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Comparison between Curb-65 and A-Drop severity score and its correlation with clinical outcome in Covid-19 patients admitted in a tertiary care center

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Abstract
Background: Respiratory failure is the leading cause of mortality in patients with COVID-19. CURB-65 and A-DROP are widely used in predicting the severity and outcome in Community Acquired Pneumonia (CAP). However these tools have not been assessed in patients with COVID-19 infection. A simple tool to stratify patients with COVID-19 pneumonia and for predicting the outcome at the time of hospital admission would be useful.
Objective: To calculate CURB-65 and A-DROP score in COVID 19 patients and to correlate them with clinical outcome, hospital stay and CT severity score.
Methods: This cross sectional study included consenting adult patients who presented with COVID 19 infection confirmed by real time RT-PCR, conducted at the hospital attached to Bangalore Medical College and Research Institute involving 100 subjects. CURB-65 and A-DROP score was calculated, CT scan of thorax was done at the time of admission. Patients underwent various biochemical investigations. Based on WHO criteria patients were divided into mild, moderate and severe COVID-19 illness. We assessed the outcome with relation to measured CURB-65 /A-DROP score to know the prognosis in COVID19 patients.
Results: The mean±SD age of the subjects was 55.61 ± 14.22 with 34 females and 66 males. Among 100 patients 76(76%) recovered where as death was seen in 24(24%). Maximum recovered patients had CURB-65 score 0, 1 and 2 and A-DROP score 0, 1 and 2 whereas maximum death patients had CURB-65 score 3, 4 and 5 and A-DROP score of 3,4 and 5. Chi-square test showed statistical significant association between CURB-65 score and Outcome ($\chi 2=39.7$; p=0.00), statistical significant association was also between A-DROP score and Outcome ($\chi 2= 43.55$; p=0.00). Chi-square test applied to associate the A-DROP and CURB-65 score showed statistical significant association between the two scores ($\chi 2= 194.65$; p=0.00). Both the scores individually showed statistically significant correlation with CT severity and duration of hospital stay.
Conclusion: This study revealed significant correlation between the clinical severity of COVID 19 illness with CURB-65 and A-DROP scores. Study also showed significant correlation between the two measured scores with CT severity score and also duration of hospital stay. Hence, CURB-65 and A-DROP score can be used to assess the severity and predict the outcome in COVID 19 infection.

Keywords: Covid-19, Curb-65 score, A-Drop score

Introduction
Corona viruses are non-segmented positive-stranded RNA viruses [1]. The serious corona virus disease outbreaks in the past two decades were- severe acute respiratory syndrome (SARS) in 2003 [2] and Middle East respiratory syndrome (MERS) [3] in 2012. Since December 2019, severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) has been recognized as the causal factor in a series of severe cases of pneumonia originating in Wuhan, China [4]. This disease has been named corona virus disease 2019 (COVID-19) by WHO.SARS-CoV-2 causes potential damage to vital organs such as lung, heart, kidney, and infection poses a considerable risk to patients [5]. Respiratory failure is the leading cause of mortality in patients with COVID-19. Myocardial injury, kidney or liver injury and Multi organ dysfunction are among the other complications leading to death. Several prognostic factors such as older age, male gender, presence of co morbidities and smoking have been found to be associated with severe disease or death.

The rapidly progressed hypoxemia and acute respiratory distress syndrome were commonly observed in patients with SARS-CoV-2 viral pneumonia [6]. Although several severity scores including Pneumonia Severity Index (PSI) [7], CURB-65 [8], CRB-65 [8]. A-DROP [9] and SMART-COP [10] have been developed to identify community acquired pneumonia (CAP) patients with high risk and offer therapeutic advice, the underestimation of death risk of viral pneumonia in these scores has been reported by previous studies [11, 12]. The national early warning score 2 (NEWS2) was developed by National Health Service (NHS) England [13], along with quick sequential organ failure assessment score (qSOFA), was proposed as candidates for prognostic prediction for severe COVID-19 in the condition of limit medical source [14]. CURB 65 and A-DROP are widely used in predicting the severity and outcome in community acquired pneumonia. CURB-65 has also been found to be useful in predicting 14 days mortality in hospital acquired pneumonia. However these tools have not been assessed in patients with COVID 19 pneumonia.

