How to cite: Jesus DS, Matias JB, Santos MC, Santa Cecília LM, Sacramento MS, Baptista Neto et al. Cardiovascular rehabilitation in discrete coronaropathy with reduction of functional capacity: case report. Rev Bras Fisiol Exerc 2020;19(1):65-74. DOI: https://doi.org/10.33233/rbfe.v19i1.3986

RBFEx
ISSN: 2675-1372

Brazilian Journal of Exercise Physiology

Case Report

Cardiovascular rehabilitation in discrete coronaropathy with reduction of functional capacity: case report

Reabilitação cardiovascular na coronariopatia discreta com diminuição da capacidade funcional: relato de caso

Daniela Santos de Jesus,[1,2] Jackeline Barbosa Matias[1,2,3], Milena Cipriano Santos[1,3] Lucas Mendes Santa Cecília[1,3], Marvyn de Santana do Sacramento[1,2,5], José Francisco dos Santos[2], Jefferson Petto[1,2,3,4,5]

1. ACTUS CORDIOS Reabilitação Cardiovascular, Respiratória e Metabólica, Salvador, Bahia, Brazil.
2. Faculdade do Centro Oeste Paulista, Bauru, São Paulo, Brazil.
3. Faculdade Adventista da Bahia, Cachoeira, Bahia, Brazil.
4. Escola Bahiana de Medicina e Saúde Pública, Salvador, Bahia, Brazil.
5. Centro Universitário do Instituto Social da Bahia, Salvador, Bahia, Brazil.

ABSTRACT

Introduction: Cardiovascular diseases (CVDs) are responsible for a number of deaths worldwide. Among CVDs, coronary artery disease (CAD) is a more serious complaint and results in a high rate of hospitalizations and high costs. The treatment of coronary artery surgery (revascularization), is the treatment of the coronary heart disease (CHR) treatment. The cost benefit of conservative treatment is higher than the clinical procedure, but nevertheless explored in the literature regarding CAD. **Objective:** to describe the case of a patient with CAD who opted for conservative treatment. **Case description:** Male, 52 years old, sedentary, former smoker for 12 years, with clinical diagnosis of CAD, arrhythmia, hypertension and dyslipidemia. Joins the CR service in August of 2018, complaining of shortness of breath, fatigue, difficulty climbing and descending stairs, calls to perform activities of daily living and work. The six-month CR program consists of remote ischemic preconditioning, inspiratory muscle training, neuromuscular and clinical exercises. All exercises were performed with electrocardiographic monitoring. Exercise progression was performed after the first month, without a third month and no fifth month. **Results:** Decreased blood pressure 140/90 vs. 110/70mmHg, increased $VO_{2\ max}$ 32 vs. 52ml/kg.min, left ventricular ejection fraction improved 50 vs.68%, hypertrophy of LV posterior wall diastolic and interventricular septum 12vs9mm and reduction of left ventricular mass 299 vs. 213g. 87% improvement in quality of life by Minnesota 72 vs. 9 points plus drug reduction: carvedilol 25 vs. 12,5mg, aldactone withdrawal. Throughout the program as monomorphic ventricular extrasystoles of the patient disappeared. **Conclusion:** Conventional treatment seems to be a viable and cost-effective option in patients with CAD before surgery, which should be further explored in clinical practice.

Key-words: Coronary Disease, Surgery, Cardiac Rehabilitation.

RESUMO

Introdução: O tratamento farmacológico para controle dos fatores desencadeantes da Doença Arterial Coronariana (DAC) são a linha de frente inicial. No entanto, uma opção adjuvante ao tratamento farmacológico é a Reabilitação Cardiovascular (RC). Portanto, o **objetivo** deste estudo é mostrar os resultados da RC na melhora da qualidade de vida e funcionalidade de um paciente com coronariopatia discreta. **Descrição do caso:** Sexo masculino, 52 anos, sedentário, ex-fumante há 12 anos, com diagnóstico clínico de DAC discreta, arritmia, hipertensão arterial sistêmica e disli-

Received on: October 21, 2019. Accepted on: January 10, 2020.

