obtained during the exercises worked as a positive stimulus for their motivation.

Incentive spirometry was important not only in the training of respiratory muscles[8] but also in the motivation and commitment to complying with the sessions due to its ability to establish visual goals to be achieved. Its use may occur before the session and after the rest, with improved results in this second evaluation compared to the first.

Chest radiography confirmed pulmonary involvement, as well as the location and extent of lobar consolidation[8]. The appearance of hypertransparency was slightly evident on the last day, not following the evolution presented by data such as SpO2, Modified Borg Scale monitoring, pulmonary auscultation and the reduction in sputum upon coughing. However, the imaging changes may not immediately translate current changes[8].

This case study reflects the importance of the RN in developing and improving its respiratory function assessment techniques in order to carry out a systematic assessment, if necessary, readjust its intervention based on the data obtained.

In this research, it would have been beneficial to carry out sessions with a shorter time interval, because a greater evolution between the 20th and 21st of February. According to gasometric values obtained, the reversion of the marked hypoxemia occurred only in this period and was not limited by the reduction of oxygen supply, which was initially at a rate of 5L/min and which at the end of the program was administered at 1L/min. This situation is not in line with what Cordeiro & Menoita defend in their bibliography, when state that the people as the target of this study, that is, without previous respiratory pathology, in a situation of bacterial pneumonia, regular arterial blood gas analysis is not justified, except in low SpO2[8].

It is relatively frequent that people with Influenza A who are overinfected with bacterial pneumonia develop severe hypoxemia conditions difficult to reverse. In this case study, both focuses were addressed with the appropriate interventions directed towards their resolution, supported by the most updated bibliography. The lack of other similar studies did not make it possible to establish a comparison of the increase in pO2 associated with a respiratory rehabilitation intervention plan.

FINAL THOUGHTS

This case study highlighted the benefits of the respiratory function, in the ventilation and expectoration focuses, resulting from the specialized intervention of the specialist nurse in rehabilitation nursing.

In respiratory functional reeducation, it is essential to perform a subjective assessment of respiratory function, complemented by physical examination and complementary diagnostic data, such as chest teleradiography and gasimetric data. It results in a set of data that allow the rehabilitation nurse to analyze the information obtained, identify problems and plan the respective interventions, supported by reliable and valid instruments.

Thus, the gains obtained by the functional respiratory reeducation centered on the perception of dyspnea by the Modified Borg Scale, with a reduction from 2 to 0; on breathing pattern with absence of recruitment to accessory muscles, decrease in respiratory cycles per minute accompanied by a more regular pattern with diaphragmatic excursion; on auscultation, essentially of the posterior thorax, with an overall increase in vesicular murmur and reduction in crackling sounds; on chest X-ray with the appearance, although slight but progressive, of hypertransparency in both lung fields; in cough, with training to use directed cough, ending the sessions with an essentially dry cough; in gasimetric results showing the beginning of reversal of hypoxemia in the last session; in the weaning from the supplemental oxygen supply, starting with 5L/min and ending with 1L/min.

To obtain the abovementioned gains, it was essential to use specialized techniques directed to the different focuses, including the ventilation focus: interventions such as the resting position, massage of accessory muscles, control and dissociation of respiratory times, expiration with semi-closed lips, rotation of the humeral scapula, global opening with a stick, bilateral lower costal and abdominodiaphragmatic re-education, thoracic mobilization exercises and incentive spirometry. In the spectorate focus, techniques such as accessory maneuvers (vibration, percussion and compression), assisted/directed coughing, huffing and the forced expiration technique are evidenced, supported by the previous use of nebulizers with saline solution.

Based on the epidemiological data obtained, bacterial pneumonia as a possibility of secondary infection resulting from Influenza A is an increasingly growing fact. It is hoped that this case will contribute to giving visibility to the importance that rehabilitation nursing can have in reducing the comorbidities resulting from these episodes. It would be beneficial to develop more studies on this pathology, which despite being characteristically restrictive, suffers from seasonal influence.

It is suggested in future studies the possibility of performing earlier and more regular sessions (or even preferably daily) in order to contribute to a better clarification of the importance that the intervention of respiratory functional reeducation by RN can obtain in sustained severe hypoxemia and thus reduce the length of hospital stay, culminating in an increased level of evidence. Intervention plans with greater emphasis on aerobic exercises using cycle ergometers and thoracic mobilizations are also suggested, allowing the ventilation-perfusion index. In some cases, intervention plans of shorter duration and/or divided into two daily moments will be considered.

