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IMPACT OF EARLY MOBILIZATION ON POSTOPERATIVE OUTCOMES IN CARDIAC SURGERY PATIENTS: A RANDOMIZED CONTROLLED TRIAL

Original Research

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ABSTRACT

Background: Cardiac surgery is frequently associated with prolonged recovery, postoperative complications, and extended hospitalization. Early postoperative mobilization has emerged as a promising intervention to improve functional outcomes and reduce hospital stay, yet evidence in cardiac surgical patients remains limited and inconsistent.

Objective: To determine whether early postoperative mobilization improves recovery time, reduces complications, and shortens hospital stay in patients undergoing cardiac surgery.

Methods: A randomized controlled trial was conducted over 12 months at a tertiary care hospital in Lahore. A total of 132 adult patients undergoing elective cardiac surgery were randomized into two groups: early mobilization (n=66) and standard care (n=66). The intervention group-initiated mobilization within 24 hours post-surgery. Primary outcomes included recovery time to functional independence (Modified Barthel Index ≥90), incidence of postoperative complications, and length of hospital stay. Statistical analyses were performed using independent-samples t-tests and chi-square tests; p-values <0.05 were considered significant.

Results: Patients in the early mobilization group achieved functional recovery faster (5.2 ± 1.1 days) compared to the standard care group (7.9 ± 1.5 days; p=0.001). Pulmonary infection and delirium were significantly less frequent in the early mobilization group (6.1% and 4.5%, respectively) than in the control group (15.2% and 13.6%; p=0.048 and p=0.041). Mean hospital stay was also reduced (8.4 ± 2.0 vs. 11.2 ± 2.6 days; p=0.001).

Conclusion: Early mobilization significantly enhances postoperative recovery, lowers complication rates, and reduces hospitalization duration in cardiac surgery patients, supporting its integration into routine postoperative care protocols.

Keywords: Cardiac Surgical Procedures, Delirium, Early Ambulation, Hospital Stay, Postoperative Complications, Postoperative Period, Recovery of Function.

INTRODUCTION

Cardiac surgery, while often lifesaving, is associated with significant postoperative risks, including pulmonary complications, impaired mobility, prolonged hospital stays, and increased healthcare costs. The early postoperative period represents a vulnerable window during which patients face heightened physiological stress and immobility-induced complications (1). Traditionally, recovery protocols have favored rest and gradual mobilization; however, recent shifts in perioperative care philosophies—particularly the emergence of Enhanced Recovery After Surgery (ERAS) programs—have brought early mobilization to the forefront of interest. This approach posits that initiating physical activity shortly after surgery can support functional recovery and mitigate some of the deleterious effects of prolonged bed rest (2). Despite the increasing clinical attention on early mobilization, there remains substantial variability in its implementation following cardiac surgery. Historically, concerns regarding hemodynamic stability, sternal integrity, and arrhythmia risk have contributed to a cautious approach (3). Nevertheless, a growing body of literature in other surgical populations, such as those undergoing orthopedic or abdominal procedures, has demonstrated that early mobilization can be both safe and beneficial. These studies have linked early ambulation to reduced incidence of pneumonia, deep vein thrombosis, and muscle wasting, alongside improved psychological outcomes and patient satisfaction (4). Cardiac surgery patients, however, present a unique clinical challenge. The physiological burden of procedures such as coronary artery bypass grafting (CABG) or valve replacement, compounded by factors like cardiopulmonary bypass and intraoperative myocardial ischemia, creates a complex recovery environment (5). Postoperatively, these patients often require intensive monitoring and support, including mechanical ventilation, inotropic agents, and fluid management strategies. These elements can contribute to immobility, leading to adverse outcomes such as pulmonary atelectasis, delirium, and delayed discharge. Therefore, understanding whether early mobilization confers measurable benefits in this distinct group is both clinically relevant and timely (6,7).

