MEDICAL SCIENCE

Optimizing cardiac therapeutic intervention strategies for patients undergoing Coronary Artery Bypass Graft (CABG) surgery towards recovery and quality of life enhancement: A case study

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ABSTRACT

Coronary artery bypass grafting (CABG) is a standard type of surgery to treat coronary heart disease. Although restoring the circulation of blood is the main goal of CABG, an effective rehabilitation program is also crucial to the procedure's success. In this instance, elective CABG was performed on a 59-year-old male patient with severe coronary artery disease. The sufferer's postoperative care included a sophisticated intervention that included regular physical activity, dietary modifications, and psychological counselling. The rehabilitative approach included health education, sequential mobilization, a monitored exercise program, dietary counselling, guidance to quitting smoking, and stress management techniques. A framework of evaluation is necessary for the patient's progress to be based on objective measures such as functional status, quality of life, etc. The significance of a well-planned and comprehensive rehabilitation program for CABG patients' postoperative treatment is highlighted by this case study. It highlights the need of using a multidisciplinary team to provide holistic treatment that is taken into account.

Keywords: Coronary artery bypass grafting, cardiac rehabilitation, borg scale.

1. INTRODUCTION

Coronary heart disease is a severe global health disease (Tian et al., 2019). Coronary artery disorder (CAD) is a constriction of coronary arteries which is due to a buildup of fatty material inside the arteries walls (Nahar, 2021). Cardiovascular illnesses are the leading causes of mortality in Europe,

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accounting for 40% of men (19% ischemic heart disease) & 49% of women (19% ischemic heart disease). CVS disorders are also on the rise, the leading reason for death in Romania (Townsend et al., 2016). Symptoms of coronary artery disease are chest pain, drowsiness (severe fatigue), palpitation, arrhythmia, dyspnea, and swelling of the limbs (Tian et al., 2019).

Coronary artery bypass surgery (CABG) is utilized to cure coronary artery disease. It guides blood around the narrowed or occluded area of the main artery, improving the flow of blood and improving the source of oxygen to the tissues. In coronary artery bypass grafting, one or more arterial coronary arteries treat the arteries to restore blood supply to the heart muscle (Townsend et al., 2016). Depending on the research structure, overall age, sex, and geographical area, global statistics indicated a 5-8% incidence of CAD and a 10-20% prevalence of peripheral artery disease (PAD).

According to the reduction of atherothrombosis for continued health (reach) registry, 18-35% of CAD patients and 46-68% of PAD patients had the disorder in one or two vascular beds. The use of drugs to treat controllable CVD risk factors differed by nation (reduced in France than in Canada); statins and aspirin were the most often utilized therapy in chronic disease patients. Although medical advances have increased rates of survival, there is still a need to reduce the social load of disease (Bauersachs et al., 2019).

Mortality from cardiovascular disease rises equally in all age categories and for males and females with diabetes mellitus or myocardial infarction and these two is highly synergistic. Diabetes mellitus (DM) has reached pandemic amounts around the world, and its incidence is increasing. A diagnosis of diabetes mellitus (DM) has the same serious consequences as a diagnosis of coronary artery disease (CAD). Furthermore, diabetes (particularly type 2 diabetes) is linked to a collection of indicators of risk for coronary artery disease (CVD).

People with DM had a 75% to 85% incidence of hypertension, and a 60% to 70% prevalence of obesity. CAD is a major reason for death in type 1 and 2 diabetes, and it is linked with a 2- to 4-fold higher predisposing factor of heart disease mortality. Over 70% of those with diabetes above 65 years of age will die because of heart disease or stroke. Also, individuals with diabetes had a higher death rate after myocardial infarction and a worse overall long-term prognosis the CAD (Aronson and Edelman, 2014). Raised lipoprotein is a hereditary lipid condition that is an indicator of cardiovascular disease (Oo et al., 2020). This case report aims to highlight the importance of postoperative rehabilitation in optimizing patient outcomes following CABG.