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MODULAÇÃO CARDÍACA PELO EXERCÍCIO FÍSICO NA PESSOA COM INSUFICIÊNCIA CARDÍACA DESCOMPENSADA – RELATO DE CASO

MODULACIÓN CARDÍACA POR EJERCICIO EN LA PERSONA CON INSUFICIENCIA CARDÍACA DESCOMPENSADA - REPORTE DE CASO

CARDIAC MODULATION BY EXERCISE IN A PATIENT WITH DECOMPENSATED HEART FAILURE - CASE REPORT

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Bruno Delgado[1]; Ivo Lopes[1]; Eugénia Mendes[2]; Leonel Preto[2]; Bárbara Gomes[3]; André Novo[2]

1 - Centro Hospitalar Universitário do Porto; 2 - Escola Superior de Saúde do Instituto Politécnico de Bragança; 3 - Escola Superior de Enfermagem do Porto

RESUMO

Introdução: Os doentes com insuficiência cardíaca descompensada caracterizam-se por apresentar elevada intolerância à atividade, associada a dispneia e edemas. O treino de exercício físico permite promover um aumento da tolerância ao esforço, assim como melhoria da função cardíaca.

Objetivo: Identificar sinais de modulação cardíaca e consequente melhoria da capacidade funcional após a implementação de um plano de exercício físico estruturado.

Método: Relato de caso de abordagem quantitativa. Pessoa com insuficiência cardíaca descompensada de etiologia isquémica e valvular, manifestando elevado grau de intolerância à atividade assim como descompensação hemodinâmica.

Foram avaliados parâmetros fisiológicos como FC, TA, PSE pela escala de Borg e a sua tolerância à atividade, no momento da admissão e ao longo das sessões de treino. O T6MM foi aplicado em 2 momentos distintos: ao 4º dia de internamento e à data da alta, como forma de avaliar a evolução da capacidade funcional. O doente em questão encontra-se inserido num ensaio clínico randomizado onde se pretende avaliar a eficácia e segurança do exercício físico, sendo utilizados como instrumentos de avaliação a escala de LCADL, o Índice de Barthel, assim como do T6MM.

Resultados: Verificou-se uma melhoria da capacidade funcional da pessoa, avaliada pelo teste dos 6 minutos de marcha (T1: 210m, T2: 295m), assim como uma redução da frequência cardíaca em repouso (85 bpm vs 68 bpm) e de treino (145bpm vs 94bpm). Não foram verificados eventos adversos durante as sessões de treino.

Conclusões: A intervenção implementada nesta situação clínica revelou-se segura, sendo igualmente eficaz na melhoria da capacidade funcional e modulação da frequência cardíaca em repouso e durante o treino.

Descritores: Treino Aeróbio, insuficiência cardíaca, reabilitação cardíaca; Enfermagem de Reabilitação

RESUMEN

Introducción: Los pacientes con insuficiencia cardíaca descompensada se caracterizan por una alta intolerancia a la actividad asociada con disnea y edema. El entrenamiento físico permite una mayor tolerancia al ejercicio y una función cardíaca mejorada.

Objetivo: identificar signos de modulación cardíaca y la consiguiente mejora de la capacidad funcional después de la implementación de un plan de ejercicio estructurado.

Método: Relato de caso de enfoque cuantitativo. Paciente con insuficiencia cardíaca descompensada de etiología isquémica y valvular, que manifiesta un alto grado de intolerancia a la actividad, así como descompensación hemodinámica.

Los parámetros fisiológicos como frequenica cardiaca, tensión arterial, percepción subjetiva del esfuerzo evaluada por la escala de Borg y la tolerância del paciente a la actividad en el momento de la admisión y durante las sesiones de entrenamiento. El T6MM se aplicó en dos momentos diferentes: en el cuarto día de hospitalización y en la fecha de alta, como una forma de evaluar la evolución de la capacidad funcional. El paciente en cuestión es parte de un ensayo clínico aleatorizado que tiene como objetivo evaluar la eficacia y la seguridad del ejercicio físico, y se utiliza como herramientas de evaluación en la escala LCADL, el índice de Barthel y el T6MM.

Resultados: Hubo una mejora en la capacidad funcional de la persona, evaluada mediante la prueba de caminata de 6 minutos (T1: 210m, T2: 295m), así como una reducción en la frecuencia cardíaca en reposo (85 lpm frente a 68 lpm) y entrenamiento. (145bpm vs 94bpm). No se encontraron eventos adversos durante las sesiones de entrenamiento.

Conclusiones: La intervención implementada en esta situación clínica demostró ser segura e igualmente efectiva para mejorar la capacidad funcional y modular la frecuencia cardíaca en reposo y durante el entrenamiento.

Descriptores: Insuficiencia cardíaca, ejercício, reabilitacion cardíaca, enfermeira de rehabilitación

ABSTRACT

Introduction: Patients with decompensated heart failure are characterized by low exercise tolerance associated with dyspnea and edema. Exercise training promotes exercise tolerance as well as an improvement in ventricular function.

Objective: To identify signs of cardiac modulation and consequent improvement of functional capacity after the implementation of a structured exercise plan.

Method: It is a quantitative approach case report, about a patient with decompensated heart failure of ischemic and valvular etiology, manifesting a high degree of activity intolerance as well as hemodynamic decompensation.