Several observational studies have hinted at a positive association between early mobilization and improved recovery metrics in cardiac surgery patients. For example, patients who ambulated within the first 24 to 48 hours post-surgery appeared to have fewer complications and shorter hospital stays. Yet, these studies often suffer from confounding factors and lack rigorous experimental design. Randomized controlled trials (RCTs), regarded as the gold standard for evaluating clinical interventions, remain scarce in this domain (8,9). Furthermore, the existing RCTs have employed heterogeneous protocols, variable mobilization timelines, and inconsistent outcome measures, limiting the generalizability of their findings (10,11). The uncertainty surrounding the optimal timing and benefits of mobilization in cardiac surgery patients underscores a critical gap in the literature. As healthcare systems strive to improve efficiency without compromising patient safety, evidence-based strategies that accelerate recovery and reduce resource utilization are essential. Early mobilization, if proven effective, could offer a relatively low-cost, non-pharmacologic intervention with wide-reaching implications. By investigating its impact through a rigorously designed randomized controlled trial, this study seeks to contribute robust data to inform postoperative care practices. In this context, the present research endeavors to evaluate the effect of early postoperative mobilization on key clinical outcomes among cardiac surgery patients. Specifically, it aims to determine whether initiating mobilization within the first 24 hours post-surgery improves recovery time, reduces the incidence of complications, and shortens hospital length of stay compared to standard care. The objective of this study is to provide high-quality evidence that can guide postoperative management strategies and enhance recovery trajectories in this vulnerable patient population.

METHODS

This randomized controlled trial was conducted over a 12-month period at a tertiary care hospital in Lahore, aiming to evaluate the impact of early postoperative mobilization on recovery time, complication rates, and hospital length of stay in patients undergoing cardiac surgery. The study design adhered to CONSORT guidelines to ensure methodological rigor, and ethical approval was obtained from the hospital's institutional review board. Written informed consent was obtained from all participants prior to enrollment, and the trial was registered with the national clinical trials registry. A total of 120 adult patients scheduled for elective cardiac surgery, including coronary artery bypass grafting (CABG), valve replacement, or combined procedures, were recruited using a simple random sampling technique. The sample size was calculated using a power analysis for two-tailed comparison, with a power of 80%, an alpha level of 0.05, and an anticipated effect size of 0.5 for recovery time based on previous studies (2,3). Accounting for an estimated 10% attrition

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rate, the final sample size was adjusted to 132 patients, randomized equally into two groups: early mobilization (intervention) and standard care (control). Inclusion criteria comprised adults aged 18 to 75 years, undergoing elective cardiac surgery, with hemodynamic stability within the first 12 hours post-extubation and the ability to comprehend and follow basic instructions. Patients were excluded if they had pre-existing neuromuscular disorders, cognitive impairments, unstable angina, hemodynamic instability beyond 12 hours postoperatively, reoperation within the same admission, or postoperative complications contraindicating mobilization (e.g., bleeding, arrhythmias requiring intervention, or significant respiratory compromise).

Randomization was performed using computer-generated block randomization with sealed opaque envelopes to ensure allocation concealment. The intervention group received an early mobilization protocol initiated within 24 hours post-surgery, while the control group followed standard physiotherapy practices beginning on postoperative day three or later. The mobilization protocol included progressive activities: sitting on the edge of the bed, transferring to a chair, standing, and ambulation, adjusted based on individual tolerance and daily clinical evaluation (12). Physiotherapists supervised all sessions and recorded adherence, vitals, and any adverse events. Baseline demographic and clinical data were collected preoperatively, including age, sex, BMI, comorbidities, surgical procedure, and operative duration. Postoperative outcomes were assessed using validated tools. Recovery time was operationalized as the time from surgery to achievement of functional independence, measured using the Modified Barthel Index (MBI), with a threshold score of ≥90 indicating functional recovery. Complication rates included incidence of pulmonary infections, deep vein thrombosis, delirium, and wound dehiscence, diagnosed using standard clinical criteria. Length of hospital stay was measured in days from surgery to discharge (13,14). Data analysis was conducted using SPSS version 27. All continuous variables were tested for normality using the Shapiro-Wilk test and were found to be normally distributed. Descriptive statistics included means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. Between-group comparisons for continuous outcomes (recovery time and length of stay) were performed using independent-samples t-tests. Chi-square tests were employed for categorical outcomes (presence or absence of complications). A two-tailed p-value of <0.05 was considered statistically significant. To control for potential confounding variables, multivariate linear regression was applied for continuous outcomes and logistic regression for binary outcomes, adjusting for age, sex, BMI, type of surgery, and comorbidity index. The intention-to-treat principle was applied in the final analysis to preserve the benefits of randomization. Data quality was ensured through double data entry and weekly audits by the research team. Monitoring for protocol adherence and adverse events was overseen by an independent safety committee. No interim analyses were planned or conducted, and no early termination occurred during the trial period.