Correspondence: Daniela Santos de Jesus, Av. Anita Garibaldi, n 1518 - Ondina, Salvador - BA, 40170-130, E-mail: daniela.reabilitacao@gmail.com.

pidemia. Ingressa na RC em agosto 2017, com queixas de falta de ar, fadiga, dificuldade ao subir e descer escadas, limitações para realizar atividades de vida diárias e laborais. **Resultados:** Diminuição da pressão arterial 140/90 vs. 110/70mmHg, aumento do $VO_{2\ máx}$ 32 vs. 52ml/kg.min, melhora da fração de ejeção do ventrículo esquerdo 50 vs. 68%, diminuição da hipertrofia concêntrica com espessura diastólica da parede posterior do VE e do septo interventricular 12 vs. 9mm e redução da massa ventricular esquerda 299 vs. 213g. Melhora de 87% na qualidade de vida avaliada pelo Minnesota 72 vs. 9 pontos, além da diminuição e retirada de fármacos. **Conclusão:** Um programa de Reabilitação Cardiovascular individualizado parece promover melhora da qualidade de vida, funcionalidade e dos aspectos clínicos do paciente com coronariopatia discreta.

Palavras-chave: Doença das Coronárias, Cirurgia, Reabilitação Cardíaca.

Introduction

Cardiovascular diseases (CVDs) are responsible for a high number of deaths worldwide. In 2016, approximately 17.6 million people died from CVDs [1]. In Brazil, that same year were 362 thousand deaths [2]. Among CVDs, coronary artery disease (CAD) has the highest incidence and results in a high rate of hospitalizations and high costs [3].

CAD becomes significant when ≥ 70% of the vessel diameter is obstructed following larger epicardial arteries or when ≥ 50% stenosis in the left coronary trunk diameter occurs [4]. According to Leaman's score, 84% of the blood flow that irrigates the ventricles arrives through the left coronary artery. Of this blood that reaches the left coronary artery, 66% is directed to the anterior descending artery and 33% to the circumflex artery [5].

In cases of chronic CAD, even without significant obstructions (mild coronary artery disease), some patients may have heart failure (HF), with classic clinical features of decreased functional capacity and negative impact on performing activities of daily living. The pharmacological treatment to control the triggering factors of CAD associated with the drugs used to reduce the symptoms of HF is the initial front line. However, an adjuvant option to pharmacological treatment is Cardiovascular Rehabilitation (CR).

Several studies indicate how much cost-benefit CR is superior than other isolated treatments, such as pharmacological and myocardial revascularization surgery or angioplasty [6]. However, the effect of CR associated with pharmacological treatment in HF patients due to CAD with non-significant obstructions is still poorly explored in the literature. Therefore, the aim of this study is to describe the effect of CR on HF in a patient with CAD with calcified plaques without significant obstructions

Case description

JFS, male, sedentary, 52 years old, 1.75m tall, 78kg, waist circumference 123 cm, Body Mass Index (BMI) 25.5kg/m^2, former smoker for 12 years, diagnosed with systemic arterial hypertension, obstructive sleep apnea and coronary artery disease with non-significant calcified plaques (obstructions less than 50% in the circumflex and posterior descending artery) determined by CT angiography. He was referred to the Cardiovascular Rehabilitation service of the CORDIS Clinic in Salvador - BA / Brazil on August 17, 2017.

During the first evaluation, the patient reported that for about 4 to 5

months he had been feeling short of breath, fatigue, difficulty climbing and descending stairs, difficulties in performing his work activities, as well as decreased activity and sexual capacity. These data were compatible with the clinical diagnosis of chronic heart failure.

