

A SYSTEMATIC REVIEW OF POSTOPERATIVE FALLS AND COMPLICATIONS IN OLDER ADULTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

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Abstract

Postoperative falls represent a critical but often overlooked complication in elderly patients recovering from coronary artery bypass grafting (CABG) in Pakistan. Advanced age, combined with pre-existing cardiovascular and metabolic conditions, places these patients at heightened risk for mobility impairments, delirium, and muscle weakness after surgery. Although CABG procedures are increasingly performed within the country, comprehensive insight into postoperative trajectories for this population is still limited. This review evaluates empirical studies that have documented complications such as surgical site infections, cardiac rhythm disturbances, respiratory problems, postoperative cognitive changes, and functional decline, and explores how these outcomes influence fall risk during rehabilitation. The existing literature suggests that these complications frequently hinder mobility, prolong recovery, and elevate susceptibility to falls. Additional risk enhancers including inadequate glycemic regulation, reduced muscle strength, impaired balance, and insufficient postoperative supervision—further exacerbate vulnerability. Evidence from Pakistan remains fragmented, with minimal focus on long-term functional outcomes, fall incidence, and structured rehabilitation. The findings highlight the pressing need for coordinated postoperative management, timely mobilization practices, and standardized fall-prevention strategies to improve recovery and reduce adverse events among this high-risk group. The review also underscores major evidence gaps and calls for robust, locally conducted research to strengthen geriatric cardiac surgical care in Pakistan.

INTRODUCTION

Coronary artery bypass grafting (CABG) has continued to be a key surgery procedure in patients with advanced coronary heart disease, especially the elderly who tend to have many comorbidities and a lower physiological status. With the aging of the global population, the number of CABG candidates who are aged thus

fall within the geriatric bracket which is frail, has reduced functional reserves and complicated health requirements. These susceptibilities due to age increase the risk of developing postoperative complications, delayed functional recovery, and long-term impairment. Several investigations prove that elderly age is an excellent prognostic

indicator in the negative postoperative outcomes, i.e., cardiac, renal, and respiratory complications, and higher mortality rates in both short-term and long-term (Safaie et al., 2015). It is thus important to understand the pattern and burden of postoperative complications among this population to focus on the optimal care delivery and enhance the clinical pathways.

Falls are a highly significant but understudied issue among geriatric CABG patients in the context of traditional postoperative risks. In elderly patients, falls tend to be an indication of weakness, loss of balance, polypharmacy, hemodynamic instability and changes in cognition after surgery. Piatek et al. (2017) also include fatigue, pain, sleep disturbances, and immobility among factors that also increase the risk of falls. The effects of falls within the postoperative cardiac experience may be severe, which encompass sternal wound dehiscence, delayed recovery, wound infections, recurrent surgery, prolonged stay in hospitals, and rehabilitative impairment. This is further constrained by the psychological aftermath- increased fear of falling and less confidence to move around, further reducing the quality of life (Hannan et al., 2003). Nevertheless, falls are not sufficiently reported in the literature in comparison with other cardiopulmonary complications (arrhythmias and hemodynamic instability) (Jawitz et al., 2020).

Cardiovascular disease reaches high prevalence in Pakistan, with the number of CABG surgeries carried out in the tertiary care hospitals steadily growing. Nonetheless, studies involving older Pakistani CABG patients are rather scattered. Local outcomes measures on postoperative outcome rarely involve functional recovery and fall risk, but focus on perioperative complications and mortality (Jan et al., 2021). The role of frailty in surgical vulnerability is supported by evidence by Tariq et al. (2025) stated that older patients have more frequently reported postoperative atrial fibrillation and extended hospital stays but there is minimal information regarding the interaction of the two complications plus mobility, rehabilitation and fall risk in the Pakistani setting. Weakness has been identified as the major predictor of postoperative outcomes. A recent

systematic review and meta-analysis have found out that frail patients receiving CABG have increased chances of 30 day and 1 year mortality, and are at higher risk of longer hospitalization and increased readmission rates (Sharifi, 2023). These results raise the concerns of the routine frailty measurement as an element of the preoperative assessment, especially in the geriatric population whose functional frailty can aggravate the impact of surgical stress and postoperative morbidity. However, Pakistan has no extensive and disease-specific evidence to cover postoperative complications in association with falls, frailty, and functional decline. The studies available in literature only record the traditional clinical events without addressing the most important issues, including the fall rate, limitations in movement, and rehabilitative care. This lack of centralized evidence limits the implementation of standardized postoperative care plans, specific fall-prevention approaches, and multidisciplinary rehabilitation options, which are based on geriatric considerations. This gap is significant to address to resolve the problem of patient safety, reduce unnecessary morbidity, and promote functional healing in older patients of cardiac surgery.

