

Original Article

CHANGE IN PERCENTAGE OF MORTALITY AFTER 4 WEEKS OF PULMONARY REHABILITATION IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a group of disorders characterized by chronic air flow limitations either irreversible or partially reversible. The BODE index is been known for measuring mortality in Patients with COPD. **Materials and Methods:** This is a non randomized experimental study (pre and post design). Total of 15 patients (n=15), 11 male and 4 female subjects underwent 4 weeks of Pulmonary Rehabilitation (PR) program. We recorded 6 MWT, MRC rating scale, FEV₁ and BMI (BODE index) pre and post to 4 weeks of PR. **Results:** The 6 MWT and MRC rating scale were statistically significant after 4 weeks of PR with p value of 0.01 and 0.02 respectively. The FEV₁ and BMI were not statistically significant after 4 weeks of PR with p value of 0.47 and 0.15 respectively. The change in percentage of mortality was also not statistically significant after 4 weeks of PR with p value of 0.16. **Discussion & Conclusion:** It is concluded that only 6 MWT and MRC rating scale showed significant change and it is also a well predictor of survival and hence these two variables should be considered for measuring change in mortality after PR.

KEY WORDS: PULMONARY REHABILITATION; BODE INDEX; 6 MWT; MRC GRADING; MORTALITY IN COPD.

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BACKGROUND

COPD includes chronic bronchitis and emphysema, is a progressive disease characterized by chronic airflow limitation/ obstruction that is either irreversible or partially reversible. It is generally very difficult to separate out chronic bronchitis and emphysema; hence it is clubbed together as COPD.¹⁻⁴ Epidemiological assessment, the rounded-off median prevalence rates were assessed as 5 percent for male and 2.7 percent for female subjects of over 30 years of age in India.⁵ As the disease progresses, some patients develop systemic manifestations, including exercise limitation^{6,7}, peripheral muscle dysfunction⁸⁻⁹, pulmonary hypertension¹⁰, malnutrition^{11,12} and recurrent exacerbations leading to hospitalizations.¹³ Pulmonary Rehabilitation (PR) has been found effective in

patient with COPD, which has highest evidence. The body mass index (BMI) (B), degree of obstruction (O), dyspnoea (D) and exercise capacity (E), or BODE index¹⁴ are also independent predictors of survival in COPD^{15,16}, but BODE index is a well predictor of percentage of mortality more than individual components.¹⁷ The objective of this study is to measure change in percentage of mortality after 4 weeks of pulmonary rehabilitation using BODE index in patients with COPD.

MATERIAL AND METHODS

Study Subject: The inclusion criteria was, those who had prior diagnosis of COPD were included, and those who had any secondary complication related to heart condition or even orthopedic condition which limits them to undergo rehabilitation were excluded.

Variables recorded

Patient's history was studied thoroughly for exclusion criteria, and variables like, age, height, pulmonary function test for FEV1, MRC grading for Dyspnea, 6 minute walk test for exercise capacity were taken for consideration. After measuring all the above variables BODE scores were calculated and corresponding percentage of mortality was also calculated using QxMD software, this calculation is based on the study published by B R Celli et al. in New England Journal of Medicine in 2004 stating The Body-Mass Index, Airflow Obstruction, Dyspnea, and Exercise Capacity Index in Chronic Obstructive Pulmonary Disease.

Pulmonary Rehabilitation

PR program was individualized. PR program was multidisciplinary, out-patient program consisting of a supervised training under the trained physiotherapist thrice a week (45 minutes to 1 hour) for four weeks. After the completion of each session patients had undergone supervised breathing exercises which included relaxed diaphragmatic and pursed lip breathing exercises. The exercises consisted of aerobic exercises (treadmill, cycling or stepping up and down), strength exercises focusing mainly on larger group of muscles including latissimus dorsi, pectorals, quadriceps and hamstrings. Some accessory muscle exercises were also given like rhomboids, hip abductors and calf raises which helps in posture. Supplemental oxygen was also given for all the patients with COPD with 2 liters per minute to maintain saturation above 95% and to improve exercise tolerance.

Analysis of variables

The pre and post change in variables for all the components of BODE index were measured. This change in all components was then correlated with previously measured variables. Paired t test was used to calculate p value, and $p < 0.05$ is considered statistically significant (95% confidence interval).

RESULTS

Study Population:

Total of 15 patients (n=15), including 4 females and 11 males were included in this study. The variables and points were calculated using

6 MWT, MRC grading, BMI and FEV1. BODE quartile were calculated using following tables;

Characteristics of patient	Data
Total Subjects	n=15
Male	n=11
Female	n=4
Age	65.2 ± 5.96*
FEV1#	44.24 ± 19.87*
Weight	70.47 ± 11.70*
Height	167.05 ± 4.96*
BMI	25.34 ± 3.68*
# indicates percentage	
* indicated standard deviation (SD)	

Table 1. Characteristics of Patients population
Characteristics of patients after calculating BODE score (0 to 10 scoring format), using QxMD software and then each patient were grouped as per quartiles given in table 2.

