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Exploring Postoperative Outcomes In Coronary Artery Bypass Grafting (CABG) Patients And Role Of AI Based Strategies: A Scoping Review

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ABSTRACT

Background

This comprehensive review consolidates existing research about postoperative outcomes after coronary artery bypass grafting (CABG), a prevalent yet high-risk cardiac procedure. Notwithstanding improvements in surgical methods and perioperative management, CABG patients often encounter multisystem problems, including cardiac arrhythmias, pulmonary dysfunction, renal impairment, neurological impairments, and infections. These problems correlate with extended hospitalizations, elevated readmission rates, and increased healthcare expenditures.

Materials and Methods

A thorough literature search was performed in the Cochrane Library, MEDLINE, EMBASE, and CINAHL databases in accordance with PRISMA-ScR criteria and the Arksey and O'Malley methodological approach. Studies comprising adult CABG patients with follow-up durations of up to six months were incorporated. Data extraction concentrated on complication profiles, detection timeframes, hospital stay duration, and recovery metrics.

Results

Narrative synthesis indicated a significant correlation between the early identification of problems and decreased hospital durations. The review highlighted significant deficiencies in the current literature, including inconsistencies in monitoring techniques, insufficient focus on long-term outcomes, and inadequate representation of older and female patients.

Conclusion

Recent evidence indicates that artificial intelligence-based monitoring systems could improve early intervention and recovery. This analysis highlights the necessity for standardized postoperative care protocols and additional research into long-term recovery, quality of life, and cost-effective surveillance measures to enhance CABG results.

Keywords

Coronary Artery Bypass Grafting, Postoperative complications, Scoping review, Cardiac surgery outcomes, Artificial intelligence in healthcare,

INTRODUCTION

Coronary artery bypass grafting (CABG) remains one of the commonly performed surgical procedure in the treatment of severe coronary artery disease (CAD), as it has shown to improve long-term survival with minimal major adverse cardiovascular events [1]. Despite significant advancements in surgical techniques, perioperative management and postoperative rehabilitation, CABG is still associated with considerable

risk of postoperative complications, hospital readmissions and emergency department (ED) re-visits, contributing to increased healthcare burden and resource utilization [2].

The 30-day morbidity and mortality rates following CABG have been reported at 14.0% and 2.0% respectively, categorizing it as a high-risk procedure [3]. Studies indicate that 14% of Medicare patients undergoing CABG are readmitted within 30 days of discharge, while 10% present to the ED often due to surgical complications, cardiac dysfunction, or other comorbid conditions [4]. Additionally, 7% of patients experience multiple readmissions or ED visits, highlighting the complex recovery process and the need for improved postoperative care strategies [5].

Postoperative complications following CABG are multisystemic. Cardiovascular complications such as atrial fibrillation (AF), congestive heart failure (CHF), myocardial infarction (MI), pericardial effusion and thromboembolism-induced early graft failure contribute to increased morbidity; with AF affecting 30% of patients and cardiac tamponade occurring in 20% [6]. Pulmonary complications including postoperative pneumonia, pleural effusion and acute respiratory distress syndrome (ARDS) are prevalent. Renal dysfunction is also a significant concern, with acute kidney injury (AKI) occurring in up to 23% of CABG patients. Neurological complications including stroke, delirium, and postoperative cognitive impairment are common; with postoperative stroke occurring in 5% of cases [7]. Infectious complications seen include deep sternal wound infections (DSWI), mediastinitis, urinary tract infections (UTIs) and sepsis. These pose substantial risks particularly in patients with diabetes or obesity. DSWI, although rare (1–2% incidence), has a high mortality rate of 6–30%, making it a serious postoperative concern [8]. Additionally, chronic post-sternotomy pain affects 21–56% of CABG patients, often leading to persistent discomfort and functional impairment [9].

