The Impact of Continuous Positive Airway Pressure (CPAP) on the Cardiac Rehabilitation of Patients with Congestive Heart Failure: Case Report

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Congestive heart failure is a pathology that limits the patient's physical function. This study analyzed one patient who was submitted to a cardiac rehabilitation program associated to Continuous Positive Airway Pressure (CPAP), by assessing the results of the six-minute walk test (6MWT) and a questionnaire on the quality of life and performing an echocardiographic assessment before the study and after six weeks. The distance walked by the patient increased from 152.5 m to 520.44 m at the 6MWT. The Minnesota questionnaire score decreased from 62 to 18. Ejection fraction increased from 33% to 36%. Therefore, the management chosen for this case improved the patient's physical performance and quality of life.

Introduction

Currently, congestive heart failure (CHF) affects thousands of individuals worldwide and it is considered by some authors as a pandemic state[1]. According to a recent review carried out by the Brazilian Public Health System (SUS), approximately 23 million individuals have CHF, with 2 million new cases every year[2], which has made the disease a priority for the World Health Organization (WHO). There are an estimated 6.4 million people in Brazil with this condition, which affects 1% to 2% of the general population[2].

Such patients directly benefit from regular physical training, considering that the latter promotes a progressive improvement in exercise tolerance, a decrease in resting heart rate (HR), an increase in maximal oxygen consumption (VO_{2max}) and higher oxygen (O_2) supply to the myocardium, as well as increased oxidative capacity of the skeletal muscle[3].

The use of positive pressure seems to be beneficial in this population. The treatment using Continuous Positive Airway Pressure (CPAP) can improve cardiac function and bring CHF symptom relief. This improvement is attained through the increase in the intrathoracic pressure, which decreases the left ventricular (LV) preload and afterload such as the transmural pressure, culminating with an increased stroke volume and outflow volume. Thus, it can be stated that the CPAP improves the mechanics of a failing heart[4].

The main characteristic of these patients is the intolerance to physical exercise, detected through dyspnea and fatigue; based on this presupposed concept, it becomes necessary to promote a cardiovascular rehabilitation program for these patients, with the objective of allowing the patient with cardiopathy to resume an active and productive life as soon as possible[2].

Key words

Heart failure; exercise; rehabilitation; quality of life.

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Methods

The present is a case study of a 51-year-old female patient with heart failure of Chagasic origin, who presented NYHA (New York Heart Association) functional class (FC) III[2], without any musculoskeletal or pulmonary comorbidities. The patient was submitted to an echocardiogram, answered a quality of life questionnaire (adapted Minnesota Living with Heart Failure Questionnaire)[2] and performed the Six-minute Walk Test[5] (6MWT) before initiating the Cardiac Rehabilitation protocol and after the six-week program was completed. The patient was followed by the same examiner throughout the entire study, who was blinded to the treatment.

The training protocol consisted of four weekly sessions for a period of six weeks, during which a continuous positive pressure of 10cmH_2O was applied to the airways during the entire session time (CPAP ResMed LightWeight II).

The training sessions consisted of aerobic activity on a treadmill or bicycle ergometer (Reebok TR1 and Reebok Power Bike, respectively), alternately on each day and resistance exercises for the upper and lower limbs (dumbbells and Reebok ankle weights, respectively), also alternately on each day.

During the training sessions, the patient was always followed by the same examiner. During the first week of training, the aerobic activity lasted 20 minutes and three types of resistance exercises were performed. On the second week of training, the aerobic activity lasted 25 minutes and 4 resistance exercises were performed. From the third to the sixth weeks of training, the aerobic activity lasted 30 minutes and 5 resistance exercises were performed.

The patient maintained her target heart rate (70-80% of

maximum HR) throughout the aerobic activity and the weight load was increased every two weeks by at least 1 kg in the resistance exercises (up to the patient's limit).

The patient had the blood pressure, heart rate and oxygen peripheral saturation (DIGIT pulse oximeter) measured every 15 minutes.