Physiological parameters such as Heart Rate, Blood Pressure, Subjective perception of effort evaluated by the Borg scale and the tolerance of the patient to activity at baseline and throughout the training sessions. The 6MWT was applied at two different moments: on the 4th day of hospitalization and at discharge, as a way to evaluate the evolution of functional capacity. This patient is enrolled on randomized clinical trial that aims to evaluate the feasibility and safety of exercise, being used as assessment tools the LCADL scale, the Barthel Index, as well as the 6MWT.

Results: There was an improvement in the patient's functional capacity, assessed by the 6-minute walk test (T1: 210m, T2: 295m), as well as a reduction in resting heart rate (85 bpm vs 68 bpm) and training heart rate (145bpm vs 94bpm). No adverse events occured during training sessions.

Conclusions: The intervention implemented in this clinical situation proved to be safe and equally effective in improving functional capacity and modulating heart rate at rest and during exercise training.

Keywords: Breathing Exercises; Bacterial Pneumonia; Rehabilitation Nursing; Case Reports.

INTRODUCTION

Heart failure (HF) is a syndrome characterized by signs and symptoms such as dyspnea, fatigue and edema, which lead to decreased exercise tolerance, greater functional dependence and impaired performance in activities of daily living (ADL), as well as limitations in social life and, consequently, decreased quality of life[1-5].

HF has a significant economic impact due to the high cost of treatments, the person's disability and lack of productivity, as well as high mortality rates[6,7]. It affects an estimated 20 million people worldwide, with a predicted 25% increase in prevalence by 2030, and a doubling of the inherent costs is expected[8]. It represents in Portugal more than 50,000 hours of hospitalization, corresponding to about 12% of in-hospital deaths[9].

HF is classified according to the patient's functional status using the New York Heart Association (NYHA) scale[10,11] into 4 classes, according to table 1.

The treatment of HF is multifactorial, including a wide variety of pharmacological therapies and non-pharmacological interventions, such as cardiac rehabilitation (CR). CR can be defined as a sum of activities that favorably influence the underlying causes of cardiovascular disease, so that the patient can effectively manage their therapeutic regimen and achieve functional, psychological and social maximization, in order to resume their role in society [12-14].

Parameters	
Class I	Absence of symptoms, tolerance to normal physical activity
Class II	Asymptomatic at rest; ADL's cause symptoms such as dyspnea and/or tiredness
Class III	Asymptomatic at rest, less intense activities than ADL's cause symptoms
Class IV	Symptomatic even at rest

Table 1 – Functional classes NYHA

Physical exercise (PE) is a safe, afordable and viable therapeutic resource, being a crucial component of CR. According to the recommendations of the European Society of Cardiology, patients with HF should be included in aerobic training programs, in order to promote their functional capacity (FC) and improve the characteristic symptoms of HF[1,4,13]. The performance of regular physical activity in people with stabilized chronic HF is directly related to the decrease in cardiovascular mortality, improvement quality of life, decrease hospitalization rates and even reduced intolerance to physical exercise itself, being essential its inclusion in the daily clinical practice of all centers that provide care to patients with HF [4,13,15]. Aerobic training (AT) is the best-founded training typology for the treatment of people with chronic HF[1,10,11], and there is no minimum beneficial limit for it, that is, the minimum amount of exercise performed by the patient will always benefit from not performing any type of training or physical activity[1]. The beneficial effects of PE are related to the

improvement of cardiovascular and respiratory function, that is, increased maximum oxygen consumption, decreased myocardial oxygen consumption, decreased blood pressure (BP) and heart rate (HR) at rest, increase in the threshold of anginal symptoms and lameness, as well as control and reduction of cardiovascular risk factors (CRF)[16,17].

The PE prescription is based on Frequency, Intensity, Time and Type of exercise (FITT), which must be adjusted according to the type of care (inpatient or outpatient), the stage of the disease (acute or chronic) and the limitations or motivation of the person[10,17]. Despite all the benefits and recommendations for its application in an inpatient context, PE training is however largely underused[10], and there is still not enough reasoning to prove its level of effectiveness and safety when implemented in people hospitalized for decompensated HF.

Some of the factors that lead to this underutilization are related to the physiological limiting mechanisms characteristic of the disease, namely the decrease cardiac output, decrease contractility, diastolic impairment, increase peripheral vascular resistance, mitral regurgitation, chronotropic incompetence, inadequate distribution of the blood flow to skeletal muscle and endothelial dysfunction. All these physiological characteristics of HF compromise the performance and effectiveness of PE training; however, it is known that regular PE training promotes the reversal of most of these mechanisms by the autonomic modulation it produces, contributing not only to promote an increase in PE tolerance but also to improve the patient's prognosis[18,19].

During the training session, there are numerous physiological responses that must be monitored in order to ensure the patient's safety. Thus, the following situations constitute clinical risk criteria: 1) diastolic blood pressure (DBP) ≥110 mmHg; 2) decrease in systolic blood pressure (SBP) > 10 mmHg during PE with an increase in its intensity; 3) significant ventricular or atrial arrhythmias, with or without associated signs/symptoms; 4) second or third degree atrioventricular block; 4) signs/symptoms of PE intolerance, such as subjective perception of effort (SPE) greater than 8 on the modified Borg scale, angina, severe dyspnea and changes in the electrocardiogram (ECG) suggestive of myocardial ischemia[15,17,20]. In addition to these recommendations, the existence of falls and any muscle damage, such as adverse events resulting from PE training, should also be considered.

