

Original research article

Assessment of Six Minute Walk Test following Six Weeks Structured Pulmonary Rehabilitation Exercise in Patients with Post Tuberculosis Lung Sequelae

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Abstract

Background: Post tuberculosis sequelae causes significant impairment in the quality of life. Pulmonary Rehabilitation (PR) improves physical conditioning of the body in patients with respiratory diseases.

Aims and objectives: To assess the baseline pulmonary exercise capacity using Six Minute Walk Test (6MWT) in post Tuberculosis (TB) lung disease patients and to re-assess pulmonary exercise capacity following administration of pulmonary rehabilitation exercise in post TB lung disease patients using 6MWT.

Materials and Methods: 42 out of 45 patients with post tuberculosis sequelae were assessed by 6MWT, spirometry, modified Borg Scale Index. They were subjected to six weeks of pulmonary rehabilitation with walking and balloon blowing and were re-assessed later.

Results: The distance walked in Visit 1 and Visit 2 (after six weeks Pulmonary Rehabilitation) was 489.91 ± 86.79 and 527.425 ± 78.03 respectively which is statistically significant ($p < 0.000$). The Modified Borg scale index of the subjects in Visit 1 and Visit 2 (after six weeks Pulmonary Rehabilitation) was 1.54 ± 1.08 and 1.36 ± 0.98 respectively which was statistically significant ($p < 0.002$).

Conclusion: The results revealed a significant improvement in exercise capacity in terms of distance walked in 6-MWT and improvement in Modified Borg Dyspnea Scale after 6 weeks of PR. Henceforth the authors of this study recommend 30 minutes of brisk walking for 5 days a week and balloon blowing exercises as a part of Pulmonary Rehabilitation exercise protocol in post TB patients which can be practiced even in Rural areas.

Key words: Post tuberculosis sequelae, Six Minute Walk Test, Pulmonary Rehabilitation

Introduction

In the recent times, the prevalence and incidence of respiratory diseases has been increasing, emerging as one of the most common cause of morbidity and mortality. The burden of tuberculosis is on the rise, and is endemic in most Asian countries¹.

Even though TB is treated with Anti Tubercular Therapy, many present with post tubercular changes in the lungs which impairs physical ability and quality of life.² Post tuberculosis spirometry commonly show stable restrictive or mixed ventilatory disorder and rarely present with pure obstructive disorder. The respiratory endurance and physical conditioning of the body in patients with respiratory diseases can be improved by carefully designed disease specific Pulmonary Rehabilitation exercises for patients with post TB lung disorders, cystic fibrosis, pulmonary fibrosis, restrictive thoracic disease and COPD³⁻⁷.

Different protocols of exercise training may have variable response in patients with respiratory diseases. Performing varied exercise regime on a regular basis, after long duration of anti tubercular treatment may not be possible in rural set up owing to the multiple requirements for a single exercise protocol. However walking and balloon blowing are simple cardio respiratory exercise protocol that can be feasible in rural set up.

Six Minute Walk Test (6MWT) is one of the most common Pulmonary Function Test used to assess the activities pertaining to daily living and responses to all systems involved during exercise including pulmonary, cardiovascular, neuromuscular units & metabolism than the other walk tests.⁸ This study is designed to assess the pulmonary exercise capacity of patients treated for pulmonary TB after simple pulmonary rehabilitation exercises like walking and balloon blowing for six weeks, using the 6-MWT .

Objectives

1. To assess the baseline pulmonary exercise capacity using 6MWT in post TB lung disease patients
2. To re-assess pulmonary exercise capacity following administration of pulmonary rehabilitation exercise in post TB lung disease patients using 6MWT.

Materials & Methods:

Subjects:

Inclusion criteria:

- Treated Pulmonary Tuberculosis Patients Above 18 years of age written informed consent.

