Original Research Article

Correlation of Functional Capacity and Disease Severity Indices with Quality of Life in Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) reduces exercise capacity which in turn restricts patient's ability to carry out daily activities and affects Quality Of Life (QOL). Six minute walk test is a simple measure to assess functional capacity which can be an indirect measure of quality of life. There is a paucity of literature on correlation of six minute walked distance (6MWD) with quality of life in Indian scenario hence need for present study.

Methodology: This was a tertiary care hospital based Observational study with an aim to find correlation between functional capacity and QOL in patients with COPD. Spirometry-confirmed COPD GOLD category I-IV patients of 5 years or more disease duration, in the age group of 50-70 years, either gender were included. The study factors were six minute walked distance and QOL questionnaires (SGRQ-C, SF 12, and CAT). The data was analysed using Pearson's correlation.

Results: A total of 30 subjects were enrolled and moderate correlation was observed between 6MWD and QoL scores SF-12 and CAT, (r=0.442 and -0.410) respectively, with a p value < 0.05. The disease severity as assessed by mMRC dyspnoea scale and BODE score showed moderate correlation with 6MWD (r=-0.559 and -0.537respectively, with a p value <0.002).

Conclusion: A moderate correlation exists between functional capacity and QOL in patients with varying degree of COPD. The 6 MWT may be good test to reflect the health-related QOL in COPD patients.

Key Words: Functional capacity, Six minute walked distance, Quality of Life, Chronic Obstructive Pulmonary Disease

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a commonly prevalent disease with a considerable burden of disease in the population. [1] WHO estimates around 65 million people having moderate to severe COPD. [2] There are 30 million COPD patients in India, [3] with a significant and growing percentage of COPD mortality, which is estimated to be amongst the highest in the world. [4] It is a highly incapacitating health problem, which not only affects the physical functioning, but also leisure and professional activities and emotional and sexual relationships. [5] It is associated with symptoms of dyspnea and fatigue which causes restrictions on patient's exercise tolerance leading to major impact on their ability to carry out daily activity which in turn reduces Quality of life (QoL). [6]

Airflow obstruction in COPD is largely irreversible and the disease does not follow the classic GOLD severity grades based on the Spirometry (assessed by FEV1), as postulated by the current

guidelines, [1] and the interventions for managing the disease are primarily aimed at improving patients' health related QOL. [7] The comprehensive assessment of the effects of COPD requires a battery of instruments that not only tap the disease effect (disease-specific questionnaires) but also the overall effect of the disease on everyday functioning and emotional well-being (generic questionnaires). [8]

There are a variety of functional capacity tests available and no consensus in the literature about which of these tests has better correlation with health-related quality of life. The six minute walk test (6MWT) is a simple practical test that requires a 100-ft hallway, no exercise equipment or trained technicians and measures the 6 minute walked distance which has been shown to correlate with both disease specific and generic health-related quality of life instruments in other disease states in the literature, but very few studies have been done to correlate functional capacity with quality of life in patients with COPD in India, hence the need for present research.

MATERIALS AND METHODOLOGY

This Observational study was carried out at a Tertiary care Academic Institute in Central India, with a primary objective to correlate functional capacity test score as measured by six minute walked distance of Chronic Obstructive Pulmonary disease subjects and their health status evaluated by health related quality of life (HRQol) questionnaires namely, St. George's Respiratory Questionnaire-C (SGRQ-C), Short-form-12 (SF-12) and COPD Assessment Test (CAT). The secondary objective was to correlate disease severity as evaluated by (GOLD staging, mMRC dyspnea scale and BODE index) with six minute walked distance and QoL scores. **Inclusion Criteria:** The subjects were clinically stable cases of COPD attending Pulmonary Medicine OPD between the age group of 50-70 years of either gender, with duration of symptoms for atleast 5 years, irrespective of smoking status and

