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Effects of an 8-Week Structured Physiotherapy Rehabilitation Program in a Post-Operative CABG Patient: A Case Report

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Abstract:

Background: Coronary artery bypass graft (CABG) surgery improves cardiac function but often leads to reduced physical capacity and quality of life. Structured rehabilitation is essential for optimizing recovery. **Objective**: To evaluate the effects of an 8-week structured outpatient physiotherapy program on aerobic capacity, strength, pulmonary function, chest expansion, and quality of life in a post-CABG patient. **Methods**: A 62-year-old male, 9 months post-CABG and post-surgical wound dehiscence repair, presented with fatigue and exertional difficulty. Baseline assessments included VO_2 max via Modified Bruce Protocol, strength via 10RM, pulmonary function (FVC, FEV1), chest expansion, and quality of life via SF-36. The intervention included aerobic training (treadmill, cycle ergometer) and progressive resistance exercises, administered 5 days/week for 8 weeks.

Results: VO_2 max improved from 16.5 to 24.2 ml/kg/min (46.6% increase). Strength improved in the quadriceps (10 kg to 18 kg) and biceps (6 kg to 12 kg). FVC increased from 2.1 L to 2.8 L and FEV1 from 1.7 L to 2.3 L. Chest expansion increased from 3 cm to 3.8 cm. SF-36 score improved from 58 to 79, indicating better quality of life. **Conclusion**: The 8-week physiotherapy program led to significant gains in cardiovascular fitness, muscle strength, pulmonary function, and quality of life. This case highlights the value of structured outpatient rehabilitation in functional and physiological recovery post-CABG.

Keywords: Aerobic Capacity, Cardiac rehabilitation, Post Operative CABG, Resistance Exercises.

INTRODUCTION

Cardiovascular disease (CVDs) encompass a wide range of disorders that affect the heart and blood vessels. Coronary artery disease (CAD), also known as coronary heart disease, is a type of CVD that impacts the coronary arteries, which are responsible for 85% of CVD-related deaths worldwide[(1)]. For patients with CAD, surgical intervention for myocardial revascularization can significantly impact their overall lifestyle and daily physical activities, potentially leading to notable physical impairment and a decreased quality of life[(2)]. Cardiac rehabilitation has demonstrated substantial benefits for post-CABG patients. These benefits include more than a 30% reduction in mortality[(3)], a decrease in readmission rates[(4)], and a reduction in the manifestation of major cardiovascular risk factors, including high blood pressure (BP), dyslipidemia, hyperglycemia, and smoking[(5)]. Therefore, implementing cardiac rehabilitation is essential for maintaining positive outcomes and supporting long-term health after surgery. Exercise training, a key component of cardiac rehabilitation, is known to improve vascular circulation and enhance muscle oxidative capacity, among numerous other benefits[(6)].

RESEARCH METHODOLOGY

Study design, setting, and ethical consideration.

The present study was a case report conducted at the OPD Physiotherapy unit in Latur, Maharashtra, India. The duration of the study was 8 weeks. Ethical clearance was obtained from the institutional ethical committee, and written informed consent was secured from the participant before the study commenced.

Study participant.

A 62 year old male which was a Post operative case of CABG was referred to Department of Cardiovascular and respiratory Physiotherapy for outpatient rehabilitation. The patient is on medical treatment for Diabetes Mellitus. The CABG procedure was per formed 9 months back before the Protocol Started. The patient had a suture site infection after the Surgery causing Dehiscence of Suture for which he later underwent Plastic Surgery for the wound Repair.

Procedure.

Medical information regarding the post operative CABG was obtained from the medical records of the patient.
Demographic data was also obtained.
The Patient's Chief complaint was Fatigue on exertion which was present since Post Surgery also The patient had an Associated complaint of Tightness in the chest. Difficulty in climbing stairs, Difficulty in walking for longer distance.

Outcome measures

Outcome measures were taken at two time points: at baseline and after 8 weeks of intervention.

1. Modified Bruce: Aerobic endurance was assessed using treadmill testing, specifically the Modified Bruce Protocol. VO2 max was calculated Before and after the Protocol.
2. Quality of Life: It was Assessed using the SF36 QOL questionnaire.
3. Chest Expansion: Measured with a measuring tape.
4. Pulmonary Function Test: Pulmonary function variables were measured via spirometry using a SP10BT spirometer. The tests were performed with patients in both sitting and lying positions. A nose clip was used, and measurements followed the recommendations of the American Thoracic Society (ATS) and the European Respiratory Society (ERS). The highest value from three technically satisfactory maneuvers was recorded. Slow vital capacity (VC) was measured during an inspiratory maneuver, followed by measurements of forced vital capacity (FVC), forced expiratory volume in one second (FEV1), peak expiratory flow (PEF), and FEV% (FEV1/FVC). Predicted values were adjusted for age, sex, and height. Peripheral oxygen saturation (SpO2) was measured using a pulse oximeter.
5. Strength Testing: 10 RM testing was conducted according to the Strength Testing protocol.