The process of the adaptation of such interventions in Pakistan, however, demands the knowledge of the local patient characteristics, contextual risk factors, and systemic constraints. An appraisal synthesized of literature available will assist in defining the major factors contributing to a postoperative vulnerability and fall risk thus informing the adaptation of international best practices to locally relevant strategies. Finally, conventional postoperative complications and increased risk of falls are the dual burden of the older CABG patients in Pakistan, which put their recovery and quality of life at risk. The fact that, currently, there is limited access to integrated and context-specific evidence hinders the provision of effective and geriatric-sensitive care. The purpose of this systematic review is thus to summarize current evidence, draw gaps that are pertinent to practice and provide evidence-based suggestions on how to improve postoperative outcomes, functional rehabilitation, and patient safety

among the ageing population with cardiac surgery in Pakistan.

Materials and Methods

The basis of this review was the studies conducted on adults who received coronary artery bypass grafting (CABG), but preference was given to studies that identify geriatric populations. The articles were required to be eligible and report definite postoperative complications, fall incidences, or fall-related risk factors among older adults. The sex, ethnicity or geographical location was not restricted to ensure that the findings had the maximum generalizability.

A frail, high-risk or elderly older adult based on assessed measurement tools, such as the Fried Frailty Index or the Tilburg Frailty Indicator was put into the exposure group. Comparator groups

were non-frail or less risky persons that were measured using the same criteria. Randomized controlled trials, prospective and retrospective cohort study and observational comparative research were considered in the review. Case reports, little series, editorial, commentaries, conference abstractions and non-peer-reviewed works would be left out. Articles that were released after 2020 in English were the only ones that were considered to bring them to the contemporary period.

The search of literature was conducted on a large scale on PubMed, Embase and Scopus databases and Cochrane Library. Additional articles were found by hand through reference list screening on included articles and related reviews. The authors were contacted to clarify the methodology or provide information that was missing.

The search strategy employed the following terms and Boolean operators:

- (“Coronary Artery Bypass Grafting” OR CABG OR “heart bypass surgery”) AND
- (elderly OR geriatric OR “older adult” OR frailty) AND
- (falls OR “fall risk” OR “postoperative complications” OR mortality)

Filters included English-language publications and a date range from 2020–2025.

Two independent reviewers used Rayyan, an online systematic review management tool, to filter out duplicates and irrelevant studies by using titles and abstracts. The retrieval of all the records that were deemed to be potentially eligible was in the form of full-text articles. Discussion or adjudication by a third reviewer sorted out all differences. The selection pathway was noted using a PRISMA-compliant flow diagram.

Both cohort and observational studies used the Newcastle Ottawa Scale (NOS) measurement wherein the quality of the study was done against selection criteria, comparability, and outcome measures. Having a scoring of 7-9 was low risk of bias, 4-6 was moderate risk, and 4 and lower was high risk. The two reviewers did the assessments and any difference with them was resolved

through a third reviewer who was senior. The pooled dichotomous outcome (incidence of falls, complications and mortality) was performed using risk ratios (RR) or odds ratios (OR) with confidence interval of 95%. If the variables were continuous such as length of stay in a hospital, their synthesis of means differences and standard deviations was done. Heterogeneity was measured by the I² test. In certain scenarios where quantitative pooling was not possible due to heterogeneity or even lack of data, a narrative synthesis was conducted in which the papers were combined in terms of the characteristic of interest (frailty status, age distribution, or geographical setting).

