



Reverse Left Ventricular Remodeling: Effect of Home-Based Multidisciplinary Cardiac Rehabilitation in Patient with Dilated Cardiomyopathy

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Abstract

Background: Dilated cardiomyopathy mostly causes enlargement of heart and heart failure. The purpose of this case report is to describe how multidisciplinary cardiac rehabilitation using the home-based patterns reverse left ventricular remodeling in dilated cardiomyopathy.

Case Report: A 29-year-old male, repeated hospitalization for heart failure with poorly controlled, received home-based tailored cardiac rehabilitation, repeated chest pain and breathing difficulties, heart fell sharply. The results of auxiliary examinations showed enlargement of heart, with left ventricular ejection fraction of 34.3%, left ventricular end diastolic diameter from 7.5 cm, left ventricular end systolic diameter from 6.2 cm. However, when we consider family economic conditions, we find that the CRT-implant therapy is not suitable for him. Meanwhile they were far removed from hospital. Afterwards, we decide to adopt multidisciplinary cardiac rehabilitation to help him to alleviate symptoms, reverse left ventricular remodeling and improve the quality of life. Then, we provide home-based CR included comprehensive assessment, scientifically tailored and individualized cardiac rehabilitation prescription and remote wireless ECG monitoring. After 7 month home-based CR, his left ventricular Ejection Fraction (EF) improved from 34.3% to 62.2%, left ventricular end diastolic diameter from 7.5 cm to 5.7 cm, left ventricular end systolic diameter from 6.2 cm to 3.8 cm, VO₂peak improved from 13.67 to 26.25, VO₂AT (ml/kg/min) improved from 7.74 to 14.48, VE/VCO₂ decreased from 41.8 to 27.6, there were no adverse events. During the follow-up period his cardiac function maintained stability and live a happy life.

Conclusion: Home-based CR help patient with EF reduced heart failure reverse the left ventricular remodeling, improve the quality of life, proved to be safety.

Keywords: Reverse left ventricular remodeling; Dilated cardiomyopathy; Multidisciplinary cardiac rehabilitation

Introduction

Dilated cardiomyopathy is a common disease, with the left ventricular dysfunction as the main characteristics.

Usually when we face the dilated cardiomyopathy, cardiac resynchronization therapy and medication should be the first choice, but this patient had no CLBBB, the more helpful and valuable treatment to the patient would be the multidisciplinary Cardiac Rehabilitation (CR).

Case Presentation

A-29-year-old male patient was diagnosed with dilated cardiomyopathy three years ago, he had a left ventricular ejection fraction of 34.3%, and the UCG shows the left ventricular enlargement, experienced edema of both lower limbs and progressive dyspnea, no obvious incentive. However he did not take medicine irregularly. Now he experienced edema of both lower limbs and progressive dyspnea with exercise intolerance again, and his condition was classified as New York Heart Association class III. Thereby, he seeks for the advanced strategies. After carefully examination, we decided to prescribe cardiac rehabilitation for him. Since the patient live in another city far from my hospital. We aim to perform home-based CR for him.

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Received Date: 06 Dec 2021

Accepted Date: 20 Jan 2022

Published Date: 24 Jan 2022

Citation:

Fan X, Lei S, Ding R. Reverse Left Ventricular Remodeling: Effect of Home-Based Multidisciplinary Cardiac Rehabilitation in Patient with Dilated Cardiomyopathy. *Ann Clin Case Rep.* 2022; 7: 2096.

ISSN: 2474-1655

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Table 1: Results.

Demographics		
Age	29	
Height (cm)	175	
Weight (kg)	112	
BMI	36.57	
Comorbidities		
Obesity	yes	
Hypertension	none	
diabetes	none	
CVD	none	
NYHA-class	III	
cardiovascular risk factors		
GAD-7	0	Normal
PHQ-9	5	mild
PSQI	16	
SF-12	38.75	poor
Smoking, years	cession 4years	
wine	A cup once a day	
Diet	A preference for meat	
Laboratory analysis		
Triglyceride mmol/l	1.75	
High density lipoprotein mmol/l	0.94	Low
Low density lipoprotein mmol/l	2.03	
Total cholesterol mmol/l	3.18	
HbA1c I%	6.4	
Echocardiography		
LVEF, %	34.3	
LVEDD, cm	7.5	
LVESD, cm	6.2	
Baseline CPET-performance		
VO ₂ peak (ml/kg/min)	13.67	
VO ₂ AT (ml/kg/min)	7.74	
VE/VCO ₂	41.8	
RERpeak	1.03	
HRrest (beats/min)	84	
HRpeak (beats/min)	126	
SBPrest (mm Hg)	not tested	
SBPpeak (mm Hg)	128	

Initial examination

Comprehensive cardiac rehabilitation assessment is the starting point of cardiac rehabilitation assessment. The patient were assessed from the following aspects, including history and comorbidities cardiovascular risk factors, cardiovascular function, quality of life, causes of exercise limitation, exercise cardiovascular risk and physical fitness, the initial time is February 5th, 2018. The results are represented in Tables 1-5. Based on the above evaluation results, we formulated cardiac rehabilitation prescriptions for patients according to the guidelines of The American Heart Association and the American Society of Sports Medicine, including medication prescriptions,

Table 2: Medication prescription.

