

Shoulder pain, disability and kinesiophobia in patients undergoing coronary artery bypass graft surgery: A prospective cross-sectional observational study

Dr. Manish Kumar¹, Dr. Bhawna Verma², Dr. Sandeep Singh³, Dr. Amandeep Bhana⁴, Dr. Sachin Kumar⁵

¹ Assistant Professor, Department of Physiotherapy, IEC University, Baddi, Himachal Pradesh, India

² Associate Professor, College of Physiotherapy, Pt. B.D. Sharma, University of Health Sciences, Rohtak, Haryana, India

³ Associate Professor, Department of Cardiothoracic and Vascular Surgery, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, India

⁴ Assistant Professor, Department of Physiotherapy, Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India

⁵ Assistant Professor, Department of Physiotherapy, IEC University, Baddi, Himachal Pradesh, India

Abstract

Background: Shoulder pain, disability, and kinesiophobia are frequent yet under-examined complications in patients following coronary artery bypass graft (CABG) surgery. These factors may adversely impact rehabilitation outcomes and overall quality of life in post-CABG patients.

Objective: This study aimed to evaluate the presence and extent of shoulder pain, disability, and kinesiophobia in patients after CABG surgery, and to analyse the interrelationships between these variables.

Methods: A prospective cross-sectional observational study was conducted on 40 patients (aged 45–75 years) who underwent planned CABG surgery. Participants were assessed preoperatively and at two-month follow-up for shoulder pain and disability using the Shoulder Pain and Disability Index (SPADI) and for movement fear using the Tampa Scale for Kinesiophobia (TSK). Data were analysed using appropriate statistical tests to compare pre- and post-surgery outcomes and evaluate correlations among measures.

Results: The mean age of participants was 59.32 ± 8.76 years, with a predominance of males (85%). There was a significant increase in both SPADI pain and disability scores at follow-up (pain mean difference: -4.65 ± 4.88 , $p < 0.05$; disability mean difference: -6.65 ± 6.32 , $p < 0.05$), indicating increased shoulder pain and disability post-surgery. However, changes in TSK scores were not statistically significant (mean difference: -1.57 ± 5.30 , $p = 0.44$), suggesting minimal change in kinesiophobia levels. Postoperative SPADI and TSK scores showed a moderate positive correlation, indicating that increased shoulder disability may be associated with heightened kinesiophobia.

Conclusions: The findings suggest that CABG surgery is associated with a significant increase in shoulder pain and disability, while kinesiophobia remains largely unchanged in the immediate postoperative period. These results highlight the need for comprehensive rehabilitation strategies targeting both physical and psychological domains in the post-CABG population. Further research with larger and more diverse samples is warranted to develop effective interventions for optimizing functional recovery and quality of life in cardiac surgery patients.

Keywords: Coronary artery bypass graft (CABG) surgery, shoulder pain, shoulder disability, kinesiophobia, postoperative complications, rehabilitation, SPADI (Shoulder Pain and Disability Index), Tampa Scale for Kinesiophobia, cardiac surgery, range of motion, musculoskeletal complications

Introduction

Coronary artery disease (CAD) is one of the major cardiovascular diseases affecting the global human population. This disease has been proved to be the major cause of death in both the developed and developing countries. Lifestyle, environmental factors, and genetic factors pose as risk factors for the development of cardiovascular disease [1]. In most developed countries, coronary artery disease (CAD), mostly caused by atherosclerosis of coronary arteries, is one of the primary causes of death. From 1990s to 2000s, mortality caused by acute MI declined up to 50%. The incidence of CAD is related with age, gender, economic, etc. Atherosclerosis contains some highly correlative processes such as lipid disturbances, thrombosis, inflammation, vascular smooth cell activation, remodelling, platelet activation, endothelial dysfunction, oxidative stress, altered matrix metabolism, and genetic factors. Risk factors of CAD exist among many individuals of the general population, which includes hypertension, lipids and lipoproteins metabolism disturbances, diabetes mellitus, chronic kidney disease, age, genders, lifestyle, cigarette smoking, diet, obesity, and