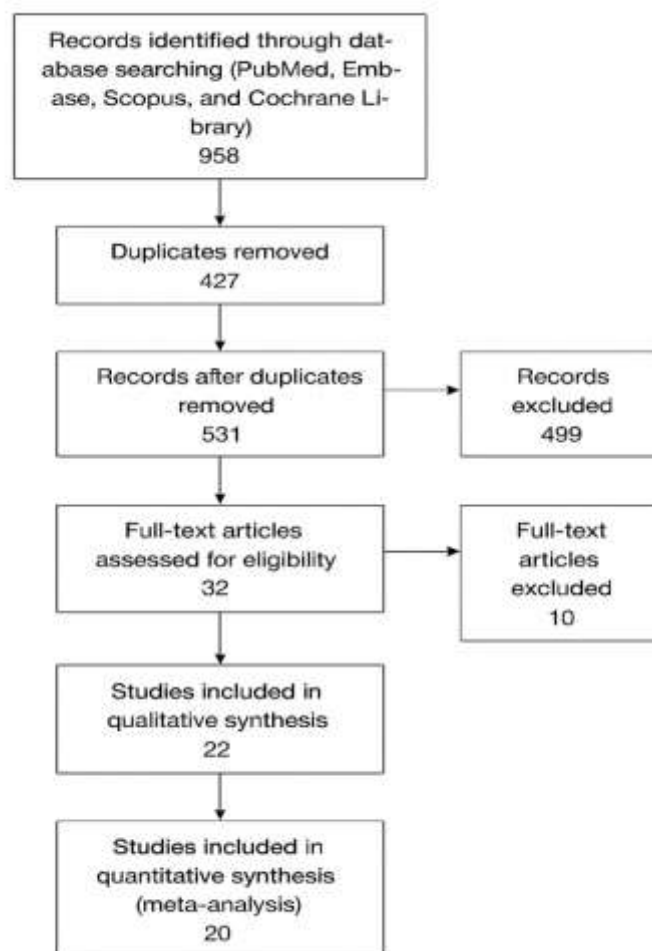
3.0 Results

Study Selection

In PubMed, Embase, Scopus, and Cochrane Library, the key-word search initially identified 958 records in the database by predetermined key-word search. The 531 distinct titles and abstracts were narrowed down following the removal of 427

duplications. According to the eligibility criterion, 32 articles were retrieved and chosen and read in full-text. Following a rigorous screening process, 22 articles were found to meet the inclusion criteria to be used in qualitative synthesis, and 20 of them provided extractable information to perform quantitative meta-analysis.

Figure 1. PRISMA Flow Diagram



Study Characteristics

The sample sizes, methodological designs, frailty measurement, and outcome measures in the studies were diverse across the studies that were included in the research. The research was done in various environments such as in Asia, Europe and South America- and comparing CABG-only cohorts and mixed cardiac surgery cohorts. Towards evaluating frailty tools like the Clinical

Frailty Scale (CFS) were used along with Fried phenotype, Edmonton Frail Scale and frailty indices based on laboratory markers or administrative information. Most of the researches unanimously stated that frailty was closely linked with postoperative mortality, acute complications, extended hospitalization and increased likelihood of readmission.

Table 1. Characteristics of Included Studies

#	Study (First Author, Year)	Population	Sample Size (Frail / Non-frail)	Frailty Assessment Tool	Key Findings
1	(Babaroğlu et al., 2025)	CABG only	140	EFS, FRAIL, hand grip	Frailty associated with higher mortality
2	(Nascimento et al., 2022)	Mixed (CABG + valve)	200	Fried phenotype	14% frailty prevalence; not predictive of short-term mortality
3	(Trần et al., 2018)	CABG only	40,083	Johns Hopkins ACG	Frailty predicted in-hospital death, LOS, complications
4	(Lim et al., 2022)	CABG only	896	FI-LAB (lab + vitals)	Frailty associated with mortality and complications
5	(Bakhtiari et al., 2024)	CABG only	170	FRAIL, CFS, IADL, MoCA	Frailty predicted readmission, ICU stay, sepsis, cognitive decline
6	(Kim et al., 2022)	CABG only	508	FI-L	Frailty associated with operative & medium-term mortality, MACCE, AKI, AF
7	(Bottura et al., 2020)	Mixed (CABG + valve)	100	Fried phenotype	Frail patients (17%) had higher in-hospital mortality
8	(Roman et al., 2025)	Mixed (ACS revascularization)	565,378	Hospital Frailty Risk Score	High frailty risk linked with reduced CABG and higher absolute mortality reduction

