



Original Article

Correlation of 5-Repetition Sit-to-Stand Test with Borg Dyspnoea Scale and GOLD Spirometric Classification in Patients with COPD

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a major global health problem associated with significant morbidity and mortality. Functional assessments such as the “5-repetition sit-to-stand test (5STS)” may serve as accessible tools to estimate disease severity, especially in resource-limited settings. This study assesses the relationship between the 5STS and the Borg dyspnoea scale, along with the GOLD spirometric classification, in Indian patients diagnosed with COPD.

Methods: In this cross-sectional study, 71 stable COPD patients from a tertiary care center in Mumbai were evaluated. Participants underwent spirometry, 5STS, and dyspnoea assessment using the modified Borg scale. Patients were also classified according to the GOLD spirometric classification. Statistical correlations and comparisons were performed using Spearman’s correlation, ANOVA, and post-hoc Tukey tests.

Results: Participants had a mean age of 65.7 ± 8.3 years, with males comprising 80.3% of the study population. The mean 5STS completion time was 14.98 ± 3.64 seconds. The 5STS demonstrated a strong positive correlation with the Borg dyspnoea scale ($r = 0.857$, $p < 0.001$). ANOVA revealed significant differences in 5STS times across GOLD spirometric categories ($p < 0.001$). Cronbach’s alpha demonstrated high reliability of 5STS in reflecting symptom severity (0.829).

Conclusion: The 5STS test shows a strong correlation with established COPD severity indices and is a reliable, inexpensive, and rapid assessment tool. It holds potential as a surrogate marker for disease severity in resource-constrained settings.

Keywords: Chronic obstructive pulmonary disease, 5-Repetition sit-to-stand test, Borg dyspnoea scale, GOLD spirometric classification, Functional exercise capacity.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a long-term respiratory disorder marked by continuous airflow obstruction and an increased inflammatory reaction to harmful gases and particulate matter.¹ It is anticipated to rank as the third most common cause of death worldwide.² In India, COPD is a growing epidemic, driven by smoking, biomass fuel exposure, and increasing life expectancy.³ Traditional assessment of COPD severity relies on spirometry and multidimensional indices such as the combined COPD assessment incorporating symptoms, spirometry, and exacerbation history.¹ However, the feasibility of such assessments in resource-limited settings remains challenging.

Functional performance tests such as the 5-repetition sit-to-stand test (5STS) offer a simple, quick, and equipment-light alternative. The 5STS assesses lower limb strength and functional status and has shown promise in elderly and COPD populations internationally.^{4,5} Its relationship with conventional COPD severity indices in Indian patients has not yet been investigated.

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This research seeks to evaluate the correlation between the 5STS, Modified Borg Dyspnoea Scale, and GOLD spirometric classification in COPD patients.

METHODS

An observational cross-sectional study was carried out at Jaslok Hospital and Research Centre, Mumbai.

Participants

About 71 consenting stable COPD patients diagnosed as per GOLD guidelines¹ were recruited. Inclusion criteria were age >18 years, clinical diagnosis established based on spirometric criteria, with a “post-bronchodilator FEV₁/FVC ratio” less than 0.70, and no exacerbations in the preceding four weeks. Exclusion criteria included recent lower limb surgery, unstable cardiac disease, neurological limitations, and severe musculoskeletal conditions.

Data Collection

Demographic data, smoking history, and comorbidities were recorded. Spirometry was performed using ATS-compliant equipment.⁶ The “modified Borg scale” was employed to evaluate dyspnoea.⁷ The 5STS involved timing participants as they stood and sat five times without arm support from a standardized chair. Patients were classified by GOLD spirometric stages one to four.

