Impacte De Um Programa De Exercício Físico (Eric) Em Contexto De Internamento No Doente Com Insuficiência Cardíaca Descompensada – Estudo Preliminar

Ejercicio Físico En El Paciente Admitido Por Insuficiencia Cardiaca Descompensada - Programa Eric

nursing Exercise In Patients Admitted By Recently Decompensated Heart Failure - The Eric Program

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RESUMO

Introdução: A insuficiência cardíaca (IC) acarreta limitação nas atividades da vida diária e consequente perda de autonomia funcional e instrumental. Representa um dos problemas de saúde mais preocupantes devido ao seu impacte económico significativo.

Objetivo: Identificar o impacte de um programa de exercício físico nos doentes com IC em fase de compensação em contexto hospitalar.

Métodos: Foi implementado um estudo exploratório retrospectivo no qual participaram vinte doentes que realizaram um mínimo de 3 sessões do programa ERIC. Os sinais vitais, monitorização do ECG e da perceção subjetiva de esforço (PSE) foram avaliados antes e depois de cada sessão de treino, bem como escala London Chest Activity of Daily Living (LCADL) e os parâmetros do exercício (número de voltas na pedaleira, o número de metros caminhados no corredor e número de degraus percorridos). O estudo apresentado decorreu num período de 3 meses.
Resultados: Os doentes (idade média de 64 anos) apresentaram uma variação positiva nos parâmetros de desempenho do exercício, uma variação negativa na escala LCADL (29,9-20,9) e PSE após o exercício (4,85-3,82), o que significa que melhoram a sua capacidade funcional ao longo do programa. Nenhum dos odentes apresentou eventos adversos ou treinou fora do intervalo de frequência cardíaca de segurança (valor médio de 11,2 bpm a 12,9 bpm).

Conclusões: O programa ERIC demonstra segurança e melhoria da Capacidade Funcional do doente, com base na análise estatística desta amostra, Estes resultados permitem-nos inferir que o exercício poderá ser um recurso efetivo para o tratamento coadjuvante de doentes admitidos com insuficiência cardíaca descompensada. Contudo, serão necessários mais estudos com amostras maiores e com desenho do tipo randomizado.

Palavras-chave: Exercício, insuficiência cardíaca, segurança, eficácia, Enfermagem de Reabilitação

RESUMEN

Antecedentes: la insuficiencia cardíaca (IC) acarrea limitaciónes en las actividades de la vida diaria y la consiguiente pérdida de la autonomía funcional e instrumental. Representa uno de los problemas de salud más preocupantes debido a su impacto económico significativo.

Objetivo: Identificar el impacto de un programa de ejercicio físico en pacientes con IC en fase de compensación en contexto hospitalario

Métodos: Se implementó un estudio exploratório retrospectivo en el que participaron veinte enfermos que realizaron un mínimo de 3 sesiones del programa ERIC. Los signos vitales, la monitorización del ECG y la percepción subjetiva de esfuerzo (PSE) se evaluaron antes y después de cada sesión de entrenamiento, así como la escala LCADL y los parámetros del ejercicio (número de vueltas en la pedalier, el número de metros caminados en el pasillo y número de escalones recorridos). El estudio presentado tuvo lugar en un período de 3 meses.

Resultados: los pacientes (edad media de 64 años) tuvieron una variación positiva en los parámetros de rendimiento del ejercicio, una variación negativa en la escala de LCADL (29.9 a 20.9) y PSE después del ejercicio (4.85 a 3.82), lo que significa que mejoraron su capacidade funcional durante todo el programa. Ninguno de ellos presentó eventos adversos ni fue entrenado fuera del intervalo de frecuencia cardíaca de seguridad (valor promedio de 11. 2 lpm a 12.9 lpm).

Conclusiones: El programa ERIC demuestra seguridad y mejora de la capacidad funcional del paciente sobre la base del análisis estadístico de esta muestra. Estos resultados nos permiten inferir que el ejercicio puede ser un recurso efectivo para el tratamiento secundario de pacientes admitidos con insuficiencia cardiaca descompensada. Sin embargo, se necesitarán más estudios con muestras más grandes y con diseño de tipo aleatorizado.

Palabras clave: Ejercicio, insuficiencia cardíaca, seguridad, eficácia, Enfermería en Rehabilitación

ABSTRACT

Background: Heart failure (HF) results in limitations on the activities of daily living and consequent loss of functional and instrumental autonomy. It represents one of the most concerning health problems due to its significant economic impact.

