

Assessment of Balance in Subjects Following Coronary Artery Bypass Graft Surgery: A Quasi-experimental Study

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ABSTRACT

Introduction: Coronary Artery Bypass Graft (CABG) surgery is commonly performed to improve cardiac outcomes; however, many patients experience functional limitations in the early postoperative period. Balance impairment and increased fall risk are frequently overlooked during routine cardiac rehabilitation.

Aim: To evaluate changes in balance and fall risk before and after CABG surgery using the Berg Balance Scale (BBS) and Morse Fall Scale (MFS).

Materials and Methods: A quasi-experimental study was conducted at the Department of Physiotherapy, SDM Narayana Hrudayalaya, Dharwad, Karnataka, India, from January 2022 to December 2022. Thirty adults who underwent elective CABG were included. Balance was assessed within 24 hours preoperatively and again after postoperative medical stabilisation

(approximately 5-7 days postsurgery) using the BBS and MFS. Pre- and postoperative scores were compared using paired t-tests.

Results: The mean age of the subjects was 59.8±8.2 years; 17 (56.7%) males and 13 (43.3%) females. The mean BBS score significantly decreased from 48.0±5.0 preoperatively to 37.3±5.0 postoperatively ($p<0.001$). Conversely, the mean MFS score significantly increased from 22.5±10.6 to 38.0±7.6 following surgery ($p=0.002$), indicating a higher fall risk in the early postoperative period.

Conclusion: Patients recovering from CABG demonstrate significant balance impairment and increased fall risk shortly after surgery. Incorporating routine balance assessment and early physiotherapy interventions may enhance patient safety and functional recovery.

Keywords: Berg Balance Scale, Coronary artery bypass graft, Fall risk, Morse Fall Scale

INTRODUCTION

The CABG surgery is a commonly performed procedure for managing advanced coronary artery disease. Advances in surgical techniques and perioperative care have significantly improved survival outcomes; however, many patients continue to experience functional limitations in the early postoperative period, including reduced mobility, generalised weakness, and impaired postural control [1,2]. These physical deficits may negatively influence the speed and quality of recovery following surgery.

Balance impairment following CABG is a clinically relevant issue that often receives limited attention during routine postoperative care. Prolonged bed rest, reduced lower limb muscle strength, postoperative pain associated with sternotomy, and temporary physiological alterations related to cardiopulmonary bypass have all been reported to contribute to postural instability after cardiac surgery [3-5]. Furthermore, common comorbid conditions such as diabetes mellitus and hypertension may worsen neuromuscular control through mechanisms such as peripheral neuropathy and vascular stiffness, thereby increasing the risk of balance dysfunction [6,7].

Emerging evidence suggests that similar impairments occur in patients following cardiac surgery. Smolis-Bąk E et al., reported an increased fall risk among individuals after cardiac surgical procedures [8], while Abolahrari-Shirazi S et al., demonstrated significant reductions in both static and dynamic balance performance following CABG using functional balance assessments [9].

Clinical assessment tools such as the BBS [10] and MFS [11] provide simple, reliable, and objective methods for evaluating balance performance and fall risk in hospital environments. Despite their proven validity and ease of administration, these tools are infrequently utilised in patients recovering from CABG surgery. With this background, the present study was conducted with the aim of

evaluating changes in balance and fall risk before and after CABG surgery using the BBS and MFS.

The study hypothesis was that patients undergoing CABG surgery will demonstrate a decline in balance and an increase in fall risk scores during the early postoperative period.

MATERIALS AND METHODS

A quasi-experimental study was conducted at the Department of Physiotherapy, SDM Narayana Hrudayalaya, Dharwad, Karnataka, India, a tertiary care centre providing comprehensive cardiac services from January 2022 to December 2022. Ethical approval was obtained from the Institutional Ethics Committee of SDM College of Medical Sciences, Dharwad (Approval No. SDMIEC: 087:2017). Written informed consent was obtained from all participants prior to inclusion in the study.

Inclusion criteria: Thirty patients aged between 45 and 75 years who were scheduled for elective CABG surgery were consecutively recruited during the study period. Patients were included if they were medically stable, cognitively intact, and willing to provide written informed consent.

Exclusion criteria: Patients with neurological conditions such as stroke, Parkinson's disease, vestibular disorders, or severe musculoskeletal problems that could independently affect balance were excluded.

Sample size: A formal a priori sample size calculation was not conducted. Participant recruitment was based on availability of eligible patients undergoing elective CABG during the study period, reflecting real-world clinical practice.

Study Procedure

The presence of common comorbidities, including diabetes mellitus and hypertension, was recorded from medical records. Details

related to disease severity, such as duration of illness, glycaemic control, and blood pressure control, were not documented as part of the study protocol. Smoking status was obtained through patient self-report and classified as either present or absent; detailed smoking history, including pack-years or the distinction between current and former smokers, was not assessed. Baseline balance assessments were performed within 24 hours prior to surgery. Postoperative assessments were conducted once participants were medically stable, which typically occurred approximately 5-7 days following surgery, after successful extubation, removal of chest drains, and clearance for mobilisation by the surgical team.

