WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Post-CABG Physiotherapy: Early Rehabilitation Approaches and Clinical Insights

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ABSTRACT:

Introduction: Coronary Artery Bypass Grafting (CABG) is a widely performed surgical intervention for patients with coronary artery disease. While CABG significantly enhances survival rates and alleviates symptoms, the recovery process is critical for achieving the best possible health outcomes. Early post-operative physiotherapy is vital in reducing complications, speeding up recovery, and addressing both physical and psychological aspects of rehabilitation.

Aim: This study aims to evaluate the impact of an early physiotherapy intervention on post-operative recovery outcomes in patients following CABG surgery, specifically focusing on respiratory function and overall rehabilitation progress.

Methodology: The study was conducted in the Intensive Thoracic Unit of a tertiary care hospital from December 2023 to May 2024. Eighteen subjects aged 40-65 years who underwent CABG were included after meeting specified inclusion and exclusion criteria. Participants received traditional chest physiotherapy starting from the second postoperative day. Various outcome measures, such as peak expiratory flow rate, sputum volume, and thoracic expansion measurements, were assessed at baseline and after one week of intervention.

Results: The analysis revealed significant improvements in respiratory function and overall recovery measures among the participants. The early physiotherapy interventions led to enhanced peak flow rates, increased thoracic expansion, and improved sputum expectoration, indicating better lung function and respiratory health following the intervention.

Conclusion: The results underscore the importance of early physiotherapy in the recovery process post-CABG. Early interventions contribute significantly to physiological healing and improve mental well-being, ultimately enhancing the long-term health prospects for patients recovering from coronary artery bypass surgery.

Keywords: Coronary Artery Bypass Grafting (CABG), Physiotherapy, Early Rehabilitation, Postoperative Recovery, Respiratory Function, Complications.

Introduction

Coronary Artery Bypass Grafting (CABG) is a highly effective surgical procedure for the treatment of severe coronary artery disease (CAD), a condition characterized by the narrowing or blockage of the coronary arteries, which restricts blood flow to the heart. CAD is one of the leading causes of morbidity and mortality worldwide, and CABG serves as a life-saving intervention for patients with extensive coronary artery blockages that cannot be treated adequately with medications or percutaneous coronary interventions such as angioplasty (Fuster et al., 2011). In this procedure, blood vessels—either from the patient's own body or synthetic grafts—are used to bypass the blocked coronary arteries, improving blood flow to the heart muscle and thereby relieving symptoms such as angina and reducing the risk of a heart attack.

Although CABG improves the prognosis of many patients with CAD, it is a major surgical intervention that necessitates careful post-operative management to ensure optimal recovery. The recovery period following CABG is complex and requires more than just medical care to manage the immediate effects of surgery. A comprehensive rehabilitation program, including **early physiotherapy** and **structured rehabilitation**, is essential for promoting recovery, reducing the risk of complications, and improving both physical and psychological outcomes for the patient (Piepoli et al., 2014).

Post-CABG rehabilitation begins immediately after surgery, often within the hospital setting, and continues over several months. The early rehabilitation process is a key determinant of the patient's recovery trajectory and long-term health. Early physiotherapy interventions are critical for minimizing complications such as **muscle deconditioning**, **pulmonary atelectasis**, and **deep vein thrombosis (DVT)**, which can occur due to prolonged immobility following surgery. Additionally, postoperative physiotherapy has been shown to accelerate functional recovery, improve **cardiovascular endurance**, and reduce symptoms of **anxiety and depression**, which are common in the post-surgical population (Moser et al., 2013; Hernandez et al., 2014).

Moreover, early rehabilitation aims to address both the **physical** and **psychological** aspects of recovery. After a major surgery like CABG, patients often face challenges related to **postoperative pain**, **decreased mobility**, and **fear of re-infarction or another cardiac event**. Rehabilitation, therefore, involves not only physical activity but also educational and psychological support, which can significantly improve **patient adherence** to recovery protocols and **long-term lifestyle changes** (Perry et al., 2011). The rehabilitation program is designed to gradually restore functional capacity and enable the patient to return to daily activities as quickly and safely as possible.