Pre-existing problems or surgical complications may lead to congestive heart failure (CHF). Vasospasm, air bubbles and graft ischaemia are examples of early postoperative problems that usually peak two hours after reperfusion and might be caused by decreased fibrinolysis, left ventricular dysfunction, and enhanced platelet activation [10]. Thromboembolism-induced graft failure has been documented during the first month. Following CABG, 20% patients developed pericardial effusion; making cardiac tamponade a serious consequence. Nearly half of instances of delayed cardiac tamponade (>48 hours) progressed into severe tamponade, necessitating immediate intervention [11]. Atrial fibrillation is the most frequent postoperative electrophysiological anomaly following CABG, which is arrhythmogenic. Acute myocardial infarction sequelae such as cardiogenic shock, myocardial rupture, and post-infarction pericarditis can potentially result in CHF [12].

Despite extensive research on CABG outcomes, significant gaps exist in understanding the long-term postoperative trajectory, particularly regarding functional recovery, quality of life, and long-term complications [13]. While early postoperative complications are well-documented, less attention has been given to long-term sequelae such as persistent cardiac dysfunction, neurocognitive impairment and the impact of frailty on recovery outcomes [14]. Furthermore, variations in postoperative management across different healthcare settings may contribute to disparities in patient outcomes, warranting further investigation [15]. This scoping review examines existing literature with the aim to identify and categorize key postoperative complications, map their prevalence and severity, evaluate hospital readmission rates and functional recovery, and identify gaps in existing literature for future research. Through the synthesis of current information, this review aims to guide future research trajectories and facilitate the formulation of more efficacious care solutions.

To achieve its objectives, this review covers six major research topics. Secondly, it examines the categories of postoperative complications—cardiac, pulmonary, renal, neurological, and others—frequently encountered in CABG patients, along with their occurrence and severity across various healthcare environments. Third, it delineates the risk factors linked to these problems and examines how these variables interact to affect patient outcomes. Fourth, it assesses the influence of postoperative complications on patient recovery patterns, hospital readmission rates, and overall quality of life. Eventually, it highlights the shortcomings in existing literature that require additional investigation to enhance the comprehension of long-term results and to guide evidence-based advancements in postoperative care.

MATERIALS AND METHODS

Design

This scoping review followed the methodological framework proposed by Arksey and O'Malley**,** later refined by the Joanna Briggs Institute**.** PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines were employed to ensure transparency and rigor. For this review, a detailed protocol was developed and registered with the Open Science Framework (OSF) under the ID https://doi.org/10.17605/OSF.IO/W8E9P, which is publicly accessible.

Initially, the objective was to explore patient characteristics and recovery challenges following Coronary Artery Bypass Grafting (CABG). However, due to the unexpectedly large volume of literature, the scope was refined to specifically focus on studies evaluating post-operative recovery and patient outcomes. This provided a more systematic synthesis of findings while preserving the scope of pertinent evidence.

Search Strategy

This review employed various databases, including the Cochrane Library, MEDLINE, CINAHL, and EMBASE to identify relevant studies. In addition, lateral (manual) searches were conducted to capture additional literature on CABG and postoperative complications. All processes adhered to PRISMA-ScR criteria to guarantee the accuracy of the methods. The search and selection process were guided by predetermined inclusion and exclusion criteria**.**

Eligibility Criteria

Studies were included if they focused on adult patients (≥18 years) who underwent CABG and reported postoperative complications. Included designs encompassed Observational studies, cohort studies, case-control studies, clinical trials, systematic reviews, and meta-analyses. Studies were required to document the occurrence, timing, or identification of surgical complications with the following six-month period. Excluded were studies focused on non-CABG cardiac surgeries, those lacking complication data, and non-peer-reviewed literature (e.g., case reports, editorials, conference abstracts). Furthermore, studies with unclear procedure or that used only logistical regression without further models were also excluded.

Selection of Sources of Evidence

The selection of studies adhered to a three-step procedure to guarantee systematic inclusion. First, two independent reviewers screened titles and abstracts to exclude irrelevant studies. Next, eligible studies were imported into Covidence for structured screening. During the second phase, abstracts not focused on postoperative CABG complications were removed. Finally, full-text screening was conducted independently by two reviewers, with discrepancies resolved via discussion or consultation with a third reviewer.

