

Cardiac Rehabilitation Following Orthotropic Heart Transplantation in a Young Adult: A Case Report

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Abstract

Heart transplantation is the definitive treatment for end-stage heart failure. Post-transplant patients commonly experience deconditioning, muscle atrophy, and functional decline. This case report describes the implementation of Phase I cardiac rehabilitation in a 30-year-old male who underwent orthotropic heart transplantation for idiopathic dilated cardiomyopathy. Early physiotherapy, initiated on postoperative day two, resulted in progressive improvements in muscle strength, functional independence, and exercise tolerance. By the final inpatient session, the patient ambulated over 300 meters unaided and climbed stairs independently. These findings support the integration of structured early rehabilitation in post-transplant care.

Keywords

Heart Transplantation, Cardiac Rehabilitation, Physiotherapy, Functional Recovery, Exercise Tolerance

1. Introduction

1.1. Background

Heart transplantation remains the gold-standard therapy for patients with terminal heart failure refractory to medical management. The majority of candidates exhibit significant physical deconditioning and functional impairment due to the underlying disease, leading to decreased independence and quality of life. Furthermore, pre-transplant patients often experience limitations caused by hospitalizations, activity intolerance, and complex medication regimens that include immunosuppressant. Postoperative challenges include muscle atrophy, metabolic imbalances, and psychological disturbances that can impede rehabilitation and prolong recovery [1].

Cardiac rehabilitation (CR) encompasses a comprehensive approach aimed at optimizing physical, psychological, and social health. It is characterized by tailored exercise programs, behavioral modifications, and risk factor management, which have been proven to reduce morbidity and mortality in cardiac populations. For transplant recipients, early mobilization and rehabilitation are crucial components that can facilitate recovery, prevent complications such as myopathy, and promote functional independence [2].

1.2. History of Presentation

A 30-year-old male with a history of epilepsy (managed with levetiracetam following a switch from sodium valproate due to suspected thrombocytopenia) presented with progressive dyspnea, fatigue, and reduced exercise tolerance from July 2024. Investigations confirmed idiopathic dilated cardiomyopathy with severely impaired left ventricular function (LVEF 20%). Coronary computed tomography angiography identified an anomalous high-origin right coronary artery with intramural course and significant ostial stenosis. Right heart catheterization confirmed pulmonary hypertension and reduced biventricular output. The patient underwent orthotropic heart transplantation on 14 April 2025 at Royal Hospital, Sultanate of Oman. Postoperative mechanical ventilation was maintained with assisted spontaneous ventilation (PEEP: 5 cm H₂O) and pharmacological support including norepinephrine, milrinone, and inhaled nitric oxide (20 ppm). The patient was successfully extubated on postoperative day two. Capable of breathing spontaneously via nasal cannula at 2 L/min, with stable vital signs (HR 109 bpm, BP 132/67 mmHg, SpO₂ 100%).

1.3. Past Medical History

The patient had a documented history of epilepsy, initially managed with sodium valproate, subsequently switched to levetiracetam in October 2024 due to suspected valproate-induced thrombocytopenia. No prior cardiac interventions or other significant comorbidities were reported.

2. Method

2.1. Differential Diagnosis

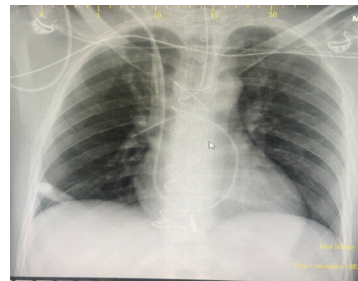
Primary considerations included ischemic cardiomyopathy, myocarditis, and hereditary cardiomyopathy. These were excluded following coronary imaging, serological testing, and cardiac biopsy, confirming an idiopathic etiology.

