Jurnal Ners Volume 9 Nomor 3 Tahun 2025 Halaman 4886 - 4896
JURNAL NERS
Research & Learning in Nursing Science
http://journal.universitaspahlawan.ac.id/index.php/ners

EFFECTIVENESS OF EARLY MOBILIZATION IN RESTORING PHYSICAL FUNCTION AND PREVENTING IMMOBILIZATION IN POSTOPERATIVE CORONARY ARTERY BYPASS GRAFT (CABG)

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Abstract

The Coronary Artery Bypass Graft (CABG) procedure involves surgical trauma that triggers an inflammatory response, pain, and muscle weakness, so the patient tends to restrict movement. Physiologically, immobilization also reduces blood circulation, increases the risk of thrombosis, and worsens lung function due to lack of early mobilization. This study aims to systematically expose the effect of early mobilization on the recovery of physical function and prevention of immobilization in postoperative coronary artery bypass graft (CABG). The method uses search through 4 main databases, namely PubMed, Scopus, Sciencedirect and ProQuest with a span of 5 years from 2020 to 2025. The literature search used keywords, namely "early mobilization exercises", "immobilization prevention", "physical function", "post-operation CABG". The critical appraisal guidelines of the Joanna Briggs Institute are used for article quality assessment reviews. Results of this study is a total of nine articles were extracted related to early mobilization in the restoration of physical function as well as immobilization prevention in postoperative coronary artery bypass graft (CABG). Overall, the article produced several findings related to the existence of physical recovery and immobilization prevention points that support patients with several types of mobilization interventions ranging from basic to the use of tools implemented using various durations, frequencies and intensities. Early mobilization has a positive impact on the physical and psychological aspects and independence of patients. These findings support the need to implement early mobilization protocols as a standard part of CABG postoperative management, based on patient conditions, to optimize clinical outcomes and prevent immobilization-related complications.

Keywords: *early mobilitation, coronary artery bypass graft, physical function, immobilitation, nursing care*

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INTRODUCTION

Coronary heart disease (CHD) is the leading cause of death globally, and Coronary Artery Bypass Graft (CABG) is often the therapeutic option for managing coronary artery blockages (Allahbakhshian et al., 2023). However, postoperatively, patients are prone to decreased physical function, muscle weakness, and immobilization complications such as muscle atrophy, deep vein thrombosis, and decreased functional capacity. Prolonged immobilization not only slows recovery but also increases the risk of serious complications, prolongs hospitalizations, and adds to the burden of health care costs (Esmealy et al., 2023).

Prevalence based on WHO data, cardiovascular disease causes about 17.9 million deaths every year, with CHD as the main contributor. After CABG, about 20-30% of patients experience a significant decrease in functional capacity if they do not get adequate rehabilitation (Tajbakhsh et al., 2018). Studies also show that postoperative immobilization increases the risk of hospital-acquired deconditioning by up to 40%, worsening patients' quality of life and increasing the likelihood of remission. This confirms the importance of early rehabilitation interventions to prevent such negative impacts (Rezaei et al., 2022).

The Coronary Artery Bypass Graft (CABG) procedure involves surgical trauma that triggers an inflammatory or infectious response, pain, and muscle weakness, so the patient is likely to restrict movement (Han et al., 2022). If the intervention is not given in accordance with the patient's clinic, it is feared that immobilization will lead to a decrease in muscle strength, balance disorders, and a decrease in activity tolerance. Physiologically, immobilization also reduces blood circulation, increases the risk of thrombosis, and worsens lung function due to lack of early mobilization. This condition creates a vicious cycle where patients find it increasingly difficult to recover due to their ever-decreasing physical limitations (da Costa Torres et al., 2016).