Table 1: Distribution of study population based on modified Borg dyspnea scale

Modified Borg dyspnea scale	No. of patients	Proportion
0	1	1.41
1	4	5.63
2	7	9.86
3	9	12.68
4	13	18.31
5	16	22.54
6	7	9.86
7	12	16.90
8	0	0
9	2	2.82
10	0	0

Table 3(a): Reliability Statistics for 5STS Time and Borg dyspnoea scale

Statistic	Value
Cronbach's Alpha	0.829
Number of Items	2

Table 3 (b): Item descriptive statistics

Variable	Mean	Standard deviation
Borg Dyspnoea Scale	4.52	1.97
5STS Time (seconds)	14.98	3.67

GOLD Spirometry classification of study population

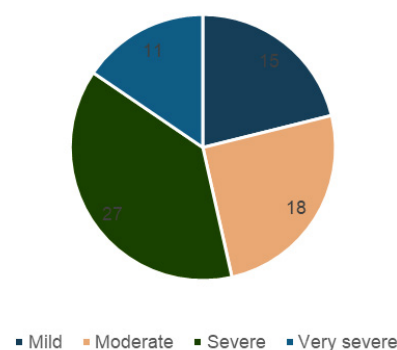


Figure 1: Distribution of GOLD spirometry classes in study population

RESULTS

Among the participants, 57 were male (80.3%) and 14 were female (19.7%), with a mean age of 65.7 ± 8.3 years. The mean COPD duration was 9.4 ± 4.8 years. 48 out of 71 patients (67.6%) gave a positive history of smoking with a median smoking index of 15 pack years. Inhalation of biomass fuels was an associated risk factor in 7 (9.9%) cases, while for 16 (22.5%) participants, long-term exposure to dust, fumes, and chemicals in the workplace was the risk factor for COPD.

The mean 5STS completion time was 14.98 ± 3.64 seconds. Table 1 shows the distribution of the study population based on the modified Borg dyspnea scale. The 5STS time showed a strong correlation with the Borg dyspnoea scale ($r = 0.857$, $p < 0.001$) (Table 2). Additionally, reliability analysis using “Cronbach’s alpha” demonstrated a value of 0.829, indicating good internal consistency between the 5STS time and the Borg dyspnoea scale (Table 3). This reinforces the consistency

Table 2: Correlation of Borg dyspnea scale with 5STS

			Borgs dyspnea scale	5STS time taken (sec)
Spearman's rho	Borgs dyspnea scale	Correlation coefficient	1.000	.857(**)
		Sig. (2-tailed)	.	<0.001
	5STS time taken (sec)	Correlation coefficient	.857(**)	1.000
		Sig. (2-tailed)	<0.001	.

** Correlation is significant at the 0.01 level (2-tailed).

or “reliability” of the 5STS as a practical tool for assessing “COPD” severity.

The baseline distribution of GOLD spirometry classification of the study population is mentioned in Figure 1. 5 STS was also compared with the GOLD spirometric Classification using One-Way ANOVA since the data passed the ‘Normality test’. The test showed that the time taken to perform the 5STS increased as the disease progressed from mild to a very severe stage (Tables 4, and 5).

“Post hoc evaluation” was performed through the application of the “Tukey HSD test” when the p-value of One-Way ANOVA was statistically significant. It showed that the average time taken to perform the 5 STS changed significantly when the one group was compared with the other 3 groups. For example, the time taken for the 5 STS in the mild group was significantly lower than the time taken by the moderate group and so on and so forth (Table 6).

DISCUSSION

The 5STS test assesses lower limb muscle strength and simulates a fundamental activity involved in daily life. While

several functional and composite tools such as the BODE index, six-minute walk test, maximal oxygen consumption, hand grip strength, “COPD assessment test (CAT)”, “incremental shuttle walk test”, age dyspnoea obstruction (ADO) index, and “St. George’s respiratory questionnaire” are commonly employed in COPD evaluation, many of these require specialized equipment, trained personnel, or rely heavily on patient-reported outcomes. In contrast, the 5STS is a simple, quick, and largely operator-independent assessment requiring minimal equipment. This study aimed to determine whether the 5STS could reliably reflect patients’ symptomatic status, as evaluated by the modified Borg dyspnoea scale, alongside objective disease severity assessed via GOLD spirometric classification.