Exclusion criteria:

- Active pulmonary tuberculosis patients diagnosed with microbiologically and radiologically.
- Physical disability that could interfere with six minute walk test.
- Patients with psychiatric illness, cardiac disease, neuromuscular disease and metabolic disorder.
- Long term oral / parenteral corticosteroid therapy.

The purpose of the study was communicated to the patients who were enrolled based on predetermined inclusion – exclusion criteria and their participation in research was voluntary. The study was carried out at a tertiary care hospital.

The baseline evaluation of biophysical profile, fatigue and dyspnoea using modified Borg index⁹, oxygen saturation, spirometry was done. The patients were then subjected to 6 MWT.

The patients were familiarized with pulmonary rehabilitation exercise after which the patients continued the exercise daily for a period of six weeks. Those patients who discontinued the exercise for 2 or more consecutive days were excluded from the study. Telephonic interview regarding execution of exercise was done on weekly basis.

Post six week pulmonary rehabilitation assessment of biophysical profile, fatigue and dyspnoea using Modified Borg index, oxygen saturation, spirometry was recorded and the subject were reevaluated for 6-MWT. Post six week pulmonary rehabilitation modified Borg index and distance walked in 6-MWT was compared with Visit 1 values.

SIX MINUTE WALK TEST: A 30 m corridor in the hospital was used for the test. An arrow was pasted at the end of the corridor to indicate the patient the direction to turn. Patients were instructed to walk from end to end at their self-selected pace, while attempting to cover as much distance as possible in the 6 minutes. They were given standardized encouragement at 1, 3, and 5 minutes during the walk: “You're doing a good job” (minute 1), “You're halfway done” (minute 3), “You have 1 minute to go” (minute 5)¹⁰. Distance walked was recorded in meters.

SPIROMETRY: A computerized spirometry was done using RMS Spirometer Helios 401 VERSION 3.3.37

The lung volumes and capacities during various breathing manoeuvres were recorded.

PULMONARY REHABILITATION EXERCISE(PR)

1. Walking: 30 minutes of brisk walking for 3 to 5 days a week for a total duration of 6 weeks¹¹.
2. Balloon blowing exercise: The subjects were asked to sit in upright position and asked to breathe in through the nose to the maximum possible and breathe out into the balloon at the maximum rate and maintain the state for a second. After that they were asked to close the mouth of the balloon immediately and repeat breathing in and out into the balloon. This was done 3 times to complete one set. This was performed at 2 times maximum over a minute. The same was repeated a total of 3 sets with a minute of rest between the sets, was performed for 3 to 5 days a week for 6 weeks duration¹².

Study design and statistical analysis:

Study Design: Prospective observational study

Sample Size: All patients who met the inclusion criteria visiting the hospital in specified duration of 6 months (Duration study) were recruited.

The patient recruitment, data collection and analysis in the present study were employed only after getting Human Ethical clearance certificate from Institutional Human Ethics Committee.

Data was entered into Microsoft Office 2021. Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) software version 21.

Descriptive statistics were expressed using Mean and Standard Deviation. Paired ‘t’ test was used for comparison when appropriate. The p value <0.05 was considered statistically significant for all the analysis.

Results

45 patients with post TB lung sequelae were recruited for the study (n=45), of which 3 patients didn't complete the prescribed Pulmonary Rehabilitation hence were dropped out of the study. Demographic and baseline characteristics of the participants are shown in Table 1.

FVC, FEV1 and FEV1/FVC comparison of mean values of all outcome measures after six weeks of PR showed no significant improvement with p values 0.646, 0.358 and 0.637 respectively as shown in Table 2.

In Visit 1, baseline and post 6-MWT saturation, heart rate, respiratory rate of subjects were noted as shown in Table 3. In Visit 2 after six weeks Pulmonary Rehabilitation, baseline and post 6-MWT saturation, heart rate, respiratory rate of subjects were noted as shown in Table 4.

The distance walked in Visit 1 and Visit 2 (after six weeks Pulmonary Rehabilitation) was 489.91 ± 86.79 and 527.425 ± 78.03 respectively which is statistically significant ($p = 0.000$) as shown in Figure 1.