One solution that has proven effective is the implementation of early mobilization and rehabilitation exercises in 24–48 hours postoperatively. Early mobilization, such as breathing exercises, stretching, and gradual ambulation, can improve circulation, prevent immobilization complications, and accelerate the recovery of physical function. Structured cardiac rehabilitation programs, including aerobic and resistance exercise, have also been shown to improve functional capacity, reduce the risk of recurrent cardiovascular complications, and improve patients' quality of life pasien (Afxonidis et al., 2021). Based on scientific evidence, early rehabilitation post-CABG should be the standard of care to minimize immobilization and speed recovery. However, the implementation still varies between agencies due to the lack of clear protocols. This study aims to evaluate the effectiveness of early mobilization and rehabilitation exercises in the recovery of physical function and prevention of immobilization in CABG patients. The results are expected to be the basis for the development of evidence-based clinical guidelines, thereby improving patient outcomes and the efficiency of the health system.

METHOD

This study is a systematic review that explores the effect of early mobilization and rehabilitation exercises in physical function recovery and immobilization prevention in *Postoperative Coronary Artery Bypass Graft* (CABG) patients. The articles used were obtained from four main databases, namely Scopus, PubMed, Science Direct, and ProQuest. The systematic review process includes searching, analyzing, and drawing conclusions from various published studies in a structured and holistic manner. This study follows the *guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (*PRISMA)* to ensure the quality and transparency of the analysis

Eligibility Criteria

This study established eligibility criteria that included inclusion and exclusion criteria. The inclusion criteria used are as follows: (1) Articles originating from scientific journals or proceedings, (2) Sources of articles taken from Scopus, PubMed, Science Direct, and ProQuest databases, (3) Journals or proceedings are open access, (4) Articles are available in *full text format*, (5) Publications are written in English or Indonesian, (6) Range of years of publication between 2020 to 2025, (7) The content of the article discusses the effect of early mobilization and rehabilitation exercises on physical function recovery and immobilization prevention in *postoperative Coronary Artery Bypass Graft* (CABG) patients, (8) Using a randomized controlled clinical trial (RCT) research design and an Experimental Study. Meanwhile, the exclusion criteria in this study are articles that do not meet one or more of the inclusion criteria..

Literature search was conducted on articles published in the range of 2020 to 2025 using keywords based on *Medical Subject Headings* (MeSH), including: *("early mobilization" OR "mobilization" OR "rehabilitation" OR "physical therapy") AND ("nursing" OR "nurse" OR "nurses") AND ("post-operative" OR "post-surgery" OR "post-surgical" OR "after surgery") AND ("Coronary Artery Bypass Graft" OR "CABG" OR "heart surgery" OR "cardiac surgery")*

Study Selection

The selection process began by identifying articles from the four databases using keywords that had been adjusted to MeSH. Researchers independently screened based on inclusion criteria, resulting in a total of 193 articles, with the following distributions: Scopus (n = 42), PubMed (n = 44), Science Direct (n = 82), and ProQuest (n = 23). After removing duplicate articles (n = 31), the next process is to review the titles and abstracts to exclude irrelevant studies (n = 19). Articles that have full text but do not discuss the appropriate outputs are also excluded (n = 72). Finally, a total of 9 articles were selected for analysis in this systematic review (Figure 1).

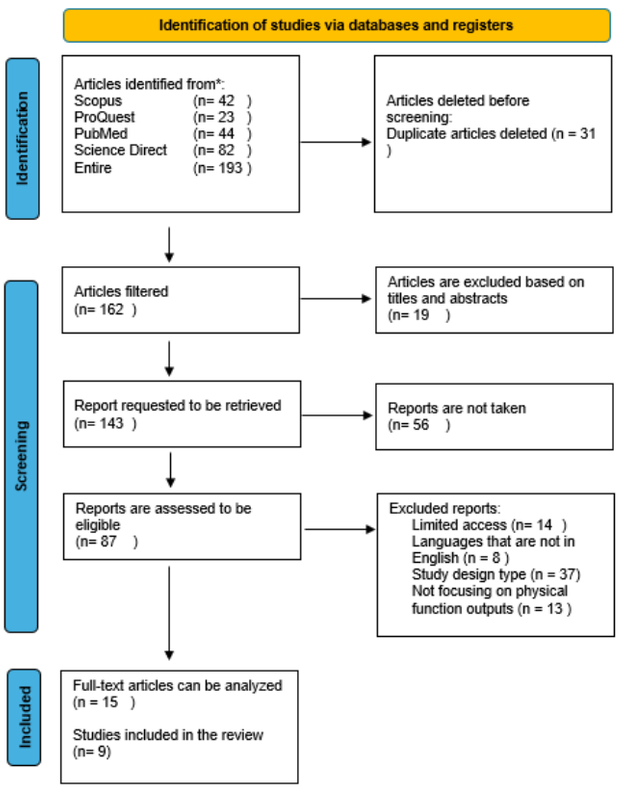

Figure 1: The Featured Reporting Item for Systematic Review searches for articles that fit the criteria.