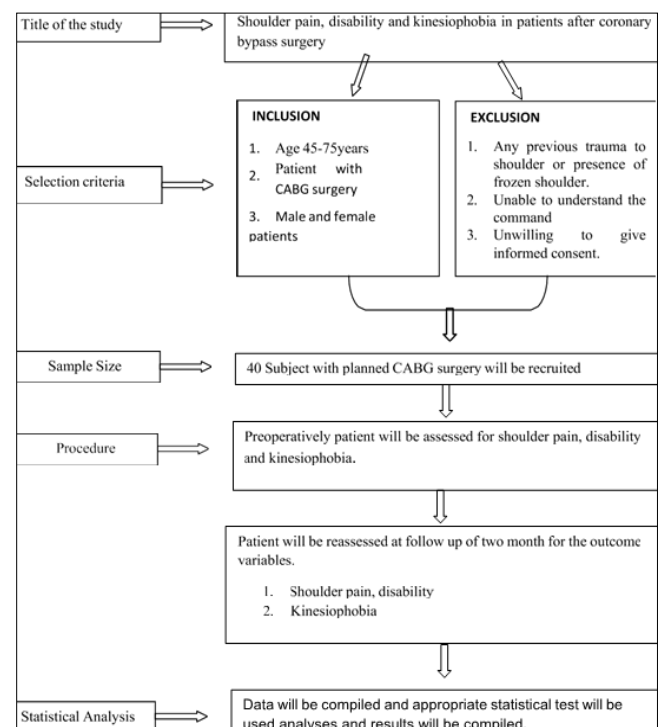
family history. Angina pectoris is caused by myocardial ischemia in the main expression of pain in the chest or adjoining area, which is usually a result of exertion and related to myocardial function disorder. Typical angina pectoris would last for minutes with gradual exacerbation. Rest, sit, or stop walking are the usual preference for patients with angina, and reaching the maximum intensity in seconds is uncommon [2]. Coronary revascularization has matured as a field since coronary artery bypass grafting (CABG) was first developed over 50 years ago, with diagnostic and treatment methods having advanced dramatically. CABG remains the standard of care for obstructive coronary artery disease, particularly for patients with multivessel disease or diabetes. It is now recognized that not all CABG is created equal operative strategy, including conduit choice for bypass grafts and target coronary selection, affects survival. A multidisciplinary approach including surgeons with a special interest in CABG is recommended to optimize treatment selection and outcomes [3]. In recent decades in the EU, the proportion of the elderly has increased due to low population growth and longer life expectancy. This has increased the incidence of