Data Charting Process

A structured data extraction form was developed and piloted prior to formal data collection. Extracted data were stored in an Excel spreadsheet and independently verified by two reviewers for accuracy and completeness. Data fields included publication details (title, author, year, country, study design), population characteristics (age, gender, comorbidities, number of grafts), and outcomes (type, severity, and timing of complications; readmission rates; recovery markers; long-term outcomes). Intervention data such as monitoring strategies and standard vs improved care models were also collected.

Risk factors and predictors of complications and mortality were identified. Descriptive statistics were used for categorical data, while interquartile ranges (IQR) summarized continuous data. A narrative synthesis was conducted to consolidate and interpret findings. Additionally, a PRISMA-ScR flow diagram was generated to visually represent the selection process.

Patient and Public Involvement Statement

None of the participants or public members participated in the design, execution, or reporting of this investigation. The findings were synthesized from previously published literature and therefore did not require ethical approval. Results will be disseminated through peer-reviewed publications and conference presentations to enrich the current evidence base on CABG postoperative outcomes.

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RESULTS

Selection of sources of evidence

A comprehensive literature review across databases such as PubMed, MEDLINE, EMBASE, Scopus, Google Scholar, and the Cochrane Library resulted in 1,374 records. After removal of 784 duplicate records, 590 unique studies were screened. Of these, 320 studies were excluded for reasons including incomplete reporting of hospital stay, undefined surgery timing, lack of gender-specific data, and insufficient description of risk factors or operative conditions. In the final selection process, 47 additional studies were excluded for failing to meet key inclusion criteria (e.g. inadequate explanation of complications or non-representative age ranges), leaving 20 studies for inclusion in the review. A PRISMA flow diagram details the screening process in line with PRISMA-ScR guidelines (**Figure 1**).

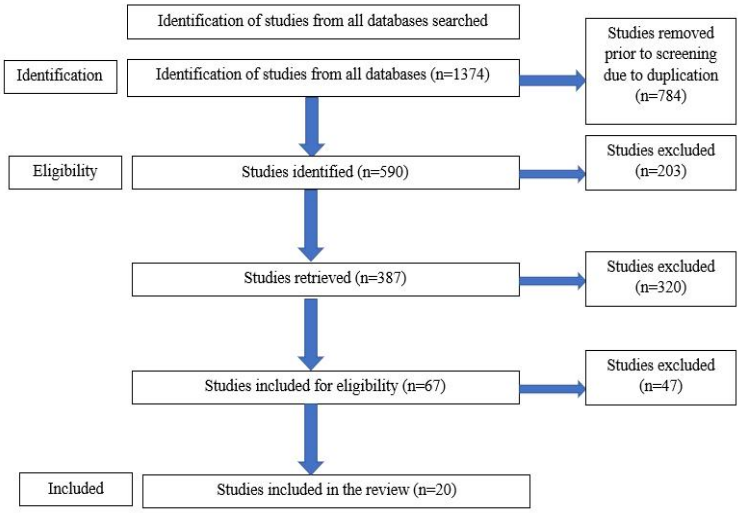


Figure 1: PRISMA-ScR flowchart

General Study Characteristics

Twenty studies met the inclusion criteria for this scoping review (Table 1). The majority of this research were randomized controlled trials, signifying a primary emphasis on rigorous experimental technique. Overall, study populations were predominantly male with mean ages commonly in the early- to-mid 60s. Across the studies, patients frequently presented with several cardiovascular risk factors and comorbidities—for example, history of acute coronary syndrome, myocardial infarction, hypertension, diabetes mellitus, and cigarette smoking. Many studies also reported additional risk factors such as dyslipidaemia, chronic obstructive pulmonary disease, and renal insufficiency. Furthermore, the number of coronary artery grafts varied among patients, and some studies included subgroups undergoing combined procedures (e.g., CABG with valve repair).