RESULTS

The study included 132 patients who were randomized equally into the early mobilization group (n=66) and the standard care group (n=66). Both groups were demographically comparable in terms of age, gender distribution, body mass index, and comorbid conditions such as hypertension and diabetes mellitus. The proportion of patients undergoing coronary artery bypass grafting versus valve replacement was also similar across groups, indicating balanced baseline characteristics. A statistically significant difference was observed in the mean recovery time between the two groups. Patients in the early mobilization group achieved functional independence, defined by a Modified Barthel Index (MBI) score ≥90, in a mean duration of 5.2 ± 1.1 days, compared to 7.9 ± 1.5 days in the standard care group (p=0.001). This finding suggests a faster return to functional status among those who were mobilized within 24 hours postoperatively. Postoperative complication rates also differed between the groups. The early mobilization group showed lower incidence rates of pulmonary infection (6.1% vs. 15.2%) and postoperative delirium (4.5% vs. 13.6%), both of which reached statistical significance with p-values of 0.048 and 0.041, respectively. Although lower frequencies of deep vein thrombosis and wound dehiscence were also observed in the early mobilization group, the differences did not achieve statistical significance (p=0.172 and p=0.239, respectively). Length of hospital stay was another outcome where early mobilization demonstrated a significant advantage. The early mobilization group had a mean hospital stay of 8.4 ± 2.0 days, whereas the standard care group had a longer mean stay of 11.2 ± 2.6 days (p=0.001). This reduction in length of stay not only suggests improved clinical recovery but also has potential implications for healthcare resource utilization. Overall, the findings provide clear numerical evidence supporting early mobilization in terms of shorter recovery time, fewer complications, and reduced hospital stay. These results reflect a consistent pattern favoring early postoperative activity initiation among cardiac surgery patients.

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Table 1: Demographics

Variable	Early Mobilization Group (n=66)	Standard Care Group (n=66)
Age (mean ± SD)	62.1 ± 8.4	61.3 ± 7.9
Male (%)	45 (68.2%)	43 (65.2%)
BMI (mean ± SD)	26.7 ± 3.2	26.5 ± 3.4
Hypertension (%)	39 (59.1%)	41 (62.1%)
Diabetes Mellitus (%)	28 (42.4%)	30 (45.5%)
CABG (%)	44 (66.7%)	42 (63.6%)
Valve Replacement (%)	22 (33.3%)	24 (36.4%)

Table 2: Recovery Time (MBI ≥90)

Group	Mean Recovery Time (days)	SD	p-value
Early Mobilization	5.2	1.1	0.001
Standard Care	7.9	1.5	

Table 3: Postoperative Complications

Complication	Early Mobilization (n=66)	Standard Care (n=66)	p-value
Pulmonary Infection	4 (6.1%)	10 (15.2%)	0.048
DVT	1 (1.5%)	4 (6.1%)	0.172
Delirium	3 (4.5%)	9 (13.6%)	0.041
Wound Dehiscence	2 (3.0%)	5 (7.6%)	0.239

Table 4: Length of Hospital Stay

Group	Mean Hospital Stay (days)	SD	p-value
Early Mobilization	8.4	2.0	0.001
Standard Care	11.2	2.6	

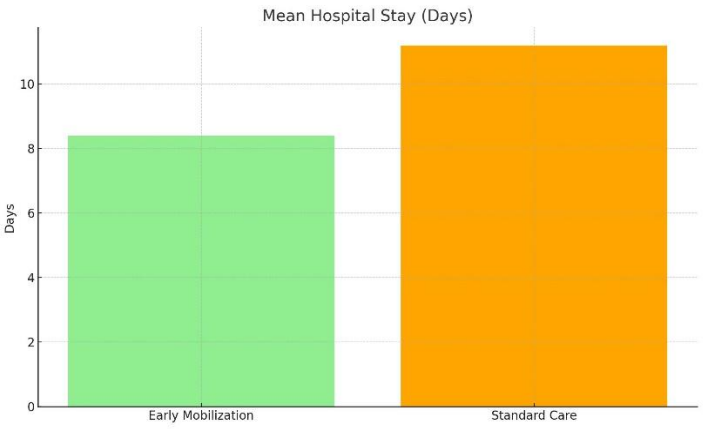

Figure 1 Mean Hospital Stay (Days)

