

Using CAT score as a marker of severity in patients with Acute Exacerbation of COPD

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Abstract:

Background&Method: The aim of this study is to evaluate the correlation between CAT score, mMRC score, Inflammatory markers and severity of COPD exacerbation was carried in Department of Respiratory Medicine, Lilavati Hospital and Research Centre, Mumbai. Study population and sample size was 75 patients (inpatients and outpatients) visiting Lilavati Hospital and Research Centre diagnosed with acute exacerbation in already proven cases of COPD on the basis of anthonisen criteria were enrolled in the study.

Patients attending Pulmonary medicine OPD / in-patients of Lilavati Hospital and Research centre diagnosed as AECOPD (Clinician based diagnosis), satisfying the inclusion and exclusion criteria were included in study after written informed consent. Number of COPD exacerbations in the last 1 year, on bases of history given by patient was noted. And according to that they were divided in frequent and non frequent exacerbators. With frequent exacerbators having two or more than two exacerbations in the previous year. Also Patient's FEV1 on the basis of the last available spirometry report was noted and patient was characterized as per the GOLD criteria of COPD severity.

Result: In our study 57 patients had two or more exacerbations in the previous year (frequent exacerbators) and 18 patients had less than 2 exacerbation in the previous year. It was found that CAT score was significantly higher in frequent exacerbators as compared to others. In frequent exacerbators CAT score mean was 30.35, and in non frequent exacerbators Mean CAT score was 25.89. Non-parametric correlation between pre-treatment values of various variables. CAT score and mMrc grades shows significant correlation. (p values <0.01). CRP and PCT levels also shows significant correlation. (p values <0.05).

Conclusion: The CAT score is associated with the changes of systemic inflammation following exacerbations, and it is as responsive to the treatments as other measures such as mMrc dyspnea scale and inflammatory biomarkers. The CAT scores can reflect the health status of COPD patients, and are potentially useful to assess the treatments response following COPD exacerbations. The CAT is particular useful for health settings where access to other advance diagnostics are limited. CAT score was significantly higher at exacerbation in patients with history of frequent exacerbations. The CAT is particular useful for health settings where access to other advance diagnostics are limited. CAT score was significantly higher at exacerbation in patients with history of frequent exacerbations. CAT score not only

includes dyspnea but also other components like cough, phlegm, chest tightness, limitation of daily activities, sleep quality and energy which makes it a better score for assessment of quality of life.

Keywords: CAT score, mMRC score, Inflammatory, severity & COPD.

Study Designed: Cross sectional observational study.

1. INTRODUCTION

“Chronic obstructive pulmonary disease (COPD) is a common preventable and treatable disease. It is characterized by persistent airflow limitation which is usually progressive and associated with an enhanced chronic inflammatory response in the airways and lung to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients.”[1]

Globally, COPD has emerged as the major cause of morbidity and mortality expected to become the 3rd most leading cause of death and the 5th leading cause of loss of ‘Disability Adjusted Life Years’ (DALYs) by 2020 as per projection of the Global Burden of Disease Study (GBDS).[2]

Exacerbation of COPD is defined as a sustained worsening of the patient’s condition, from the stable state and beyond normal day-to-day variations, that is acute in onset and necessitates a change in regular medication in a patient with underlying COPD.[3]

COPD exacerbations cause hospital admissions, morbidity and mortality, directly leading to the deterioration of health-related quality of life.[4] It is generally believed that exacerbations are important targets for treatment and prevention of disease progression of COPD.[5]

This generally includes an increase in one or more of the following symptoms- cough increases in frequency and severity, sputum production increases in volume and/or changes character, dyspnoea increases.

COPD exacerbations are very important in the course of the disease as are associated with significant mortality and morbidity including hospitalizations and economic losses with progressive increase in decline of lung function.

The causes of acute exacerbations of COPD (AECOPD) are multifactorial. Mostly, half of the AECOPD cases are attributed to respiratory infections (50%), but exacerbations are also associated with pollution, temperature changes, allergens (30%), and other co-morbidities (26%) such as heart failure and pulmonary thromboembolism.[6]

Clinicians routinely use various methods to assess the health status and response to treatment of COPD patients, but a simple and objective instrument to evaluate the treatments response following acute exacerbation of COPD is still lacking currently. The COPD Assessment Test (CAT) is a recently introduced, patient-completed instrument to assess and quantify health-related quality of life and symptom burden in patients of COPD.[7,8] It comprises 8 questions, each presented as a semantic 6-point (0–5) differential scale, providing a total score out of 40. Scores of 0–10, 11–20, 21–30, 31–40 represent mild, moderate, severe or very severe clinical impact, respectively [9] [annexure 1]. Evidence has shown its good internal consistency and test-retest reliability [8,10] and it is suitable for routine clinical use for both stable and exacerbating COPD.[11-14]

COPD exacerbations are usually accompanied with increased airway and systemic inflammation.[15,16] The dynamic changes of systemic inflammatory biomarkers following exacerbations can be used to evaluate the therapeutics efficacy.[17] Symptomatic

improvement and reduction in systemic inflammatory markers can be seen in seven days following a positive treatment.[15]

2. MATERIAL & METHOD

The study was carried in Department of Respiratory Medicine, Lilavati Hospital and Research Centre, ATertiary Health Centre in Bandra, Mumbai, Maharashtra from June 2014 - June 2015.