The Modified Borg scale index of the subjects in Visit 1 and Visit 2 (after six weeks Pulmonary Rehabilitation) was 1.54 ± 1.08 and 1.36 ± 0.98 respectively which was statistically significant ($p = 0.002$) as shown in Figure 2.

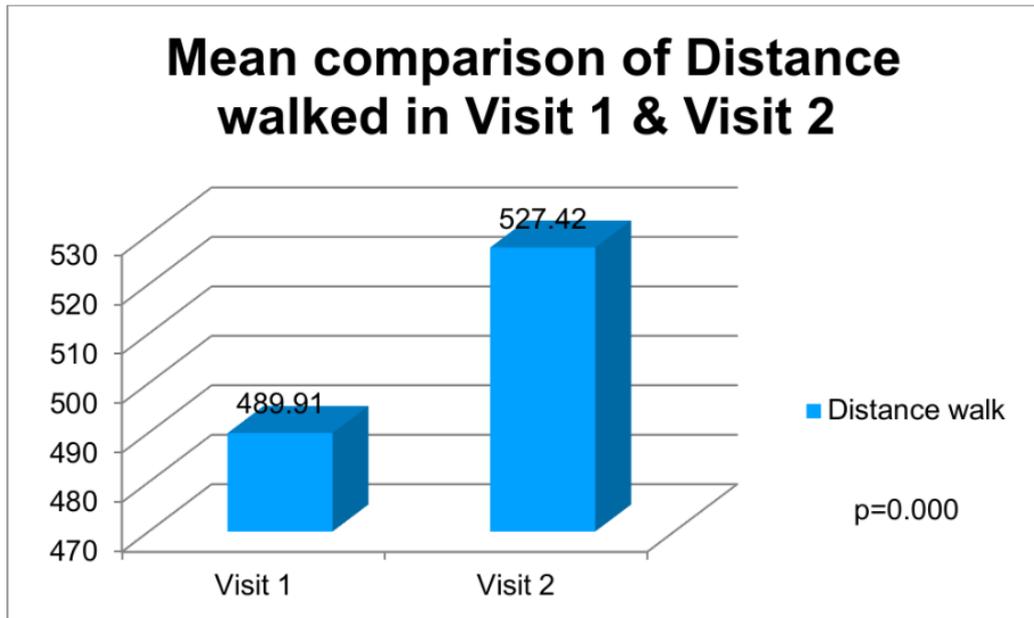


Figure 1: The mean comparison of distance walked in Visit 1 and Visit 2

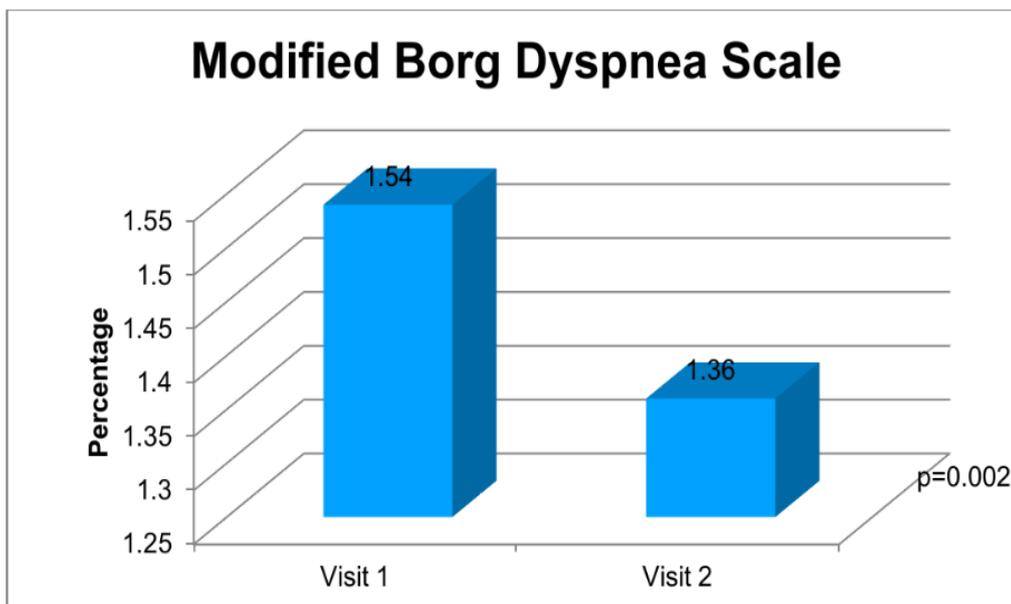


Figure 2: The Modified Borg Scale index of the subjects in Visit 1 and Visit 2.

Table 1: Comparison of demographic and baseline characteristics of patients.

Demographics and baseline characteristics		(n=45) mean±SD
Age		48.28±15.67
Gender	Female	17(37.8)
	Male	28(62.2)
Height		1.59±0.10
Weight		51.71±10.40
BMI		20.36±3.97
Heart rate		83.71±10.29
Respiratory rate		23.20±4.20

Table 2: FVC, FEV1 and FEV1/FVC in Visit 1 and Visit 2.

	PFT1	PFT2	P value
	mean±SD	mean±SD	
FEV1(actual)	1.39±0.54	1.43±0.53	0.358
FVC(actual)	1.87±0.58	1.90±0.57	0.646
FEV1/FVC	72.97±13.81	73.53±13.34	0.637

Table 3: Baseline and post 6-MWT saturation, heart rate, respiratory rate of patients in Visit 1

	6MWT		P value
	Pre test (mean±SD)	Post test (mean±SD)	
Heart rate	84.15±10.36	94.02±14.06	0.0000
Respiratory rate	23.11±4.22	27.17±3.41	0.0000
Saturation	95.44±2.15	93.64±2.90	0.0000

Table 4: Baseline and post 6-MWT saturation, heart rate, respiratory rate of patients in Visit 2.

	6MWT		P value
	Pre test (mean±SD)	Post test (mean±SD)	
Heart rate	82.80±8.22	93.91±11.35	0.0000
Respiratory rate	20.22±2.60	25.71±2.89	0.0000
Saturation	96.53±1.65	94.42±2.35	0.0000

Discussion