CHD and the number of cardiac surgeries in the elderly. When deciding upon possible surgical treatment in the elderly, the poorer cardiac status of the patient, the greater number of comorbidities, and the 2 greater preoperative risk must be considered. With the improvement and introduction of new 11 operating techniques, lower mortality and morbidity have been reported with respect to the characteristics of older patients. Different models to predict outcomes after CABG have been developed [4]. Kinesiophobia is described as “an excessive, irrational, and debilitating fear of movement and activity resulting from a feeling of vulnerability to painful injury or reinjury” and was first discussed in the context of chronic pain [5]. The effects of rehabilitation results on kinesiophobia in CAD patients have not yet been researched. Clinical experience has shown that some CAD patients avoid exercise and physical activity because they feel reluctant to move their bodies. As a natural reaction to acute damage [6], Kinesiophobia was introduced in the field of chronic pain and is defined as “an excessive, irrational, and debilitating fear of movement and activity resulting from a feeling of vulnerability to painful injury or reinjury”. Kinesiophobia has been shown to have a negative influence on the outcome of rehabilitation and is consequently of importance in the clinical situation. More specifically, kinesiophobia is associated with impaired physical performance, increased self-reported disability, and may predict future occupational disability. Based on clinical experience, some patients with CAD seem afraid to move their body and consequently avoid physical activity and exercise. In the acute stage after a cardiac event, fear and associate avoidance behaviours are accepted. However, there appears to be a group of patients who cannot cope with their fear which subsequently results in long term avoidance of physical activity and exercise. It seems important to identify these patients as avoidance behaviour is considered an exaggerated maladapted behaviour, leading to negative physiological and psychological consequences. Avoidance behaviour has been well documented in patients with chronic pain, but has so far not been thoroughly investigated in patients with CAD [5]. The Tampa Scale for Kinesiophobia (TSK) is a well-used questionnaire that has been used to assess kinesiophobia in relation to a number of pain problems. Patients with CAD have a modified, heart specific form of the TSK called the TSKSV Heart [5]. With the linked dread of physical therapy or fear of the effects of physical rehabilitation, this questionnaire was created to test for kinesiophobia. Patients with CAD have found the TSKSV Heart to be genuine and dependable [7, 3]. To avoid motions that strain the sternum, such as shoulder extension and horizontal abduction, patients are advised due to the possibility of sternal non-union or malunion. When these elements come together, the shoulder joint's range of motion may be restricted, which may result in long term movement restrictions in the elderly. After CABG, it's likely that the anterior upper arms, shoulders, and chest wall bones will sustain severe injury. The most significant side effect following CABG is pain, particularly in the chest [8, 12]. Clinical experience has shown that some CAD patients avoid exercise and physical activity because they feel reluctant to move their bodies. As a natural reaction to acute damage Therefore, this study was conducted with the primary objective to determine the prevalence of shoulder dysfunction among postoperative CABG patients and to evaluate the relationship of kinesiophobia with shoulder dysfunction. In orders to avoid

stretching of chest the patients tend to limit shoulder motions. Musculoskeletal and neurological problems following CABG surgery are clinically seen. The surgeon's recommendation for 14 weeks of shoulder immobility following cardiac surgery is significantly associated with postoperative shoulder dysfunction, which is primarily brought on by improper patient positioning, muscle division, injury to the long thoracic nerve, and internal jugular vein cannulation 32%,33% of people worldwide have frozen shoulder, which causes thoracic and shoulder pain [9].

Materials and Methods

The present study was a prospective cross-sectional observational study conducted from August 2023 to July 2024 at the College of Physiotherapy, Pt. B. D. Sharma PGIMS Rohtak, aiming to assess shoulder pain, disability, and kinesiophobia in patients undergoing coronary artery bypass graft (CABG) surgery. Ethical clearance was obtained from the institutional biomedical research ethical committee of Pt. B. D. Sharma University of Health Sciences (Ref. No. BREC23TH-Physiotherapy13), and written informed consent was secured from all participants. Forty patients aged between 45 and 75 years, scheduled for CABG surgery, were recruited using conventional sampling. Inclusion criteria encompassed male and female patients planned for CABG, while exclusion criteria included previous shoulder trauma, frozen shoulder, inability to comprehend commands, and refusal to consent. Outcome measures included the Tampa Scale for Kinesiophobia (heart-specific version) and the Shoulder Pain and Disability Index (SPADI), both administered preoperatively and at two months postoperative follow-up. Participants received routine physiotherapy pre- and post-surgery. Data analysis was performed using SPSS software, with mean and standard deviation calculated for demographic and outcome variables. Paired t-tests assessed changes between pre- and post-operative scores, with significance set at $p < 0.05$. This methodology facilitated the evaluation of the impact of CABG surgery on shoulder function and fear of movement in the studied cohort.



Results

A total of 40 patients (34 males, 6 females) aged 45-75 years (mean 59.32 ± 8.76 years) undergoing coronary artery bypass graft (CABG) surgery were assessed for shoulder pain, disability, and kinesiophobia preoperatively and two months postoperatively. The majority of participants (80%) had normal BMI, with 20% overweight.

TAMPA Scale for Kinesiophobia

The mean TAMPA scale scores for kinesiophobia were 43.37 ± 2.87 preoperatively and 44.95 ± 4.11 postoperatively. The difference was not statistically significant (mean difference = -1.57 ± 5.30, p = 0.44), suggesting no significant change in fear of movement post-CABG.