2.2. Investigations

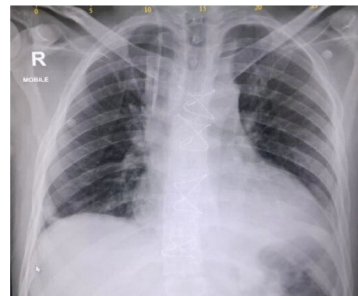
On examination, the patient appeared thin but was alert, oriented, and fully conscious. Most assessments were performed with the patient in the Semi-Fowler's position. Vital signs included a heart rate of 110 bpm, blood pressure of 135/75 mmHg, and respiratory rate of 18 breaths per minute. The patient was receiving oxygen support via nasal cannula at 2 L/min. He was attached to arterial and in-

travenous lines, femoral and brachial lines, a Swan-Ganz catheter, implantable cardioverter-defibrillator (ICD) leads, ECG leads, pulse oximeter, and urinary catheter. The patient was afebrile, with normalized chest expansion and a Glasgow Coma Scale (GCS) score of 15/15, indicating optimal cognitive function in communication, memory and perception.

Arterial blood gas analysis post-extubating is presented in **Table 1**. Hemoglobin was 9.2 g/dL. Chest radiography on day one showed fully expanded lungs in **Figure 1(A)**, a subsequent film on day three demonstrated mild left-sided pericardial effusion **Figure 1(B)**.



A) Intubated



B) Extubated

Figure 1. Post-surgery X-ray.

Table 1. Arterial blood gas results immediately following extubation.

ABG parameter	Patient value	Normal value
pH	7.44	7.35 - 7.45
PCO ₂	41 mmHg	35 - 45 mmHg
PO ₂	119 mmHg	83 - 108 mmHg
HCO ₃	28 mmol/L	22 - 28 mmol/L
Base excess	+3.6	-2 to +2

2.3. Management

Written informed consent was obtained from the patient prior to enrolment in the rehabilitation program. The institutional ethics committee of the Royal Hospital approved the clinical management described herein. Physiotherapy commenced on postoperative day two, conducted seven days per week for 20 - 30

minutes per session (seven sessions total). The program was well structure and supervised by physiotherapist.

Patient position was kept in upright and semi-Fowler positions were encouraged to optimize ventilation-perfusion matching and oxygenation. Respiratory exercises were done using diaphragmatic breathing and incentive spirometry was implemented to enhance pulmonary efficiency. However, early mobilization activities progressed from bed exercises and sitting at the edge of the bed to ambulation, commencing with short distances and advancing to over 300 meters in last session.

Strengthening exercises done for both Upper and lower limb exercises progressed by using Thera-Band resistance training. Shoulder abduction was restricted to protect the sternal wound. Stair training was introduced in session six.

The starting intensity from bed active exercise with 10 repetitions twice a day and progress to 15 repetitions then use of Thera band. Taught to the patient to stop when even feeling tired or pain increase more than 3/10 in numeric pain rating scale and the Borg Rating of Perceived Exertion Scale used to identify the short of breath during the exercise.

2.4. Follow-Up

The patient was hospitalized for 14 days (12 days in the intensive care unit, 2 days in the general ward). Outcome measures including Manual Muscle Testing [1], the Borg Rating of Perceived Exertion Scale [2], the Barthel Index [3], the ICU Mobility Scale [4], and the Modified Borg Dizziness Scale [5] were assessed at sessions one and seven. Results are presented in **Table 2** and **Table 3**.

Table 2. Manual muscle testing of lower limb antigravity muscles (0 = no contraction; 5 = full resistance). Grades 0 - 5 per Medical Research Council scale.

Muscle group	ICU (1st session)		Ward (7th session)	
	Left	Right	Left	Right
Hip flexor	4/5	4/5	5/5	5/5
Knee extensor	4/5	4/5	5/5	5/5
Plantar flexor	4/5	4/5	5/5	5/5
Dorsiflexor	4/5	4/5	5/5	5/5

Table 3. Session-by-session outcome measure scores.