Thus, it is understood the importance of PE training in promoting the patient's FC and also as a supporting mechanism to the treatment and clinical stabilization, and it should be implemented whenever possible and using adequate monitoring.

The purpose of this case study is to assess the safety and effectiveness of an exercise training plan targeted at a complex cardiac patient.

METHODOLOGY

Case study based on the guidelines of CAse REport (CARE), since they allow the design of a more logical and clear case study structure, presenting a proposal for its organization in several relevant items. The items were fulfilled and the necessary adaptation was made to the case in question[21].

The data presented refer to a person admitted due to decompensated heart failure in a hospital in the northern region of the country, belonging to the District of Porto; which was part of a longitudinal study of the randomized experimental type. The patient in question proved to be a particular case of interest as, during the initial training sessions, his HR always exceeded the defined safety limits. However, according to a team consensus, it was decided to keep training with adequate surveillance, in order to assess its effectiveness in cardiac modulation and increase in functional capacity. In an initial phase, this patient quickly reached HR values of around 140 bpm, which is an indication to interrupt training, however we understand that if we did so, we would greatly limit the progression in training and compromise the functional gain expected from the performance of physical exercise training. In the aforementioned study in which the patient is inserted (ERIC-HF: Early Rehabilitation in Cardiology – Heart Failure), the participants are submitted to an aerobic training protocol with progressive levels of intensity, during the hospitalization period. Functional capacity is assessed at admission using the Barthel Index (BI) and London Chest of Daily Living Activities (LCADL) and at discharge with the same instruments, plus the 6-minute walk test (P6MM). The progression through the physical exercise program is evaluated based on the recording of the training volume performed, namely the number of laps performed on the trademill, the number of meters walked and the number of steps covered, according to the training protocol (Table 2) with the time spent in each training session also being registered.

Stage	Designation
I	Breathing and calisthenic exercises in the standing or supine position
II	5-10 min of cycling
III	5-10 min of gait
IV	10-15 min of walking
V	Stage IV + 5 minutes of stairs

Table 2 – stages of the ERIC-HF protocol

The criteria for inclusion in the study are 1) being over 18 years-old; 2) hospital admission for decompensated heart failure and 3) ability to provide informed consent.

As this is an intervention in patients in the clinical stabilization phase, exclusion criteria for the implementation of the training program were defined. These criteria are manifested as temporary, that is, if the clinical condition that determines the non-start of the training program is resolved, the person can restart the training protocol again: 1) osteoarticular

pathology compromising exercise performance; 2) inotropic drugs in perfusion; 3) dysrhythmias and/or precordial pain in the last 24 hours; 4) acute pulmonary edema in the last 12 hours; 5) SBP > 180 mmHg or <80 mmHg; 6) need for continuous oxygen therapy > 3 l/min; 7) glycemic decompensation in the last 12 hours.

All data protection rules and obtaining free and informed consent were complied with. The aforementioned study is authorized by the ethics committee of the hospital where it is decorated and is registered on the clinicaltrials.gov platform with the identification number: NCT03838003.

To describe the data, the Microsoft Excel program was used, namely to build the tables and graphs.

CASE PRESENTATION

Anamnesis

Mr. F.S. is a 60-year-old male, Caucasian, married and with 2 children. There are no known previous cardiovascular events, presenting as CRF: Hypertension, Diabetes Mellitus, Dyslipidemia, Sedentary lifestyle, Stress and active smoking with about 40 units/pack/year.

The patient was admitted to hospital with severe dyspnea (characteristic of patients with decompensated HF, resulting from the accumulation of pleural exudate, which generates a limitation in chest expansion - compromised ventilation, as well as in alveolar hematosis, generating dyspnea) with about 1 week of evolution, referring to progressive loss of functional capacity and was no longer able to climb and descend stairs normally, due to the feeling of shortness of breath she had. He had edema up to the region of the knees bilaterally, having been diagnosed with inaugural heart failure. He was in NYHA class III and cardiac echocardiographic examination revealed severe depression of left ventricular function (ejection fraction of 23%).

Patient reported being previously autonomous in ADL, carrying out his work function without difficulties.

Patient also did not demonstrated knowledge about safety precautions regarding his health status, did not take any type of medication – did non-adherence to the therapeutic regimen, did not have dietary care or any type of physical activity.

Regarding the anthropometric data relevant to the determination of cardiovascular risk, Mr. F.S. had a weight of 58 Kg and a height of 1.68 meters with a BMI of 20.5. The abdominal perimeter was 91cm and the hip was 83cm.