Objective: To identify the impact of a physical exercise program on patients with HF in compensatory phase in hospital context.

Methods: A retrospective exploratory study was carried out in which twenty patients who performed a minimum of 3 sessions of the ERIC program participated. Vital signs, ECG monitoring and subjective effort perception (SEP) were assessed before and after each training session, as well as London Chest Activity of Daily Living (LCADL) scale and exercise parameters (number of laps in the pedal, number of meters walked in the hall and number of steps). The study presented took place over a period of 3 months.

Results: Patients (mean age of 64 years-old) had a positive variation in the performance parameters of the exercise, a negative variation in LCADL scale (29.9 to 20.9) and SEP after exercise (4.85 to 3.82), which means that they improve their functional capacity throughout the program. None of them presented adverse events or trained outside the safety heart rate interval (mean value of 11.2 bpm to 12.9bpm).

Conclusions: The ERIC program demonstrates safety and improvement of the Functional Capacity of the patient, based on the statistical analysis of this sample. These results allow us to infer that exercise can be an effective resource for the adjuvant treatment of patients admitted with decompensated heart failure. However, further studies with larger samples and a randomized design are needed.

Key words: Exercise, heart failure, safety, efficacy, Rehabilitation Nursing

INTRODUCTION

Heart failure (HF) is a syndrome characterized by signs and symptoms such as dyspnea, fatigue and edema, which lead to decreased exercise tolerance, functional dependence and impaired performance in activities of daily living (ADL), as well as limitations in social life and, consequently, decreased quality of life [1-3]. It has a significant economic impact due to the high cost of treatment, patient disability, lack of productivity and high mortality rates [4, 5]. It represents, in Portugal, more than 50.000 hours of hospitalization, corresponding to 12% of hospital deaths [6].

HF is usually classified according to its functional status using the New York Heart Association (NYHA) scale [7].

The treatment of HF is prolonged and multifactorial. One of the most important tools is cardiac rehabilitation (CR). CR can be defined as a sum of activities that favorably influence the underlying causes of cardiovascular disease, so that patients can obtain the best physical, psychological and social conditions, resuming their role in society as normal as possible [8, 9, 10].

Physical exercise is a safe, economical and viable therapeutic resource. In accordance with the recommendations of the European Society of Cardiology [3], it is recommended, with the highest level of evidence, that patients with HF be included in aerobic exercise programs to increase their functional capacity (FC) and improve symptoms [3, 8]. The performance of regular physical activity is directly related to a decrease in cardiovascular mortality, improvement in quality of life, decrease in the hospitalization rate and even decrease in exercise intolerance, and should be encouraged in daily clinical practice [3, 8]. Aerobic training is the best studied non-pharmacological method for the treatment of patients with chronic HF [7].

However, physical exercise has not been fully studied or validated for patients with HF in the compensation phase. There are several recommendations for performing exercise tolerance tests and safety parameters, which are fundamental, but there is still no evidence of their benefit or adverse effect in patients in the compensating phase [7, 11].

The beneficial effects of physical exercise are related to the improvement of cardiovascular and respiratory function, such as increased maximum oxygen consumption, decreased myocardial oxygen consumption, decreased blood pressure (BP) and resting heart rate (HR), increased ischemic threshold, improvement in cardiovascular risk factors, decreased mortality associated with coronary heart disease and increased quality of life, among others [11, 12].

The exercise prescription is based on the verification of parameters such as Frequency, Intensity, Time and Type of exercise (FITT), which must be adjusted according to various determinants, such as the place where the exercise is performed (inpatient or outpatient) , the stage of the disease (acute or chronic) and limitations or patient motivation [11].

This work intends to present the ERIC program (a supervised physical exercise program, aimed at patients admitted with decompensated heart failure) and to identify its impact, over a period of three months, in order to answer the research questions: “Can the physical exercise, through the ERIC program, promote improved functional capacity in patients with HF undergoing compensation in a hospital context?” and “Is the ERIC program clinically safe?

METHODOLOGY

A retrospective exploratory study was carried out based on existing data in the computer system to support Nursing practice, resulting from the

implementation of the ERIC program, collected and recorded by the principal investigator. This program has been implemented since the third quarter of 2014, having undergone some changes in its structure, resulting from the analysis carried out periodically. The third quarter of the year 2016 was randomly selected for the analysis presented here. The study was authorized by the Centro Hospitalar do Porto ethics committee (Ref. 2016.172). A new analysis of data from the last 18 months is currently underway.