Methodological Quality Assessment

The authors identified the quality of research articles by considering the risk of bias by assessing the methodological quality of a study and determining the extent to which the study addresses possible bias in its design, implementation, and analysis. In this case, a systematic review uses critical appraisal tools from the Joanna Briggs Institute (JBI), which follows the research design used (Barker et al., 2023). A single reviewer (NSAPM) independently assesses articles that meet the inclusion criteria by assessing the validity of the methodology before being included as an equestrian article using JBI critical appraisal assessments for several types used, including randomized controlled trials (RCTs) and quasy experimental studies. The JBI critical appraisal contains several questions to assess the quality of the research. The JBI assessment for quasy experimental studies includes 9 questions regarding similar characteristics associated with exposure, how exposure is measured, bias factors, outcomes measured, reported, follow-up time, strategies for addressing incomplete follow-up, and statistical analysis used (Barker et al., 2024).

The JBI assessment for RCTs included 13 questions regarding randomization used, allocation for blinded groups, treatment groups, randomized participants, assessors, follow-ups, intervention outcomes, and statistical analysis used. The assessment criteria are rated "yes", "no", "unclear", or "none"; Each answer with a domain of "yes" is assigned one point, and the rest of the rankings are assigned a value of zero. Each assessment is then calculated and summed up. If the research assessment is at least 50%, then the assessment meets the critical assessment at the cut-off point. The risk of bias in this literature review uses the assessment of research methods from each study, including aspects of theory, design, sample, variables, instruments, and data analysis.

Table 1. Criteria for Assessment of Research Results.

No.	Author, and Year	Study Design	JBI (%) Critical Apraissal
1.	(Cui et al., 2020)	RCT	11/13 (85%)
2.	(Jalili et al., 2025)	RCT	12/13 (92%)
3.	(Afxonidis et al., 2021)	RCT	12/13 (92%)
4.	(Han et al., 2022)	RCT	10/13 (77%)
5.	(da Costa Torres et al., 2016)	RCT	11/13 (85%)
6.	(J. Chen et al., 2021)	RCT	10/13 (77%)
7.	(Ma et al., 2024a)	RCT	10/13 (77%)
8.	(Aktürk Tuncer, 2024)	RCT	11/13 (85%)
9.	(Arab Shahraby et al., 2025)	Quasy-experimental	9/9 (100%)