Critical Appraisal of Individual Sources of Evidence

A rigorous critical evaluation of the 20 included studies was not conducted, as the main aim was to delineate and synthesize the scope of available literature on postoperative outcomes after CABG. We gave less importance to the quality of individual studies. We have noted major limitations reported by the original authors of studies – References as supplementary information, figures as "figures" attachment itself, Table (PDF) as supplementary information.

Distribution of study designs

The methodological environment for research on CABG postoperative outcomes is highlighted by the distribution of study designs **(Figure 2).** The research framework predominantly consists of randomized controlled trials (RCTs), esteemed for their capacity to systematically assess the effectiveness of therapies and correlate treatments with improved postoperative results, including diminished complications and expedited recovery. Besides RCTs, those included were Observational Studies. These studies provide important information on the occurrence of complications and real-world patient care. By improving generalisability, these designs frequently assess risk variables and long-term outcomes, supporting the results of RCTs.

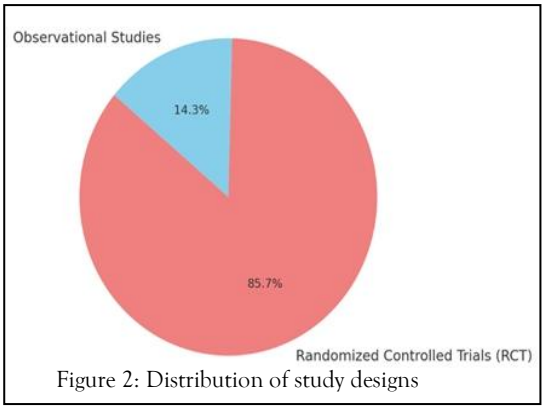
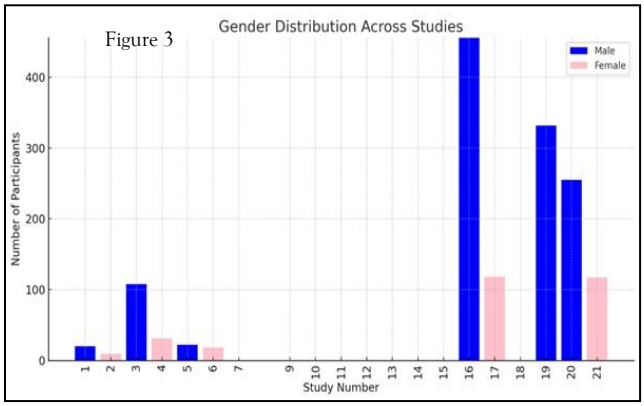


Figure 2: Distribution of study designs

Figure 3



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Gender distribution across studies

Most research indicate a predominance of male participants; however, a minority exhibit a more even gender ratio. Some studies have a more balanced ratio, but the general trend leans towards male dominance in study populations. This could indicate a higher prevalence of cardiovascular diseases among men or gender bias in study selection **(Figure 3)**.

Time taken to detect complications across the identified studies

There is considerable variability with regard to the time needed for complication detection across studies **(Figure 4)**. Study 1 and Study 19 demonstrated the most protracted peak in complication identification, reaching approximately 1050–1200 minutes (17.5–20 hours) postoperatively. Conversely, Studies 4, 9, and 16 indicated the briefest detection times, varying from 38 to 290.8 minutes (roughly 38 minutes to 4 hours and 50 minutes). The variances are represented as peaks and troughs on the timeline, signifying that certain difficulties necessitated more rigorous observation for detection, whereas shorter durations may suggest swift complication identification or less complex clinical situations.