Aims of the Study

1. To calculate CURB-65 and A-DROP score in COVID-19 patients.
2. To determine the association between CURB-65 and A-DROP score and clinical outcome (discharge /death) in COVID 19 patients.
3. To assess the correlation between CURB-65 and A-DROP score and CT severity score in COVID-19 patients.

Materials and Methods

This cross sectional study was conducted on 100 patients with RT-PCR confirmed COVID-19 infection admitted in Department of Medicine of hospitals attached to BMCRI from September 2020 to December 2020. Inclusion criteria were age more than 18 years who are willing to participate in the study and give informed written consent. Exclusion criteria were patients less than 18 years and patients who are known case of Chronic Kidney Disease.

After obtaining approval from the Institutional Ethics Committee of BMCRI, written informed consent was taken from the patients. Co-morbid conditions like metabolic disorders, endocrine disorders, renal disorders, cardiac disorders, respiratory disorders will be confirmed with past medical history. CURB-65 and A-DROP score was calculated and CT scan of thorax was done at the time of admission. Patients underwent biochemical investigations which included complete blood count, quantitative CRP, renal function test, liver function test and coagulation profile. Based on CT severity index patients were divided into mild, moderate or severe COVID19 illness for earlier intensive care intervention and also to assess the outcome in relation with the measured CURB-65 /A-DROP score to know the prognosis of the COVID19 patients.

Statistical Analysis

SPSS (Statistical Package for Social Sciences) version 20. [IBM SPASS statistics (IBM corp. Armonk, NY, USA released 2011)] was used to perform the statistical analysis. Data was entered in the excel spread sheet. Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard deviation, median, IQR (based on data distribution) for quantitative variables, frequency and proportions for qualitative variables. Inferential statistics like Chi-square test was applied for categorical variables. Pearson's / Spearman's correlation was applied to correlate the CURB 65 and A-DROP severity score. The level of significance was set at 5%.

Results

The present study was conducted in the Department of Medicine, Bangalore Medical College and Research Institute. A total of 100 cases of COVID-19 pneumonia were taken and the data obtained thereby are presented and analysed below.

Mean age of the subjects was 55.61 ± 14.22 with minimum age of 22 yrs and maximum age of 85 yrs. Maximum subjects were in the age range of 51 to 60yrs- 26(26%) followed by 61 to 70 yrs- 24(24%), 41 to 50 yrs – 19(19%), above 70 yrs- 14(14%), 31 to 40 yrs- 11(11%) and 20 to 30 yrs- 6(6%).

Out of 100(100%) subjects, two-third of the subjects- 66 (66%) were males and one-third- 34(34%) of the subjects were females.

Around three-fourth of the subjects- 76 (76%) were recovered whereas there was death in around one-fourth – 24 (24%) of the subjects. Diabetes mellitus (DM) and Hypertension (HTN) as Co morbidities was present in 23 (23%) subjects, DM alone was present in 18 (18%) subjects, HTN alone was present in 13 (13%) subjects, while 10 (10%) had other Co morbidities and 36 (36%) had no Co morbidities.

CURB-65 score of 1 was present in 41 subjects followed by score 2- 34 subjects, score 3- 2 subjects, Score 0-10 subjects, Score 4- 2 subjects and Score 5- 1 subject.

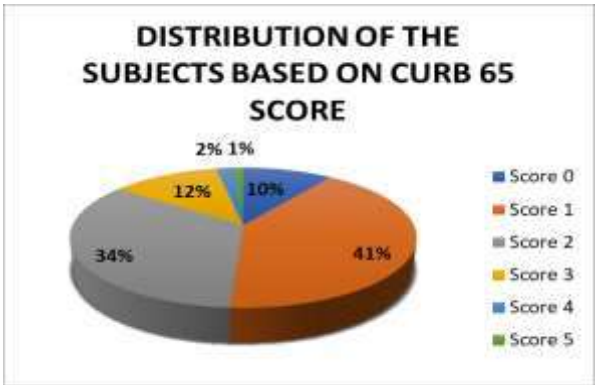

Fig 1: Distribution of subjects based on CURB-65 score.