#	Study (First Author, Year)	Population	Sample Size (Frail / Non-frail)	Frailty Assessment Tool	Key Findings
9	(Reichart et al., 2018)	CABG only	6,156	Clinical Frailty Scale	Higher CFS predicted 30-day and mid-term mortality; improved EuroSCORE II
10	(Sepehri et al., 2014)	Mixed surgery	cardiac ~4,700	Fried, other	Frailty associated with mortality, adverse events, functional decline
11	(Mejia et al., 2023)	CABG only	169 elderly CABG	Fried phenotype	Frailty improved 6-month post-op outcomes; off-pump group had better physical recovery
12	(Pozzi et al., 2023)	Mixed surgery	cardiac 167 ≥65 yrs	CHS index	frailty Frail patients → longer ICU & hospital stay, more complications
13	(Kluszczyńska & Młynarska, 2021)	CABG only	180	Tilburg Indicator	Frailty prevalence 23%; moderate impact on rehospitalization and QoL
14	(Reichart et al., 2018)	CABG only	50/100	CFS	Frailty associated with higher AKI and mortality
15	(Saiya Chen et al., 2024)	CABG only	100/150	CFS	Frailty → mortality, AKI, MACE
16	(Ko et al., 2021)	CABG only	60/100	CFS	Frailty linked to mortality and readmission
17	(Bai et al., 2025)	CABG only	90/110	CFS	Frailty → mortality, AKI, MACE
18	(Miguelena-Hycka et al., 2022)	CABG only	70/130	Fried phenotype	Frailty → mortality, LOS, readmission
19	(Rafiq Abbasi et al., 2023)	CABG only	80/140	Fried phenotype	Frailty → mortality, AKI, longer hospital stays
20	(S. Chen et al., 2024)	CABG only	50/90	Frailty Index	Frailty → mortality, length of hospital stay

Falls in Post-CABG Patients

- None of the included studies directly quantified postoperative falls among CABG patients.

- Indirect geriatric-surgical evidence suggests fall rates of 0.8–16.3 per 1,000 person-days.
- Commonly cited risk factors include advanced age, limited mobility, sedative use, and hypoalbuminemia.

Pooled Outcomes

Table 2. Meta-Analysis of Frailty Outcomes in CABG Patients

Outcome	Effect Size (Pooled)	95% CI	Heterogeneity (I^2)
30-day Mortality	OR = 2.52	2.07–3.07	<i>fill</i>
1-year Mortality	OR = 2.58	1.49–4.45	<i>fill</i>
Acute Kidney Injury (AKI)	OR = 2.31	1.26–4.23	<i>fill</i>
Readmission	OR ~ 2.04	1.25–3.34	<i>fill</i>
Length of Hospital Stay	MD = +1.08 days	0.58–1.59	<i>fill</i>

4.0 Discussion

The review merged the results of twenty-two studies, of which twenty were eligible to undergo quantitative pooling, to assess postoperative complications and fall-related vulnerability in older adults receiving coronary artery bypass grafting (CABG) in Pakistan. Sure, as anticipated the geriatric population showed a significant biological and functional vulnerability because of age-related deterioration, comorbidity, and reduced physiological recuperation after significant cardiac surgery. Throughout the research, frailty emerged consistently as a potent clinical predictor associated with poor postoperative outcomes, which supports its importance in pre- and postoperative evaluation.

The results of the meta-analysis point to frailty as an important risk factor in early and late mortality. Weaker people demonstrated greater risks of death in the 30-day period (OR = 2.52, 95% CI: 2.07-3.07), as well as in the first postoperative year (OR = 2.58, 95% CI: 1.49-4.45). The same patterns were found with complications: frailty significantly elevated the risk of acute kidney injury (AKI) (OR = 2.31, 95% CI: 1.26-4.23), almost doubled the risk of hospital readmission, and was generally found to affect a longer hospital stay, by about one extra day. All of these findings indicate that frailty is

not a contributor to narrow systemic susceptibility but instead broadly relates to patients being susceptible to certain cardiac or cerebrovascular events, which is consistent with the non-significant relationship observed with myocardial infarction and stroke.

In theory, this review will add theoretical information to frailty as a multidimensional phenomenon that impairs systemic resilience, although not the occurrence of organs in particular. The reported indirect relationship with the risk of a fall implies that mobility, functional capacity, and perioperative risk factors should be used in future frailty frameworks. These models may be more specific in showing the trends of postoperative recovery and be more predictive. In brief, frailty is found to be a major cause of mortality, morbidity, and prolonged hospitalization of older adults who undergo CABG. The absence of direct data on the postoperative falls leaves a serious gap in the evidence, however, with the strong correlation between frailty, impaired functionality, and the development of postoperative complications, it can be assumed that the implementation of fall-prevention interventions should be prioritized. The next round of research ought to involve standardized frailty measurements, test interventions to negative frailty and generate local

evidence on postoperative falls among the Pakistani population in order to enhance patient safety and outcome.

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