All enrolled participants completed both preoperative and postoperative assessments, and no dropouts were recorded. Balance evaluations were conducted by physiotherapists trained in administering the BBS and MFS. To ensure consistency, the same assessor evaluated each participant during both assessment sessions whenever feasible. Assessors were not informed of specific surgical details.

Standard safety precautions, including close supervision and the use of gait belts, were maintained throughout the assessment procedures. Potential perioperative factors such as medication use, duration of intensive care unit stay, and cardiopulmonary bypass time were not analysed separately. However, conducting postoperative assessments after medical stabilisation helped minimise the influence of acute postoperative factors on balance performance.

Outcome measures: Functional balance was assessed using the BBS, which consists of 14 standardised tasks with scores ranging from 0 to 56, where higher scores indicate better balance performance [10]. Fall risk was evaluated using the MFS [11]. The instrument consists of the following six variables: a history of falling (0=No, 25=Yes); the presence of a secondary diagnosis (0=No, 15=Yes); the use of ambulatory aids such as a cane, wheelchair, or walking frame (0=None, 15=wheelchair/bedrest, 30=nurse assist); the administration of intravenous therapy (0=No, 20=Yes); types of gait (0=normal, 10=bedrest, 20=immobile); and mental status (0=oriented to own ability, 15=cannot orient to own ability). The total scores ranged from 0 to 125.

STATISTICAL ANALYSIS

Data analysis was performed using Statistical package for Social Sciences (SPSS) version 20.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including means, standard deviations, and percentages, were used to summarise the demographic and clinical data. The Shapiro-Wilk test confirmed that the continuous variables were normally distributed. To compare the pre- and postsurgical BBS and MFS scores, paired t-tests were applied. Effect sizes (Cohen's d) were calculated to quantify the magnitude of change, with 0.2, 0.5, and 0.8 indicating small, medium, and large effects, respectively and a p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the participants was 59.8 years (range: 45-75 years). Of the 30 participants, 17 (56.7%) were male, and 13 (43.3%) were female. The majority (76.7%) were not engaged in active employment [Table/Fig-1].

Overall, the patients showed a reduction in balance scores along with higher fall risk scores after CABG [Table/Fig-2].

DISCUSSION

In the present study, patients experienced a significant reduction in balance and an increase in fall risk scores following CABG, as reflected by lower BBS scores and higher MFS scores in the early postoperative period, thus is consistent with the study hypothesis.

These findings thereby supporting the study hypothesis, indicating

Variables	Category	n (%)
Age (years)	Mean±SD	59.8±8.2
Gender	Male	17 (56.7)
	Female	13 (43.3)
Occupation	Non working/retired	23 (76.7)
	Employed	7 (23.3)
Hypertension	Yes	18 (60.0)
	No	12 (40.0)
Diabetes mellitus	Yes	16 (53.3)
	No	14 (46.7)
Smoking history	Yes	10 (33.3)
	No	20 (66.7)
Multiple comorbidities	≥2 conditions	14 (46.7)

Table/Fig-1: Demographic and clinical characteristics of participants (N=30).

Outcome measure	Pre-op (Mean±SD)	Post-op (Mean±SD)	Mean difference (95% CI)	p-value	Effect size (Cohen's D)
Berg Balance Scale (BBS)	48.0±5.0	37.3±5.0	-10.8 (-13.3 to -8.2)	<0.001	-2.14 (Large)
Morse Fall Scale (MFS)	22.5±10.6	38.0±7.6	15.5 (10.8 to 20.2)	0.002	1.68 (Large)

Table/Fig-2: Pre- and Post-CABG balance outcomes.

that CABG surgery is associated with a significant decline in balance and an increase in fall risk during the early postoperative period. The current study findings are consistent with previous studies reporting postoperative declines in functional performance and balance after cardiac surgery, thus accepting the hypothesis. Busch JC et al., reported that structured resistance and balance training improved functional capacity in elderly patients undergoing CABG [3]. Similarly, Nazari N et al., demonstrated early postoperative deficits in strength and balance following CABG [4]. Smolis-Bąk E et al., observed an increased risk of falls after cardiac surgery [8], while Abolahrari-Shirazi S et al., reported significant reductions in static and dynamic balance performance after CABG using functional balance assessments [9]. In the Indian context, Borah N et al., highlighted barriers to effective cardiac rehabilitation, including limited awareness and accessibility, which may further compromise postoperative functional recovery [12].

Several physiological and clinical mechanisms may explain the observed decline in balance following CABG. Reduced mobility during the postoperative period can result in muscle deconditioning and impaired proprioception [6].

Physiotherapy interventions should include early mobilisation, balance and proprioceptive training, lower limb and trunk strengthening, and patient education on fall prevention.

Limitation(s)

The small sample size, single-centre setting, and absence of long-term follow-up limit generalisability.

CONCLUSION(S)

The present study demonstrated that patients undergoing CABG surgery commonly experience a significant decline in balance and an increase in fall risk during the early postoperative period. These findings support the inclusion of routine balance assessment as an integral component of postoperative physiotherapy.

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