RESULT AND DISCUSSION

Table 2. Result of Literature Reseach

No.	Author, and Year	Sample	Design	Country	Intervention	Duration	Instrument	Results	Key Findings Related To physical function and prevention of immobilization
1	(Cui et al., 2020)	178 postoperative patients of OPCABG	RCT	China	Precision early ambulation (sitting at the edge of the bed, standing for 5 minutes and a maximum of 5x repetitions) with the next day of training walking in stages.	Starting from the first 3 days post surgery to 90 days after surgery.	First bowel movement, PTSD Checklist-Civilian (PCL-C)	Increased Mobility: More PEA patients achieved ambulation targets: Day 2: 84.3% (PEA) vs. 69.7% (control). Day 3: 83.1% (PEA) vs. 55.1% (control). The distance was further walked on day 3 (75.67±29.73 m vs. 56.17±25.0 m, P<0.001). Gastrointestinal Recovery: The time of first bowel movement was faster in the PEA group (3.18±1.23 days vs. 3.97±1.26 days, P<0.001).	The implementation of precise early ambulances based on APMHR and VO2max is effective in improving physical function, accelerating recovery, and preventing complications due to immobilization in elderly patients after heart surgery
2	(Jalili et al., 2025)	105 postoperative patients CABG	RCT	Iran	Early mobilization is in the form of ROM therapy with exercises in bed, sitting, standing and walking as well as a 45-degree change in head position with a duration of 5 minutes each.	25-30 minutes per session, 1 time/day for 5 days	Facial Pain Scale, Systolic/Diastolic Blood Pressure (SBP/DBP), Pulse Rate (HR), Arterial Oxygen Saturation (SpO2) using a monitor.	Early mobilization speeds recovery: patients are more likely to sit, stand and walk safely, thereby reducing the risk of complications due to lying down (such as muscle weakness, thrombosis, pneumonia). Stable hemodynamic parameters: Despite an increase in HR and SBP in all groups, there was no drastic change that harmed patients.	Early mobilization, especially with breathing exercises, is very beneficial for accelerating the recovery of physical function, lowering pain, improving oxygenation status, and preventing complications due to immobilization in postoperative CABG patients. This intervention is safe and can be implemented as part of cardiac rehabilitation protocols in the ICU and ward.
3	(Afxonidis et al., 2021)	78 post-OPCABG patients	RCT	Greece	Early and Enhanced Physiotherapy Care with respiratory physiotherapy and mobilisation exercises in bed,	It is carried out from the day of surgery (day 0) until the patient is discharged from the	Hemodynamic parameters: body temperature, heart rate, breathing rate, blood	Early mobilization and physiotherapy (starting on the day of surgery) significantly shortened ICU and hospital stays. Patients' oxygenation and hemodynamic	Early mobilization prevents prolonged immobilization that can lead to muscle weakness, lung

					standing and static walking and chair sitting.	ICU and hospital.	pressure, oxygen saturation (SpO2). Arterial blood gas analysis: pH, PO2, PCO2, HCO3, lactate. Echocardiography examination (LVEF) and ECG	functions improved more quickly in the EEPC group, indicating better physical recovery. There was no increased risk of complications due to early mobilization, so this intervention was safe. Early mobilization prevents prolonged immobilization that can lead to muscle weakness, lung complications, and slow recovery.	complications, and slow recovery. Breathing exercises and active mobilization from the day of surgery improve the quality of recovery and accelerate the patient's independence.
4	(Han et al., 2022)	140 patients underwent elective coronary artery bypass graft (CABG) surgery.	RCT	China	SGR (Single General Ward Rehabilitation) group: Getting rehabilitation in the ward in the form of breathing exercises and daily walking with gradual distances,	For 5 consecutive days after moving to the ward	Barthel Index	The Barthel Index score at home in the UC group (75.3 ± 12.1) was significantly lower than SGR (86.2 ± 14.1) and IGR (89.1 ± 15.5). There was no significant difference between SGR and IGR when they went home, but when moving to the ward, the IGR score was higher than that of SGR and UC.	Patients who received rehabilitation showed better physical function recovery than the UC group. There was no significant difference between SGR and IGR at discharge, but IGR was superior when moving from ICU to ward.
5	(da Costa Torres et al., 2016)	66 patients) who underwent elective coronary artery bypass grafting (CABG) surgery	RCT	Brazil	Breathing exercises and early mobilization programs. Mobilization includes: active exercises in bed, bedside sitting, standing, walking in corridors, and other functional exercises according to the patient's tolerance.	Sessions are twice a day, about 30 minutes each, from the first day to the seventh day postoperatively.	6-Minute Walking Test (6MWT), Functional Independence Measure (FIM), Baecke Habitual Physical Activity Questionnaire, Borg Scale	The intervention group (early mobilization) had a longer distance at 6MWT at return and 60 days postoperative than the control group.	Early mobilization after CABG surgery improves the recovery of physical function (evidenced by the 6MWT and FIM increases). The program also prevents the negative effects of immobilization, such as lung complications and muscle weakness, and has the potential to shorten the length of hospitalization.
6	(J. Chen et al., 2021)	34 patients undergoing heart valve	RCT	China	Individual mobilization interventions and a combination of breathing	20-30 minutes per session in the first 2 days after surgery	Handgrip Strength Test, Timed Up and Go Test	Intervention group: Increased from 17.79 kg to 20.58 kg ($p<0.001$) Control group: Decreased from 17.72 kg to	Patients who received physiotherapy during hospitalization showed