The fasting laboratory test identified: 92mg/dL glycemia, 245mg/dL triglycerides, 39mg/dL high-density lipoprotein (HDL), 110mg/dL low-density lipoprotein (LDL), total cholesterol of 198mg/dL, hemoglobin glycated (HbA1c) 6.1%, insulin 36IU/mL. This led to a classic picture of ongoing insulin resistance, even with fasting blood glucose values within normal limits.

In the ambulatory blood pressure monitoring report (ABPM) we observed absent nocturnal fall (not Dipper). Doppler echocardiography revealed alteration of grade I diastolic relaxation, slight increase in final systolic diameter 43mm (normal up to 39mm), increase in final systolic and diastolic volume respectively of 83mL and 167mL (normal up to 61 and 150mL), increase of left atrium 44mm (normal up to 40mm) slight increase in left ventricular mass 299g (normal up to 290g), increase in septum and left ventricular posterior wall thickness of 12mm compatible with concentric hypertrophy and borderline systolic function with 50% ejection fraction (below of the Brazilian average for age which is 72%). Holter demonstrated the presence of single-focal isolated bigeminated ventricular extrasystoles and episodes of unsupported supraventricular tachycardia, ischemic T-wave, and left anterior superior divisional block.

The patient underwent a maximal physical exercise test in which a maximal heart rate (HR_{max}) of 119bpm was reached, the same heart rate (HR) as the ischemic threshold, determined by a depression greater than 2mm associated with symptoms of typical angina pectoris. HR_{max} corresponded to 71% of predicted HR_{max} for age by the Karvonen equation (220 - age). Blood pressure behaved physiologically during the test. At the time of recovery and in the final stage, monomorphic left ventricular outflow tract extrasystoles were observed. The drugs used by the patient were: Carvedilol 25mg at 07h and 19h; Enalapril 5mg at 12h and 19h; Aldactone 25mg at 2pm and Acetylsalicylic Acid.

Given the evaluation and the clinical condition of the patient, the objective of CR was to restore the patient's ability to perform daily life activities without being tired. Moreover, we also aimed to improve functional capacity and control the triggering factors of CAD such as hypertension and insulin resistance, as well as containing arrhythmia. The prognosis of treatment to achieve the goals was set at six months

Cardiovascular rehabilitation program

The CR program was started in August 2017 and lasted six months, with frequency of three weekly sessions. The exercises were monitored electrocardiographically (ECAFIX multiparameter cardiac monitor, Active® model, São Paulo, SP, Brazil). Before each session, remote ischemic preconditioning (PCIR) was performed. As the systolic pressures between the arms was similar, we chose to perform this procedure on the left arm. The RIPC was performed with 30mmHg above the systolic blood pressure of the training day, with a 5-minute occlusion for 5 minutes of reperfusion in three series.

The first month's fitness session is described in Box I. Importantly, cyclic exercise (treadmill) was prescribed based on a conventional maximal physical exercise test performed before the start of the program.

Box I. August CR Protocol - twice weekly adaptive training.

Month	Modality	Dosimetry	Duration	Interval	Intensity
August	Inspiratory Muscle Training (IMT)	Two sets of 15 inspirations - 2 times weekly	-	2 minutes recovery	20cmH_2O corresponding to inspiratory muscle glycemic threshold
	Neuromuscular Exercises	Three exercises for upper limbs and 3 for lower limbs - 2 sets of 15 repetitions.	-	2 minutes recovery	Light, with Borg from 10 to 11
	Treadmill	Acceleration	5 minutes	Continuous	Light, HR between 65 and 74bpm, corresponding to 60% of the HR max obtained
		Conditioning	15 minutes		10bpm below ischemic threshold reached at MTEF (109 bpm)
		Slowdown	3 minutes		Progressive regression of load to rest

MMSS - Superior Members; Lower limbs; TEFM - Maximum Physical Effort Test.

