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Pulmonary Medicine

CROSS SECTIONAL STUDY ON CAUDA70 SCORE AND ITS RELATION WITH TREATMENT OUTCOMES IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE AT IRD, SMS MEDICAL COLLEGE, JAIPUR

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ABSTRACT **Background:** Acute exacerbation of COPD can be attributed to varying aetiologies. AECOPD has been linked to certain variables that determine prognosis. CAUDA70 score uses 6 easily measurable parameters that reflect the underlying multisystem involvement . This study was done to assess CAUDA70 score and its relation with treatment outcomes in patients with acute exacerbation of COPD. **Methods:** 150 patients admitted with an acute exacerbation of COPD were included in this hospital based cross sectional study. One point was given for each of the following variable: Confusion, Acidosis (pH<7.35), Urea >7mmol/L, Dyspnoea mMRC 4, Albumin>35g/L, Age>70 years, thus yielding a six point scoring system. The outcome of the patient was correlated with the score obtained to assess prognosis. **Result:** Out of 150 patients , 71 patients(47.3%) obtained a score up to 2. Among these patients, 58(81.69%) recovered without ventilation whereas 13(18.30%) needed non invasive ventilation for management, none of the patients required invasive ventilation and there was no mortality. Rest 79 patients(52.6%) had a score between 3 to 6. Among these patients , 8 (10.1%) required invasive ventilation, mortality was reported among 12 (15.1%), 42(53.1%) required non invasive ventilation whereas 17(21.5%) recovered without ventilation. Higher CAUDA70 score was significantly associated with a poorer outcome (p-value<0.001) in terms of higher no. of mortality and requirement of invasive ventilation. **Conclusion:** CAUDA 70 score proved to be simple and effective tool to predict the need for mechanical ventilation and prevent mortality. The findings help in determining which patients are at high risk of in-hospital death and is useful in decisions on patient admission, discharge management and health care resource allocation.

KEYWORDS : AECOPD, CAUDA70, NIV

INTRODUCTION
Chronic obstructive pulmonary disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms(dyspnea, cough, sputum production) due to abnormalities of the airways(bronchitis, bronchiolitis) and/or alveoli(emphysema) that cause persistent, often progressive, airflow limitation.[1]

COPD is now among the top three causes of mortality worldwide with more than 90% deaths occurring in low-and-middle income countries.[2]

The risk factors of COPD, include smoking[3] ,indoor air pollution, occupational exposures to coal dust, silica and asbestos, low birth weight, and recurrent infections.

COPD has a varying range of clinical presentation ranging from stable or indolent course to acute or exacerbation of COPD. Acute exacerbation of COPD(AECOPD) is a phenomenon where there is sudden onset worsening of respiratory symptoms and airway function in a patient with COPD that necessitates additional therapy.

The exacerbations may be self limiting or may lead to florid respiratory failure. Exacerbations are important as they have a negative impact on overall disease progression , hospitalizations, and the health status of the patient. The main triggers are respiratory infections , viral infections being more commonly implicated than bacterial infections and other environmental factors such as pollution.[4] Some exacerbations might be mild requiring additional therapy in the form of bronchodilators and antibiotics while some are severe requiring hospitalization or even mechanical ventilation.

Variables which have been commonly linked to an increased risk of in hospital mortality in AECOPD have included age, heart rate, serum creatinine, sodium and urea. However,there is still no established method to predict the treatment outcomes among patients admitted with AECOPD.

A clinical prediction tool could help the physicians stratify the patients by risk and target their management more effectively. Hence, this study focused on the assessment of the clinical prediction tool in successfully predicting the treatment outcomes among patients with acute exacerbation of COPD.

MATERIALS AND METHODS
A hospital based cross sectional study consisting 150 patients was carried out at Department of Respiratory Medicine, Institute of Respiratory Diseases, SMS Medical College, Jaipur, over a period of one year (2020-2021) after seeking permission from Research Review Board.