A-DROP score 2 was present in 44 subjects followed by score 1- 24 subjects, score 3- 16 subjects, Score 0-10 subjects, Score 4- 4 subjects and Score 5- 2 subjects.

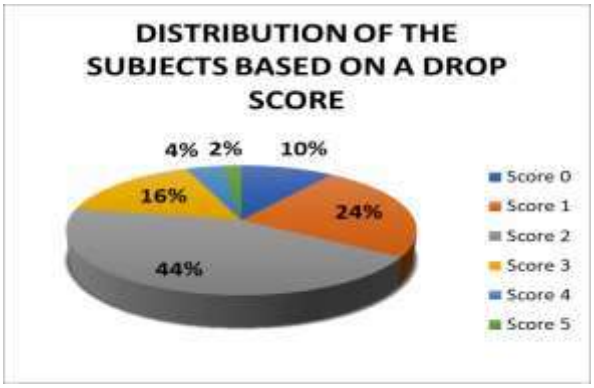

Fig 2: Distribution of subjects based on A-DROP score.

Distribution of the subjects based on CT score showed that 47 (47%) subjects had severe CT score followed by 31(31%) subjects having mild score and 22 (22%) subjects having moderate CT score. Out of 24 subjects who died, 23 subjects had severe CT score. Chi-square test was applied to associate the CT score and outcome. Chi-square test showed statistical significant association between CT score and Outcome ($\chi 2$= 30.37; p=0.00).

Maximum recovered subjects had CURB scores 0, 1 and 2 whereas maximum death subjects had CURB Score 3, 4 and 5. Chi-square test was applied to associate the CURB 65 score and outcome. Chi-square test showed statistical significant association between CURB 65 score and Outcome ($\chi 2$=39.7; p=0.00).

Table 1: Cross tabulation of CURB-65 and outcome.

Curb 65 Score		Outcome		Total
		Death	Recovered	
0	Count	0	10	10
	% of Total	0.0%	10.0%	10.0%
1	Count	5	36	41
	% of Total	5.0%	36.0%	41.0%
2	Count	6	28	34
	% of Total	6.0%	28.0%	34.0%
3	Count	10	2	12
	% of Total	10.0%	2.0%	12.0%
4	Count	2	0	2
	% of Total	2.0%	0.0%	2.0%
5	Count	1	0	1
	% of Total	1.0%	0.0%	1.0%
Total	Count	24	76	100
	% of Total	24.0%	76.0%	100.0%
Chi-square value- 39.70				
p value-0.00*				

Maximum recovered subjects had A-DROP scores 0, 1 and 2 whereas maximum death subjects had A DROP score 3, 4 and 5. Chi-square test was applied to associate the A DROP score and outcome. Chi-square test showed statistical significant association between A DROP score and Outcome ($\chi 2$= 43.55; p=0.00).