The IMT is prescribed to be done at home, however, we adopt as protocol to perform the first three sessions in the clinic so that the patient learns the procedure properly and to see if during the IMT there is no significant increase in arrhythmia, typical angina or some hemodynamic decompensation. As there was a significant increase in the number of unifocal ventricular extrasystoles (more than 10% increase) during IMT compared to rest, in the first month the patient performed this procedure only at the clinic under electrocardiographic monitoring. To determine the load, an incremental inspiratory muscle test was performed to determine the glycemic threshold load, the load at which the training was performed.

After the adaptation period, the patient underwent two further reassessments, one in September and one at the end of November and the CR protocol was updated according to his progression to training. After the first month the IMT was prescribed to be performed at home due to arrhythmia control. The PCIR was still being held at the beginning of the CR session. After the third month of CR the program began to be held three times a week. Box 2 details the protocols used in the other stages of CR.

Box 2. CR Protocol for September to December 2018 and January 2019.

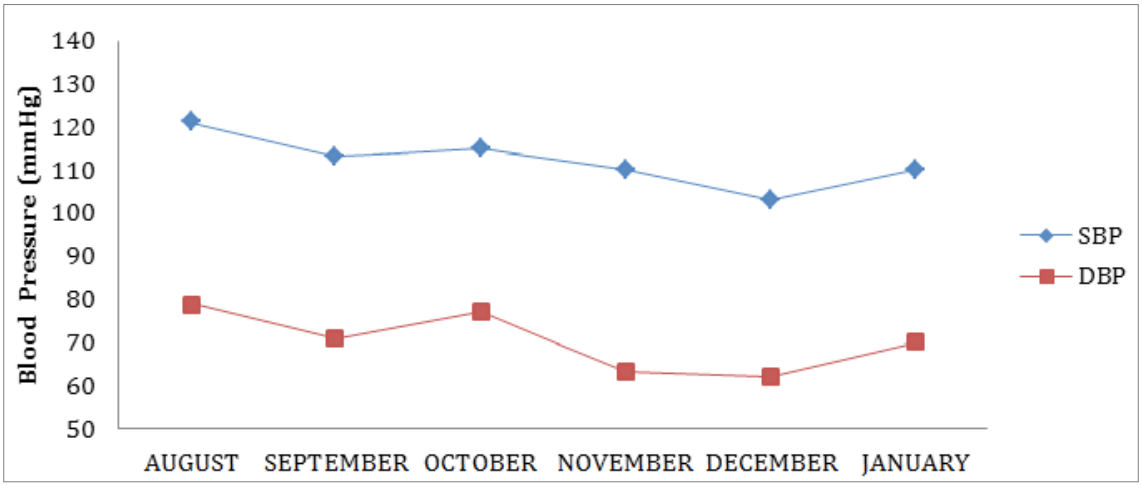
Month	Modality		Dosimetry	Duration	Interval	Intensity
September and October	Inspiratory Muscle Training (Executed at Home)		Three sets of 15 inspirations - 5 times weekly	-	2 minutes recovery	30cmH_2O
	Neuromuscular Exercises		Three exercises for upper limbs and 3 for lower limbs - 2 sets of 8 repetitions	-	2 minutes recovery	Moderate, with Borg (12-14)
	Treadmill		Acceleration	5 minutes	-	Light, HR between 65 and 74 bpm, corresponding to 60% of the HR max obtained
			Conditioning (interval)	Four blocks of 2 minutes	1minute rest between the blocks	10bpm below the ischemic threshold reached in the MTEF
			Slowdown	3 minutes	-	Progressive regression of load to rest
November, December and January	Stair training		2 moves up to 6 moves	-	2 minutes recovery	Borg (12-14)
	Treadmill	Days 1 and 3	Acceleration	5 minutes	-	Light, HR between 65 and 74 bpm, corresponding to 60% of the HR max obtained
			Conditioning (interval)	10 blocks of 30 seconds	2 minutes resting at heating speed	High Borg (16-18)
			Slowdown	2 minutes	-	Progressive regression of load to rest
		Day 2	Acceleration	5 minutes	-	Light, HR between 65 to 74 bpm. Corresponding to 60% of HR max obtained
			Conditioning (interval)	30 minutes	-	Moderate, Borg from 12 to 14
			Slowdown	5 minutes	-	Progressive regression of load to rest