TAMPA Scale	Mean (Pre)	SD (Pre)	Mean (Post)	SD (Post)	Mean Difference	p-value
Score	43.37	2.87	44.95	4.11	-1.57	0.44

TAMPA Scale (kinesiophobia) scores showed no significant change between preoperative (43.37±2.87) and postoperative (44.95±4.11) assessments (mean difference -1.57±5.30, p=0.44).

preoperatively to 10.67 ± 5.70 postoperatively (mean difference = -4.65 ± 4.88, p < 0.001), indicating increased shoulder pain after surgery. SPADI Disability scores also increased significantly from 10.82 ± 5.37 preoperatively to 17.47 ± 8.37 postoperatively (mean difference = -6.65 ± 6.32, p < 0.001), indicating greater disability related to shoulder function after CABG.

Shoulder Pain and Disability Index (SPADI)

SPADI Pain scores increased significantly from 6.02 ± 4.10

Measure	Pre-Mean±SD	Post Mean±SD	Mean Difference	p-value
SPADI Pain	6.02±4.10	10.67±5.70	-4.65±4.88	0.000**
SPADI Disability	10.82±5.37	17.47±8.37	-6.65±6.32	0.000**

The Shoulder Pain and Disability Index (SPADI) showed significant increases in pain and disability after surgery. SPADI Pain increased from 6.02±4.10 to 10.67±5.70 (p<0.001), and SPADI Disability from 10.82±5.37 to 17.47±8.37 (p<0.001).

A very weak positive correlation was found between preoperative TAMPA and SPADI scores (r = 0.019, p = 0.91), while a moderate positive correlation was observed between postoperative TAMPA and SPADI scores (r = 0.385, p = 0.014), indicating an association between kinesiophobia and shoulder pain/disability post-surgery.

Correlation between Kinesiophobia and Shoulder Dysfunction

Correlation	Pearson r	p-value	Interpretation
Preoperative TAMPA-SPADI	0.019	0.910	Very weak positive
Postoperative TAMPA-SPADI	0.385	0.014	Moderate positive

A moderate positive correlation was found between postoperative TAMPA and SPADI scores (r=0.385, p=0.014), indicating an association between kinesiophobia and shoulder dysfunction postoperatively.

A moderate positive correlation was found between postoperative TAMPA and SPADI scores (r=0.385, p=0.014), indicating an association between kinesiophobia and shoulder dysfunction postoperatively.