		surgery			exercises and ambulation with walkers			17.43 kg (p=0.22) Differences between the two groups on day 5 postoperatively significant (p<0.001)	improved hand-held strength and physical activity levels on day 5 after heart valve surgery compared to the control group.
7	(Ma et al., 2024a)	80 patients undergoing elective coronary artery bypass grafting (CABG) surgery for the first time	RCT	China	Dorsophyllation and plantar exercises ankle flexion, foot rotation, knee flexion/extension, and hip abduction/adduction. Leg lift exercises with weights (starting 0.5 kg, gradually increased). Exercise runs 5×/day (minimum 10 minutes/session) from the 2nd–3rd day postoperatively.	Intervention is carried out until the patient goes home	PHQ-9 (Patient Health Questionnaire-9), GAD-7 (Generalized Anxiety Disorder-7), PSQI (Pittsburgh Sleep Quality Index)	The intervention group (early rehabilitation exercises) had a 30% incidence of edema, significantly lower than the control group (52.5%) (p < 0.05). The 6-Minute Walking Test (6MWT) in the intervention group showed an increase in walking distance compared to the control	Pulmonary complications (PPC) and atrial fibrillation did not differ significantly between groups, but complications within 30 days of discharge were lower in the intervention group. Early mobilization reduces the risk of deep vein thrombosis (DVT) and muscle atrophy through active exercise in the ICU and ward. Early rehabilitation is effective in improving physical function, reducing edema, and speeding up ambulation. Mobilization from the ICU is safe, prevents immobilization complications (DVT, muscle atrophy), and improves mental health.
8	(Aktürk Tuncer, 2024)	56 Adult patients undergoing elective coronary artery bypass graft (CABG) surgery	RCT	Turkey	Exercise mobilizes out of bed using a walking aid and a combination of pain management medication.	It is done 3 times a day, every 4 hours (10.00, 14.00, 18.00, and 22.00) during the ICU on the first day after surgery.	Patient Mobility Scale, Observer Mobility Scale	The pain score in the intervention group (using a walker) was significantly lower at all stages of mobilization than in the control group (p < 0.001). The mobility score of the intervention group was significantly higher (meaning more independent and easier to move) at all stages compared to the control (p <	Walking aids are effective in reducing pain during early mobilization after heart surgery. Helps patients more easily and independently move out of bed. Recommended as part of early mobilization protocols to

							0.001).	speed recovery and prevent immobilization.
9	(Arab Shahraby et al., 2025)	96 post-CABG patients	Quasy-experimental study	Iran	Early mobilization (EM) protocols include breathing exercises with the extremity ROM as well as bed inclination exercises.	3 days on day 0 after extubation, day 1 post surgery and day 2 after post surgery.	Visual Analog Scale – Fatigue (VAS-F), Borg Scale	There were significant differences between the intervention and control groups in both fatigue scores and physical activity tolerance (p<0.001)	Early mobilization protocols are effective and safe to reduce fatigue and increase physical activity tolerance in CABG patients in the ICU. This intervention can prevent the adverse effects of immobilization and speed up the patient's recovery after heart surgery.

Characteristics of the Selected Studied

The assessment of the results obtained by the included articles is shown in Table 1. Of the nine articles with RCT research design with criteria of 1-13 questions, three articles received a "no" answer of 3 points with a score of 10/13 (77%) but were still categorized as good quality and three articles received one "no" answer with a score of 11/13 (85%) and two articles with an assessment score of 12/13 (92%) but all three were still in the good quality category. One article with a quasi-experimental study design with criteria of 1-9 questions with complete overall aspects so that it gets a perfect assessment score of 9/9 (100%) and is categorized as good quality. The results of the review of a total of 9 articles achieved a score of >50%, thus meeting the critical appraisal assessment, which will then be used to analyze the data.