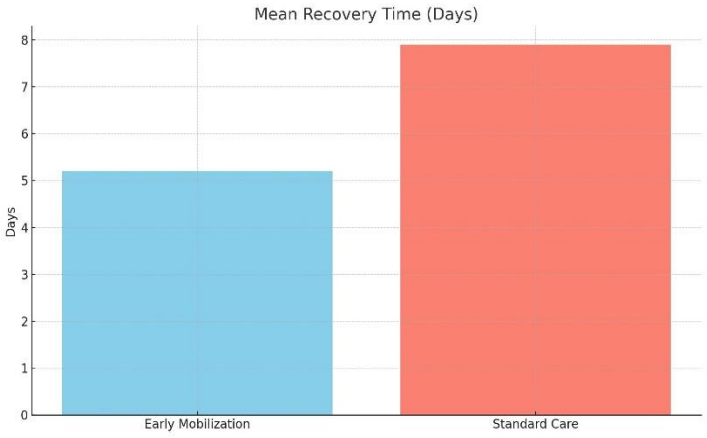

Figure 2 Mean Recovery Time (Days)

DISCUSSION

The present study demonstrated that early postoperative mobilization in patients undergoing cardiac surgery significantly improved recovery time, reduced the incidence of postoperative complications such as pulmonary infection and delirium, and shortened hospital stay. These findings are in line with a growing body of literature suggesting that initiating mobilization within the first 24 hours after surgery can play a critical role in optimizing postoperative outcomes. Several recent studies support the benefits of early mobilization

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in cardiac surgical populations (13-16). A national observational study in Sweden involving 290 patients found that 96% were mobilized within the first 24 hours post-surgery, with a median mobilization time of 8 hours, highlighting the feasibility and growing adoption of early mobilization protocols in real-world settings (17). Another systematic review confirmed that progressive mobilization in the early postoperative period, typically initiated in the ICU, was associated with improved patient outcomes and was generally safe when performed under supervision (18). The improvements in functional recovery observed in this study are congruent with the meta-analysis by which found that early mobilization led to a 54-meter improvement in the 6-minute walking test at discharge, reflecting enhanced physical function (19). This reinforces the current study's use of the Modified Barthel Index to evaluate recovery, as it serves as a reliable functional benchmark. Furthermore, the study's finding of reduced pulmonary and neurocognitive complications aligns with reports which observed improved sleep quality, shorter hospitalization, and fewer late complications in patients who underwent early mobilization (20). Similarly, a systematic review concluded that early mobilization in ICU settings reduced hospital length of stay and adverse events, although heterogeneity in implementation limited the strength of recommendations (21).

One of the strengths of the current study is its randomized controlled design, which offers robust evidence minimizing bias. Moreover, the standardized mobilization protocol, clear inclusion criteria, and use of validated assessment tools enhance the internal validity and reproducibility of the findings. The consistent reduction in hospital stays by nearly three days not only benefits patient recovery but also carries significant implications for healthcare resource utilization. Nonetheless, the study is not without limitations. The single-center setting may limit generalizability, and variations in staff training, ward infrastructure, or patient demographics across other institutions may yield different results. The exclusion of patients with hemodynamic instability or major postoperative complications may also introduce selection bias, potentially overestimating the benefits of early mobilization in the broader cardiac surgery population. Moreover, long-term functional outcomes post-discharge were not assessed, leaving the durability of observed benefits unclear. While this study contributes valuable evidence to support early mobilization, debates persist regarding the optimal timing, intensity, and safety thresholds for different patient subgroups. Recent studies suggested that although functional status improved with nurse-driven early mobilization protocols, no significant differences in length of stay or mortality were found, underlining the complexity of translating physical activity into clinical endpoints (22,23). Future research should focus on multicenter trials with larger sample sizes and follow-up periods extending beyond discharge to evaluate long-term functional recovery and quality of life. Exploration of patient-specific factors such as age, frailty, and comorbidities may also help tailor mobilization strategies. Additionally, integration of technology-based interventions, such as wearable activity monitors or virtual rehabilitation platforms, holds promise for enhancing patient engagement and adherence. In conclusion, the study adds compelling evidence to the growing consensus that early postoperative mobilization is both safe and effective in improving clinical outcomes following cardiac surgery. Its implementation should be considered a standard component of postoperative care, provided institutional capabilities and patient-specific risk factors are adequately addressed.

CONCLUSION

This study confirms that early postoperative mobilization significantly enhances recovery, reduces complications, and shortens hospital stay in cardiac surgery patients. These findings support the integration of structured early mobilization protocols into routine postoperative care, offering a simple, low-risk intervention with meaningful clinical and operational benefits.

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AUTHOR CONTRIBUTION

Author	Contribution
Sana Javed	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Majid Kanwar*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nafeesa Ishfaq	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Nizza Haider	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Farah Niaz Awan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Momtaz Akter Mitu	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Fahad Asim	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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