2. PATIENTS INFORMATION

A 59-year-old man presented to the cardiac department at Shalinitai Meghe multispeciality hospital with a history of coronary artery disease, as well as several bouts of angina and myocardial infarction (MI) in the previous two years. He was experiencing chest pain that was extending to his left shoulder, as well as trouble doing intense exercise. Medications such as antiplatelet medicines, statins, and beta-blockers have been used to treat him. After one month, the patient's symptoms increased, and it was planned for coronary artery bypass grafting (CABG) operation. The patient gave a history of alcohol consumption and smoking since 10 years.

3. CLINICAL FINDINGS

According to the assessment's findings, dyslipidemia and hypertension have both existed for five years. Angiography outcomes Coronary angiography revealed severe triple-vessel disease with substantial stenosis in the left circumflex (LCx), right coronary artery (RCA), and left anterior descending (LAD) arteries. The stenosis in the RCA was 80%, the LCx had a 60% stenosis, and the LAD had a 70% stenosis. Echocardiography: Echocardiography showed intact systolic function and left ventricular hypertrophy. A modest impairment was indicated by the estimated ejection fraction of 50%. The chest x-ray revealed no deposit of secretion.

Figure 1 illustrates the suture markers at the sternum level. Adaptive capacity: The patient described having mild angina symptoms (Class II angina), occasionally accompanied by dyspnea when exerting themselves. Indicative of myocardial ischemia, the results of his exercise tolerance test revealed ST-segment depression at a workload of 6 METs. No notable abnormalities were found during pulmonary function testing. These clinical results supported the recommendation of CABG surgery as the appropriate course of action. A coronary artery bypass grafting procedure was done on the patient on June 1st, 2023. In supine lying, the patient was examined. On the front chest wall, there was a 25 cm long suture (Figure 2).

The patient reported experiencing pain at the suture site and having trouble shifting around in bed. All vital signs are within normal ranges; however, there is grade 2 tenderness throughout the suture length, decreased chest expansion, and the patient's functional ability as well as limitations in daily activities. Event timeline is in (Table 1).

Figure 1 Demonstrates the chest x-ray of PA (posterior-anterior) view, which allows viewers to see the sutures

Figure 2 (A) shows the anterior aspect of the thoracic wall where a bandage was applied; (B) shows the suture on the anterior thoracic wall

Table 1 Shows the timeline of event

Events	Date of Events
Patient diagnosed with coronary artery disease	04/05/2021
Patient visited Shalinitai Meghe multispecialty hospital	26/05/2023
Pre-operative physiotherapy management starts from	27/06/2023
Operated for coronary artery bypass graft surgery	01/06/2023
Post-operative physiotherapy management starts from	02/06/2023

Therapeutic Intervention

The patient had pre-operative cardiac rehabilitation in the form of chest physical therapy prior to CABG surgery. Breathing exercises have been suggested for the patient. Incentives spirometry is also used to improve the effectiveness of ventilation reduce the effort needed to breathe, promote gas exchange and oxygenation, and prevent postoperative pulmonary issues. Breathing exercises techniques such as the diaphragm, thoracic expansion and others enlarging your thoracic cavity and activating your lungs. Figure 3 and Table 2 depict cardiac rehabilitation.