spirometry confirmed COPD Gold category I-IV, were enrolled. **Exclusion criteria:** COPD patients with acute or recent history of exacerbation or on home Oxygen therapy with co-morbid conditions namely Asthma, Tuberculosis, Diagnosed Cancer, Uncontrolled Hypertension, Uncontrolled Diabetes Mellitus, Cardio-vascular, Neurological and/or Osteoarticular disease with functional limitations precluding testing, psychiatric illness, cognitive limitations, lack of motivation and patients not willing to participate. Study factors: Patient's detailed history, baseline demographic data and disease severity evaluation were recorded in a pre-designed proforma. Six minute walk test was performed on a 30 meter corridor marked at every 3 meters as per recommendations of ATS. Individuals walked back and forth along the corridor as many times as possible in six minutes. [9] After the six minute walk test was performed by the patients, Quality of life questionnaires namely SGRQ-C, SF-12 and CAT were administered in their local dialect and scores were recorded.
Statistical analysis was done using Epi Info Software Version 6. Pearson's Correlation was used at a level of significance (p=< 0.05).

RESULTS

A total of 30 patients were enrolled in the study, of them 26 were males and 4 were females with mean age of 61.19± 6.96 and 57.75 ± 11.14 respectively (Range 45-70 years). The mean Body mass Index (BMI) of the patients was 19.25 ± 3.92 with a range of 12.57 to 26.1. The mean duration of disease as ascertained by the symptoms was 11.66 ± 5.58 with a range of 5 to 16 years. Out of 30 patients, 24(80%) were smokers with 38±15.43 mean pack-years of smoking, 4(13.33%) females had biomass smoke exposure and 2 (6.66%) patients were ex- smokers. On evaluation of disease severity using GOLD staging, 14 (46.66%) patients were in grade 2 and 13 (43.33%) were in grade 3 and rest were in grade 1 (6.66%) and grade 4 (3.33%). On

assessment of dyspnoea using mMRC scale, 13(43.33%) patients belonged to grade 3, 8(26.66%) patients to grade 1, rest were 4(13.33%) in grade 2, 3(10%) in grade 0, and 2(6.66%) in grade 4. The mean BODE index score signifying the severity of disease and overall survival rate was 5.26 ± 2.54.

In the present study, six minute walked distance showed statistically significant moderate correlation with the Physical Health component score of SF-12 and CAT score (r=0.442, p value=0.015 and r=0.410, p value=0.025 respectively). However, there was no association found between six minute walked distance and all the domains of SGRQ-C. There was no correlation found between GOLD stage and scores of various quality of life questionnaires. The mMRC dyspnea grade was found to be correlated with Physical Health component score of SF-12(r= -0.526, p value= 0.03). The study revealed statistical significant moderate positive correlation of BODE score with Activity score and Total score of SGRQ-C (0.521 p=0.003 and 0.439, p=0.015 respectively). Also, a moderate negative correlation was observed between Mental Health component score of SF-12 and BODE score. (p value=0.026)

The correlation between six minute walked distance and disease severity indices with the three quality of life questionnaires is shown in table 1 and is represented by r.

There was a statistically significant moderate negative correlation found between six minute walked distance with mMRC scale and BODE score. (r= -0.559, p value =0.001 and r= -0.537, p value = 0.002 respectively) The correlation of six minute walked distance with disease severity indices is shown in table 2.

In the present study, the mean Qol scores for SGRQ-C was 23.99±7.89, the Physical Health Component score of SF-12 was 33.98±8.64, the Mental Health Component score of SF-12 was 37.97±11.50

and the mean CAT was 17.83±6.89, as observed across the varying disease severity states. The worst score of SGRQ-C was observed for Grade 4 GOLD stage patients. Poor Physical Health Component scores of SF-12 were observed with advancing disease severity stages except GOLD stage 4 with only one patient. The Mental Health component scores did not show similar trend with advancing grades of disease severity. The mean CAT score was 17.83±6.89 which implies that most of the patients had a moderately affected health status according to CAT scoring. [10]

Grade 3 dyspnea patients had the worst quality of life scores as recorded by SGRQ-C. The Physical Health component of SF-12 showed the least QoL in grade 4 dyspnea patients. However, the mental health component did not show the same trend. The highest Mental Health component score of SF-12 was observed in grade 4 dyspnea patient while the least score was observed in grade 2 dyspnea patients. As the disease severity and dyspnea levels increase, the patients gain mastery over their symptoms with acceptance of their disease state, thus better mental QoL scores despite worsening dyspnea. The worst CAT score was observed in grade 2 dyspnea patients with a mean of 20.0±2.94 and the scores suggest a moderately affected health status in our patient population.