We emphasize that although the treadmill prescription continued with the same percentage values of effort intensity, the velocities corresponding to these intensities were increased, since the patient had improved functional capacity, which in turn caused the need to increase the speed to achieve the same heart rates initially prescribed. In addition, in the last three months of the program, stair training was included and the treadmill was performed in two days at high intensity interval, based on the Borg subjective perception scale, and one day at moderate intensity continuously. The program was held every other day.

This case report was submitted and approved by the Ethics and Research Committee of Feira de Santana State University, Feira de Santana, BA, Brazil under CAAE No. 0036.059.000-11.

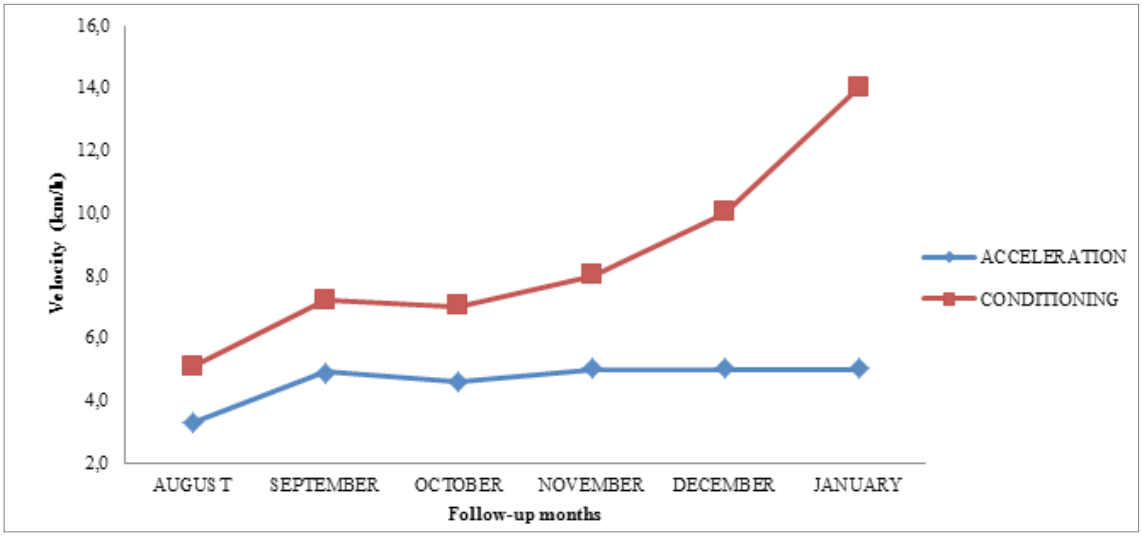
Results

Graphic 1 shows the mean arterial pressure (BP) due to each month of treatment. We observed that there was a reduction in the monthly average, from the first month of intervention to the last, of systolic (121mmHg vs. 110mmHg) and diastolic (79mmHg vs. 70mmHg) blood pressure. Mean arterial pressure at baseline was 93mmHg vs. 83mmHg reflecting an 11% improvement. In the first evaluation the BP was 140/90mmHg, characterizing borderline systemic arterial hypertension and in the last evaluation the BP was 110/70mmHg.



Graph 1. Monthly mean systolic and diastolic resting blood pressure during CR sessions. SBP - Systolic Blood Pressure; DBP- Diastolic Blood Pressure.