The results were obtained with a total of 9 articles published from 2020 to 2025 and published in English. Articles with RCT research designs are eight articles and one article with a quasi-experimental study design presented in Table 3. From this article, 4 studies were conducted in China, and a total of 2 studies were conducted in Iran, others from Turkey, Greece and Brazil as many as 1 article each.

Tabel 2 Characteristics of Respondents

No.	Author, and Year	Age (Years)	Gender (%)
1.	(Cui et al., 2020)	Group: 65.1 ± 4.6 Control: 66.2 ± 4.5	M: 127 (71%) F: 51 (29%)
2.	(Jalili et al., 2025)	40 – 60 years old	M: 101 (96%) Q: 5 (4%)
3.	(Afxonidis et al., 2021)	Group: 63.5 ± 8.9 Control: 65.1 ± 8.9	M: 65 (83%) Q: 13 (17%)
4.	(Han et al., 2022)	63.0 ± 8.7	M: 104 (74%) F: 36 (26%)
5.	(da Costa Torres et al., 2016)	18 – 80 years old	M: 38 (58%) F: 28 (42%)
6.	(J. Chen et al., 2021)	Group: 58.94 years (SD 11.38) Control: 60.19 years (SD 14.39)	M: 14 (42%) F: 19 (58%)
7.	(Ma et al., 2024a)	Group: 61.93 ± 9.51 Control: 65.28 ± 8.10	M: 61 (77.5%) F: 9 (22.5%)
8.	(Aktürk Tuncer, 2024)	Group: 64.09 (SD 11.3) Control: 60.36 (SD 10.42)	M: 46 (82%) F: 10 (28%)
9.	(Arab Shahraby et al., 2025)	52.7 (SD 8.8)	M: 54 (56%) F: 42 (43%)

Types of Coronary Artery Bypass Graft Surgery

Coronary Artery Bypass Graft (CABG) surgery is an open-heart surgical procedure performed to address significant blockage or narrowing of the coronary arteries, which cannot be adequately addressed with conservative medical therapy or percutaneous interventions such as angioplasty and stenting. This procedure aims to increase blood flow to the heart muscle by creating an alternative path (bypass) through the blocked artery area using a blood vessel graft taken from another part of the body, usually the saphenous vein from the legs or the deep mammary artery of the chest (Song et al., 2020). During surgery, the patient undergoes general anesthesia and is connected to an artificial heart-lung machine (cardiopulmonary bypass) that takes over the function of the heart and lungs while the heart is stopped to facilitate graft placement (Eikelboom et al., 2021). The main indications of CABG surgery include narrowing of the major coronary arteries by more than 50%, coronary artery disease involving multiple blood vessels (multi-vessel

disease), as well as patients with severe left ventricular dysfunction. This procedure has been clinically proven to improve survival rates and quality of life in patients with complex and severe coronary heart disease (Sandi et al., 2019).

Types of Early Mobilization Interventions Implemented

Early mobilization or ambulation after CABG surgery is one of the important rehabilitation strategies that aims to speed up patient recovery, prevent postoperative complications, and improve overall functional capacity. This mobilization intervention usually begins within 2 to 6 hours after the patient has successfully passed the extubation phase, that is, after the breathing tube is removed and the patient begins to be able to breathe independently (Afxonidis et al., 2021; Aktürk Tuncer, 2024). The mobilization approach is carried out in stages and structured, starting with breathing exercises using an incentive spirometer which is carried out five times a day for 3-5 minutes per session (Allahbakhshian et al., 2023).