Intervention: The Rehabilitation program was performed at the Physiotherapy department at CVRS OPD of the Maharashtra Institute of Physiotherapy, Latur, Maharashtra, India. The Training protocol included Aerobic Exercises and Strengthening Exercises.

Exercise Training:

Structured Aerobic Exercise Program:

Exercise was prescribed for 5 days a week over a period of 12 weeks. Initially, the patients target heart rates were calculated using Karvonen's formula. Each exercise session included the following components:
- Warm-up exercises: 5-10 minutes of active range of motion (ROM) exercises for all peripheral joints of the upper and lower limbs.
- Aerobic conditioning: 10-50 minutes of activities on a treadmill and a stationary cycle.
- Cool-down exercises: 5-10 minutes of stretching exercises for the upper and lower limbs.

The exercise protocol began with an intensity of 40%-60% of the patients' heart rate reserve for a duration of 20-30 minutes. The duration of the exercise sessions was gradually increased by 5-10% each week, reaching a maximum of 60 minutes. To progress the aerobic exercise, the resistance or speed of the training was adjusted to maintain an intensity level of "somewhat hard" on the Rating of Perceived Exertion (RPE) scale throughout each session.

Progressive resistance exercises (PRE) for improving strength of upper and lower limb:

The program was designed to enhance the strength of individual muscles using a resistance band, consisting of five exercise sessions per week. Participant completed 2 to 3 sets of each exercise, with 10 repetitions per set. He was instructed to take a minimum of 30 seconds of rest between each exercise set. Progression in the resistance exercise training program was achieved by increasing the weights used for applicable exercises and advancing through a series of exercises.

RESULTS AND DISCUSSION

Results:

The 8-week structured outpatient rehabilitation program led to significant improvements in the patient's aerobic capacity, muscular strength, pulmonary function, chest mobility, and quality of life.

Aerobic Fitness: VO_2 max increased from 16.5 ml/kg/min to 24.2 ml/kg/min, showing a 46.6% boost in cardiovascular endurance.

Strength: Strength testing indicated quadriceps strength improved from 15 kg to 18 kg, and biceps strength improved from 6 kg to 8 kg, translating to gains of 80% to 100%.

Pulmonary Function: Spirometry showed Forced Vital Capacity (FVC) increased from 2.1 L to 2.8 L, with Forced Expiratory Volume (FEV1) rising from 1.7 L to 2.3 L. The FEV1/FVC ratio remained stable at 81%-82%, indicating balanced respiratory improvements.

Chest Expansion: Chest expansion improved from 3 cm to 3.8 cm, enhancing thoracic mobility.

Quality of Life: The SF-36 score increased from 58 to 79, indicating better physical functioning, reduced fatigue, and improved overall health perception.

Discussion:

The improvements observed in this case reflect the physiological adaptations resulting from structured aerobic and resistance training in a post-CABG patient. The increase in VO_2 max (from 16.5 to 24.2 ml/kg/min) indicates enhanced cardiovascular efficiency, likely due to improved stroke volume, capillary density, and mitochondrial function within skeletal muscles. Aerobic training also improves endothelial function and oxygen extraction, contributing to greater exercise tolerance. Strength gains in the upper and lower limbs are attributed to neuromuscular adaptations, including better motor unit recruitment, and muscle hypertrophy in response to resistance training. These improvements reduce the metabolic cost of physical activity, making daily tasks easier. Improved pulmonary function (FVC and FEV1) and chest expansion suggest enhanced respiratory muscle strength and thoracic mobility, which are essential after cardiac surgery, where pain and inactivity often reduce lung volumes. The increase in quality of life scores reflects not only physical improvements but also psychological benefits of exercise, such as reduced fatigue, improved mood, and greater confidence in daily functioning. Overall, this case illustrates how targeted rehabilitation promotes physiological recovery and enhances both functional and psychosocial outcomes post-CABG.

Conclusion:

This case study demonstrates that an 8-week structured outpatient cardiac rehabilitation program, including aerobic and resistance training, can significantly improve aerobic capacity, muscle strength, pulmonary function, chest expansion, and quality of life in a post-CABG patient. These results highlight the importance of physiotherapy in promoting functional recovery, reducing post-surgical limitations, and enhancing overall well-being. Early and individualized rehabilitation should be considered an essential part of post-operative care in CABG patients.

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