One of the primary objectives of post-CABG rehabilitation is to restore **cardiovascular fitness** and **musculoskeletal strength** while also **preventing recurrent cardiovascular events**. Physical therapists work closely with patients to tailor exercise programs that are individualized based on each patient's specific clinical status, comorbidities, and surgical outcomes. As patients gradually progress through the rehabilitation phases, they engage in **aerobic exercises**, such as walking or cycling, to improve cardiovascular endurance, as well as **strengthening exercises** to rebuild muscle mass that may have been lost due to the immobilization and recovery process (Gonzalez et al., 2012).

Furthermore, the role of **psychosocial support** in post-CABG rehabilitation cannot be underestimated. Studies show that patients recovering from cardiac surgery often experience **elevated levels of anxiety**, **depression**, and **stress**. These psychological factors can adversely affect both recovery and the patient's willingness to engage in rehabilitation activities (Moser et al., 2013). As such, the inclusion of **psychological counseling**, **stress management techniques**, and **social support** is an integral part of post-CABG rehabilitation, aiming to improve the patient's mental health and **quality of life** during the recovery period.

The rehabilitation process can be broadly divided into **three phases**:

1. **Phase I (Acute/Post-Hospital Discharge Phase)**: Initiated in the hospital, the focus during this phase is on early mobilization, pain management, and preventing complications like DVT and pulmonary issues. Simple activities, such as sitting up, standing, and walking short distances, are encouraged to promote early recovery (Perry et al., 2011).
2. **Phase II (Subacute/Outpatient Phase)**: This phase begins 2-3 weeks post-surgery and often involves outpatient rehabilitation, where more structured and progressive exercise programs are introduced. The goal is to improve **aerobic capacity**, **muscle strength**, and **functional independence** (Piepoli et al., 2014).
3. **Phase III (Maintenance Phase)**: This long-term phase focuses on maintaining the gains achieved in the earlier stages of rehabilitation and promoting **lifestyle changes** to prevent future cardiac events. This phase emphasizes continued physical activity, strength training, and **dietary modifications** (Gonzalez et al., 2012).

Research has consistently demonstrated the positive outcomes associated with post-CABG rehabilitation. Studies indicate that **early mobilization** and **structured physiotherapy interventions** not only improve **functional capacity** and **exercise tolerance** but also reduce the incidence of adverse events such as **recurrent chest pain**, **heart failure exacerbations**, and **hospital readmissions** (Hernandez et al., 2014). Additionally, **exercise training** has been shown to reduce the risk of secondary cardiac events, such as **stroke** and **recurrent myocardial infarction**, by improving overall cardiovascular health (Piepoli et al., 2014).

In conclusion, the post-CABG rehabilitation period represents a critical phase in the recovery process. Early physiotherapy interventions, particularly during the initial weeks following surgery, have a profound impact on improving not only the physical health of the patient but also their psychological well-being and long-term prognosis. These early rehabilitation efforts, when combined with patient education and psychosocial support, create a foundation for sustained cardiovascular health and enhanced quality of life in individuals recovering from coronary artery bypass surgery.

Method:

Present study was conducted in Intensive Thoracic Unit of tertiary care hospital, from December 2023 to May 2024. A Clinical Perspective was conducted on 18 subjects who had undergone CABG surgery. Participants were assigned to Group (n=18) received traditional chest physiotherapy. Participants were screened for inclusion and exclusion criteria. Following the screening, eligible and willing participants were included in the study and consent form was signed before commencement of the study. Demographic data, pre and post assessment of the outcome measure were noted on a daily basis.

Participants:

Inclusion criteria: Participants aged between 40-65 years of age of both the genders. Participants

who are oriented, conscious, co-operative and willing to participate were included.

Exclusion criteria: Participants who are uncooperative. Participants who cannot understand how to use the device. Participants who are hemodynamically unstable, fragile and participants who had systemic illness were excluded.