Graphic 2 represents the average velocities (km/h) performed on the treadmill of the heating and conditioning phase according to each month of CR. At the beginning of treatment, in the conditioning phase the patient reached a speed of 3.5km/h. However, at the end of the CR program it reached a speed of 14.4km/h, without showing signs or symptoms of typical angina pectoris. This represented an improvement of 411%, demonstrating considerable improvement in functional capacity and ischemic threshold. It is important to note that throughout the program the patient's monomorphic ventricular extrasystoles, which arose during exercise, completely withdraw.



Graphic 2. Monthly average velocity practiced in CR sessions.

In the new Doppler echocardiography performed by the same evaluator, no change in volumes and diameters was observed, resulting in a 38% reduction in final systolic volume (84 vs. 53mL) and a 17% reduction in final diastolic diameter (43 vs. 36mm). Left ventricular mass decreased by 8% (299 vs. 213mg), left ventricular posterior wall and interventricular septum thickness decreased by 25% (12 vs. 9mm). Diastolic dysfunction was no longer identified and there was a 36% increase in left ventricular ejection fraction (50 vs. 68%). No further laboratory examination was performed after the CR program.

Table I shows the results of pre and post RC MTEF. We noticed a clear improvement in functional capacity, especially the increase in indirect $VO_{2\ max}$, chronotropic reserve, cardiac output and distance covered. We also point out that no extrasystoles were seen at the peak of exertion and during the recovery period, and no ST-segment depression and typical angina pectoris symptoms were identified.

Table I. Evolution of cardiovascular conditioning - Comparison of exercise test results before and after CR.

Variable	Pre-RC Values August 12/2017	Post-RC Values February 02/2018	Percentage of evolution
Log (m)	5500	7300	33%
VO_2 max (ml/kg.min)	32,31	52,31	62%
MVO_2 max (EV/min)	23,69 ml O_2 100g	21,14 ml O_2 100g	11%
Cardiorespiratory fitness	Regular (AHA)	Excellent (AHA)	-
HR max (bpm)	119	140	18%
PAS max (mmHg)	180	140	22%
DBP max (mmHg)	80	80	-
Chronotropic deficit	28,7%	16,2%	44%
Chronotropic reserve (bpm)	48	76	58%
Cardiac debt (l/min)	17,05	23,84	40%
Systolic debt (ml/syst)	143,29	170,28	19%

HR_{max}: Maximum Heart Rate; $MVO_{2\ max}$: Maximum myocardial oxygen uptake; DBP_{max}: Maximum Diastolic Blood Pressure; PAS_{max}: Maximum Systolic Blood Pressure; $VO_{2\ max}$: Maximum oxygen volume.

When we evaluated the quality of life test (Minnesota) we initially checked for a score of 72 points. In the last evaluation, six months later, the score obtained was 9, showing an evolution of 87%, with improvement in the aspects of sexual activity, sleep quality, leisure, sports, walking and climbing stairs and the level of attention and concentration. In addition, there were no more complaints of pain, tiredness and fatigue. Finally, all improvements culminated in the patient's return to daily living and working activities. Given the improvement in clinical and functional variables, the attending physician, after six months of CR, reduced the dosage of carvedilol from 25mg to 12mg and withdrew the use of aldactone.

Discussion

The results of this case report suggest that CR is a viable adjuvant treatment for HF patients due to CAD with calcified plaques and non-significant obstructions.

The basic pharmacological treatment of HF with borderline or decreased ejection fraction aims to reduce HR, preload, afterload and promote coronary vasodilation. Physical exercise was potentiating, or even, the protagonist feature of the treatment objectives mentioned above. By analyzing BP behavior, we observed a clear reduction in preload and afterload throughout treatment, with an 11% reduction in mean resting blood pressure. We also identified BP improvement at the peak of the effort in which, for a higher workload, there was a 22% lower elevation in SBP. The impact of training on CF was also clear. During the program, we found that the speed on the treadmill initially used for conditioning was 4.5km/h. At the end of the six months of rehabilitation, the speed evolved to 14.4km/h, without the patient showing any signs or symptoms of cardiac discomfort. We also observed a 58% increase in chronotropic reserve between the first and last TEFM. In conclusion, we highlight the effect of exercise on the ischemic threshold identified in the first MTEF. As reported in the results, in the second test no electrocardiographic signs or symptoms of ischemia were seen, which reflects improved circulation in the ischemic area. This probably occurred due to the opening of collateral circulation, angiogenesis and even due to the increase in the size of coronary arteries [7].