Inclusion Criteria
- Age above 40 years.
- Diagnosed case of COPD (as per the GOLD guidelines), presenting with acute exacerbation.
- Patients who have given written informed consent.

Exclusion Criteria
- Other pulmonary diseases mimicking AECOPD like pneumothorax, pleural effusion, congestive heart failure etc.
- Patients with any chronic illness like cardiac diseases, liver diseases, renal failure, immunocompromised states (PLHIV, Malignancy).
- Pregnant females.

Detailed history was elicited from the patients and general

physical examination and systemic examination was carried out. The patients underwent thorough evaluation including complete blood counts, chest x-ray, arterial blood gas analysis and the following six parameters were recorded:

1. Confusion
2. Acidosis (pH<7.35)
3. S. Urea>7mmol/L
4. Dyspnea (mMRC grade IV)
5. S. Albumin (<35g/L)
6. Age >70 years

Each parameter was given a score of one and the total score obtained was further correlated to one of the following treatment outcomes :

• Recovered without ventilation
• Rrequired NIV
• Required invasive ventilation
• Poor outcome (in the form of mortality).

The data entry was done in google excel spreadsheet and the final analysis was done using the statistical package for social sciences (SPSS-20) software, IBM manufacturer, Chicago, USA, ver2.1.0. The presentation of categorical variables such as age, sex, occupation, residential area, symptoms, past history, were analysed and presented in terms of number and percentage. Quantitative data like Spo2,TLC and pCO2 were presented in terms of mean plus or minus standard deviation. Pearsonian Chi square tests were applied for association between CAUDA70 score and prognosis. StudentT tests were applied for Comparison between CAUDA70 Score and SpO2, CAUDA70 Score with TLC and CAUDA70 Score and pCO2 levels.

For statistical significance, P value of less than <0.05 was considered clinically significant and p value less than <0.005 was considered highly clinically significant.

RESULTS

Of the study subjects most of the patients were above 60 years (65%) and the rest were between 40-60 years of age, there were 49 females (33%) and 101 males (67%) out of the total 150 studied patients with AECOPD. 121(80.6%) of the subjects were either current or ex smokers .

S. No.	Gender	No. of patients	Smoker	Age 40-60 years	Age>60 years
1.	Male	101(67%)	100	37	64
2.	Female	49(33%)	21	18	30
3.	Total	150(100%)	121	55	94

Sex
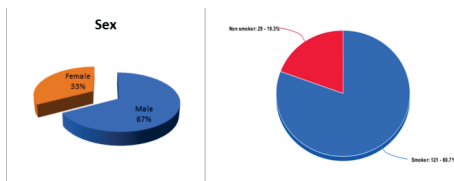
In the study 53% the subjects had score between 3-6 and 47% subjects had score in the range 0-2.

CAUDA70 Score
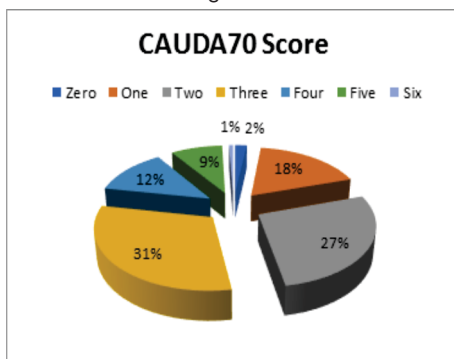
Out of the 150 subjects, 5% reported confusion, 29% had acidosis , 43% had elevated serum urea levels, Dyspnoea (84%) and hypoalbuminemia (74%) were the most recurring parameters and 45% subjects were aged more than 70 years.

S. No.	Variable	Yes(Percentage)	No(Percentage)
1.	CONFUSION	7(5)	143(95)
2.	ACIDOSIS(pH<7.35)	44(29)	106(71)
3.	SERUM UREA(>7mmole/L or >42mg/dl)	65(43)	85(57)
4.	DYSPNEA(mMRC GRADE 4)	126(84)	24(16)
5.	SERUM ALBUMIN(<3.5g/dl)	111(74)	39(26)
6.	AGE ≥70 YEARS	37(23)	113(77)

It was observed that patients with score between 3-6 had more mortality and a greater requirement for invasive ventilation than those having a score between 0-2. Since the p value was less than 0.001, it was considered statistically significant.