The hospitalization lasted 13 days. After a diagnostic study, a Severe Aortic Stenosis was identified, associated with 2-vessel ischemic coronary disease, corresponding to the etiology of the HF manifested by the patient. Valvular and ischemic diseases had surgical resolution and the patient was proposed for revascularization surgery and aortic valve replacement.

A benign arrhythmia – difficult to control atrial fibrillation – was also identified. The administration of any negative chronotropic drug (decrease in heart rate) provoked a bradycardic response, and it was not possible to maintain this therapy. This problem was solved with the implantation of a definitive Pacemaker on the last day of hospitalization, before the patient was reffered to the cirgical centre.

Rehabilitation Nursing Assessment

In order to assess the functional status and degree of management capacity of the therapeutic regimen of Mr. F.S: 4 instruments were used at different times, namely: BI, LCADL, T6MM and Heart Failure Self-Care Scale (EAIC).

The LCADL scale is assessed on admission and every 2 days until discharge, in order to measure the impact that dyspnea – the main symptom of HF – has on the person's ADL performance[22,23].

The BI was assessed at admission and at discharge, allowing for the identification of other self-care limitations not resulting from HF[24.25].

The T6MM was implemented as soon as the patient presented aerobic capacity to perform it, being repeated at the time of discharge, in order to assess the evolution of their functional capacity. This is an easy-to-administer, cheap and safe test that allows you to assess submaximal functional capacity. The person should walk at the maximum possible speed[26,27]; however, since ADL are not performed at maximum speed, in an inpatient context, the person can walk at their usual speed, as some researchers have tested[28 -30]. It should be noted that gait ability is a reliable indicator of functional capacity[26, 31].

The EAIC was only assessed on admission as it allows understanding the degree of knowledge that the patient has about their clinical condition as well as the strategies use to keep themselves as healthy as possible, ending with an assessment of the person's perception of their ability to assess their overall health status. The use of this instrument allows the rehabilitation nurse to identify which areas of Knowledge and Learning Skills should be worked on[32].

Since the main rehabilitation intervention in this clinical situation focuses on aerobic exercise training, hemodynamic parameters are also evaluated allowing the assessment of the degree of clinical safety for performing the various exercises, as well as determination of the intensity of the training to be performed. These parameters correspond to the safety indicators previously mentioned, namely: systolic and diastolic blood pressure (before and immediately after the end of the training session), heart rate HR at rest and during training (with special attention to the maximum value of HR reached), SPE at rest, during training and at the end of it. In addition to these parameters, it was also verified in all training sessions the existence of some of the previously defined exclusion criteria.

Rehabilitation Nursing Diagnoses

The rehabilitation nursing diagnoses inherent in this clinical case were defined respecting the language of the International Classification for Nursing Practice (ICNP®) version 2015[33]; however some of the focuses used are not yet parameterized, so the inherent interventions they are not fully described according to CIPE. The following are focuses of attention and respective rehabilitation nursing diagnoses:

- Compromised ventilation
- Intolerance to the activity present in a high degree
- Self-care: compromised physical activity
- Exercise (integrated into self-care: physical activity)
- Moderate dependence on self-care: hygiene, toilet use and walking (due to activity intolerance)
- Potential to improve knowledge about CRF and health precautions: HF – teaching about complications of the pathological process, strategies to adopt for the effective management of the therapeutic regimen (fluid management, control of salt intake, adjusted medication, oedema surveillance, early detection of signs of impending clinical worsening).

Rehabilitation Nursing Interventions - aerobic exercise training protocol

The interventions described below refer mostly to the training plan carried out by Mr. F.S., as well as the evolution data throughout it. Several identified diagnoses (Table 3) result from the person's physical deconditioning and, as such, their resolution is largely related to the improvement in functional capacity resulting from exercise training.
The identified focuses of attention, namely 1) ventilation, 2) activity intolerance and 3) Self-care physical activity, are closely linked to each other and the resolution of formulated diagnoses, producing health gains sensitive to rehabilitation nursing care, are essentially due to the exercise plan implemented. The ventilation focus is the most relevant at an early stage, since if ventilation is compromised it will not be possible to progress in the intensity of the training plan, as oxygen supply is essential for good exercise performance and how such resolution of the diagnosis "compromised ventilation" requires immediate attention, resorting to functional respiratory re-education. After optimizing ventilation, it is possible to progress in the training plan, promoting the resolution of the diagnosis "high degree of activity intolerance", since the person will be able to obtain better physical conditioning by performing the ADL in an increasingly autonomous and unrestricted manner. , being later possible to reach higher levels of aerobic capacity, contributing to the resolution of the diagnosis "compromised physical activity self-care", whose functional content is related not only to physical capacity but also to the promotion of knowledge about exercises and their benefits .
The implementation of an exercise plan necessarily implies its planning, in accordance with internationally defined prescription criteria[17]. In this way, the planning of the implemented training protocol is presented (Figure 1):