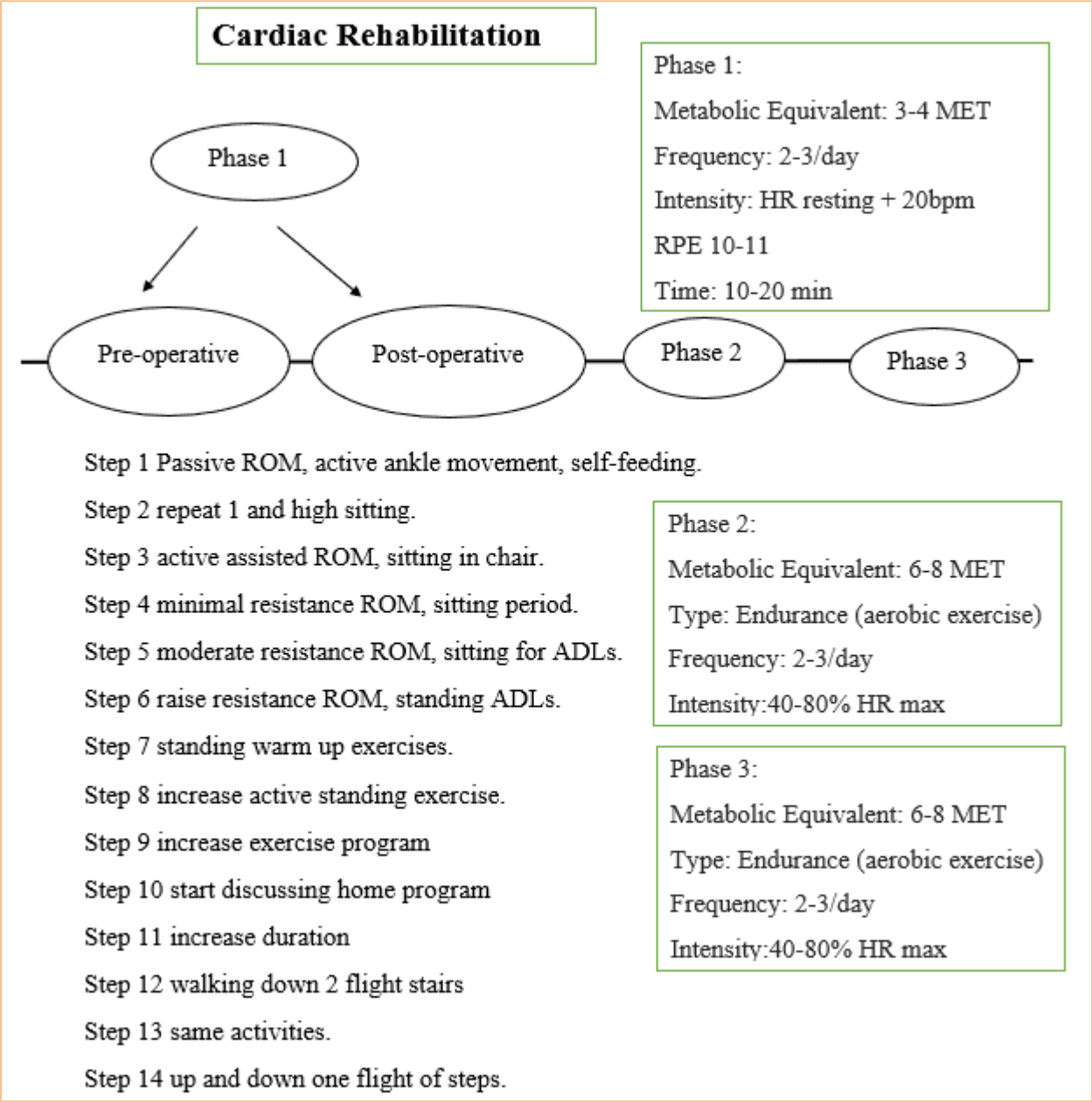

Figure 3 shows the cardiac rehabilitation.

Table 2 shows the phase wise cardiac rehabilitation

Phase 1: Inpatient	Phase 2: Outpatient	Phase 3: Maintenance
Education: Inform the patient about the significance of pulmonary rehabilitation, its advantages, and what to anticipate.	Education and Counseling: Provide instructional workshops on heart anatomy, drugs, stress management, and long-term care tactics.	Continuing Exercise Intervention: Patients should be encouraged to keep up their normal exercise regimen, either on their own or under supervision.
Monitoring and controlling postoperative pain by applying chest pads with belt (sternal belt): Is important for patient comfort and making it easier for patients to engage in rehabilitation activities.	Risk modification: Give the patient information and encouragement to adopt and maintain a heart-healthy lifestyle, including methods for quitting smoking, managing their weight, and managing their stress.	Reiterate the value of maintaining a heart-healthy lifestyle: Which includes a nutritious diet, regular exercise, stress management, and frequent check-ups with medical professionals.
Chest physiotherapy: Teaching coughing	Evaluation: To maintain safety and	Follow-up Evaluations: Arrange