S. No.	Different Score	Prognosis (Outcome)				Total	χ2	p-value
		Poor Outcome	Recovered without ventilation	Requiring Invasive Ventilation	Requiring Non Invasive Ventilation			
1.	.00	0	3	0	0	3	150.10	<.001**
2.	1.00	0	23	0	4	27		
3.	2.00	0	32	0	9	41		
4.	3.00	2	17	0	27	46		
5.	4.00	5	0	1	13	19		
6.	5.00	4	0	7	2	13		
7.	6.00	1	0	0	0	1		
8.	Total	12	75	8	55	150		

CAUDA70 score with SpO_2 and pCO_2 levels were also correlated with CAUDA70 score and it was seen that patients with a higher CAUDA70 score had lower SpO_2 and higher pCO_2 levels. Since p value was less than 0.001, it was considered statically significant. Also patients with a higher CAUDA70 score had an elevated TLC level. It was considered statistically significant as the p-value is <0.03.

S. No.	CAUDA70 SCORE	SpO2 levels(mean ± Standard Deviation)	Arterial pCO2 level(mean± Standard Deviation)	Total leucocyte count(mean ± Standard Deviation)
1.	00	90.33±7.23	41.33±8.73	11.26 ±2.73
2.	01	86.00±7.59	44.67±10.75	9.22 ±2.65
3.	02	83.46±7.32	48.56±9.83	10.05 ±4.82
4.	03	80.50±8.17	55.91±12.05	11.81 ±4.87
5.	04	74.94±10.58	71.16±10.44	12.87 ±7.25
6.	05	65.38±14.23	84.77±13.76	13.65 ±4.08
7.	06	66.00±00	77.00±00	16.80 ±00

DISCUSSION

The study objective was to assess the relation of CAUDA70 score and its association with treatment outcomes among acute exacerbation of COPD patients who were admitted at IRD, SMS Medical College, Jaipur.

A total of 150 acute exacerbation of COPD patients were included in the study. In our study, 101 (67%) are males and 49 (33%) are females, which is explained by the increased consumption of tobacco in men. Most of the patients were aged more than 45 years suggesting the chronic pathophysiological process involved in the development of COPD. Moreover, 121 subjects were smokers which is a well established risk factor for the development of the disease and subsequent flare ups.

It was found that 47.3% (71 patients) obtained a score up to 2 and 52.6% (79 patients) had a score between 3 to 6. Among the patients who had a score of up to 2 , none of the patients

required invasive ventilation and there was no mortality. It was also observed that 58 patients recovered without ventilation whereas 13 patients needed non invasive ventilation for management.

Among the 79 patients who had a score between 3-6 , 8 patients required invasive ventilation and mortality was reported among 12 patients. Also 42 patients required non invasive ventilation whereas 17 patients recovered without ventilation. Higher CAUDA70 score was significantly associated with a poorer outcome (p-value<0.001).

Results of our study show that patients with CAUDA 70 score 3 and above have poor prognosis compared to those having score of 0 to 2.

Out of the 6 parameters studied, it was observed that 84% (126 patients) had Grade IV mMRC dyspnea which was followed by 74% (111 patients) reporting serum albumin level <3.5g and 45% (67 patients) having age more than 70 years. Elevated urea was seen in 43%(65 patients) and acidosis and confusion were present in 29%(44 patients) and 5%(7 patients) respectively. The reason behind choosing the above parameters was justified as follows. Increased Urea levels appeared as an important predictor to reflect acute kidney injury as with impaired gaseous exchange and carbon dioxide retention there is reduced renal blood flow and eGFR.[5] Low serum albumin levels suggest chronicity of the disease and is associated with higher morbidity[6]. In COPD, the hormonal balance is shifted towards catabolism, especially in the later stage of the disease. Confusion, marker of poor outcome in community acquired pneumonia, arise in AECOPD due to hypercapnia[7]. Thus all the parameters suggest the severity of AECOPD and the presence of respiratory failure. Therefore higher CAUDA 70 score correlated with poor prognosis in AECOPD.