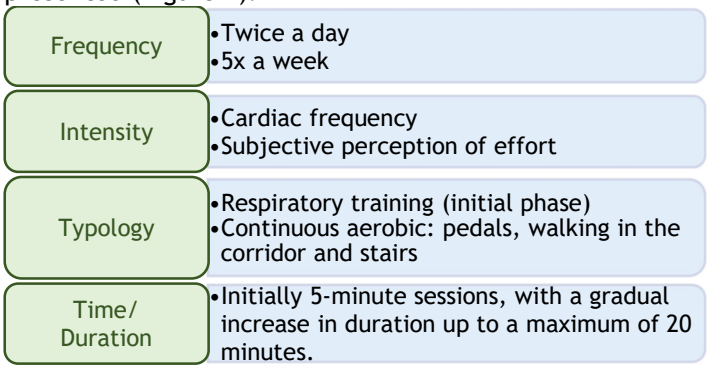


Figure 1 – Training protocol implemented

The implementation of the exercise protocol took place after the first 24 hours of hospitalization, and the patient signed an informed consent for this. In each session, the clinical safety criteria were always verified, as well as the criteria previously defined as exclusion. As this is a training program that takes place during the clinical stabilization phase, it was not always possible to implement the 2 sessions daily for clinical reasons, namely fasting for diagnostic exams or even refusal by the person on certain days.

It should be noted that the relevance of this clinical case is centered on the fact that Mr. FS has performed most of the training sessions with HR values usually outside the parameters defined as standard, however the implementation of this training protocol was targeted of consensus of the multidisciplinary team (nurses, specialist nurse in rehabilitation nursing and assistant physician) and with its implementation, the modulating effect of physical exercise on HR was notorious.

Focus: Ventilation	
Diagnosis	Interventions
Compromised ventilation	• To evaluate ventilation • To position the person • To optimize ventilation • To perform respiratory kinesitherapy (emphasis on inspiratory time) • To train the use of devices (incentive spirometer)
Evolution data	The person demonstrated the ability to perform the various techniques, improving ventilation and, consequently, their ability to subsequently start the defined aerobic training plan.

Focus: Activity intolerance	
Diagnosis	Interventions
High degree of activity intolerance (Self-care hygiene, use of the toilet and walking compromised, due to intolerance to the activity)	• To assess activity intolerance • To plan activity (training protocol + ADL) • To plan rest • To teach about energy conservation strategies • To encourage the use of breathing technique and effort re-education
Evolution data	The person showed an improvement in the level of intolerance to the activity during hospitalization, performing self-care progressively more autonomy and with less sensation of dyspnea.
Focus: Self-care: physical activity	
Diagnosis	Interventions
Self-care: compromised physical activity	• To assess self-care: physical activity • To implement aerobic training protocol • To monitor blood pressure • To monitor heart rate • To monitor oxygen saturation • To monitor heart rate • To monitor subjective perception of effort • To evaluate 6-minute walking test
Evolution data	The person complied with the training plan throughout the hospitalization, managing to progress in intensity, obtaining significant functional improvement.

Table 3 – Rehabilitation Nursing Interventions

RESULTS

The implementation of the aerobic training protocol, integrated in the aforementioned research study, allowed the sick person to improve their functional capacity and, consequently, resolve the altered nursing diagnoses. Concomitantly, and this being one of the most relevant aspects of this clinical case, the effect of cardiac modulation by exercise was noticeable. The importance of this effect is linked to the fact that the maladjusted chronotropic response is a limiting factor to the continuity of exercise, namely, a HR value above 30 bpm compared to the value at rest is an indication to discontinue the exercise. In this clinical situation, the intention is precisely to modulate the HR by exercise, since the pharmacological measures would not be fully effective, in order to allow the sick person to improve their FC.

The planning of the sessions with the respective volume of training performed is presented below, as well as the vital parameters evaluated - important in determining the intensity of the training and its safety (Table 4).