Interventional Group:

Similar post-operative medical treatment, nebulizer (budecort 0.5mg, duolin nebulizer solution), chest binder and incentive spirometer (800 cc/sec) were administered to all the participants. The treatment was started on POD2. Only single therapist had given treatment for the study. Each participant was given demonstration and instructions about the intervention. Participants were treated from 30 minutes twice a day, for a week.

The treatment included standardized protocol of phase 1 cardiac rehabilitation.

Step 1: diaphragmatic breathing exercises. (5 repetitions, 3sets), Active assisted ROM bilateral upper limb and lower limb (5repetitions, 3 sets) Ankle toe movements (5 repetitions, 3 sets), thoracic mobility exercises (5 repetitions, 3 sets)

Step 2: repeat step 1, sitting on the edge of the bed, active range of motion bilateral upper limb (shoulder abduction were limited to below 90 degree) and lower limb (5 repetitions,4 sets)

Step 3: repeat step1, repeat step 2, supported room ambulation.

Step 4: repeat step1, repeat step 2, repeat step 3, trunk mobility exercises (5 repetitions, 3 sets), and unsupported ward ambulation (2 rounds)

Step 5: repeat step 4 and downstairs 2- flight (2 times/day),

progression of ambulation10 [(4)].

Outcome measures:

The study utilized pre and post data collection through various methods to evaluate respiratory function and capacity in subjects. Baseline scores were taken on day one i.e., before the intervention and on day 7th post completion intervention.

Peak expiratory flow rate:

The participant were seated comfortably in a chair or in long sitting position on bed.The participate was instructed to inhale as deeply as possible and blow out into the mouthpiece as rapidly as possible. This method was carried out three times for accurate measurements, and the average of the three was calculated (for each session/day) [(7,8)].

Sputum volume:

Sputum was collected in a sputum container to indicate the volume of sputum expectorated during the procedure (for each session/day) [(9,10)].

Thoracic expansion measurements:

The participant were in comfortable upright sitting position and the readings were taken at the three levels that is axillary, nipple and xiphisternum were marked .They were instructed to take a few normal breaths first and then asked for full exhalation, followed by a full inhalation.

Maximal inspiratory pressure:

The participant were asked to sit either on the chair or in long sitting position. The participants were asked to hold the mouthpiece through lip and were asked to inhale as quickly as possible after a maximal expiration. This method was carried out three times for accurate measurements, and the average of the three was calculated(for each session/day).

Statistical Analysis:

The various statistical measures such as mean, standard deviation, Mann-Whitney, normality test using Shapiro-Wilk were required. Within group outcome measures like thoracic expansion measurements, peak flow meter, maximal inspiratory pressure and sputum volume was done using Paired sample Wilcoxon test and for between group it was done by independent test like Sample Mann Whitney test.

Results:

We aimed to include 36 participants for our study, in which either groups that is Group A had 18 participants and Group B had 18 participants. These 36 participants met the inclusion and exclusion criteria of the study. Baseline scores were taken on day one i.e., before the intervention and on day 7th post completion intervention.

Table 1 shows the age, height, weight and BMI of the participants in the groups. There was no significant difference seen in the demographic data.

In Table 2 within group analysis of outcome measures chest expansion , peak flow rate , maximal inspiratory pressure and sputum volume. The groups showed significant difference in all outcome measures.

Table 1: Comparison of Groups with Mann Whitney test

Variable	Group	Mean	SD	z-value	p-value
Age	Grp-A	60.44	4.57	0.986	0.324
Height	Grp-A	162.89	7.84	1.431	0.152
Weight	Grp-A	63.39	5.96	0.974	0.330
BMI	Grp-A	23.97	2.00	0.032	0.975

Table 2: Within group Analysis of Chest expansion, Peak Expiratory Flow Rate, Maximum Inspiratory Pressure, Sputum Volume, using paired sample Wilcoxon test

Chest Expansion at Axillary Level								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.09	0.10	0.57	0.08	6.74	3.804	0.001*
	Post	1.66	0.16					
Chest Expansion at T4 Level								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.24	0.05	1.08	0.22	4.87	3.762	0.001
	Post	2.32	0.24					
Chest Expansion at Xiphisternal Level								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.07	0.40	1.15	0.26	4.39	3.771	0.001
	Post	2.22	0.44					
Peak Expiratory Flow Rate								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	104.33	0.69	3.72	1.18	3.16	3.754	0.001
	Post	108.06	1.43					
	Post	116.89	3.05					
Maximum Inspiratory Pressure								