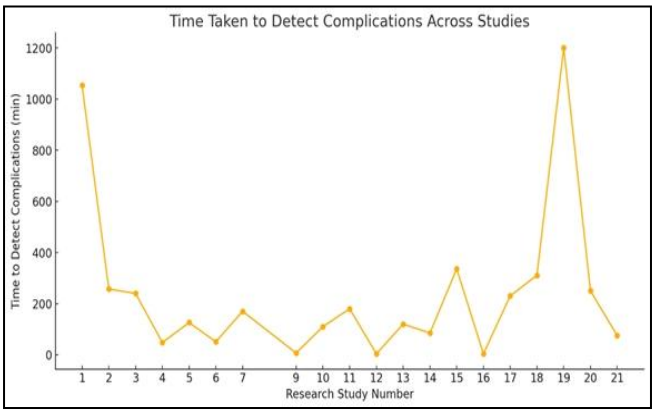

Figure 4: Time taken to detect complications across the studies

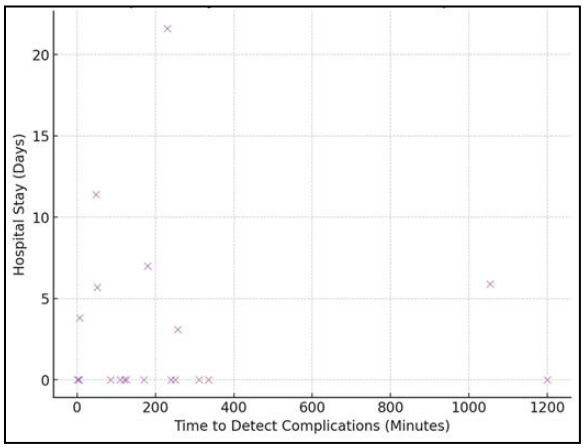

Figure 5: Hospital Stay vs. Time to Detect Complications

Hospital Stay vs. Time to Detect Complications

A link exists between extended hospitalizations and the latency in detecting complications **(Figure 5)**. Research indicating earlier identification of problems typically indicated reduced hospital stays, highlighting the importance of prompt diagnosis in decreasing hospitalization stay.

Clinical Review of Postoperative Complications

Aneurysms constituted the most commonly reported complication, representing over 16% of cases, so demonstrating a notable prevalence in the examined literature. The rates of reintubation were significantly elevated, indicating serious postoperative respiratory difficulties. Infections and atrial fibrillation were often noted, underscoring the hazards of postoperative sepsis and cardiac arrhythmias. Pacemaker dependency and atelectasis emerged as moderately prevalent consequences, presumably associated with underlying or progressing respiratory compromise. Neurological and renal problems were recognized as major concerns post-surgery. Infrequent yet severe consequences including stroke, graft coronary aneurysm, cardiac arrest, shock, and sternotomy-associated problems. While rare, these occurrences possess significant clinical severity and necessitate vigilant observation. Effusion and postoperative hemorrhage were documented with reduced incidence; nonetheless, they remain clinically significant and necessitate ongoing vigilance during recovery.

Outcome and Complication Profiles:

The review revealed a wide range of postoperative complications: **Cardiac Complications:** Commonly reported occurrences included myocardial infarction, arrhythmias (with postoperative atrial fibrillation observed in up to 30% of patients in certain trials), and congestive heart failure. **Pulmonary complications:** pneumonia, atelectasis, and the necessity for reintubation. In certain cases, extended mechanical breathing or reoperation for hemorrhage was necessary.

Renal and Neurological Outcomes: Renal impairment, cerebrovascular accident, and changed awareness levels were significant concerns post-surgery. **Infection and Wound consequences:** Infectious consequences varied from superficial to deep sternal wound infections and were consistently linked to heightened morbidity. A significant observation from the synthesis was the inconsistency in the duration needed to identify problems.

Certain studies revealed early detection within minutes, while others reported peak detection times occurring as late as 17.5 to 20 hours postoperatively. A direct correlation was noted between the swift identification of problems and the duration of hospital stay: studies indicating faster detection generally reported reduced hospitalization lengths. A clear narrative synthesis—strengthened by organized tables and the identification of research deficiencies—this review amalgamates quantitative data (e.g., detection times and hospital stay lengths) with qualitative findings (e.g., male prevalence and multisystem complications), providing a thorough overview of postoperative challenges following CABG. This dual approach highlights the variability in research methodology and outcome metrics, while directing future research objectives.