Names	Methods	Notes
ACE-I Acertil 4mg Beta-blocker	One tablet a day, once a day	
Aldosterone Carvedilol 12.5 mg	One tablet a day, twice a day	
Vasorel 20 mg	One tablet a day, three times a day	
Potassium Chloride Sustained Release Tablets 500 mg	One tablet a day, three times a day	
Furosemide 20 mg	two tablets a day, once a day	P.M.16:00
Spirinolactone 20 mg	One tablet a day, once a day	

exercise prescriptions.

Discussion

Dilated cardiomyopathy is characterized by ventricular dilatation and systolic dysfunction in the absence of known abnormal loading conditions [1]; it leads to recurrent occurrence of hospitalization as progression to advanced HF, eventually accounts for high all-cause mortality and heart transplantation/death. The causes or pathophysiology of heart failure in DCM may be variable, but Left Ventricular (LV) remodeling is considered the major pathway to deterioration in Left Ventricular (LV) systolic function [2]. It's reported that LV reverse remodeling was associated with ~50% lower mortality rates at 10-year follow-up in DCM patients [3]. Over the decades, the Guideline-Directed Medical Therapy (GDMT) has been shown significant benefits on reversing LV remodeling and substantial functional recovery in patients with DCM. It's widely recognized that timely therapy with Angiotensin-Converting Enzyme (ACEI) inhibitors and beta-blockers confers a LV reverse remodeling and substantial improvement of LVEF in anthracycline-induced cardiomyopathy [4]. This case firstly demonstrates the successful utilization of home-based cardiac rehabilitation to improve cardiac function and outcomes in a young male with dilated cardiomyopathy. He showed a significant improvement in peak Oxygen Consumption (VO₂peak), left ventricular ejection (%), and left ventricular end diastolic diameter from baseline after 2 years multidisciplinary cardiac rehabilitation based on tailored exercise training, combining with tailored psychological intervention, dietary counseling, risk factors control, advice on refraining from smoking and leisure physical activity [5]. Numerous studies have reported favourable effect of exercise-based CR on LA volume, left ventricular geometry and function, and cardiac prognosis in patients with Coronary Artery Disease (CAD) [6,7]. Isao Nishi et al. [8] reported that in CHF patients with advanced LV dysfunction on b-blocker therapy, exercise training successfully improves exercise capacity without adversely affecting LV remodeling or causing serious cardiac complications. However to date, there are no studies focused on CR in heart failure specifically due to dilated cardiomyopathy, future studies should work on this specific population. Significantly, in this case, the young male actually received a home-based CR model under remotely guides from our CR team. Not surprisingly, Home-Based Medical Care (HBMC) is a powerful modality which provides high-quality, patient-centered care beyond the limitation of time and space, especially, during this time of COVID-19 crisis [9,10]. In this report, we indicated the safety and effectiveness of such a home-based CR program consistent with other HBMC.

Conclusion

Dilated cardiomyopathy is an incurable disease, the left ventricular

Table 3: Exercise prescription.

	Frequency	Intensity (Bases on AT)	type	Time (min/d)	progression	Notes
Aerobic exercise	5days a week	95-105 beat/min	walking	initial from 5	Gradually added to 40min	
Resistance exercise	3 days a week	Moderate	Heel lift dumbbell preacher curls	10		Execution will begin in half a month
Breath exercise	5 days a week	Moderate	Deep breathing training	Initial from 5	Gradually added to 30min	
Flexibility exercises	5 days a week	Moderate	Joint stretch (shoulder and hips)	10		

Table 4: Change in medical status.

	2018.2.5	2018.5.15	2018.8.20	2019.2.27	2019.4.24	2019.8.24	2020.5.26
VO ₂ peak (ml/kg/min)	13.67	24.07	26.25	20.47	28.71	26.25	23.31
VO ₂ AT (ml/kg/min)	7.74	13.58	14.48	14.61	14.71	15.27	13.28
VE/VCO ₂	41.8	29.5	27.6	30.2	29.4	27.3	29.7
RERpeak	1.03	1.25	1.12	1.06	1.13	1.12	1.10
HRrest (beats/min)	84	82	74	94	85	98	115
HRpeak (beats/min)	126	162	160	148	169	169	173
SBPrest (mm Hg)	Not tested	104	106	113	111	149	166
SBPpeak (mm Hg)	128	149	155	130	165	161	196

Abbreviations: VO₂peak: Peak Oxygen Consumption; VO₂AT: Oxygen Consumption At Anaerobic Threshold; VE/VCO₂slope: The Slope of Increase in Ventilation Over Carbon Dioxide Output; RERpeak: Respiratory Exchange Ratio at Peak Exercise; Wattmax: Maximal Workload; HRrest: Heart Rate at Rest; HRpeak: Heart Rate at Peak Exercise; SBPrest: Systolic Blood Pressure at Rest; SBPpeak: Systolic Blood Pressure at Peak Exercise

Table 5: The changes in UCG.

	2018.01.23	2018.5.15	2018.8.20	2019.8.21	2020.5.26
Left ventricular ejection (%)	43.3	45.2	62.2	55.5	60.3
Left ventricular end diastolic diameter	7.5	6.9	5.7	6.0	6.2
Left ventricular end systolic diameter	6.2	5.3	3.8	4.2	4.2

dilation were would have happened significantly along with the evolution. A case is reported of the using the CR in a 29-year -old man with dilated cardiomyopathy. The report demonstrated that the adoption of CR would help patients achieve better clinical treatment effect and maximize the reversal of left ventricular remodeling. At the same time the advantage of the home-based model was also proved to be safe and effective.

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