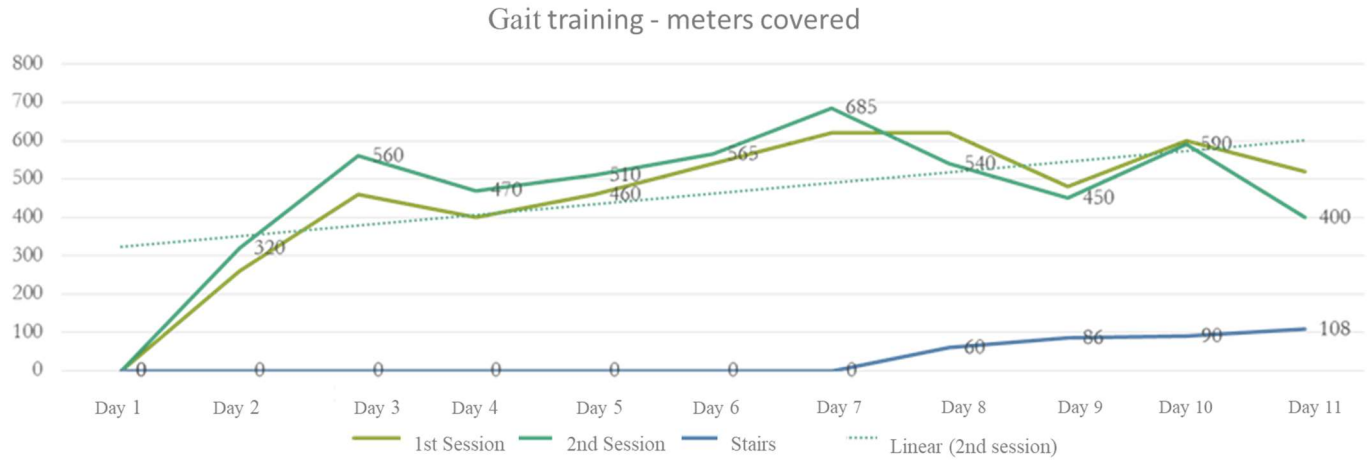
According to the data presented in Table 4, it is verified that Mr. FS performed bidaily training on most days, reaching a progressively greater training volume and exercise time in each session, maintaining a speed of about 3km/h on the march. Regarding the hemodynamic parameters directly related to training safety - BP and HR - there is a tendency for the SBP values to decrease after training, as well as the maximum HR during exertion. It should be noted that the patient in question was not on negative chronotropic medication. The subjective perception of exertion measured by the modified Borg scale is manifested in a range of values considered as mild to moderate (0 to 4).

For a better interpretation of the results, two graphs representing the volume of training performed are presented below, namely the number of meters covered (Graphic 1) and the variation in HR at rest and during effort (Graphic 2).

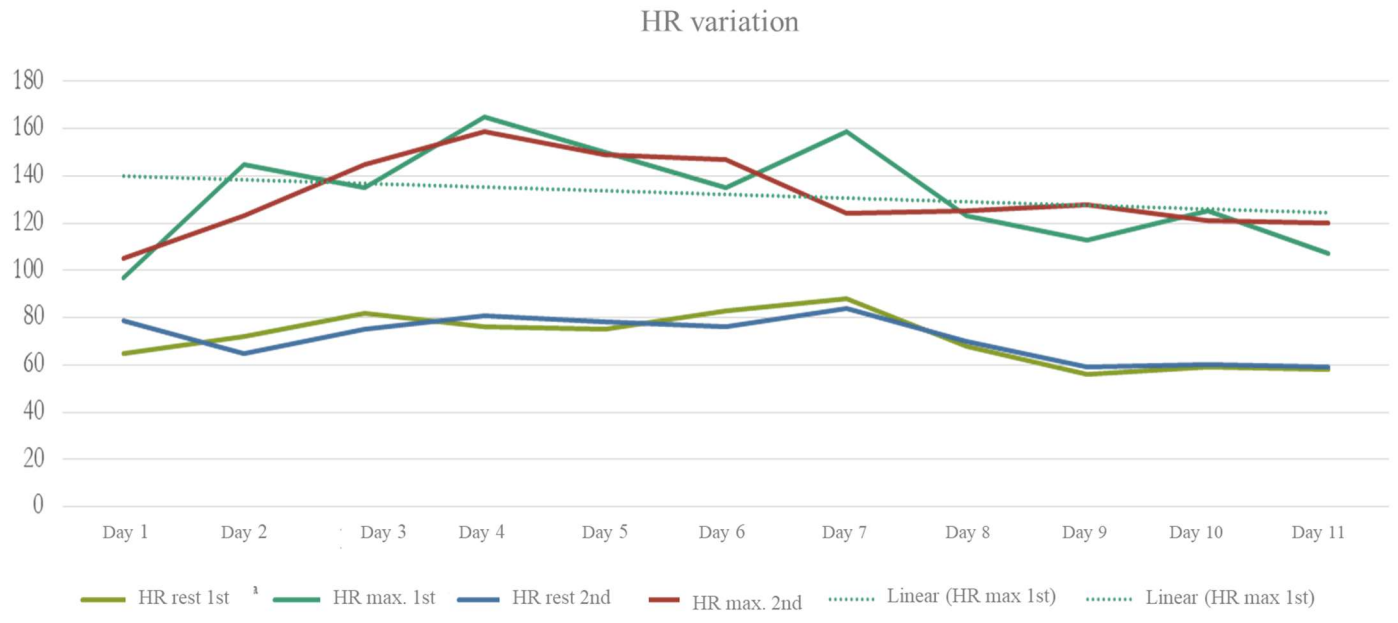
Date	Stage	Duration	TA rest	CF rest	TA effort	CF maximum	Borg	Turns	Meters	Degrees
1st hospitalization week										
25-09	II	5	116/59	85	158/67	107	1	324		
25-09	II	10	121/57	79	144/72	105	1	713		
27-09	III	5	116/57	72	140/63	145	1		260	
27-09	III	7	107/59	85	125/68	123	2		320	
2nd hospitalization week										
01-10	IV	10	125/60	82	149/65	135	2		480	