DISCUSSION

Renal Complications

Postoperative renal dysfunction remains a major concern after CABG. Kidney injuries including acute kidney injury (AKI), the need for renal replacement therapy and even death- is strongly associated with postoperative renal function. Notably, 10% of patients who develop renal complications after cardiac surgery are responsible for an annual expenditure of approximately $100 million [16]. In this context, several factors have been implicated: diabetes, obesity, blood transfusions, advanced age and the use of prolonged external ventilation. Moreover, the measurement of glomerular filtration rate (GFR) may also serve as a predictor for concomitant cardiovascular morbidities [17]. In the perioperative phase, biochemical markers such as elevated lactate levels and reductions in hemoglobin, red blood cell count, haematocrit, and cerebral oxygen saturation further indicate renal injury. In addition, increased neutrophil/ lymphocyte and platelet/ lymphocyte ratios have been associated with the development of AKI [18].

Pulmonary Complications

Pulmonary complications arise in roughly 2.3% of CABG procedures, affected by various preoperative and intraoperative factors such as advanced age, obesity, diabetes, inadequate glycaemic control, preexisting vascular conditions, postoperative atrial fibrillation (POAF), extended cardiopulmonary bypass, blood transfusions, chronic obstructive pulmonary disease, and anticoagulant administration [20]. Acute respiratory distress syndrome (ARDS) is a frequent complication observed in these patients; its diagnosis hinges on parameters like arterial partial pressure, pulmonary dysfunction, hypoxia, and the oxygen saturation to inspired oxygen ratio [21]. Although blood transfusions during CABG have the potential to induce lung injury, elevated levels of Endocan 1 (ESM-1) postoperatively are most strongly linked to ARDS. [22] Furthermore, extended mechanical ventilation—as well as higher perioperative mortality rates—have been reported particularly in robot-assisted CABG procedures, especially among older patients, those with reduced left ventricular ejection fractions, or those exposed to prolonged anaesthesia. In contrast, off-pump CABG has been associated with improved respiratory outcomes [23]. The routine use of chest tubes to prevent fluid accumulation, although effective, carries a risk of causing pneumothorax upon removal. Moreover, while tension pneumothorax remains an uncommon event, pleural effusion occurs in 41–87% of patients in the early postoperative phase, particularly following on-pump CABG and is further influenced by factors such as carotid stenosis, the extent of coronary disease, ventilation duration, mammary artery graft use, and length of hospital stay [24]

Myocardial Infarction and Stroke

Cardiac problems, such as myocardial infarction (MI) and stroke, are less prevalent generally but are disproportionately elevated in diabetes individuals. MI has been reported in up to 8% of CABG cases, and its occurrence significantly increases the risk of both readmission and postoperative mortality [25]. Thin-capped fibroatheroma plaques and graft calcification are two morphological changes that have been reported in conjunction with elevated cardiac troponin I levels and typical ECG abnormalities like ST-segment elevation and depression [26].

Additionally, a pronounced drop in haemoglobin (anaemia) may precipitate MI, while albuminuria in diabetic patients is linked to heightened cardiovascular mortality— including MI and stroke [27].
Neurological complications are also a critical concern. Recent data indicate that approximately 1.7% of patients exhibit imaging-confirmed stroke post-CABG [28]. These neurological events are frequently associated with higher C-reactive protein (CRP) levels, and a clear relationship exists between elevated CRP and increased rates of MI and stroke. Overall, stroke is implicated in 1.6–3% of adverse CABG outcomes; its occurrence not only predisposes patients to other morbidities such as congestive heart failure and MI but also increases mortality risk by up to fivefold, particularly when intraoperative events like cerebral hypoperfusion or embolism are involved [29].