Results

At the first assessment, the patient presented an ejection fraction (EF) of 33% at the echocardiogram, which increased to 36% after the training protocol was completed (Chart 1). The patient presented an initial Minnesota Living with Heart Failure Questionnaire score of 62 points, which decreased to 18 points after the training. The distance walked by the patient at the 6MWT increased from 152.5 m to 520.44 m after the training (Chart 2).

It was observed that the oxygen consumption by the myocardium (systolic BP X HR), had an initial value of 10,200, which decreased to 8,280 after the training. The patient also showed a decrease in NYHA FC from III to II.

Discussion

Our study analyzed the effects of a cardiac rehabilitation program associated to the use of Continuous Positive Airway Pressure (CPAP) in the treatment of patients with CHF.

Some studies have indicated that the use of CPAP can improve cardiac and pulmonary function and bring symptom relief to patients with CHF[4,6], working as an adjuvant therapy in these patients. The results of the present study are in accordance with those presented by the study of Wittmer et al[7], which concluded that CPAP improves the tolerance to physical exertion. Although the aforementioned authors evaluated pulmonary function, they did not define the influence of the pulmonary function and/or hemodynamics on the attained results[7].

Such results correlated directly with the analysis of some

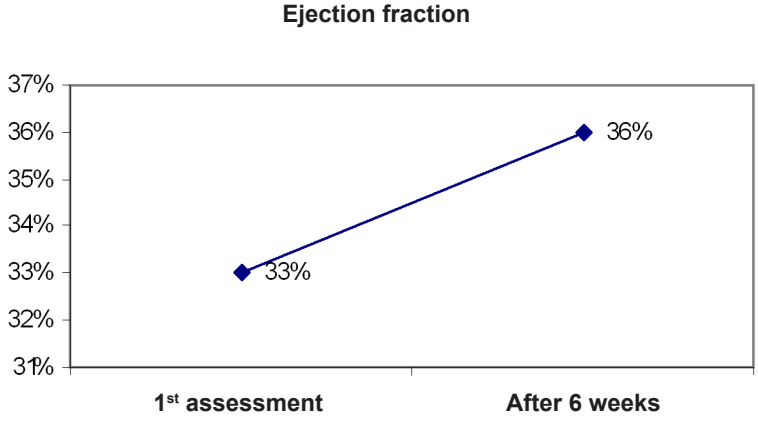

Chart 1 - Ejection fraction before and after the six weeks of training.

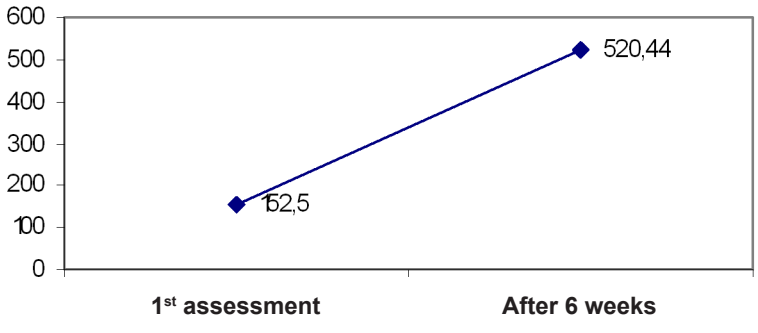

Chart 2 - Distance walked at the 6-minute walk test before and after the six weeks of training.

authors[8,3], who reported that the practice of physical exercises decreases both systolic BP and HR, with a consequent decrease in VO_{2max} [7,9].

In a randomized and controlled study, which analyzed the impact of a six-month physical training program in patients with CHF, a statistically significant increase in the left ventricular ejection fraction was observed in the training group (increase of 30 to 35%)[10]. Our case study attained similar results; however, these results were obtained within a much shorter period of time (6 weeks), a fact that led us to the hypothesis that CPAP can accelerate this process.

Conclusion

In our study, the association between CPAP and cardiac rehabilitation was shown to be important for the improvement of the patient's physical performance, cardiac function and quality of life. This procedure did not result in any complications. Randomized, controlled and multicenter studies are necessary to demonstrate such benefits on a large scale.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

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