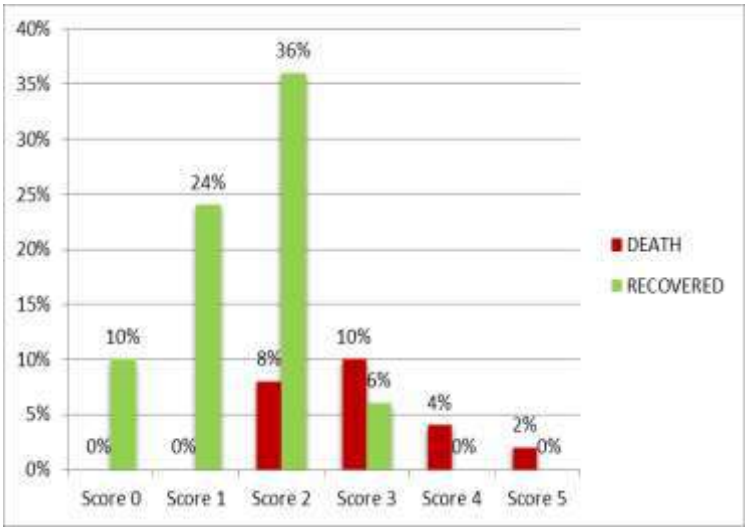

Fig 3: Distribution of A-DROP score based and outcome

Mean hospital stay was higher for subjects having CURB score 2- 16.71 ± 7.983 followed by CURB Score 1- 13.46 ± 6.83, CURB score 3-12.83 ±7.493. Mean hospital stay was higher for subjects having A DROP score 2- 17.41 ± 7.854 followed by Score 3- 13.88 ± 8.131, score 1- 10.75 ± 3.948.

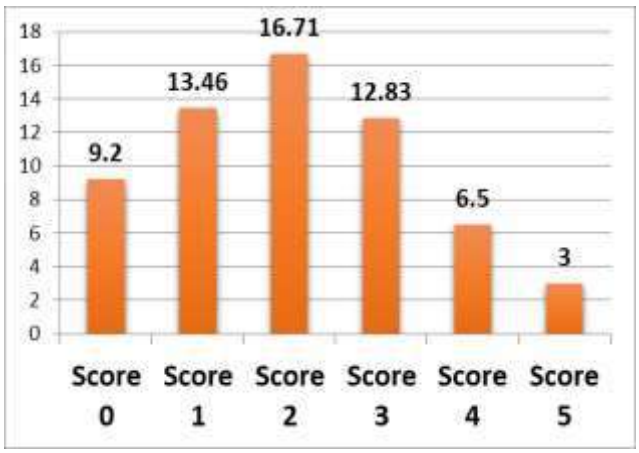

Fig 4: Distribution of mean hospital stay (in days) based on curb 65 score

Mild CT Score subjects had CURB score of 0,1 and 2 whereas severe CT score subjects had CURB score 2 and 3. Chi-square test was applied to associate the CT score and CURB 65 scores. Chi-square test showed statistical significant association between CT score and CURB 65 scores ($\chi 2$= 25.88; p=0.004).

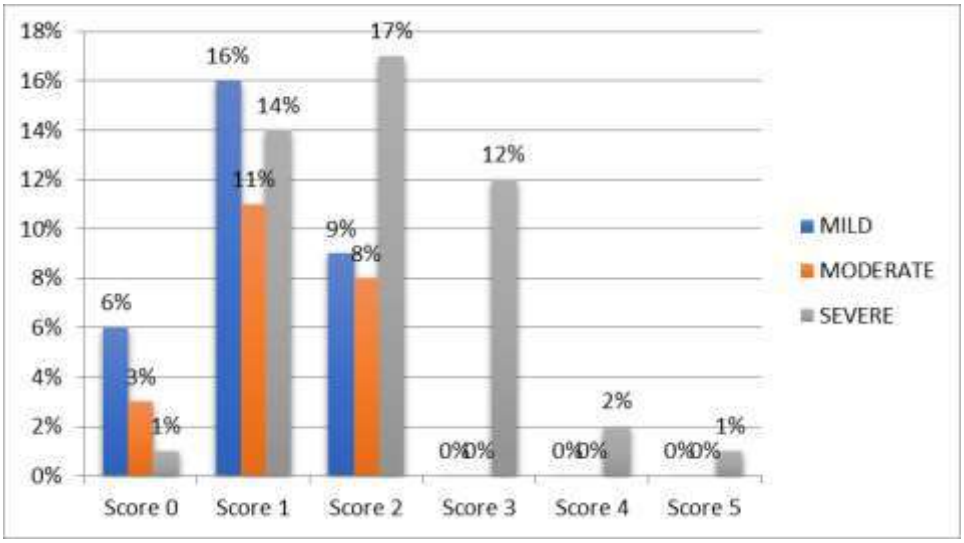

Fig 5: Cross Tabulation of Curb 65 Score and Severity Based on CT Score

Cross tabulation of A DROP score and severity based on CT score showed that mild subjects had A DROP score of 0 and 1 whereas severe CT score subjects had A DROP score 2 and 3. Chi-square test was applied to associate the CT score and A DROP scores. Chi-square test showed statistical significant association between CT score and A DROP scores ($\chi 2$= 61.66; p=0.00).