This exercise is important to prevent lung complications such as atelectasis (partial collapse of the lungs) and pneumonia that are common in heart surgery patients. Furthermore, patients were given extremity mobilization exercises such as ankle pumps (movements of moving the ankles up and down) for 15 repetitions three times a day, as well as passive range of motion (ROM) exercises in the upper and lower extremities for 10 minutes twice a day to maintain blood circulation and prevent blood clots (deep vein thrombosis) (Esmealy et al., 2023; Jalili et al., 2025). In the second phase, which is 24-72 hours postoperatively, patients are encouraged to sit at the bedside for 5-10 minutes three times a day and do static walking for 2-5 minutes twice a day with the help of a physiotherapist. After 72 hours, the patient begins to ambulate in the hospital corridor with a gradually increasing distance, starting from 25-50 meters twice a day on the third day, increasing to 75-100 meters three times a day on the fourth day, as well as a cyclic ergometer exercise with low resistance for 5 minutes twice a day. This gradual approach is essential to adjust the patient's physical abilities and prevent fatigue or cardiovascular complications during the rehabilitation process (da Costa Torres et al., 2016b; Ma et al., 2024b; Tazreean et al., 2022).

Duration and Frequency of Early Mobilization Training Interventions

The duration and frequency of CABG postoperative early mobilization exercises were systematically designed based on the patient's clinical condition and recovery stages. Breathing exercises using incentive spirometers are performed five times a day with a total duration of about 15 minutes per day for 1 to 5 days postoperatively. This exercise has been shown to be effective in increasing blood oxygenation and reducing the risk of lung complications (Ma et al., 2024b). Ankle pump exercises are performed three times a day for 10 minutes in the first 1 to 3 days postoperatively to improve venous blood flow and prevent the formation of blood clots that can lead to thrombosis. Passive range of motion movements on the extremities are performed twice a day for 20 minutes between the second to fourth days to maintain joint flexibility and prevent stiffness that can impede mobility (Kanejima et al., 2020; Shan et al., 2022).

In the corridor ambulation phase, the patient walks for 15 minutes three times a day from the third to fifth days after surgery, with the distance gradually increasing from 25 meters to reach 100 meters. Studies that measured the effectiveness of this protocol using the 6-Minute Walk Test (6MWT) showed an increase in average mileage of 277 meters after the intervention, signaling a significant increase in the patient's functional capacity and physical endurance. In addition, this exercise approach also contributes to a reduction in the length of hospital stay as well as reduces the risk of serious complications such as pneumonia and deep vein thrombosis, thereby speeding up the recovery process and improving the quality of life of patients after CABG surgery (Aktürk Tuncer, 2024; Cui et al., 2020; Tazreean et al., 2022).

Effects of Interventions on Pain Intensity and Physical Function

Extraction data show that early mobilization or ambulation interventions have been shown to significantly improve physical function recovery and prevent complications due to immobilization in postoperative heart surgery patients, especially after Coronary Artery Bypass Grafting (CABG) surgery or heart valve surgery. Based on the studies in the table, early mobilization that begins from the first or second day postoperatively, such as bedside sitting, standing, gradual walking, and breathing exercises, provides noticeable benefits (Cui et al., 2020). For example, the study showed that patients who received early ambulatory interventions based on APMHR and VO2max achieved faster mobilization targets, with 84.3% of patients able to walk on the second day compared to 69.7% in the control group. In addition, the walking distance on the third day was also longer (75.67 m vs. 56.17 m), indicating a significant increase in physical capacity (Cui et al., 2020).

Early mobilization is also effective in preventing immobilization complications such as muscle weakness, deep vein thrombosis (DVT), and pneumonia. The study found that range of motion (ROM) exercises and a 45-degree head

position change for 5 minutes accelerated the recovery of physical function without disrupting hemodynamic stability (Jalili et al., 2025). Patients who undergo early mobilization are able to sit, stand, and walk faster, thus reducing the risk of complications such as thrombosis and pneumonia. Similar was reported by (Afxonidis et al., 2021), where respiratory physiotherapy and active mobilization from the day of surgery shortened ICU and hospital stays, as well as prevented muscle weakness and complications. In addition, early mobilization contributes to the recovery of oxygenation function and patient independence. Other studies showed that a 30-minute breathing exercise and walking program twice a day improved mileage in the 6-Minute Walking Test (6MWT) and Functional Independence Measure (FIM) scores at home as well as 60 days postoperatively (da Costa Torres et al., 2016a).