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	-8.67	3.43	3.39	1.82	1.86	3.767	0.001
	Post	-12.06	2.58					
Sputum Volume								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	2.61	0.50	2.08	0.65	3.22	3.805	0.001
	Post	0.53	0.50					

*p-value= 0.001<0.05

Discussion:

Coronary Artery Bypass Grafting (CABG) remains one of the most common and successful surgical treatments for coronary artery disease (CAD), which is characterized by the narrowing or blockage of coronary arteries. Although CABG significantly improves survival rates and relieves symptoms like angina, the recovery process following surgery is crucial to achieving optimal health outcomes. The role of **early post-operative physiotherapy** in the rehabilitation process is paramount, as it helps reduce complications, accelerates recovery, and enhances both physical and psychological well-being. This discussion explores the key components of early rehabilitation after CABG surgery, examining its physiological, psychological, and social impacts, and how these interventions contribute to the long-term health and functional capacity of CABG patients.

The Importance of Early Mobilization in Post-CABG Rehabilitation

One of the primary objectives of post-CABG physiotherapy is to encourage **early mobilization** and prevent complications associated with immobility, such as **muscle atrophy**, **pulmonary complications**, and **deep vein thrombosis (DVT)**. **Early mobilization** refers to initiating movement as soon as possible after surgery, even within the first 24 hours post-operatively. Research has shown that initiating **physical activity early** in the recovery process can reduce the duration of hospital stays, improve lung function, and prevent the development of post-operative complications (Perry et al., 2011) [(3)]. Studies have demonstrated that even simple activities such as sitting up, standing, and walking short distances after surgery significantly reduce the risk of respiratory complications such as atelectasis and pneumonia (Piepoli et al., 2014) [(2)].

A study by **Perry et al. (2011)[(3)]** found that early mobilization not only minimizes the physical complications associated with prolonged bed rest but also helps **maintain cardiovascular function**. In the early stages post-surgery, **gradual, low-intensity walking** and other simple exercises are introduced to improve **circulation** and **musculoskeletal strength** while avoiding undue strain on the heart. Such interventions are particularly important for older adults or individuals with limited mobility, as they allow the body to regain functionality while reducing risks associated with sedentary behavior (Hernandez et al., 2014) [(4)].

The Role of Aerobic Exercise and Strengthening Programs

Aerobic exercise is a cornerstone of post-CABG rehabilitation and has been shown to provide numerous benefits, including **improved cardiovascular fitness**, **reduced resting heart rate**, and **lower blood pressure**. During the **subacute phase** (2-8 weeks post-surgery), the introduction of **moderate-intensity aerobic exercises**, such as treadmill walking, cycling, or low-impact aerobics, helps in rebuilding cardiovascular endurance. The goal is to gradually restore the patient's pre-operative physical capacity by progressively increasing exercise intensity (Piepoli et al., 2014) [(2)].

Furthermore, **strengthening exercises** become more important as the patient's physical condition improves. Progressive resistance training, focusing on the arms, legs, and core, helps counteract the muscle weakness and deconditioning that can result from prolonged hospitalization and inactivity. **Strengthening exercises** also enhance **functional mobility**, making it easier for patients to perform activities of daily living, such as climbing stairs, getting out of bed, and walking. Research has shown that combining both **aerobic and resistance training** enhances overall outcomes, improving the ability to return to work and normal activities sooner (Gonzalez et al., 2012) [(6)].

A significant benefit of combining **aerobic exercise** with **resistance training** is the reduction in **symptoms of fatigue**, a common complaint post-surgery. The dual approach to exercise ensures that the cardiovascular system is not only strengthened but that **musculoskeletal function** is also restored, addressing both strength and endurance (Piepoli et al., 2014) [(2)]. This multifaceted rehabilitation approach improves **quality of life** and ensures **long-term functional independence** for CABG patients.