The BODE index which is a predictor of mortality in patients with COPD was chosen as one of the disease severity index. The patients with worst quality of life scores on SGRQ-C, SF-12 (PHS), SF-12 (MHS) and CAT having mean scores of 27.25±7.83, 27.34±7.63, 32.68±15.06 and 22.0±4.58 respectively, had only 18% survival rate in the next four years. (Least BODE scores of 7-10 points)

The mean scores of all the quality of life questionnaires viz; SGRQ-C, SF-12 and CAT with various disease severity indices i.e. GOLD staging, mMRC dyspnea scale, and BODE index are shown in Table 3.

Table 1: Shows correlation of six minute walked distance and various parameters with QOL scores.

Correlations of Six minute walk distance and disease severity parameters with SGRQ-C Score, SF-12, CAT score

		SGRQ-C				SF-12		CAT Score
		Symptom Score (in %)	Activity Score (in %)	Impact Score (in %)	Total Score (in %)	Physical Health Score	Mental Health Score	
Six Minute Walk Distance	r	-0.165	-0.164	-0.138	-0.192	0.442*	0.157	0.410*
	p-value	0.384	0.387	0.468	0.309	0.015	0.407	0.025
GOLD	r	0.255	0.268	0.023	0.243	-0.266	-0.049	0.038
	p-value	0.175	0.152	0.903	0.196	0.155	0.795	0.842
MMRC	r	0.230	0.274	0.315	0.338	-0.526**	-0.026	0.336
	p-value	0.221	0.142	0.090	0.067	0.003	0.893	0.070
BODE Score	r	0.232	0.521**	0.149	0.439*	-0.277	-0.407*	0.290
	p-value	0.217	0.003	0.432	0.015	0.138	0.026	0.120

r=Pearson's correlation, p value=Statistical Significance.

Table 2: Shows the correlation of six minute walked distance 6MWD with various disease severity indices.

Parameters	Correlational coefficient/ Statistical Significance	GOLD Stage	mMRC Dyspnea Grade	BODE Score
Six Minute walked distance	r	-0.086	-0.559	-0.537
	p value	0.650	0.001	0.002

r=Pearson's correlation, p value=Statistical Significance.

Table 3: Shows Qol scores of COPD patients with various disease severity indices.

Disease Severity Indices	Number of patients (N)	SGRQ-C Score (X ± SD)	SF-12 Physical Health Score (X ± SD)	SF-12 Mental Health Score (X ± SD)	CAT Score (X ± SD)
GOLD Stage 1	02	17.52 ±3.30	39.7±1.41	19.3±8.62	20.0±4.24
GOLD Stage 2	14	24.61±9.33	36.22±8.50	41.72±8.26	17.21±8.65
GOLD Stage 3	13	22.75±3.32	41.72±8.26	39.39±8.33	17.76±5.35
GOLD Stage 4	01	44.49	42.8	39	17
mMRC Gr 0	03	22.54±5.42	42.2±7.52	43.83±2.63	15.66±3.51
mMRC Gr 1	08	19.79±4.43	37.85±9.25	39.13±7.68	13.75±4.55
mMRC Gr 2	04	21.04 ±4.84	33.82±8.29	27.5±10.75	20.0±2.94
mMRC Gr 3	13	27.86±9.83	31.37±6.97	37.65±13.89	19.92±8.89
mMRC Gr 4	02	23.78±1.24	23.5±5.65	47.6±2.82	19.5±2.12
Bode index (0-2 points)	03	20.73±8.18	42.1±9.87	36.3±4.10	13.0±7.21
Bode index (3-4 points)	11	24.31±10.29	37.26±8.32	39.36±12.46	18.09±8.90
Bode index (5-6 points)	09	22.17±3.65	32.44±5.94	40.95±8.53	15.88±4.01
Bode index (7-10 points)	07	27.25±7.83	27.34±7.63	32.68±15.06	22.0±4.58