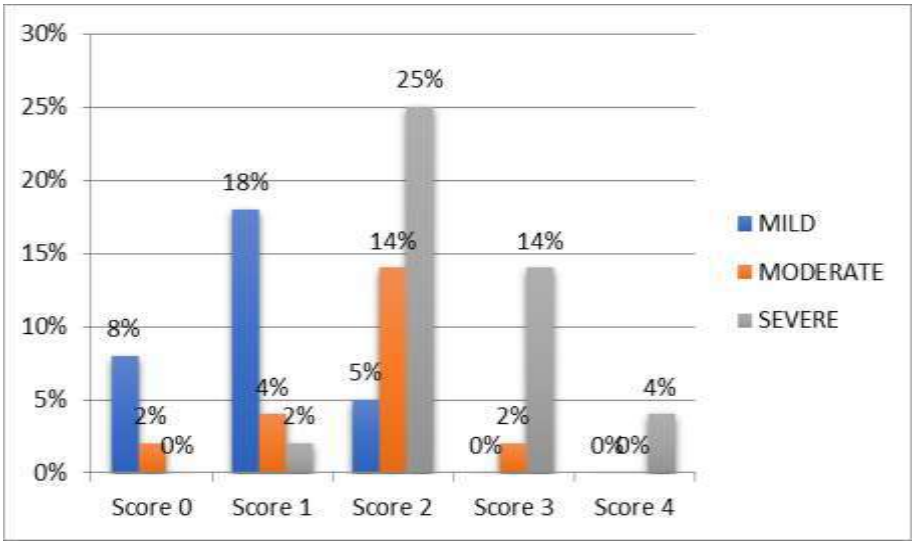

Fig 6: Cross Tabulation of a Drop Score and Severity based on CT Score

Cross tabulation of CURB- 65 and A drop score showed that 8 subjects matched for Score 0, 18 subjects matched for score 1, 19 subjects matched for Score 2, 5 subjects matched for score 3, 1 subject each matched for score 4 and 5. Chi-square test was applied to associate the A DROP score and CURB 65 scores. Chi-square test showed statistical significant association between A DROP score and CURB 65 scores ($\chi 2$= 194.65; p=0.00).

Kappa measures of agreement Coefficient for the two scores was performed and was 0.33, suggesting both the scores have equal efficacy in predicting the outcome.

Table 2: Cross tabulation of CURB 65 score and A-DROP score

A-Drop Score		Curb 65 Score						Total
		0	1	2	3	4	5	
0	Count	8	2	0	0	0	0	10
	%	8.0%	2.0%	0.0%	0.0%	0.0%	0.0%	10.0%
1	Count	2	18	4	0	0	0	24
	%	2.0%	18.0%	4.0%	0.0%	0.0%	0.0%	24.0%
2	Count	0	21	19	4	0	0	44
	%	0.0%	21.0%	19.0%	4.0%	0.0%	0.0%	44.0%
3	Count	0	0	11	5	0	0	16
	%	0.0%	0.0%	11.0%	5.0%	0.0%	0.0%	16.0%
4	Count	0	0	0	3	1	0	4
	%	0.0%	0.0%	0.0%	3.0%	1.0%	0.0%	4.0%
5	Count	0	0	0	0	1	1	2
	%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%	2.0%
Total	Count	10	41	34	12	2	1	100
	%	10.0%	41.0%	34.0%	12.0%	2.0%	1.0%	100.0%
Chi-square value- 194.65								
p value- 0.00*								

Mean LDH (602.32± 197.962), D-Dimer (1.63 ± 1.56), CRP (118.89 ± 97.87), Ferritin levels (733.8 ± 489.4), days in hospital (15.36 ± 8.502) were higher for subjects with severe CT score. ANOVA test was applied to compare the values among the groups based on CT score. ANOVA test showed statistical significant difference with respect to LDH (p=0.00), D-Dimer (p=0.001), CRP (p=0.025), Ferritin (p=0.027) and days in hospital (p=0.034).

