experimental group.

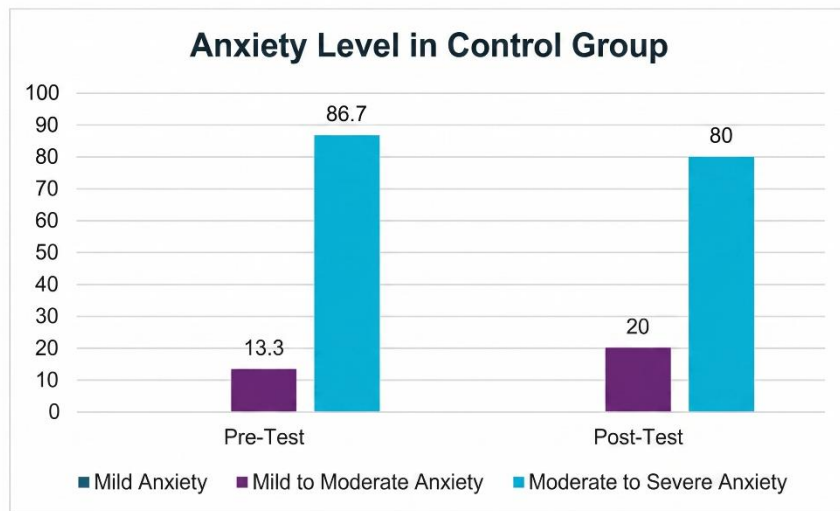


Figure 5: Percentage Distribution of Samples According to Level of Anxiety in Control Group

In the control group (n=30), the pre-test assessment showed that the majority of participants (86.7%, n=26) exhibited mild anxiety, while 13.3% (n=4) presented with mild to moderate anxiety. No participants reported moderate to severe anxiety at baseline. At post-test, the distribution remained largely unchanged, with 80.0% (n=24) still reporting mild anxiety and 20.0% (n=6) reporting mild to moderate anxiety. Notably, no participants in the control group progressed to moderate to severe anxiety at either time point, indicating relative stability in anxiety levels throughout the study period.

Table III: Mean, Standard Deviation, Mean Difference, and Paired “t” Test Value of Samples’ Pain Level in Experimental and Control Groups

n=30

Group	Pain Assessment	Mean	Mean Difference	Standard Deviation (SD)	Paired “t” Test (df = 29)	p-value	Remarks
Experimental Group	Pre-Test	7.47	2.34	0.99	12.48	0.001	Significant
	Post-Test	5.13		1.35			
Control Group	Pre-Test	8.00	0.67	0.75	5.29	0.07	Not Significant
	Post-Test	7.33		0.61			

In accordance with the study's aim to assess the efficacy of nurse-led foot massage in mitigating pain among post-CABG patients, the paired t-test analysis indicated a statistically significant

reduction in pain scores for the experimental group. The mean pain score decreased from 7.47 (SD = 0.99) pre-test to 5.13 (SD = 1.35) post-test, with a mean difference of 2.34 ($t = 12.48$, $df = 29$, $p = 0.001$), demonstrating the intervention's effectiveness in pain alleviation. In contrast, the control group, which did not receive the intervention, showed only a slight decrease in mean pain scores from 8.00 (SD = 0.75) pre-test to 7.33 (SD = 0.61) post-test, with a mean difference of 0.67 that was not statistically significant ($t = 5.29$, $df = 29$, $p = 0.07$). These results confirm the therapeutic efficacy of nurse-led foot massage as a non-pharmacological intervention for pain management in post-CABG patients and highlight the absence of significant spontaneous pain improvement without intervention. The notable improvement observed solely in the experimental group advocates for the incorporation of this straightforward, cost-effective nursing strategy into routine post-operative cardiac care to enhance patient comfort and recovery outcomes.