and huffing, deep breathing methods can help to enhance lung function and avoid respiratory issues. Using incentive spirometry, the vital capacity will be raised (Figures 4A, 4B). Thoracic Expansion (Figure 5A): To increase lung expansion and air entry.	modify the intensity as necessary throughout exercise sessions, continuously check the patient's heart rate, blood pressure, and symptoms.	regular evaluations to track the patient's development, examine risk factors, and, if necessary, modify the treatment strategy.
Mobilization: Encourage early mobility and walking (Figure 5B) within recommended limits to avoid problems and improve daily living activity. Step up to stair climbing, ramp walking, and static cycling.	Create rehabilitation goals by doing a thorough assessment of the patient's physical, psychological, and social situation to establish a baseline.	Long-Term Healthcare: Collaborate along with the patient's main treatment physician and other specialists to make sure that care continues and to address any new problems or worries.
Medication Management: Ensure that prescription drugs are taken as directed and educate the patient about their purpose and any negative effects.	Exercise Training: A customized exercise regimen, including aerobic workouts, strength training, and flexibility drills, based on the patient's functional capabilities.	Relapse Avoidance: Inform the patient about probable difficulties and relapse prevention techniques including recognizing triggers, getting help from friends and family, and maintaining motivation.
Psychosocial Support: Evaluate the patient's mental health offer counselling to patient	Medication Examine: Work with the patient's medical team to review the patient's medications and resolve any issues or modifications that may be required.	* The specifics and length of each phase may change as per patient's health status. For the best patient care, it is crucial to seek the advice of medical experts and adhere to evidence-based recommendations.
Dietary habits: Educate the patient about the need of a healthy diet following CABG surgery.	Facilitate attendance at support groups: To provide peer connection, experience sharing, and extra emotional support.	

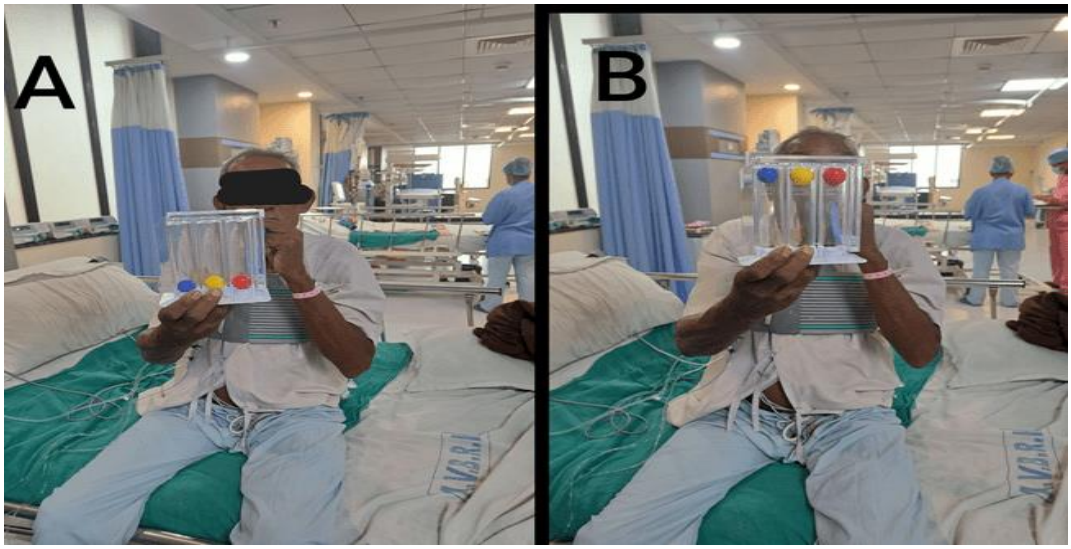

Figure 4 (A) Patient was performing incentive spirometry (post-operative day one); (B) Performing incentive spirometry (1200 cc with three second of hold)

Outcome Measures

Outcome measures were listed in (Table 3).