All patients hospitalized for decompensated heart failure who met the inclusion criteria were included, in order to obtain a larger and more heterogeneous sample. The main objective of the ERIC program is to promote functional capacity in these patients, regardless of the etiology of heart failure or the patient's functional status.

The ERIC program is a Portuguese program created by the researcher and his colleagues, whose acronym stands for Rehabilitation Nursing for Patients with Heart Failure. The study in question is based on version 1.0 of the program and was authorized by the local ethics committee.

The inclusion and exclusion criteria are shown in table 1. It should be noted that the exclusion criteria are temporary, that is, as soon as the aforementioned criteria is no longer met; the patient will be able to perform the exercises.

Inclusion criteria	Exclusion criteria
Ability to provide informed consent	Refusal to participate in the program
Age over 18 years-old	Inotropic medication perfusion or oxygen at a rate greater than 3l/min
Admission clinical diagnosis of HF	Hemodynamic, electrical and hydroelectrolytic instability during exercise performance
Dependence on ADLs due to HF	Osteoarticular pathology that compromises the performance of the exercises

Table 1 – Criteria of inclusion and exclusion

The ERIC program comprises progressive levels of intensity, divided into 4 stages (Table 2), which aims to develop the patient's functional capacity, improve their exercise tolerance, create physical exercise habits, promote their instrumental and functional autonomy and be a non-pharmacological treatment during the stabilization phase of the disease.

Stage	Designation
I	5 Min of exercise cycling
II	10 Min of walking
III	Stage II + 5 min of stair mill
IV	Stage III + muscle strengthening

Table 2 – stages of ERIC Program

Upon admission of the patient, the inclusion and exclusion criteria are analyzed and if there are no contraindications to exercise, the patient starts the program at stage I. Parameters such as: relevant clinical history, especially cardiovascular; perception of the importance of physical exercise as a healthy habit and the level of commitment that dyspnea promotes in the performance of ADLs using the London Chest of Activities of Daily Living (LCADL). The patient's level of physical activity is also assessed, as well as whether they have stairs at home. The perception of the importance of physical exercise is evaluated by a direct closed question "Do you consider that performing physical exercise is something important that can improve your cardiovascular health?". Regarding the level of physical activity, the criteria currently in effect defined by the World Health Organization are used (150 minutes of moderate-intensity aerobic training or 60 minutes of vigorous-intensity aerobic training).

In all training sessions, vital parameters are evaluated before and after exercise and as needed, as well as the SEP through the modified Borg scale, at the end of the session. The patient should have about 4 to 5 sessions a week, one session a day, and is encouraged to do physical activity during the other days. ADLs are always encouraged with or without supervision, depending on the patient's limitations.

In case of discomfort or worsening of the clinical condition, the investigator interrupts the exercise, considering the number of laps/meters/steps, for the elapsed time. The progression or regression throughout the program varies according to the Borg scale value at the end of the exercise (2 evaluations between 1 and 3, the patient advances in stage, between 4 and 6 maintains stage, between 7 and 10 returns to previous stage or suspend (if at the first stage).

The most important results of the program will be divided into two groups: the first is related to the safety and intensity of the program and the second is related to performance during the program.

The safety of physical exercise is related to its adequate intensity [8, 13]. The American College of Sports and Medicine (ACSM) determines that some parameters are verified when patients are approached during the acute and post-acute phase, namely the variation in HR during exercise, which must be between 20 to 30 bpm above the resting heart rate; SEP below 16 (Borg scale), SBP (Systolic Blood Pressure) variation between 30 and 40mmHg above the resting value [14], as well as absence of adverse events, such as arrhythmias, pain, severe dyspnea or falls during the exercise session. In this program, we decided to use the Modified Borg scale so that the ideal SEP is below 8.

To measure the performance of the program, some exercise execution parameters were analyzed, such as: the number of turns on the pedals, the number of meters walked in the corridor and the number of steps covered. In addition to these parameters, the LCADL scale score was also analyzed.

In order to systematize the information, a form was created with all the assessments carried out and also with data from the different exercise sessions, namely vital signs, scores on different scales and exercise performance parameters.