Study population and sample size was 75 patients (inpatients and outpatients) visiting Lilavati Hospital and Research Centre diagnosed with acute exacerbation in already proven cases of COPD on the basis of anthonisen criteria were enrolled in the study.

Patients attending Pulmonary medicine OPD / in-patients of Lilavati Hospital and Research centre diagnosed as AECOPD (Clinician based diagnosis), satisfying the inclusion and exclusion criteria were included in study after written informed consent.

Number of COPD exacerbations in the last 1 year, on bases of history given by patient was noted. And according to that they were divided in frequent and non frequent exacerbators. With frequent exacerbators having two or more than two exacerbations in the previous year. Also Patient's FEV1 on the basis of the last available spirometry report was noted and patient was characterized as per the GOLD criteria of COPD severity.

In our study on the diagnosis of AECOPD patients were given CAT questionnaire to fill which became pre treatment CAT score. Their modified medical research council grades(mMrc grades) were also done. On the day of diagnosis routine blood investigations were sent (chest xray, complete blood count, renal profile, sputum for aerobic culture, sputum for afb stains). Inflammatory markers (C-reactive protein and procalcitonin) were sent on the day of diagnosis of AECOPD.

Inclusion criteria:

1. Patients with a proven diagnosis of COPD (on basis of history, radiologically and spirometry)
2. All Out patients as well hospitalized patients with a clinician's diagnosis of AECOPD.

Exclusion criteria:

1. Patients who were admitted with acute exacerbation of COPD during the present episode to other hospital and referred to our institution.
2. Patients who had taken any antibiotics or steroids within the last 4 weeks prior to admission
3. COPD Patients admitted with the following diagnosis mimicking acute exacerbation of COPD.

- Pneumonia
- Pneumothorax
- Pleural Effusion
- Pulmonary Thromboembolism
- Acute Left Ventricular Failure
- Cardiac Arrhythmia
- Trauma

- Systemic Infections
 - Severe Blood loss
4. Patients with a primary diagnosis of asthma, Bronchiectasis or other active chronic respiratory disease.
 5. Any other severe systemic comorbidities like myocardial infarction, neoplasm, chronic kidney disease, stroke etc except for hypertension and diabetes
 6. Patient with psychiatric disorder.
 7. Patients not willing to participate in the study.

3. RESULTS

Table 1: Sex Distribution

Sex	No.	Percentage
Female	9	12.0%
Male	66	88.0%
Total	75	100.0%

A total number of 75 patients of exacerbation of copd meeting all inclusion criterias were included in the study. Out of these 75 patients, 66 were male(88%) and 9 patients were female (12%) In our study, patients belonged to the age group 49 to 88 years with a mean age of 68.33 years.

Table No.2 : Association among the cases between CAT Score (Pre) * CAT Score (Post)

CAT Score (Pre)		CAT Score (Post)			Total
		0 to 10 ^	11 to 20 ^	21 to 30	
21 to 30	No.	3	42	2	47
	%	6.4%	89.4%	4.3%	100.0%
31 to 40	No.	0	20	8	28
	%	0.0%	71.4%	28.6%	100.0%
Total	No.	3	62	10	75
	%	4.0%	82.7%	13.3%	100.0%

Chi-Square Tests	Value	df	p-value	Association is-
Pearson Chi-Square \$	10.251	2	0.006	Significant
Pearson Chi-Square ^	6.997	1	0.0082	Significant
Fisher's Exact Test ^			0.0045	Significant
\$ 3 cells (50.0%) have expected count less than 5. ^ Column data pooled & Chi-Square test reapplied with Continuity Correction.				
^ 1 cell (25.0%) have expected count less than 5. P-value of Fisher's Exact Test will be used.				

As from the above table CAT SCORE is compared during exacerbation and after 7 days of therapy. During exacerbation out of 75 patients 47 patients had CAT score between 21-30 i.e. severely raised CAT score. Rest 28 patients had score between 31-40 which is very severely raised CAT score.

CAT scoring was repeated after 7 days of therapy for COPD exacerbation, as shown in above table, 3 patients had scores between 0-10 (mild), 42 patients has scores between 11-20 (moderate), 10 patients had scores 21-30.

Chi square test and fishers exact test was applied to above and we found the change in CAT score was significant. With a p-value <0.0045.

