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Pulmonary rehabilitation in severe post-tuberculosis sequelae - case presentation

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Abstract

Pulmonary tuberculosis (TB) still represents a chalenge for the healthcare systems, in the active but also in the chronic phase, when TB sequelae may appear. Anatomical changes and destruction of lung parenchyma lead to loss of pulmonary volumes. The patients with post TB sequelae are expresing dyspnea, chronic cough, muscle weakness and reduced daily activity. We present the case of a 58 years old patient, with post TB sequelae (2 episodes of relapses), presenting dyspnea, chronic fatigue and bronchiectatic syndrome. He was included in a 8 weeks multidiciplinary pulmonary rehabilitation program, which comprised exercise trainng, airway clearance techniques, education. The results of PR program were positives: decrease of dyspnea (one point in mMRC scale), improvement of exercise tolerance (58 m gain at 6MWT), improvement in life quality (SGRQ decrease with 5.2 points). In conclusion, pulmonary rehabilitation may be a useful therapy in the management of post tuberculosis sequelae.

Key words: *tuberculosis, sequelae, rehabilitation, exercise,*

Introduction

Tuberculosis (TB) represents still a major health problem. Although the disease impact is major in the active phase, the TB sequelae also represent an important burden with long term consequences. The interventions that can be made in this chronic stage of disease sequelae are pulmonary rehabilitation, oxigenotherapy, nutrition and psychological counselling (1). Pulmonary rehabilitation (PR) is an evidence-based treatment conducted by a multidisciplinary team, addressed to the patients with chronic respiratory disease who has symptoms and a reduction in his daily activities (2-4). The main purpose of rehabilitation is to improve patient life and autonomy (4).

Case presentation

We present the case of a 55 years old man, non-smoker, hospitalized in our clinic for dyspnea, productive cough, and asthenia. The patients' medical history included two episodes of extensive pulmonary tuberculosis 8, respectively 1 year before, treated effectively for 6, respectively 9 months. After the last episode, he rested with chronic cough, bronchoreea, and decreased effort tolerance. At the presentation in the pneumology department, a new tuberculosis relapse was suspected and a sputum smear microscopy was performed, with no evidence of acid fast bacilli. Clinical examination reveals cachexia (BMI index 17.2 kg.m^2), impaired general status, clubbing, muscle deconditioning. At the level of the respiratory system, the vesicular murmur was present bilaterally, without bronchial rales, respiratory rate 18 / min, the SaO2 was 95% at rest.

Spirometry performed showed mixed syndrome: FEV1 =1.64 L (54.4% predicted), FVC=2.12 L (46.4% predicted). The exercise tolerance was assessed by the 6 minutes walking test (6MWT). The 6 minutes walking distance was 423 m (58% of predicted value), with increase in dyspnea on BORG scale from 2 to 5 and significant desaturation from SaO2= 95 to 91%.

Due to importance of the symptoms (dyspnea, chronic cough), severe muscle weakness and decrease effort tolerance, the participation to a pulmonary rehabilitation program was proposed. The parameters folowed before and after rehabilitation program were:

• ***dyspneea:*** measured with mMRC **(**modified Medical Research Council) dyspnea scale who has a value of 3 from 4 (score range drom 0 to 4); higher score mean worse symptoms

• ***functional lung tests***: forced vital capacity (FVC), first expiratory flow in first second (FEV1)

• ***exercise tolerance:*** measured with 6 minutes walking test 6MWT (performed twice according to ATS criteria, the highest distance traveled was choosen) and cardiopulmonary exercise test CPET (maximum oxygen uptake VO2 max was 20.05 ml/min and maximal power 85 watts)

• ***quality of life*** was assesed with SGRQ (St. George Respiratory Questionnaire, score range from 0 to 100, with high score showing impaired quality of life; in this case, the total score was 51.58 points (sypmtoms score 43.9, activity score 66.31, impact score 45.25).

Pulmonary rehabilitation (PR) program was multidisciplinary, outpatient, during 8 weeks (three sessions per week) and consisted in exercise training, chest physiotherapy, therapeutic education. Before entering in the PR program, the patient signed an informed consent approved by the ethical committee.

The lower limb exercise training was aerobic, endurance training, performed on a velo, 30 minutes per session. For the intensity of training we used the maximal power obtained during the cardiopulmonary exercise test (CPET). The velo charge in watts was set up in order to reach progressively the 60% of the VO2 max (20.5 ml/min). During every session of 30 minutes cycle training there was a 5 minutes warm-up and recovery period. The upper limb training was performed with weights, using 3 series of 10 exercise separated by a 5 minutes break. The weights have been increased progressively.

Given the presence of post TB bronchiectatic syndrome, a special concern was given to cough management and airway cleaning techniques. He was learned how to obtained an effective cough, breathing exercise, postural drainage. These exercises were firstly made under the supervision of a healthcare professional, and afterwards he continued at home daily.

He also performed daily positive expiratory pressure with a Treshold device (figure 1), that contain a unidirectional valve that opposes a resistance when the patient expire. These exercises were performed daily, 15 minutes twice daily and were continued after the PR program finished.

Fig. 1. Treshold PEP (Positive Expiratory Pressure)

After the PR program, dyspnea score decreased with one point (mMRC scale), and SGRQ score with 5.2 points. Regarding the exercise tolerance, there was a significant improvement in 6MWT distance with 58 m, and VO2 max with 1.38 ml/min (table 1). A diminution of the cough frequency with sputum discolouration was noticed.