The study found that there was a significant correlation between the serum TLC levels and CAUDA70 score. Those patients who had lower mean TLC values of 10.05 ± 4.82 had a lower CAUDA70 score compared to those patients with raised mean TLC of 16.8 ± 00 had a higher CAUDA70 score (p-value<0.03). Raised TLC levels could be due to various reasons but most common, being due to infectious cause in our clinical settings. It might also be due to steroid induced leucocytosis , used during the course of management of the disease. As mentioned earlier, infections are an important trigger factor for exacerbation of the underlying disease, hence the statistical data obtained from our study establishes infectious etiology as an important cause for AECOPD.

Also it was found in our study that there is a significant association between pCO2 levels and CAUDA70 score. Those patients who had normal mean arterial pCO_2 levels of 44.67 ± 10.75 had a lower CAUDA70 score compared to patients with an elevated mean arterial pCO_2 of 84.77 ± 13.76 had higher CAUDA70 score(p-value<0.001). Raised CO_2 levels positively correlates with severity of disease as there is marked increase in air trapping resulting in CO_2 retention causing inhibition of cell membrane repair ,suppression of innate immunity & host defense ,uncoupling of RV & pulmonary circulation , depression of myocardial contractility and increase in intracranial pressure along with narcosis which in turn affects neurological function causing confusion.

Moreover, it was observed in our study that there was a significant inverse relation between CAUDA70 score and measured mean SpO_2 levels. Those patients who had lower CAUDA70 score had slightly higher mean SpO_2 levels of 83.46 ± 7.32 when compared to patients with higher CAUDA70 score having lower mean SpO_2 levels of 66.00 ± 00 (p-value<0.001). This inverse relation could be a result of airflow limitation leading to alveolar hypoventilation and also and

increase in the physiological dead space due to ventilation perfusion mismatch.

Similar results were found in a study by Purna et al [8] who concluded that subjects with score 0-2 are at low risk of death and are likely to be safely managed at home and those with score 3 or more indicate that a patient is at high risk of in hospital mortality.

Elsokkary R, Ghanem M, Metwally M, Abdelaleem N. performed a 2 year prospective in hospital observational study in 2015 in Egypt titled '' assessment of in hospital mortality and need for mechanical ventilation in AECOPD 2 year prospective study''[9] they compared 4 scoring systems CAUDA 70, BAP 65, CURB 65, CAPS. In their study they concluded that among the four, CAUDA 70 score gave good results in predicting need for mechanical ventilation and mortality. They proved that CAUDA 70 score 3 and above have high mortality and recommended the need for mechanical ventilation.

Limitations
This study differs from other studies relating CAUDA70 score with treatment outcomes since we didn't categorize them as AECOPD and bacterial pneumonia groups, and considered all cases as AECOPD and related CAUDA70 score with treatment outcomes in them. This methodology was adopted because bacterial infection is a causative factor for exacerbation rather than a separate entity. Secondly, it was a single center study and the number of patients was less. Data can thus, cannot be extrapolated to the vast majority of AECOPD patients.

CONCLUSION
To assess the prognosis in AECOPD, CAUDA 70 score proved to be simple and effective method with six easily observable clinical variables. Based on the score we can predict the need for mechanical ventilation and prevent mortality. These findings should help in determining which patients are at high risk of inhospital death, and whether they should be managed as an in-patient or at home with early supported discharge. This scoring system also useful in decisions on patient admission, discharge management and health care resource allocation.

This study presents a new scoring system (CAUDA70), predictive of inhospital mortality in patients presenting with acute exacerbation of COPD. The six variables included in the score are all easily obtainable clinically, and are very simple to translate to an overall severity score. Following external validation, this new scoring system may be useful in decisions on patient admission, discharge management and health care resource allocation.

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