01-10	IV	12	100760	73	120/67	145	5		560	
03-10	IV	7	117/65	76	141/100	165	2		400	
03-10	IV	10	96/60	75	131/62	150	1		460	
04-10	IV	12	120/56	83	107/61	135	2		540	
04-10	IV	13	119/76	76	148/76	147	4		565	
06-10	IV	12	120/62	89	137/58	159	3		620	
06-10	IV	14	98/59	84	104/64	134	2		685	
3rd hospitalization week										
07-10	IV	15	111/54	68	137/65	129	2		620	
07-10	IV	14	112/55	61	139/65	138	3		480	
08-10	IV	15	97/53	56	143/77	130	3		620	
08-10	V	20	99/51	62	121/67	127	2		645	100
10-10	V	18	106/74	59	116/73	125	2		600	120
11-10	V	17	101/66	65	109/56	107	1		400	108
11-10	IV	13	88/54	68	112/66	94	2		470	

Table 4 – Session planning, training volume performed, and vital parameters assessed



Graphic 1 - meters covered during training.



Graphic 2 – HR variation at rest and maximum

Observing the above graphics, a positive progression in training volume can be seen: progressively higher number of meters covered, adding stair training, also with a positive trend. By analyzing the second graphic, it is possible to identify two important findings: the decrease in HR on exertion and the approximation of this value to the value at rest, revealing a smaller range of values.

During hospitalization, the patient underwent 2 gait tests, one on the 1st day, being able to walk for 6 minutes, occurring on the 4th day of hospitalization and the second on the date of discharge. The results are shown in Table 5:

	Distance	Initial TA	CF Initial	Initial Borg	Final TA	CF Maximum	Borg final
1st test	210	116/67	79	1	125/68	105	4
2nd test	295	100/59	59	0	112/70	84	2

Table 5 – Results for the T6MM

It can be verified, by analyzing Table 5, a positive difference between the 2 tests, of 85 meters, as well as a negative difference in the subjective perception of effort of 2 values. Also HR and TA values show a decrease between the 2 tests.

DISCUSSION

Based on the results presented, it is clear that the implementation of the ERIC-HF training protocol in Mr. F.S. may have been decisive in the modulation of HR, also promoting an improvement in his functional capacity measured by the T6MM.

The effect of aerobic training on the autonomic nervous system translates into a modulation of HR, that is, an adaptation of muscle fibers and sympathetic stimulation during activity, so that an unreasonably high HR is not reached, thus compromising the cardiac function and consequently the effectiveness of training[34]. Several studies have analyzed this modulating effect of exercise in patients with stabilized HF; however, there is no evidence in relation to patients undergoing clinical stabilization. However, we can verify that this effect is also likely to occur in patients in an inpatient context, contributing this as another factor that corroborates the beneficial effect of exercise training.

Clearly, the pharmacological therapy implemented during hospitalization allows contributing to the patient's clinical stabilization; however the drugs administered to this person have no potential effect in terms of HR modulation, since were not prescribed beta-blockers or other drugs with negative chronotropic effect.

Regarding functional capacity, the difference of 85 meters in the distance walked between the 2 tests performed by the patient translates into a considerable improvement, which we can classify as clinically significant[35-38]. Walking ability is accepted as an excellent indicator to infer autonomy in performing ADL and consequently infer about their functional capacity.

The joint analysis of these hemodynamic and functional parameters, such as HR and FCmeasured by the T6MM, are fundamental to understand that even in a phase of clinical instability, the specialized and differentiated intervention of the rehabilitation nurse can be decisive, especially in patients with pathologies that limit self-care such as HF.

Despite the evidence of a significant gain in functional capacity and the verified cardiac modulation, it is important to carry out the analysis of other similar clinical cases in patients included in the aforementioned study, so that it is possible to verify whether it is in fact a trend or whether these results may be associated with specific individual characteristics of Mr. FS

FINAL CONSIDERATIONS

This case study allowed us to validate the effectiveness of the rehabilitation nursing interventions in this patient, within the scope of the planning and implementation of physical exercise training aimed at cardiac patients undergoing clinical stabilization. Since the competence in physical exercise is included in the profile of the specialist nurse in rehabilitation nursing, it is essential to develop more rehabilitation programs in this direction and with evidence of health gains for the patient, sensitive to nursing care.

Throughout the implemented program, it was essential to assess the patient's progress in terms of exercise tolerance and autonomy to perform activities of daily living, due to a reduced sensation of dyspnea. It was essential to monitor these gains through the various functional assessment instruments, and it was also essential to strictly record the various training sessions, with regard to the volume, frequency and type of training performed by the patient, as a way of confirming the rigor of the planning of the exercise.

No adverse events arising from the implementation of the training protocol were recorded, thus revealing the safety of the implemented rehabilitation care, according to the previously defined planing.

More studies are needed and with more numerous samples, in order to unequivocally validate the impact that physical exercise training can have on cardiac modulation and on the promotion of functional capacity.

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