Parameters	Before rehabilitation	After rehabilitation
Dyspnea mMRC (points)	3	2
FEV1	1.64 L (45.4% predicted)	1.73 L (49.2% predicted)
FVC	2.12 L (46.4% predicted)	2.19 L (47.2% predicted)
6MWT (m)	423	481
Pmax (Watts)	95	105
VO2 (ml/min)	20.05	21.43
SGRQ score (points)	51.58	46.38

Table 1. Parameters evaluation before and after rehabilitation program

Discussion

Pulmonary tuberculosis, even with successful chemotherapy, can lead to important loss of pulmonary function. Although the bacteriological sterilisation of the lesions is achieved, the sequelare scars may amputate lung parenchyma, resulting in loss of pulmonary volumes. The structural alterations are varied, from fibrotic scars, bronchiectasis, bronchial stenosis, broncholitiasis. The incidence of post TB functional impairment varies in the literature, from 33 to 94% (4-7). In a Portuguese study that measured pulmonary function in 214 patients treated for tuberculosis, almost half of them (47.7%) have impaired lung function, the most common finding being the obstructive syndrome (34.6%) (8).

Lee studied the chronic airflow obstruction in post TB destroyed lung and compared with COPD patients, the results showing that pulmonary function in post TB destroyed lung patients (both FVC and post bronchodilators FEV1 values) were lower than in COPD control group (9).

The patients with relapses of tuberculosis are at a very high risk to develop functional impairment, pulmonary volumes decreasing after each new episode of tuberculosis, as showed in study of Hnizdo. In a group study of 2599 black South African gold miners with one, two or three episode of TB in medical history, a decrease of FEV1 was found with 153 ml, 326 ml, and 410 ml, respectively after one, two or three episodes of tuberculosis (10). Also, in post TB syndrome, it seemed to be in an inverse relationship between the magnitude of the disease on chest radiography and the forced expiratory volume in one second (FEV1)(11,12).

These functional disabilities are accompanied by decrease exercise tolerance and loss of autonomy, having a negative effect on usually daily activities. The breathlessness, the fatigue, the irreversible aspect of the disease, social isolation may also lead to a depressive syndrome.

Pulmonary rehabilitation (PR) is an individualized and comprehensive intervention, performed by a multidisciplinary team, addressed to patients with chronic respiratory disease, such as post TB sequelae. The indication of PR programs are patients with symptoms, impaired exercise tolerance and low quality of life. In post TB sequelae, there are two major directions of pulmonary rehabilitation. One is address to dyspnea and subsequently functional disability and the other one to the bronchiectatic syndrome.

Unlike COPD, there are few studies available about pulmonary rehabilitation in post tuberculosis syndrome. For the patients with impaired effort tolerance and reduction of daily living activities, exercise training can be proposed. Although the muscular training is shown to have positive effects on exercise performance (13,14), there are not clear recommendations (as in COPD) for the intensity of training and the optimal threshold.

A study from Colombia folowed the effects of a 8 weeks PR progam on aerobic capacity of patiens with post TB sequelae. The program includes exercise aerobic training and education. The lower limb training was performed on a treadmill, with progresively load increasing from 60 to 85% of maximum oxygen consumption (VO2peak). The positives changes were statistically significant for exercise tolarance (the VO_{2peak} increased by 1.7 mL/kg/min and 6MWD increased by 63.6 m), as for quality of life (SF-36 physical domain score increased by 6.98 points, whereas the SGRQ score increased by 13 points)(14).

Another study conducted in Japan compared the results of a nine week outpatient PR program in 32 post tuberculosis patients and 32 COPD patients. The positive effects were similar in the 2 groups, in terms of exercise tolerance (6MWT distance), dyspnea (MRC scale), daily activites scores (15).

Regarding our patient, the pulmonary rehabilitation program design was similar with the one used for the other COPD patients participating in the PR program. Before the rehabilitation, cardiopulmonary exercise test was used to find the maximal workload, who was 105 watts. The training was start at 60% of this load and was increase progressively at every session in order to reach 80% of the load. The benefits were obtained in symptoms, exercise tolerance (6 MWD increase with 58 m), but also in QOL (decrease of SGRQ score with 5.2 points).

As in the other type of bronchiectasis, in post TB bronchiectasis, one of the main concerns is the ineffective cough and sputum retention. The main scope is to increase the expectoration, through different techniques: controlled cough, postural and autogenic drainage, vibrations, percussions, positive expiratory pression, aso (16).

In our patient's case, respiratory physiotherapy was performed, first in the PR center and after the patient learned how to set up, he continued at home daily. Airway cleaning techniques were used, together with special devices as Threshold and lead to a discoloration of sputum and reduction in the daily amount of sputum.

In one year follow up after the PR program, the patient clinical status rested good and he suffer no other infectious exacerbation.

Conclusion

In our patient with sequelae from multiple relapses from tuberculosis that lead to functional and social disability, the pulmonary rehabilitation was safe and successful. These cases may represent good candidates for PR programs and exercise together with airway clearance techniques must be a part of their long term management.

Conflict of interest

No conflict of interest for any of the authors regarding this paper.

Informed consent

An informed consent was obtained from the patient included in this article

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