Research Gaps and Implications

Considerable diversity exists in prehabilitation and rehabilitation procedures for CABG patients, especially regarding inspiratory muscle training (IMT) and inpatient cardiac rehabilitation programs. Studies demonstrate inconsistencies in training devices, intensity, frequency, and duration of IMT, underlining the lack of standardised recommendations. Post-CABG rehabilitation procedures vary significantly; some programs include early ambulation, limb exercises, and inspiratory muscle training, while others depend only on conventional care, resulting in differences in functional recovery outcomes [30]. This variation highlights the need of multicenter randomised controlled trials (RCTs) in determining the best length, intensity, and components of rehabilitation therapies.
Multicenter randomized controlled trials (RCTs) are needed to identify the optimal duration, intensity, and components of rehabilitation programs. Developing standardised, evidence-based recommendations is critical for assuring consistent, effective postoperative treatment and increasing recovery results in CABG patients. There is a lack of longitudinal studies on long-term outcomes [31].
Data indicates that female and elderly patients have little representation in CABG clinical trials, while possessing unique complication profiles, recovery structure, and risk variables.
According to a research published in *PLOS ONE*, only 21.4% of CABG patients were women, who had higher rates of diabetes and hypertension, as well as an elevated risk of ventilator reliance and cardiac readmission. Another research in *Frontiers in Cardiovascular Medicine* found that women have a poorer prognosis after CABG, emphasising the need of determining whether these disparities are due to biological or presurgical variables. Similarly, research published in the *Journal of the American College of Cardiology* examined outcomes in CABG patients aged 80 and more, while a *Circulation* study emphasised the under-representation of high-risk elderly groups, despite the potential advantages of surgery. These findings highlight the necessity for further research to tackle gender and age differences and to develop customized rehabilitation strategies for older patients, thereby providing equitable and evidence-based care [32]. Discrepancies in the management of postoperative infections, especially sternal wound infections (SWI) and surgical site infections (SSI), continue to be a significant issue.
While certain therapies, such as preoperative skin antisepsis using alcohol-based agents and triclosan-coated sutures, have shown to be effective in preventing SSIs, others, such as antibiotic-containing wound irrigation and plastic drapes, have shown conflicting results. comprehensive study discovered that povidone-iodine (PVP-I) wound irrigation significantly reduced SSIs in both clean and clean-contaminated wounds, but antibiotic irrigation was ineffective. These findings underscore the imperative for thorough systematic reviews and meta-analyses to evaluate infection prevention strategies—such as nasal CPAP, prophylactic antibiotics, and wound care techniques—in order to establish uniform clinical guidelines [33].

Implications for Clinical Practice, Policy, and Education

A The use of structured prehabilittion, rehabilitation programs, and AI technologies significantly improves outcomes for high-risk CABG patients. Preoperative inspiratory muscle training lowers pulmonary problems and hospital stays, while multimodal exercise interventions improve functional capacity and reduce postoperative atrial fibrillation. AI technologies, when combined with systematic prior rehabilitation and rehabilitation programs, have shown potential to decrease surgical complications, reduce hospital stays, and improve functional recovery in high-risk CABG patients.

AI-driven wound monitoring tools enable early infection identification and contribute to decreased hospital readmissions, whereas machine learning algorithms enhance patient selection for less-invasive CABG procedures. Standardized, AI-enhanced therapy procedures integrated with based on evidence rehabilitation techniques could improve short- and long-term outcomes [34]. Integrating AI technologies and standardized rehabilitation protocols into healthcare teaching and practice can enhance results for CABG patients. Educating healthcare professionals in AI-assisted wound assessment and digital health platforms can facilitate prompt clinical decision-making and improve recovery outcomes. Furthermore, patient-centric digital tools, such chatbots and smartphone applications, enhance involvement, medication adherence, and real-time symptom assessment [35]. Systematic reviews and meta-analyses are essential for assessing therapies that enhance CABG outcomes. Significant findings indicate that AI-driven wound assessments surpass traditional evaluations, preoperative inspiratory muscle training effectively reduces ICU stays, and infection prevention strategies (e.g., CPAP, antibiotic prophylaxis, and dressings) are crucial for high-risk populations such as diabetics. Research contrasting early and delayed mobilization indicates substantial effects on long-term functional results and survival rates.