Table No.3: Comparison of CAT scores between cases with & without frequent Exacerbations ≥ 2 (frequent and non frequentexacerbators)

Variables	No.	Mean	SD	Median	IQR	t-value	p-value
CAT Score (Pre) #	57	30.35	2.24	30.00	30-33	-5.640	1.70E-08
	18	25.89	2.06	26.00	25-27		Difference is significant

In our study 57 patients had two or more exacerbations in the previous year (frequent exacerbators) and 18 patients had less than 2 exacerbation in the previous year. It was found that CAT score was significantly higher in frequent exacerbators as compared to others. In frequent exacerbators CAT score mean was 30.35, and in non frequentexacerbators Mean CAT score was 25.89.

Table No.4: Nonparametric Correlation between Pre-treatment values of various variables

Variables	Spearman's rho	CAT Score (Pre)	Mmrc (Pre)	CRP (Pre)	PCT (Pre)
CAT Score (Pre)	Correlation Coefficient	1	.625(**)	0.105	0.217
	p-value	.	1.00E-06	0.37	0.062
Mmrc (Pre)	Correlation Coefficient	.625(**)	1	0.005	0.175
	p-value	1.00E-06	.	0.966	0.132
CRP (Pre)	Correlation Coefficient	0.105	0.005	1	.288(*)
	p-value	0.370	0.966	.	0.012
PCT (Pre)	Correlation Coefficient	0.217	0.175	.288(*)	1
	p-value	0.062	0.132	0.012	.
** Correlation is significant at the 0.01 level (2-tailed).					
* Correlation is significant at the 0.05 level (2-tailed).					

Above table depicts non-parametric correlation between pre-treatment values of various variables.

CAT score and mMrc grades shows significant correlation. (p values <0.01).

CRP and PCT levels also shows significant correlation. (p values <0.05).

4. DISCUSSION

A total number of 75 patients of exacerbation of copd meeting all inclusion criterias were included in the study. Out of these 75 patients, 66 were male(88%) and 9 patients were female (12%). In our study, patients belonged to the age group 49 to 88 years with a mean age of 68.33 years. Out of 75 cases 66 were smokers. BMI of all 75 patients was calculated, minimum BMI was 13.84 and the highest being 34.67 with a mean of 24.03.

All cases were proven copd patients, spirometry was done before current episode of exacerbation. Spirometry showed Mild obstruction in 2.7%, moderate obstruction in 54.7% and severe obstruction in 42.7% of patients.

This study, is unique in a way that it is not many times CAT has been used to assess the treatment response and health status following exacerbations of COPD. Results have shown that the CAT and mMRC grades and the concentrations of CRP and PCT during exacerbation all decreased significantly after 7 days therapy. The CAT scores were significantly correlated with concurrent levels of CRP, PCT and mMRC grades. The change in CAT score was related to that of CRP, PCT score and mMRC grades.

Furthermore, we have shown that the CAT scores were significantly higher in patients with a history of frequent exacerbations. One recent indian study done by Salma S et al in 100 patients of COPD exacerbation concluded that Frequent exacerbators had significantly higher CAT scores than infrequent exacerbators.[16]

CRP is an acute-phase inflammatory biomarker that is normally used by clinicians, their concentrations will generally rise in response to infections but decline with the clinical recovery [17]. While PCT is a biomarker for bacterial infections. In this study, we found most patients had much higher concentrations of CRP and PCT at exacerbation, probably triggered by bacterial and/or viral infections [18].

With the symptoms recovered, both CRP and PCT had a significant reduction corresponding to the decrease of systemic inflammation, reflecting an effective treatment during the seven days.

Our results showed that moderate but significant positive correlations (correlation coefficient for pre values 0.288 and for post treatment values 0.462 with a p value <0.001) were found between the levels of CRP and concurrent CAT scores. Which means at the time of exacerbation CAT score as well as CRP levels were high, and both responded to therapy which concluded that CAT score is as good as CRP levels for therapy assessment of the patient.

The correlation was also positively significant between exacerbation CAT score and mMrc and post treatment CAT score and mMrc score. (Correlation coefficient for pre 0.625 and post treatment 0.387 with a p value of 0.001).

The correlation was not significant for PCT values and CAT scores in our study. (With coefficient ratio for exacerbation 0.113 and p values 0.335, post treatment coefficient ratio was 0.217 and p

However, in our study mean change in CAT score over the 7 days was quite dramatic (-11.56 ± 2.89 units) compared to previous studies [13].

Tu et al. in a similar study from china found that change in mean CAT score after standard treatment for copd exacerbation was (-10.36 ± 5.03 units). Which is similar to our study. They studied 78 copd exacerbation patients.[19]

5. CONCLUSION

The CAT score is associated with the changes of systemic inflammation following exacerbations, and it is as responsive to the treatments as other measures such as mMrcdyspnea scale and inflammatory biomarkers. The CAT scores can reflect the health status of COPD patients, and are potentially useful to assess the treatments response following COPD exacerbations. The CAT is particular useful for health settings where access to other advance diagnostics are limited. CAT score was significantly higher at exacerbation in patients with history of frequent exacerbations. CAT score not only includes dyspnea but also other components like cough, phlegm, chest tightness, limitation of daily activities, sleep quality and energy which makes it a better score for assessment of quality of life.

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