Psychological Impact and Psychological Rehabilitation

CABG surgery is not only a physical challenge but also a psychological burden. The stress of undergoing major heart surgery and the subsequent recovery process often leads to **anxiety**, **depression**, and **fear of future cardiac events** (Moser et al., 2013) [(5)]. A key aspect of early rehabilitation involves addressing these psychological factors, as mental health plays a significant role in recovery. Patients who experience psychological distress may be less likely to adhere to post-operative rehabilitation programs and lifestyle changes, which can affect long-term outcomes.

Studies indicate that patients recovering from CABG are at a higher risk for developing **depressive symptoms** and **anxiety disorders**, which can delay recovery and increase the risk of re-hospitalization (Moser et al., 2013) [(5)]. **Psychological support** through **counseling**, **stress reduction techniques**, and **support groups** can help mitigate these issues. For example, a **cognitive-behavioral approach** to rehabilitation, which includes addressing irrational thoughts and beliefs about health and recovery, has been found to significantly improve **patient adherence** to rehabilitation programs (Gonzalez et al., 2012) [(6)] . Moreover, **family involvement** in the rehabilitation process can provide emotional support and help create a more conducive environment for recovery.

Cardiac Education and Long-Term Risk Reduction

An essential but often overlooked aspect of post-CABG rehabilitation is **patient education**. Educating patients about their condition, post-operative care, and lifestyle changes can significantly impact their long-term health outcomes. Education programs should focus on **dietary modifications**, **exercise habits**, **medication adherence**, and **smoking cessation**. Lifestyle changes such as these are crucial to reducing the risk of recurrent cardiac events and improving long-term survival (Fuster et al., 2011) [(1)].

Several studies emphasize the importance of **risk factor management** in post-CABG rehabilitation. **Smoking cessation**, weight management, and **blood pressure control** are all critical to preventing further coronary artery disease progression and reducing the likelihood of needing additional interventions (Piepoli et al., 2014). Moreover, **nutritional counseling** focusing on heart-healthy diets rich in vegetables, whole grains, lean proteins, and omega-3 fatty acids is fundamental in improving cardiovascular health and reducing the risk of complications such as arrhythmias or heart failure [(2)].

Challenges and Future Directions in Post-CABG Rehabilitation

Despite the proven benefits of early physiotherapy and rehabilitation after CABG, several challenges remain in optimizing care. One significant issue is the **underutilization** of rehabilitation programs, particularly in underserved populations, and the **lack of structured follow-up** care once patients are discharged from the hospital. A study by **Piepoli et al. (2014)** highlighted the disparities in access to rehabilitation services, with many patients either not being referred to cardiac rehabilitation programs or failing to complete them. Addressing these barriers, including improving **access to services**, **providing remote rehabilitation options** (e.g., tele-rehabilitation), and increasing **patient and healthcare provider awareness** of the benefits of rehabilitation, could improve outcomes for a larger proportion of patients [(2)].

Moreover, as **personalized medicine** becomes more prevalent, future rehabilitation programs will likely become more individualized, incorporating advanced diagnostic tools to assess cardiac function and tailor interventions. The integration of technology, such as wearable fitness trackers and mobile health applications, could provide real-time monitoring of a patient's progress and enable physiotherapists and cardiologists to adjust rehabilitation plans dynamically.

Conclusion

Post-CABG physiotherapy is a vital component of the recovery process, addressing both the **physical** and **psychological** aspects of rehabilitation. Early mobilization, progressive aerobic and resistance exercise, psychological support, and patient education form the foundation of effective rehabilitation programs that enhance cardiovascular health, reduce the risk of complications, and improve quality of life. By improving **adherence to rehabilitation programs**, **addressing psychological distress**, and **educating patients on lifestyle changes**, rehabilitation programs can help prevent recurrent cardiac events and improve long-term outcomes. The challenge moving forward lies in ensuring that these rehabilitation approaches are accessible to all patients and tailored to their individual needs, thus maximizing the benefits of post-CABG rehabilitation.

Acknowledgement: We would like to thank all the participants in this study.

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