Session	Borg score (RPE)	ICU mobility score	Dizziness score
1	0/10	5/10	0/10
2	3/10	5/10	0/10
3	3/10	8/10	0/10
4	2/10	8/10	0/10
5	N/A (seizure episode)	5/10	7/10
6	0/10	10/10	0/10
7	0/10	10/10	0/10

Progressive improvements were observed across all outcome measures (**Table 3**). At session seven, the patient walked over 300 meters in eight minutes without rest and climbed stairs independently. A transient episode of severe dizziness at session five (score 7/10) coincided temporally with two seizure events three hours prior and mild pericardial effusion identified on echocardiography, the therapy were paused. After medical review the physiotherapy session resume after 4 hours of rest and no hemodynamics changes. The Barthel Index improved from 40/100 at session one to 100/100 at session seven, restoring pre-operative functional independence. Following discharge, outpatient cardiac rehabilitation was arranged.

Patient received a 7th session in outpatient phase of cardiac rehabilitation after discharge once a week. The program was focusing on strengthen exercises and endurance. The exercises consist of Thera band, stairs training and walking. **Table 4** shows the exercise progression. 6 mints walk test were used as outcome measurements. **Table 5** shows the improvements in over the 7th session of outpatient cardiac rehabilitation.

Table 4. Cardiac rehabilitation progreem.

NO. session	Strengthen exercises	Walking	Stairs training
1	5 - 7 reps with Thera band+ squat 5 reps	7 - 10 mints once a day	One mints a day
2	10 - 12 reps with Thera band+ squat 7 reps	10 - 15 mints twice a day	2 mints a day
3	12 - 15 reps with Thera band+ squat 10 reps	15 - 17 mints twice a day	3 mints a day
4	12 - 15 reps with Thera band+ squat 10 reps twice a day	20 mints twice a day	4 mints day
5	15 - 17 reps with Thera band+ squat 10 reps twice a day	20 - 25 mints once a day	4 mints twice a day
6	20 reps with Thera band+ squat 12 reps twice a week	25 - 30 mints once a day	5 mints twice a day
7	20 reps with Thera band+ squat 12 reps twice a week	25 - 30 mints twice a day	5 - 8 mint twice a day

Table 5. 6 mints walk test result.

NO. sessions	6 mints walk test
1	433 meters
2	447 meters
3	450 meters
4	465 meters
5	478 meters
6	470 meters
7	496 meters

3. Discussion

This case demonstrates that structured early cardiac rehabilitation can yield rapid, clinically meaningful functional recovery following orthotropic heart transplantation. Recovery was observed following rehabilitation, though multiple factors may have contributed. The patient achieved full independence within 14 days as inpatient, consistent with evidence that early mobilization of critically ill patients mitigates muscle atrophy and accelerates return to function [6]. The progressive integration of respiratory, mobilization and strengthening components mirrors protocols demonstrating improved exercise capacity and muscle strength in transplant recipients in long term especially in outpatient phase [7]. The transient dizziness episode, attributable to a pre-session seizure and mild pericardial effusion rather than the rehabilitation itself, reinforces the importance of individualised, supervised programming. The patient narrative underscores the psychological benefit of regaining physical autonomy, aligning with the multidimensional aims of cardiac rehabilitation [8]. This case report suggests the intervention is feasible and appeared safe in the short and long term in this patient.

4. Conclusion

Cardiac rehabilitation initiated on postoperative day two produced measurable improvements across all functional outcome measures in this post-heart transplant patient. A structured, stepwise approach to exercise prescription facilitated full functional recovery within the inpatient stay and outpatient. Further research involving larger cohorts is needed to establish evidence-based rehabilitation protocols for this population.

5. Learning Objectives

- 1) To recognize the feasibility and safety of initiating cardiac rehabilitation as early as postoperative day two following orthotropic heart transplantation.
- 2) To understand the stepwise progression of physiotherapy interventions—from respiratory exercises to ambulation and resistance training—within a structured Phases of cardiac rehabilitation program.
- 3) To implement cardiac rehabilitation protocol of post heart transplant surgery as this case is first case in the country.
- 4) To appreciate the importance of validated outcome measures in monitoring functional recovery and guiding rehabilitation intensity in post-transplant patients.

Ethics and Patient Consent

Written informed consent was obtained from the patient for publication of this case report. The procedures followed were in accordance with the ethical standards of the Helsinki Declaration. Ethical approval was granted by the Royal Hospital Institutional Ethics Committee, Sultanate of Oman.

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- 2) Rehabilitation department staffs.
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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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