Figure 5 (A) Thoracic Expansion; (B) Independent Ambulation

Table 3 Shows the outcome measures

Outcome Measures	On Admission	Pre – physiotherapeutic treatment (post-operative)	Post – physiotherapeutic treatment (post-operative)
Modified Medical Research Council (mMRC) Dyspnea Scale	Grade 3	Grade 3	Grade 0
Visual Analog Scale (VAS)	6/10	8/10	3/10
Nijmegen Questionnaire	17	20	06
Incentive Spirometry	< 600cc with 2 sec of hold	< 600 cc with 1 sec of hold	1200 cc with 3 sec of hold
Fatigue Severity Scale	5.2	5.5	3.6
Patient health questionnaire	15	09	04
Beck Anxiety Inventory	22	24	09

4. DISCUSSION

Cardiovascular rehabilitation (CR) focused on exercise is critical for management of cardiovascular disease and lowering predisposing factors such as hypertension (Quindry et al., 2022). The age of the CABG patient group, as well as the rising frequency of major comorbidities, presents hurdles to achieving good long-term results and using clinical practice recommendations (Scrutinio and Giannuzzi, 2008). CR is an effective therapy for a wide spectrum of heart disease patients. Its use is supported by a large body of studies that reveals betterment in cardiovascular fitness, psychological elements, and life quality, as well as decreases in mortality and morbidity. Despite this data, many practitioners underappreciate and underutilize CR, to the detriment of patient outcomes (Mc-Mahon et al., 2017).

Further randomized clinical studies in a larger sample of patients with AF, with minimal risks of bias and chance play, are required to evaluate the efficacy of exercise-based management (Risom et al., 2017). A study showed that pre-exercise training and symptom-limited exercise tolerance testing is the ideal starting point for the exercise prescription. The rest of the workout usually consists of a quick warm-up, supervised individual aerobic exercise, and a quick cool-down. 20–60-minute exercises lasting 3–5 days per week at 50–80% of one's maximum exercise capacity make up aerobic exercise.

According to relatively recent research, high-intensity interval training (HIIT) results in larger & faster improvements in exercise capacity (Mc-Mahon et al., 2017). A study said that each patient should receive an individualized ET program that contains aerobic exercise, strength training, flexibility exercises, and/or inspiratory exercises. It seems sense that for patients with no contraindications, an integrated program could be the best option. Physical evaluation results, risk stratification, comorbidities,

patient and program goals, and an individualized exercise prescription should all be taken into consideration. The regularity and intensity of the training sessions should be the general key components (Patti et al., 2021).

5. CONCLUSION

This postoperative case report highlights the critical role of physical therapy in the efficient care of a patient following coronary artery bypass grafting (CABG). The patient's preoperative evaluation revealed a significant triple-vessel coronary artery disease. After surgery, the patient was given breathing exercises and early movement, which prevented complications including deep vein thrombosis and pneumonia. The patient's physiotherapy program also included education on lifestyle adjustments to reduce the risk of additional cardiac episodes as well as strengthening exercises, cardiovascular training, and cardiovascular conditioning. The patient's physical activity and quality of life significantly improved during their hospital stay, and they were discharged in a more stable condition. The importance of physiotherapy being included in the multifaceted considerably improves the general health and long-term success of CABG patients by executing a comprehensive and tailored program.

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Author Contributions

All authors contribute equally for manuscript work & production.

Informed consent

Written and oral informed consent was obtained from patient included in the study.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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