Variables	Quartile 1	Quartile 2	Quartile 3	Quartile 4
FEV1*	≥65	50-64	36-49	≤35
6 MWT (in Metres)	≥350	250-349	150-249	≤149
MRC	0-1	2	3	4
BMI (Kg/M2)	>21	<21		
* indicates all values is in percentage				

Table 2. Variables and point values used for the computation of BMI, Degree of air flow obstruction, Dyspnea and Exercise capacity

Table. 3	BODE Quartiles			
	Q1	Q2	Q3	Q4
Number of patients	3	3	4	5

Table. 3 BODE Quartiles

The above division of patients indicates, the majority of subjects were either in Quartile 3 or 4, which indicates 70% to 80% of mortality rate.

Changes in Variables:

EXERCISE CAPACITY (6MWT)

The exercise capacity is well determined by 6 MWT which is valid and reliable method. The average distance walked before PR was 322.66 metres (± 107.76) and after 4 weeks of PR distance walked was 370.4 metres (± 145.39). There was significant improvement of 47.73 metres.

6 MWT	Recorder distance	Standard Deviation	P value
Pre	322.66	107.76	P= 0.01 (p<0.05) Significant
Post	370.4	145.39	

Table 4. Change in 6 MWT

DYSPNEA

Medical Research Council grading was used to determine dyspnea. In MRC grading, before PR the score was 2.86 units (± 0.63) and after 4 weeks of PR score was 2.2 (± 1.08). There was significant reduction in dyspnea as compared to variables recorded before PR.

MRC	Recorder Units	Standard Deviation	P value
Pre	2.86	0.63	P= 0.02 (p<0.05) Significant
Post	2.2	1.08	

Table 5. Change in MRC grading

BODY MASS INDEX

BMI was calculated using height and weight. The BMI, before PR the score was 25.32 Kgs/m² (± 4.98) and after 4 weeks of PR the score was 25.71 Kgs/m² (± 4.37). There was not significant change in BMI statistically.

BMI	Recorder Units (Kgs/m ²)	Standard Deviation	P value
Pre	25.32	4.98	P= 0.15 (p>0.05) not-significant
Post	25.71	4.37	

Table 6. Change in BMI

DEGREE OF OBSTRUCTION

The degree of obstruction is best measured by FEV₁. The FEV₁, before PR the score was 43.93% (± 19.56) and after 4 weeks of PR it changed to 44.45% (± 19.54). The change in FEV₁ was 0.52%, which indicates there was no significant change in degree of obstruction.

FEV ₁	Recorder Units (Percentage of)	Standard Deviation	P value
Pre	43.93	19.56	P= 0.47 (p>0.05) not-significant
Post	44.45	19.54	

Table 7. Change in FEV₁

MORTALITY USING BODE INDEX

The mortality was calculated using QxMD software, which is based on study published by B R Celli et al.

Percentage of Mortality	Recorder Units (Percentage of)	Standard Deviation	Change in Percentage of	P value
Pre	55%	24.09%	1.43%	P=0.16(p>0.05) not-significant
Post	53.57%	22.73%		

Table 8. Change in Percentage of Mortality

The change in average percentage of mortality was only 1.43 %, and is not statistically significant after 4 weeks of PR. Although the values were not statistically significant, but there was definitive individual improvement seen in all subjects. The individual components analysis given in tables 4 to 7, as per these tables only 6 MWT and MRC rating scale were statistically significant which showed significant improvement after 4 weeks of PR.

DISCUSSION

This is an experimental non randomized study (pre and post design), patients with COPD underwent PR program for 4 weeks, and there are several important finding. The effects of PR on BODE index was studied pre and post PR, out of which only two components that is exercise capacity and dyspnea were found to be significant. The BMI and degree of obstruction were found to be non significant when analysed using statistics. As mentioned, BODE index is a well predictor of survival in COPD¹⁷, but after PR

the survival rate remained same as compared to other predictor of survival like 6MWD¹⁸ and MRC scale¹⁹ which had significance level.

PR has minimum effect on lung function²⁰, it is beneficial in other components like dyspnea^{21,22} and exercise capacity²³⁻²⁵. The two variables from BODE had significant change after PR, so BODE can be used to measure effectiveness in Patients with COPD after PR. 6 MWD is considered significant if the changes are 50 metres²⁶, in this study the change in 6 MWD was 47.73 metres which is very close to 50 metres, indicates significant change. Although the BODE index is a good predictor of mortality, but only two of its component (6MWD and MRC) found to be significant after 4 weeks of PR, other components (FEV₁ and BMI) were not statistically significant and hence to measure survival rate in COPD after PR individual components like 6 MWD and MRC grading needs to be consider.

CONCLUSION

There was significant improvement seen in the individual components of BODE index that is 6 MWT and MRC rating scale, but degree of obstruction and BMI did not had any significant change, as a result BODE index did not showed significant change, and hence there was no significant change in percentage on mortality after PR. The effectiveness of PR is validated in number of studies, but effectiveness is found only in perception of breathlessness and exercise capacity out of all the four components of BODE.

LIMITATIONS

The limitation of this study is sample size. I suggest that same non randomized experimental study needs to be evaluated with larger samples for better evidence.

ABBREVIATIONS

6 MWT- Six minute walk test, **MRC-** Medical Research Council, **FEV1-** forced expiratory volume in one second, **BMI-** Body mass index

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CONFLICT OF INTEREST

There are no known conflicts of interest between authors related to this study.

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