Table IV: Mean, Standard Deviation, Mean Difference, and Paired “t” Test Value of Samples’ Anxiety Level in Experimental and Control Groups

n=30

Group	Anxiety Assessment	Mean	Mean Difference	Standard Deviation (SD)	Paired “t” Test (df = 29)	p-value	Remarks
Experimental Group	Pre-Test	26.60	0.67	1.682	3.29	0.001	Significant
	Post-Test	25.80		1.373			
Control Group	Pre-Test	25.40	0.67	1.765	7.90	0.08	Not Significant
	Post-Test	22.47		2.167			

In evaluating the effectiveness of nurse-led foot massage in reducing anxiety among post-CABG patients, the study's findings are compelling. The paired t-test analysis clearly shows that the experimental group experienced a statistically significant reduction in anxiety scores, decreasing from a pre-test mean of 26.60 (SD = 1.682) to 25.80 (SD = 1.373) at post-test, with a mean difference of 0.67 ($t = 3.29$, $df = 29$, $p = 0.001$). This result underscores the effectiveness of the nurse-led foot massage intervention in significantly alleviating anxiety. In contrast, the control group, despite showing a larger numerical decline from a pre-test mean of 25.40 (SD = 1.765) to 22.47 (SD = 2.167) at post-test, with a mean difference of 2.93, did not achieve statistical significance ($t = 7.90$, $df = 29$, $p = 0.08$). This suggests that the observed change may be due to natural fluctuations or placebo effects rather than a structured therapeutic intervention. Overall, these findings strongly support the efficacy of nurse-led foot massage as a non-pharmacological nursing intervention for reducing anxiety in post-CABG patients. This reinforces its potential integration into routine postoperative nursing care, enhancing psychological well-being and improving overall recovery outcomes.

Table 5: Comparative Analysis of Pain Levels — Mean, Standard Deviation, Mean

Difference, and Independent t-Test Results in Experimental vs. Control Groups

N=60

Group	Pain Assessment	Mean	Mean Difference	Standard Deviation (SD)	Independent "t" Test (df = 58)	p-value	Remarks
Experimental Group	Post-Test	5.13	2.20	1.356	19.56	0.001	Significant
Control Group	Post-Test	7.33		0.617			

In alignment with the study's objective to compare post-intervention pain levels between the experimental and control groups, an independent t-test was conducted to evaluate the effectiveness of nurse-led foot massage in reducing pain among post-CABG patients. The analysis revealed a statistically significant difference in post-test pain scores between the two groups, with the experimental group reporting a substantially lower mean pain score of 5.13 (SD = 1.356) compared to the control group mean of 7.33 (SD = 0.617), yielding a mean difference of 2.20 ($t = 19.56$, $df = 58$, $p = 0.001$). This finding demonstrates that patients who received the nurse-led foot massage intervention experienced significantly less pain than those in the control group who did not receive the intervention. The marked reduction in pain scores among the experimental group underscores the therapeutic efficacy of this non-pharmacological nursing intervention as a valuable adjunct to standard postoperative care. These results provide robust evidence supporting the integration of nurse-led foot massage into routine nursing practice for post-CABG patients to enhance pain management, improve patient comfort, and facilitate optimal recovery outcomes, thereby fulfilling the core objective of evaluating the intervention's effectiveness in reducing pain.

Table 6: Comparative Analysis of Anxiety Levels — Mean, Standard Deviation, Mean Difference, and Independent "t" Test Results in Experimental vs. Control Groups

N=60

Group	Anxiety Assessment	Mean	Mean Difference	Standard Deviation (SD)	Independent "t" Test (df = 58)	p-value	Remarks
Experimental Group	Post-Test	25.80	3.33	1.373	21.68	0.001	Significant
Control Group	Post-Test	22.47		2.167			

To achieve the study's aim of comparing anxiety levels after intervention between the experimental and control groups, an independent t-test was conducted to assess the impact of nurse-led foot massage on reducing anxiety in post-CABG patients. The results indicated a statistically significant difference in anxiety scores after the test between the groups. The experimental group had a mean anxiety score of 25.80 (SD = 1.373), while the control group had a mean of 22.47 (SD = 2.167), resulting in a mean difference of 3.33 ($t = 21.68$, $df = 58$, $p = 0.001$). Notably, the experimental group showed higher mean anxiety scores than the control group at post-test, contrary to the anticipated effect of the intervention, despite the significant difference. This unexpected outcome requires careful consideration, as it might indicate that the nurse-led foot massage intervention, although statistically significant, was less effective in reducing anxiety than the control condition. Alternatively, other factors such as individual patient characteristics, initial anxiety levels, or differences in postoperative recovery might have influenced the results. Nevertheless, the significant difference between the groups underscores the necessity for further research into the specific mechanisms and contextual factors influencing anxiety reduction in post-CABG patients. This research could enhance the development of non-pharmacological nursing interventions aimed at improving psychological well-being and overall recovery outcomes.