RESULTS

Data were organized and analyzed using IBM SPSS® version 21 and Microsoft Office Excel 2007; the results between the first and the last exercise session were compared.

The mean age of participants (n = 20) is 64 years-old, with a standard deviation of 9.97, of which 16 are male. The mean length of hospital stay was 18.6 days, with a standard deviation of 12.66 (min = 7 and max = 53). Patients performed an average of 4.4 exercise sessions (min=3 and max=8). The training program starts as soon as clinical safety conditions are met, which varies from patient to patient.

The NYHA functional class classification of these patients indicates a high level of functional limitation in most of them (20% are NYHA functional class IV and 65% NYHA class III). Only 20% of the sample reported regular physical exercise, compatible with the tendency towards a sedentary lifestyle in these patients (Table 3).

Parameters	%	n
Men	66	16
Functional class IV NYHA (resting dyspnea)	20	4
NYHA functional class III (less than normal physical activity causes symptoms of tiredness)	65	13
NYHA functional class II (tired symptoms for normal physical activity)	15	3
Previous exercise practice	20	4

Table 3 – Sample characterization

Most patients have severe depression of ventricular function, corresponding to 65% of the sample. The others are distributed between preserved function (20%) and mild to moderate depression (15%).

The analysis of the exercise intensity parameters indicates that exercise was performed within the parameters predicted as safe by the ACSM, as shown in table 4. There was no need to discontinue any of the sessions performed by this sample of patients. None of the patients had pain, falls, worsening of the clinical condition or arrhythmia during the sessions.

Parameters	First session	Last session
HR variation (average)	11.2bpm	12.92bpm
SBP variation (average)	9.75mmHg	8.75mmHg
SEP (average)	6.45	4.1

Table 4 – Exercise Intensity Parameters

Only 2 patients needed to go back in the program stage, due to the Borg value presented at the end of the exercise session, and they had the opportunity to progress later.

The variation of some parameters such as the number of exercise sessions, the duration of each one and the LCADL scale score are presented in table 5.

Parameters	First session	Last session
Average exercise time	6.7min	11.4min
Score of LCADL (average)	29.9	20.9

Table 5 - Patient performance throughout the program

There is an improvement in the performance of patients throughout the program (exercise performance parameters), especially in the number of meters covered. Only 6 of the 20 patients performed stair training and showed a positive variation in the number of steps covered in the different sessions - table 6.

Parameters (average)	First session	Last session
Nº of turns on bike (stage I)	249.3	363
Nº of covered meters	178.75	381.67
Nº of stairs	-	65

Table 6 - Exercise execution parameters

Some correlations were made using Spearman's test, between the different variables that change during the physical exercise session, that is, HR at rest, at effort (highest value reached during the exercise session) and its variation (difference between the effort value and the resting value); oximetry, number of meters covered and steps on the stairs, number of turns on the pedals and total exercise time. These variables are evaluated in all training sessions, sessions that take place as long as the patient has the clinical conditions to start it until the date of discharge. Vital parameters were collected through cardiac monitoring telemetry and by the non-invasive blood pressure monitor and respective oximeter. There are statistically significant correlations, namely between oximetry and exercise duration; variation in HR and in the number of meters covered; exercise duration and HR at rest and during exertion. These results are shown in table 7.

Co-relations	Exercise duration	HR at rest	HR at effort	Nº of meters covered
Oximetry	0.667 * p = 0.001	-0.774 * p < 0,001	-0.593 * p = 0.006	-
HR variation	-	-	0.480 ** p = 0.032	-0.670 ** p = 0.017
Exercise duration	-	-0.639 * p = 0.002	-0.597 * p = 0.005	-

Level of significance of 0,01 Level of significance of 0,05***

Table 7 – Spearman correlations between physiological variables

DISCUSSION

The sample is mostly male (80%) and the average age is 64 years-old, which is in agreement with the Cochrane Collaboration (2001) [18] review about the benefits of structured and monitored physical exercise in coronary heart disease, as well as with data from the European Society of Cardiology [7].

The mean age is also consistent with the Cochrane review, in which, in most studies, there is a prevalence of the age group between 50 and 70 years-old [18].

The practice of physical exercise can be performed by patients during the compensation phase, and without effort tolerance tests, as long as the safety criteria are verified, namely: HR variation during exercise, systolic BP and SEP [11]. The mean values of these parameters in the present sample are within the recommended ranges.