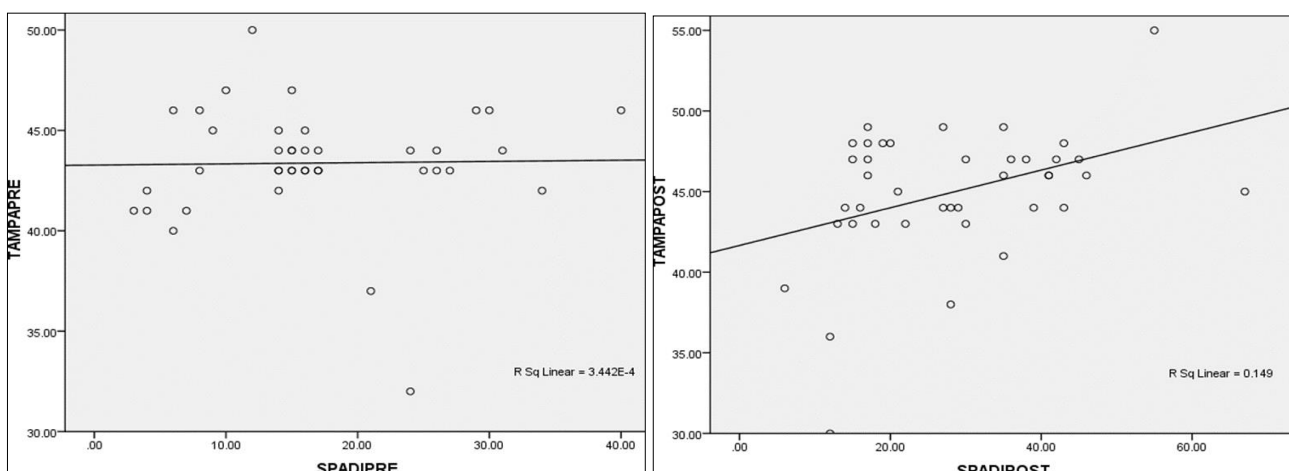


Fig 1.2: Correlation between TAMPA scale and SPADI scale

Discussion

The present study investigated demographic characteristics and assessed changes in physical function and pain perception among coronary artery bypass graft (CABG) patients using the TAMPA Scale for kinesiophobia, SPADI Pain, and SPADI Disability scales. The sample consisted of

40 participants aged 45 to 75 years, predominantly male (85%), a common trend noted in similar clinical studies though it limits generalizability to females (Malakar *et al.*, 2019) [1]. Most participants had a normal BMI (80%), indicating BMI did not significantly influence outcomes, contrasting with studies linking obesity to musculoskeletal

pain severity (Jahangiry *et al.*, 2017; Kasliwal *et al.*, 2006) [11, 15].

Kinesiophobia assessed by the TAMPA Scale showed no statistically significant change between pre- and post-intervention scores ($p=0.44$), suggesting the intervention did not effectively reduce fear of movement. This aligns with earlier findings that while kinesiophobia strongly affects chronic pain persistence and disability, it may require more targeted intervention strategies (Bäck *et al.*, 2013; Luque-Suarez *et al.*, 2019) [5, 13]. The reliability of the TAMPA Scale in chronic pain populations remains well established (Eiger *et al.*, 2022).

Conversely, significant improvements were observed in shoulder pain and disability as measured by SPADI Pain and Disability scores ($p=0.000$). The SPADI Pain subscale showed meaningful reduction in pain, consistent with therapeutic benefits documented in rehabilitation literature (Mousavi *et al.*, 2017; Mohammad *et al.*, 2019) [9, 10]. The SPADI Disability subscale also revealed significant enhancement in function, demonstrating dual benefits of the intervention—pain relief and improved ability to perform daily activities—which is vital for older adults vulnerable to disability from shoulder dysfunction. These positive outcomes affirm the relevance of combined pain management and physiotherapeutic interventions post-CABG (Manhal *et al.*, 2015) [12].

The moderate positive correlation between TAMPA and SPADI post scores indicates an interaction between fear of movement and functional impairment, emphasizing the importance of addressing psychological factors in rehabilitation (Bäck *et al.*, 2013) [5]. Age and comorbidities like diabetes and peripheral vascular disease remain critical risk factors influencing both mortality and musculoskeletal recovery after CABG (Jahangiry *et al.*, 2017; Kasliwal *et al.*, 2006) [11, 15], underscoring the need for tailored rehabilitation strategies.

Conclusion

In conclusion, this study demonstrates that the intervention was effective in significantly reducing pain and disability as measured by the SPADI scales, although no significant changes were observed in kinesiophobia as measured by the TAMPA scale. These findings have important clinical implications for the treatment of shoulder pain and dysfunction, particularly in middle-aged and older adults. Future research should continue to explore strategies for improving both physical and psychological outcomes in this population, with a focus on larger, more diverse samples.

Limitations

There are some limitations to this study that should be acknowledged. First, the small sample size ($n=40$) limits the generalizability of the findings. Additionally, the disproportionate number of male participants (85%) could have influenced the results, as gender differences in pain perception and disability are well documented. Future studies should aim to include a more balanced gender distribution and a larger sample size to validate the findings. Another 43 limitation is the reliance on self-reported measures such as the SPADI and TAMPA scales, which may be subject to bias. Future research could benefit from the inclusion of objective measures of physical function alongside self-reported data.

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