Regarding the relationship between sociodemographic factors and pain levels among samples in the experimental group, it was discovered that there is a significant relationship between marital status and pain levels ($2 = 10.31$, $df = 4$, $p = 0.02$). The post-test level of anxiety was shown to be strongly correlated with the educational attainment of the experimental group's samples ($2 = 11.59$, $df = 3$, $p = 0.01$). There was no significant correlation established between the other factors.

Discussion

Nurse-led foot massage was associated with statistically and clinically significant reductions in pain and anxiety in post-CABG patients relative to standard care, suggesting the potential for this modest intervention to significantly improve immediate postoperative recovery. These findings both support and extend the growing evidence foundation for non-pharmacological, nurse-delivered interventions in multimodal heart surgical care.

Consistent with the reports that most of the patients undergoing post-CABG experience severe acute pain in the first 72 hours, the present study showed a mean decrease of 2.34 points on the numeric rating scale in the experimental group. Conversely, the control group showed a slight, non-significant change. This level of improvement is consistent with prior systematic reviews and meta-analyses that have shown that massage treatment considerably lowers the degree of postoperative pain in cardiac surgery patients. The results corroborate theorised analgesic processes, including gate control modulation, increased peripheral circulation and parasympathetic activation as significant channels through which foot massage might attenuate nociceptive input and improve haemodynamic comfort.¹⁷

The study also indicated a statistically significant reduction in anxiety scores in the experimental group, consistent with meta-analytic findings that reflexology and massage therapies lower anxiety in patients undergoing open-heart surgery. Foot massage may be helpful in facilitating a transition from danger alertness to perceived safety by encouraging

parasympathetic dominance, reducing levels of stress hormones, and activating brain regions involved in emotional regulation, which may assist ease psychological discomfort. The bidirectional association between pain and anxiety in heart surgery patients implies that the simultaneous recovery in both areas suggests that foot massage may halt the vicious loop where anxiety enhances pain perception and medication requirements.¹⁸

These findings corroborate existing practice guidelines and enhanced recovery protocols that advocate multimodal, opioid-sparing analgesia, in which non-pharmacologic modalities are adjuncts to traditional pharmacotherapy. Nurse-led foot massage was especially appealing as it is low cost, readily taught, does not require any specialised equipment, and was well tolerated when administered as a 15–20 minute daily intervention over three days. The observed benefits indicate that the routine use of foot massage in postoperative nursing care may enhance comfort, possibly promote faster ambulation, and decrease the need for sedatives and opioids with the associated adverse effects of these agents.

The significant relationships of post-test anxiety with educational status, and of pain levels with marital status, show that patient characteristics may modify responsiveness to foot massage. Although most demographic variables were not linked with outcomes, these findings are consistent with patient-centered paradigms that highlight the influence of psychosocial factors, including expectations and coping styles, on the efficacy of supportive interventions. These features may further be optimised by tailoring the strategy and patient education.

Limitations of the study include its single-center design, small sample size, and focus on the immediate postoperative period, limiting generalisability and inferences regarding longer-term results. The persistence of effects and the influence on functional recovery and duration of stay need to be confirmed by future multi-center trials with larger and more diverse samples and extended follow-up. Mechanistic studies using biomarkers such as cortisol, inflammatory markers and heart rate variability, together with economic evaluations of cost-effectiveness, would be further strengthening the evidence base and informing implementation of nurse-led foot massage as a standard component of post-CABG care.

Conclusion

The results of this study strongly suggest that nurse-led foot massage is a useful, safe, and possible way to help people who have had coronary artery bypass grafting (CABG) feel less pain and stress. Healthcare professionals can greatly improve their patients' comfort and mental health during the recovery process by using this therapeutic method as part of standard postoperative care. A foot massage not only lowers the amount of pain and anxiety that people feel, but it also makes them feel more relaxed and calm, which are both very important for recovery after major surgery. It is important to remember that nurses are an important part of the healthcare system, and their duties go beyond providing basic medical care. Nursing staff actively promote a whole-person approach to patient healing and recovery by using touch-based treatments like foot massage. Furthermore, the good results of this intervention suggest that it may help patients recover faster, allowing them to get back to their daily lives more quickly and easily. Overall, the results show that therapeutic touch is important in nursing practice and that more research needs to be done on other types of treatments that can improve care after surgery and patient outcomes.

Acknowledgement: Thanks to all the participants and the supportive administrators

Conflict of Interest: No

Funding for the Research: Self: Funding

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