The cardiac structural improvement observed in the comparison between the first and last Doppler echocardiography is also noteworthy. Scientific literature has long signaled the effect of reverse myocardial remodeling produced by exercise, although it is still undervalued and discussed. In a systematic review study with meta-analysis published in the JACC and conducted by Haykowsky et al. [8], it was shown that exercise can promote reverse myocardial remodeling in dilated or hypertrophic heart disease. The study included 812 patients in the exercise group and 569 in the control group, evidencing the positive response that exercise promotes.

In order to achieve the benefits mentioned above, the prescription of physical exercise was based on four premises: biological and clinical individuality; specificity of training; moments of reevaluation and periodization; and idiosyncrasy caused by training. These principles make a total difference in the magnitude of the effects and, therefore, we seek to report them in detail in the case description section. The outcome of this report points out that an approach that uses these principles may be the key to obtaining results that are favorable or superior to those commonly reported in the scientific literature, which use generalist prescriptions.

It is also imperative to report the pleiotropic benefits generated by CR, ranging from decreasing drug intake (as reported in this case) to promoting a deeper sense of responsibility for the times and days of pharmacological treatment. In addition, more attention is paid to dietary reeducation, sleep quality, more active lifestyles, better understanding of the disease [9-10], as well as generating a quality emotional response to the challenges (reported in the quality of life test).

In the same direction, with treatment we were able to achieve the primary goals proposed with the CR program. We obtained 87% gain in the pa-

tient's quality of life, who at the end of the program had already resumed all their work and daily life activities. In addition, the limitations imposed by cardiovascular disease interrupt the daily flow of work activities. Thus, it is possible that there is a movement that refers to depressive aspects, and the existence of deconstruction of patients' autonomy can be glimpsed [11].

However, although CR is a viable and cost-effective alternative, it is still little explored by cardiologists. Because of this, it is necessary that it is known and recognized by these professionals, to increase the number of patients referred to these programs, because only 5 to 30% of patients with CVD are referred to CR programs, and this percentage is likely to be even lower in Brazil [12,13]. There is a need for constant efforts to publicize CR by public health agencies and health professionals in this area. Reports such as this should encourage professionals to refer this possibility of treatment to patients with cardiovascular diseases. All health professionals, not just cardiologists, cannot forget this responsibility, revealing to their patients that full treatment has a much broader spectrum than just pharmacological intervention.

Conclusion

An individualized Cardiovascular Rehabilitation program promoted improved quality of life, reestablished functionality and generated significant clinical improvements in a patient with chronic heart failure due to CAD with calcified plaques. The description of this case highlights once again the importance of health professionals offering this possibility of treatment to their patients with cardiovascular diseases.

AUTHORAL CONTRIBUTION
Conception and research design: Jesus DS, Petto J. Data collection: Jesus DS, Matias JB, Santos MC, Cecília LMS, Sacramento MS, Santos JF. Data analysis and interpretation: Jesus DS, Matias JB, Petto J. Writing of the manuscript: Jesus DS, Matias JB, Santos MC, Cecília LMS, Petto J. Critical revision of the manuscript for important intellectual content: Petto J.

ACADEMIC LINK
This study resulted in the conclusion of Daniela Santos de Jesus's degree course by the Specialization in Physiology of Exercise Applied to Rehabilitation at the Centro Oeste Paulista School, Bauru, SP, Brazil, under the supervision of Professor Doctor Jefferson Petto.