The study done by Alene et al reported respiratory impairment to be the most common TB related disability¹³. There is limitation of work capacity in patients with respiratory disease, as the lungs are unable to perform to their optimal function of alveolar ventilation and diffusion of the gases across the alveolar-capillary barrier resulting in reduced oxygen supply to the skeletal muscles¹⁴. Pulmonary rehabilitation is a comprehensive evidence based, multidisciplinary program for patients diagnosed with chronic respiratory disease. There are many studies that show PR to be beneficial in Post TB sequelae. Rehabilitation exercises improves the muscle metabolism and there by enables a person to tolerate higher magnitude of work without appreciable dyspnea¹⁴. The Modified Borg Dyspnea Scale (MBS) is a 0 to 10 rated numerical score used to measure dyspnea as reported by the patient during submaximal exercise and is routinely administered during six-minute walk testing (6MWT)⁹. Number 0 indicates that there is no breathing difficulty where as number 10 indicates that the breathing difficulty is maximal.

This study was designed to investigate pulmonary training for post PTB sequelae in a rural setting and noticed significant improvement in exercise capacity in terms of distance walked in 6-MWT and improvement in Modified Borg Dyspnea Scale after 6 weeks of PR.

Conclusion

The results revealed a significant improvement in exercise capacity in terms of distance walked in 6-MWT and improvement in Modified Borg Dyspnea Scale after 6 weeks of PR. Henceforth the authors of this study recommend 30 minutes of brisk walking for 5 days a week and balloon blowing exercises as a part of Pulmonary Rehabilitation exercise protocol in post TB patients which can be practiced even in Rural areas.

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