Discussion

Out of the 100 patients in our study, maximum number of patients were in the age group of 51-60(26%) with mean age of 55.61 years (SD 14.22). The female to male M: F ratio is 1.94: 1. In this study we calculated CURB-65 and A-DROP score at the time of admission and compared it with duration of hospital stay, outcome and association with severity of CT score.

CURB-65 score of 1 was present in 41 subjects followed by score 2- 34 subjects, score 3 in 2 subjects, Score 0 in 10 subjects, Score 4 in 2 subjects and Score 5 in 1 subject. Maximum recovered subjects had CURB-65 scores 0, 1 and 2 whereas maximum death subjects had CURB Score 3, 4 and 5. A-DROP score 2 was present in 44 subjects followed by score 1 in 24 subjects, score 3 in 16 subjects, Score 0 in 10 subjects, Score 4 in 4 subjects and Score 5 in 2 subjects.

Maximum recovered subjects had A-DROP scores 0, 1 and 2 whereas maximum death subjects had A DROP score 3, 4 and 5. In our study patients who recovered had CURB65 and ADROP score of 0, 1, 2 whereas death was seen in those with score more than 2.

Mean hospital stay was higher for subjects having CURB score 2- 16.71 ± 7.983 days and ADROP score of 2 -17.41 ± 7.854 days. Mild CT Score subjects had CURB score of 0,1 and 2, and A DROP score of 0,1 whereas severe CT score subjects had CURB score 2 and 3 and ADROP score of 2,3. Cross tabulation of CURB- 65 and A DROP score showed that 8 subjects matched for Score 0, 18 subjects matched for score 1, 19 subjects matched for Score 2, 5 subjects matched for score 3, 1 subject each matched for score 4 and 5. In this study it was found that both the scores are equally effective in stratifying COVID-19 patients, and predict the outcome.

The accuracy of a CURB 65 and ADROP severity scores to stratify and predict in-hospital death in 100 confirmed COVID-19 patients admitted to hospital was examined in our study and we found CURB 65 and ADROP were equally effective clinical tool for stratifying COVID 19 patients and predicting the risk of death for patients with COVID- 19 pneumonia.

A-DROP, a modified version of CURB-65 [9] also showed equal accuracy of in-hospital death prediction compared to CURB 65. According to previous studies, ARDS was common in severe COVID-19 pneumonia [15, 16]. The rapid progression of diffuse bilateral ground-glass opacities CT scan and massive alveolar damage with focal hemorrhage, cellular fibromyxoid exudates and hyaline membrane formation in lung histological examination also suggested a close association between COVID-19 pneumonia and low PaO_2/FiO_2 [17].

The modification of more accurate respiratory function evaluation (SpO_2 < 90% / PaO_2 < 60 mmHg in A-DROP vs. respiratory rate ≥ 30/min in CURB-65 and modification in age (male > 70/female > 75 in A-DROP vs. age > 65 in CURB-65), could be one reason for A-DROP score having equal efficacy as CURB-65 score.

A retrospective case series study involving 681 patients with COVID 19 pneumonia by Satici C *et al* showed Pneumonia severity index (PSI) performed better than CURB 65 in predicting 30 days mortality [18]. A retrospective study done by Fan G *et al*, which studied 654 hospitalised patients showed ADROP as a reliable tool for risk stratification of death in COVID 19 hospitalised patients on admission [19]. Study done by T. Kodama, H. Obinata at Tokyo, Japan among 214 patients showed that the expanded CURB-65 score can be a better predictor of an increase in oxygen requirement in patients with SARS-CoV-2 pneumonia than A-DROP and CURB 65 score [20].

Conclusion

This study revealed significant correlation between the clinical severity of COVID 19 illness with CURB-65 and A-DROP scores. Study also showed significant correlation between the two measured scores with CT severity score and also duration of hospital stay. Hence, CURB-65 and A-DROP score can be used to assess the severity and predict the outcome in COVID 19 infection.

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