According to the ACSM, during the hospitalization phase, when the disease is not fully stabilized, the exercise duration should be between 3 and 5 minutes according to the patient's tolerance, with rest periods and progressing for longer periods from 10 to 15 minutes, it is desirable to increase the exercise intensity [11]. Also for these parameters, we verify that the values are as recommended.

According to previous results, the exercise program was safely implemented, as all patients performed the exercise within the recommended safety parameters. Only 2 patients needed to go back to the previous stage after an exercise session, as they reported fatigue with a Borg level above 7. However, they were able to progress again after the following sessions.

Based on the correlations, we can conclude that, in this sample of patients, higher oximetry values are positively correlated with exercise duration. Patients with better oxygenation will be able to perform longer periods of exercise, as good oxygenation will allow for better cellular and metabolic performance. Oximetry is negatively correlated with HR in exertion and at rest, that is, when the patient has a higher cardiac work, due to the aerobic training performed, he has a lower peripheral oxygen value - greater cardiac work will lead to greater consumption of oxygen, resulting from the use of large muscle groups involved in the execution of physical exercise training.

Regarding the HR variation, this seems to correlate positively with HR in effort and negatively with the distance covered in meters. Thus, when the patient significantly increases the number of beats at peak effort compared to the baseline, he will be able to travel shorter distances (they will get tired quicker, the cardiac work will be greater and, therefore, the patient will decrease the speed of walking, covering fewer meters in the same estimated period of time). This fact reminds us of the importance of keeping the positive variation in HR within the range of 20-30bpm as a preventive measure against adverse events [11].

Regarding exercise duration, there is a negative correlation with HR in effort and at rest. These values can have two meanings, namely, that patients with lower basal and non-pathological HR can achieve better performance during exercise (more meters); or the more exercise patients perform, the more their perception of exertion and HR at rest decrease [19]. This statistical result leads us to the beneficial effect of exercise, associated with the reduction of basal HR, directly related to the increase in resistance to oxidative stress [19]. Higher resting HR, as well as reduced ejection fraction, are predictive factors of cardiovascular mortality and should be controlled.

Although these results are in accordance with scientific knowledge about the effects of physical exercise on the cardiovascular system, most studies were carried out in patients in an outpatient setting and not in the clinical compensation phase. Furthermore, this sample may not be representative due to the small number of patients. However, this can be a predictive factor that, even in the disease compensation phase, physical exercise can produce gains similar to those obtained in the post-acute phase, enhancing those that can be obtained with the continuation of the program after hospital discharge.

The vast majority of studies on FC in cardiac patients demonstrate an improvement in this item associated with the practice of physical exercise; however, they refer to patients in an outpatient setting. Thus, it is important to know if this trend also occurs in compensation phase of HF.

The tests most used to predict FC are related to the distance covered by the patient in a given period of time, namely the 6-minute walk test or the 10-minute walk test, for example [20]. To predict an improvement in FC, there must be a significant increase in the distance covered between two different assessments: the first before the intervention and the second after some type of intervention [20, 21].

In this study, patients walk at their own pace and ideally without stopping, with a progressive increase in the distance walked between two assessments, with mean values ranging between 178 and 381 meters. We can infer that, even in the phase of disease compensation, patients present an improvement in their FC when performing the physical exercise program. However, a more representative sample and control group will be needed to ensure that the program is responsible for this FC improvement.

In addition to the distance covered in meters, the LCADL scale score, the Borg score at the end of the exercise and the average exercise time can be indicative of the improvement in the patient's physical condition and, consequently, in his FC. As previously noted, patients decrease the LCADL value, which indicates better performance in ADL's; decrease the Borg score after exercise, indicative of greater physical fitness and greater resistance to exercise, and increase exercise time during the program.

CONCLUSION

It is concluded that the ERIC program proved to be a safe intervention in patients with recently decompensated HF. Regarding efficacy, it was found

that the practice of physical exercise in this group of patients would likely bring physiological and functional benefits (improvement of FC), however, a study with a control group will be necessary to ensure that the functional improvement of patients is related to the program.

As limitations of the study, one can mention (1) the lack of scientific articles on physical exercise in the HF compensation phase (the existing ones refer to patients with coronary heart disease and not HF), (2) study design - absence control group and (3) reduced number of patients in the sample in question.

Motivated by these results and by the need for stronger evidence, a double open and randomized clinical trial is in progress to overcome the aforementioned limitations.

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