POTENTIAL CONFLICT OF INTEREST
Part of the authors (Jesus DS, Matias JB, Sacramento MS and Petto J) make up the Cardiovascular Rehabilitation team ACTUS CORDIOS Cardiovascular, Respiratory and Metabolic Rehabilitation, Salvador, BA, Brazil.

References

1. Benjamin JE, Muntner P, Alonso A, Bittencourt MS, Callaway CW, Carson AP et al. Heart Disease and Stroke Statistics—2019 Update: A Report From the American Heart Association. Circulation 2019;139:01–473. https://doi.org/10.1161/CIR.0000000000000659

2. Sociedade Brasileira de Cardiologia. [homepage na Internet]. Cardiômetro: Mortes por Doenças Cardiovasculares no Brasil. [Acesso em 2019 set 24]. Disponível em http://www.cardiometro.com.br/anteriores.asp

3. Girardi PBMA, Hueb W, Nogueira CRSR, Takiuti ME, Nakano T, Garzillo CL, et al. Custos com-

parativos entre a cirurgia de revascularização miocárdica com e sem circulação extracorpórea. Rev Bras Med 2013;70(5):174-8. https://doi.org/10.1590/S0066-782X2008001800003

4. Hillis D, Smith PK, Anderson JL, Bittl JA, Bridges CR, Byrne JG et al. 2011 ACCF/AHA guideline for coronary artery by-pass graft surgery. J Am Coll Cardiol 2011;58:e123. https://doi.org/10.1016/j.jacc.2011.08.009

5. Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, Dawkins K et al. The SYNTAX Score: an angiographic tool grading the complexity of coronary artery disease. EuroInterv 2005;1:219-27

6. Anderson L, Oldridge N, Thompson DR, Zwisler AD, Rees K, Martin N, et al. Exercise-Based Cardiac Rehabilitation for Coronary Disease. J Am Coll Cardiol 2016;67(1):1-12. https://doi.org/10.1002/14651858.CD001800.pub2

7. Ramos GC. Aspectos relevantes da doença arterial coronariana em candidatos à cirurgia não cardíaca. Rev Bras Anestesiol 2010;60(6):662-5. https://doi.org/10.1590/S0034-70942010000600013

8. Haykowsky MJ, Liang Y, Pechter D, Jones LW, McAlister FA, Clark AM. A meta-analysis of the effect of exercise training on left ventricular remodeling in heart failure patients: the benefit depends on the type of training performed. J Am Coll Cardiol 2007;49(24):2329-36. https://doi.org/10.1016/j.jacc.2007.02.055

9. Castro RRT, Negrão CE, Stein R, Serra SM, Teixeira JAC, Carvalho T, et al. Diretriz de Reabilitação Cardíaca. Arq Bras Cardiol. 2005;84(5):431-9.

10. Stevens B, Pezzullo L, Verdian L, Tomlinson J, George A, Bacal F. Deloitte Access Economics Pty Ltd. Os custos das doenças cardíacas no Brasil. Arq Bras Cardiol 2018;111(1):29-36. https://doi.org/10.5935/abc.20180104

11. Wottrich SH, Quintana AM, Crepaldi MA, Oliveira SG, Quadros COP. A cirurgia cardíaca, o corpo e suas (im) possibilidades: significados atribuídos por pacientes pós-cirúrgicos. Psicol Rev 2016;22(3):654-671. https://doi.org/10.5752/P.1678-9523.2016V22N3P654

12. Petto J, Araújo PL, Garcia NL, Santos ACN, Gardenghi G. Fatores de Impedimento ao Encaminhamento para a Reabilitação Cardíaca Supervisionada. Rev Bras Cardiol 2013;26(5):364-8.

13. Santos LSTA, Gomes E, Vilaronga J, Nunes W, Santos ACN, Almeida FOB et al. Barreiras da reabilitação cardíaca em uma cidade do nordeste do Brasil. Acta Fisiatrica 2017;24(2):67-1. https://doi.org/10.5935/0104-7795.20170013