X=Mean; SD= Standard Deviation

DISCUSSION

In recent study, correlation analysis was used in order to determine the relationship between 6MWD and various scales of QoL (generic and disease specific) in patients with COPD of varying disease severity. 6MWT is a sub-maximal exercise test used to assess the functional status of patients with COPD and it was chosen as it is reliable, inexpensive, safe and easy to apply. It evaluates global and integrated response of all systems included during exercise like pulmonary, cardiovascular, musculoskeletal and neuromuscular.

Health-related QOL assessment is performed using either generic or disease-specific questionnaire, [11] and is more specific as it includes dimensions such as general health status, mental, psychological and sleep status, ability to proceed with daily life and social activities [1] and is frequently used as an outcome measure and a major goal of patient care. [8]

St. George's Respiratory Questionnaire is an useful instruments to quantify the patient's perception of the general effects of COPD on their daily life and well-being. [6,11,12] SGRQ-C has been developed using COPD data only, so is valid for this disease. It has a total score and three component score for: Symptoms, Activity and Impact; each score ranges from 0 (no impairment) to 100 (worst possible). SGRQ-C is the one of the most widely used questionnaire for assessing HRQoL in COPD patients and is well known for its reliability, repeatability and sensitivity.

The Medical Outcome Study short SF-12 questionnaire has been used to assess self -reported domain of health status. It

contains major two components i.e. physical health and mental health to assess quality of life. The score ranges from 0-100 with higher score representing the better health status. [13]

CAT (COPD Assessment Test) is developed as a short, validated COPD specific questionnaire for assessing the impact of COPD on health status. It provides a reliable measure of overall COPD severity from the patient's perspective, independent of the language. It has been suggested that CAT is likely to offer relevant alternatives to complex tools such as SGRQ. [14] CAT, a simple short questionnaire, is also used in this present study for assessing QOL in patients with COPD.

6MWD showed statistically significant moderate positive correlation with the Physical Health component of score SF-12 (r = 0.442, p = 0.015). Some authors believe that the patients with better walk scores have less restrictions in their activities and experience less impact of the disease on their daily lives. [15] It also showed a moderately negative correlation with CAT score which was statistically significant p = 0.025. However, there was no correlation found between 6MWD and all domains of SGRQ-C. Our results are quite consistent with the study of Wijkstra et al, "Relation of Lung Function, maximal inspiratory pressure, dyspnoea and Quality of Life" in which they studied 40 COPD patients whose Quality of Life was assessed by CRQ. They also found that all three dimensions of Chronic Respiratory Questionnaire were neither correlated with 6 minute walk distance nor with the maximal work load of the bicycle ergometer test. [16]

In a Systemic review and Meta-analysis by IOANNA et al in 2011, the 6MWD showed weak to moderate correlation with various health status measurement questionnaires in different studies and one study reported no association between health status and exercise capacity. [16]

No correlation was found between 6MWD and SGRQ-C, could be explained by the fact we included patient with wide range of ventilator impairements.FEV_1-22% to 82%, FVC- 43% to 92%. Furthermore, Morgan and co-workers showed that attitudes and beliefs were of greater importance in predicting everyday exercise tolerance. Therefore, the patients' perception of their illness might have a more substantial effect on exercise capacity than fatigue, emotion, mastery and disease severity. [17]

We found a moderate correlation between 6MWD and Physical Health component score of SF-12 (r = 0.442, p= 0.015). Our results are quite consistent with study of Hamilton and Haennel in which they correlate SF-36 with 6MWD.They also found a moderate positive correlation with the scale of physical functioning. [18]