Our findings demonstrated a strong positive correlation between 5STS performance and dyspnoea scores. Additionally, the time taken to complete the 5STS increased significantly with advancing disease severity according to GOLD spirometric stages. This study demonstrates a strong correlation between 5STS and established indices of COPD severity. The findings align with prior work by Bohannon *et al.*,

Table 4: 5STS time taken (seconds) compared with GOLD spirometric classification.

GOLD spirometric classification	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1) Mild	15	10.227	.9208	.2377	9.717	10.737	8.9	12.2
2) Moderate	18	13.783	1.1004	.2594	13.236	14.331	12.4	16.0
3) Severe	27	16.537	2.5189	.4848	15.541	17.533	10.0	21.4
4) Very Severe	11	19.582	2.8530	.8602	17.665	21.498	16.0	25.1
Total	71	14.977	3.6682	.4353	14.109	15.846	8.9	25.1

Table 5: Anova 5STS vs GOLD spirometric classification

	Sum of Squares	Degree of freedom	Mean Square	F	Sig.
Between Groups	663.090	3	221.030	53.114	<0.001
Within Groups	278.814	67	4.161		
Total	941.904	70			

Table 6: Post-hoc multiple comparisons of 5STS Time (seconds) across groups using Tukey’s honest significant difference (HSD)

(I) GOLD spirometry classification	(J) GOLD spirometry classification	Mean difference (I-J)	Std. error	Significance	Interval	
					Lower bound	Upper bound
1) Mild	2) Moderate	-3.5567(*)	.7132	<0.001	-5.436	-1.678
	3) Severe	-6.3104(*)	.6569	<0.001	-8.041	-4.580
	4) Very Severe	-9.3552(*)	.8098	<0.001	-11.489	-7.222
2) Moderate	3) Severe	-2.7537(*)	.6207	<0.001	-4.389	-1.118
	4) Very Severe	-5.7985(*)	.7807	<0.001	-7.855	-3.742
3) Severe	4) Very Severe	-3.0448(*)	.7297	0.001	-4.967	-1.122

* The difference in means is statistically significant at the 0.05 level

Jones *et al.* and Ozalevli *et al.*, confirming 5STS as a reliable surrogate for exercise capacity and dyspnoea assessment ^{4,5,8}.

The 5STS test offers several distinct advantages as a functional assessment tool in patients with COPD. Foremost among these is its brevity, with the majority of participants completing the test within a minute, and the longest recorded time being 25.4 seconds. Unlike the six-minute walk test (6MWT) and incremental shuttle walk (ISW) test, which require multiple attempts with rest periods of approximately 30 minutes between trials, the 5STS imposes minimal cardiovascular strain on the patient.

Additionally, the test is highly practical, requiring only a standard chair and a stopwatch — resources that are readily accessible in both hospital and primary care settings. Its simplicity means that it can be conducted by healthcare providers with minimal training and requires limited physical space, making it suitable for both clinical and home-based environments.

However, the 5STS is less suitable for patients with severely impaired mobility or poor lower limb function, limiting its applicability in those with advanced disability. Nevertheless, it remains a valuable bedside tool for quickly gauging a patient's functional status and physical capacity in routine clinical practice.

The study's limitations include the lack of a healthy control for comparison, the lack of repeated or follow-up assessments to evaluate changes over time, and no parallel evaluation using the six-minute walk test (6MWT) to compare functional capacity outcomes. Upcoming research should prioritize prospective, multicentric, and longitudinal

studies to validate these findings and assess the prognostic significance of the 5STS in broader patient populations.

CONCLUSION

The 5STS test demonstrates a strong correlation with “modified Borg dyspnoea scale” and GOLD spirometric classification in Indian COPD patients. It is a reliable, cost-effective, and feasible functional assessment tool suitable for diverse clinical settings.

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