LIMITATION

Limited sample sizes could reduce statistical power, resulting in possibly incorrect or non-generalizable results. Unrepresentative sampling can induce bias, especially when certain subsets, such as elderly persons or women, are underrepresented. When patient groups considerably diverge from the general CABG population—due to factors such as age or comorbidities—the external reliability of the findings is undermined. Inadequate follow-up periods may neglect late problems such as failed grafts or recurrent ischemia; long term data are crucial for assessing enduring therapeutic advantages. Patient heterogeneity in CABG, encompassing age, comorbidities, and disease severity, presents difficulty in standardizing conclusions across varied populations.

CONCLUSION

Postoperative complications, including renal, pulmonary, cardiac, and neurological disorders, substantially impede recovery and increase healthcare costs. Innovative AI-driven monitoring methods have potential for earlier identification and proactive management of these issues. Future study must encompass not only short-term outcomes but also investigate long-term recovery trajectories, quality of life, and the cost-effectiveness of novel surveillance systems.

CLINICAL SIGNIFICANCE

Comprehending the prevalent postoperative problems after CABG and the necessity for early detection enables doctors to execute prompt therapies, minimize hospital durations, and enhance patient outcomes. The implementation of AI-driven monitoring technologies and standardized care procedures has the potential to enhance critical care management and improve long-term recovery in post-CABG patients.

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Table 1:

Sample Characteristics	Comorbidities / Risk Factors	Main Complications	Study Design	Detection Time	Hospital Stay	Study (References)
61±10 yrs; M=69.65%	MI (55%), ACS (65%), Smoking (33%)	Not specified	RCT	1054±376 min	5.9±1.1 days	[36]
66.5±9.0; M=77.7%	Smoking (32%), HTN (57%), DM (43.9%)	Not specified	RCT	257.4 min	7±3.1 days	[37]
54.3±4.5; M=55%	DM (42.5%), HTN (37.5%)	Atelectasis, ↑PO2, ↓SaO2	RCT	240 min	7 days	[38]
64±10; M=74%	HTN (91%), Smoking (51%), DM (50%)	Not specified	RCT	48±10 min	11.4±11 days	[39]
77±7; M=65%	HTN (76%), CKD (45%), DM (24%)	Stroke, TIA, Renal disease	RCT	126±42 min	12±21 days	[40]
66±21; M=71%	Valve repl. (41%)	MI (6%), Arrhythmia (30%), Pneumonia	RCT	51±25 min	219±27 days	[41]
59±8; M=82%	LVEF 1.8±0.9	Atrial arrhythmia (10%), Pneumonia	RCT	170±41 min	5.7±1.6 days	[42]
65±10; M=75%	DM (41.7%), COPD (2.1%)	Sternal infection, High glucose	RCT	85±27 min	2 days	[43]
59±8; M=69.35%	DM (19.44%), HTN (25%)	MRSA, wound infections	RCT	336±8.5 min	4 days	[44]
61.9±11; M=66.4%	DM (62%), HTN (82.5%)	Resp. (62%), Wound (25%)	RCT	4.4±0.7 min	7 days	[45]
67.9±9.8; M=60.8%	DM (49.1%), IMA graft use	Bacteremia (31.4%), Sepsis	RCT	230.5±60.3 min	5 days	[46]
66.4±8.6; M=73%	COPD (29%), DM (44%)	Pulmonary (54%), Arrhythmia (64%)	RCT	311.2±1258.7 min	21.6±22.8 days	[47]
50.42±15.43; M=50.94%	Renal (35.8%), Coagulopathy (28%)	Bleeding, CV failure, Infection	RCT	1200 min	1 day	[48]
69 (63–74); M=82%	CKD (59%), COPD (10%)	AFib (34%), Pneumonia, Pericarditis	RCT	250 min	8 (7–10) days	[49]
<60: 27%, >70: 22%; F=19%	HTN (45%), MI (34%), Smoking (60%)	Resp. (23%), Stroke (3%), Infection (17%)	RCT	75±27 min	2–3 days	[50]