We found no correlation of 6MWD with mental health component of SF-12 and the results are quite consistent with the study of Pereira et al, who conducted a study with COPD patients in 2009 and found no correlation between 6MWT and SF-36(Physical Health Scores and Mental Health Scores). [19]

Various authors state that the reduced 6MWD seem to be one of the factors that influence the QoL of patients with COPD, although the intensity of relationship is not yet clear. They also point out that a better performance in 6MWT could mean less difficulty in performing daily physical activities and, therefore smaller disease impact. [20]

CAT scores measure clinical, symptomatic state and disease specific QoL in patients with COPD. It comprises of 8 items assessing cough, phlegm, chest tightness, and breathlessness going uphill/stairs, activity limitations at home, confidence leaving home, sleep and energy. In our study, 6MWD showed a negative moderate correlation with CAT score (r= -0.410, p= 0.025). Dyspnoea is a major symptom in patients with COPD and various studies states that, perceived

dyspnoea have a greater impact on HRQoL. The physiological basis can be explained on the fact that COPD patients show deterioration of pulmonary function caused by hyperinflation, with a consequent increase in FRC and decrease in FVC, factors that are responsible for the development of dyspnea, which in turn has a major negative impact on exercise capacity. Thus, it can be extrapolated that if the COPD patient has a low score on CAT (better QoL), he would have a better functional capacity (increased 6MWD).

In the present study, we found a moderate correlation of BODE score with Activity score of SGRQ-C(r =0.521, p =0.003) and total score of SGRQ-C(r = 0.439, p = 0.026). A moderate negative correlation of BODE score was found with Mental Health component score of SF-12(r = -0.407, p = 0.026). These results are quite consistent with that of Zenia [21] in which they found moderate to significant correlation between the BODE index scores and all the SGRQ domains. In addition, they stated that the BODE index is a predictor of mortality in patients with COPD, and was found to be associated with QoL in patients with greater disease severity. ($FEV_1 < 50\%$).

There was a statistically significant negative moderate correlation between dyspnea rating (mMRC) with Physical Health Component score of SF-12 (r= -0.526, p= 0.003). This finding can be attributed to the problem whereby dyspnea exerts a major effect on patient's ability to perform various daily activities, thus it interferes with patients HRQoL. The results are quite consistent with the explanation given by Siafakas [22] that the patients with COPD frequently decrease their activities in order to avoid the unpleasant sensation of breathlessness which in turn affects their QoL. Also, dyspnea and health reported quality of life scores are the patient's perspective towards his/her health status and must be considered as the most important aspect of COPD. [23]

We also found a negative moderate relationship between mMRC dyspnea scale and 6MWD (r = -0.559, p = 0.001) which was statistically significant. Therefore, it can be implied from the above values that clinical rating of dyspnea may influence exercise capacity which in turn may affect QoL in patients with COPD. Our findings are quite consistent with previous studies which stated that the severity of dyspnea was a significant predictor for HRQoL. [24] Similar conclusions were drawn from various other studies. [25-27]

Thus, it can be implied from this present research that dyspnea is the most prominent symptom of the COPD patients and encountering dyspnea and its management may improve QoL. Also, dyspnea level influence QoL to a greater extent than physiologic measurements do in patients with COPD. Thus, it is imperative that clinicians treat not only the medical illness itself but also the concomitant physical symptom in order to optimize QoL of patients with COPD.

Thus, it is recommended that a shift of focus is needed from the pathophysiology of disease to assessment of relief of symptoms which may provide meaningful benefit for COPD patient in terms of enhancement of QoL.

CONCLUSION

This study showed that 6MWD was correlated with generic questionnaire SF-12, COPD Assessment Test (CAT) questionnaire and mMRC dyspnea scale. Perceived dyspnea as measured by mMRC Scale and BODE Index has a better correlation with QoLQuestionnaires (SGRQ-C and SF-12).

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