This intervention also reduced edema and improved mental health where dorsflexion exercise of the legs and regular walking reduced the incidence of edema from 52.5% to 30% (Ma et al., 2024b). Overall, early mobilization is not only safe but also highly effective in accelerating the recovery of physical function, reducing immobilization complications, and improving the quality of life of post-heart surgery patients. The implementation of structured early mobilization protocols, such as those conducted in these studies, should be a standard part of cardiac rehabilitation to maximize clinical outcomes and prevent the negative effects of prolonged immobilization (Tazreean et al., 2022).

Discussion

This systematic review revealed that the initial mobilization and rehabilitation program had a significant positive impact on the restoration of functional capacity and the prevention of immobilization side effects in patients after CABG heart surgery. These findings support the concept of Early Rehabilitation which explains that physical activity immediately after surgery can increase tissue perfusion, lower the risk of complications due to bedriddenness, and accelerate the recovery of movement ability (Zanini et al., 2019). The results demonstrated that the group of patients who started mobilization within 24-48 hours postoperatively showed a more rapid development of walkability, with 84.3% of patients able to ambulate on the second day compared to 69.7% in the control group. An increase in walking distance to 75.67 meters on the third day (vs. 56.17 meters at control) also indicated a more optimal improvement in physical capacity (Cui et al., 2020; Jalili et al., 2025).

From a medical point of view, early mobilization programs are effective in preventing various immobilization-related complications such as deep vein thrombosis, decreased muscle mass, and respiratory tract infections. Other studies confirmed that respiratory therapy and joint movement exercises from the early postoperative phase significantly reduced the incidence of pulmonary embolism and DVT. These findings are consistent with physiological principles that state that prolonged immobilization causes disruption of venous blood flow, increases the risk of stasis, and triggers blood clots (Bujar-Misztal & Chciałowski, 2018). Early rehabilitation programs have also been shown to improve tissue oxygenation, as seen from the stabilization of vital signs (pulse, blood pressure, and oxygen saturation) in studies (Afxonidis et al., 2021; Kanejima et al., 2020).

Not only physically beneficial, early rehabilitation interventions also have a positive impact on the psychosocial aspects and independence of patients. The study found by (Ma et al., 2024b) that patients who followed an exercise program since ICU treatment experienced improvements in anxiety symptoms and sleep patterns based on assessments using the GAD-7 and PSQI scales. These results are in line with a comprehensive rehabilitation approach that emphasizes that rapid physical recovery can reduce psychological burden and increase patient motivation (B. Chen et al., 2021). The use of ambulatory aids has also been proven to reduce pain complaints and increase patients' independence in moving, thereby smoothing the recovery process. However, the implementation of the early mobilization program faces several obstacles such as variations in protocols between institutions and the need for strict monitoring of hemodynamic conditions (Aktürk Tuncer, 2024). However, various research evidence confirms that this intervention is safe and does not increase the risk of cardiovascular complications if carried out progressively according to the patient's ability. Therefore, the authors argue that the early mobilization program should be a mandatory component in the postoperative management of CABG, with individual modifications based on the patient's clinical condition (Allahbakhshian et al., 2023; Shan et al., 2022; Thomas et al., 2024).

Constraints and Limitations

The studies reviewed had variations in design, interventions, and outcome measurement, which may limit the ability to draw strong conclusions. Some studies have small sample sizes, which can reduce the statistical strength of the results. Responses to exercise can vary between individuals, depending on factors such as age, health conditions, and initial physical ability levels.

CONCLUSION

Based on a systematic review of nine related studies, it can be concluded that CABG

early mobilization and rehabilitation exercises provide significant benefits in accelerating the recovery of physical function and preventing immobilization complications. Evidence suggests that interventions started in 24-48 hours postoperatively, including gradual ambulation, breathing exercises, and ROM (range of motion), consistently improve ambulatory ability, reduce the risk of DVT and muscle atrophy and improve hemodynamic and oxygenation parameters. In addition, early mobilization also has a positive impact on the psychological aspects and independence of patients. These findings support the need to implement early mobilization protocols as a standard part of CABG postoperative management, with individual adjustments based on patient conditions, to optimize clinical outcomes and prevent immobilization-related complications.

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