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Pneumonia Severity Index and CURB-65 score as a Predictor of In-Hospital Mortality in Acute Exacerbation of COPD

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Abstract: ***Aim and Objective: To investigate the role of Pneumonia Severity Index (PSI) and confusion, Urea, Respiratory Rate, Blood Pressures core (CURB-65) in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disorder with Reference to Mortality. Methods: In our study a total of 100 patients of COPD with acute exacerbation were included in the study from tertiary care centre, Kolkata for a period of 12 months from December 2015 to November 2016. Results: In our study, overall in hospital mortality was 21%, while mortality in age groups 50-65, 66-80 and >80 were respectively 3.3%, 28.3% and 29.41%. Hence advanced age was associated with significant increase in mortality. The mortality among risk classes of PSI like II, III, IV and V was respectively 0%, 0%, 22.22% and 78.57% respectively. The percentage of mortality increased significantly as the PSI score increases (p value ≤ 0.001). The mortality associated with the low, intermediate and high risk classes of CURB-65 was respectively 4.17%, 14% and 50%. Mortality increased with increase in score demonstrating a significant relation between the two (p value = 0.006). Conclusion: Chronic obstructive pulmonary disease (COPD) is a global public health problem and a significant cause of chronic morbidity and mortality worldwide. Infectious are at least 75-80% of acute COPD exacerbations. Our study detected 21% in-hospital mortality. A PSI score of >130 i.e. risk class V as well as CURB-65 score of more than equal to 3 i.e. group 3, were strong predictors of in hospital mortality.***

Keywords: Chronic Obstructive Pulmonary Disease; Exacerbation; Mortality; Prognosis

1. Introduction

Episodes of acute exacerbation of chronic obstructive pulmonary disease (AECOPD) are the main causes of disease-related costs, morbidity and mortality.[1] AECOPD is also the world's third leading cause of death. Methods that can accurately classify patients at the terminal stage of the disease are also clinically beneficial.[3] A risk marker that represents the real-life clinical condition and determines the risk of death in AECOPD patients is clinically desirable. Such a marker may be used for triage of patients needing hospitalization relative to patients requiring a lower level of health care.[4] An appropriate risk measure can also be used for those in the high-risk community who need more extensive monitoring and treatment. With the exception of the decrease in lung function, several prognostic COPD markers have been reported in previous studies.[5,6–13] In the environment of acute exacerbations, studies have also shown the prognostic importance of COPD, including the incidence of exacerbations, hypercapnia and serum uric acid.[13–22] Patients with COPD report an increased prevalence of cancer, cardiovascular disease and depression compared to the general population.[23] Prospective studies have looked at COPD comorbidities and death risk.[24] The meta-analysis by Aran[25] reported that twelve prognostic factors (age, male sex, low body mass index, cardiac failure, chronic renal failure, uncertainty, long-term oxygen therapy, lower limb edoema, Phase 4 Global Initiative for Chronic Lung Disease, corpulmonal, acidemia, and elevated plasma troponin levels) were significantly associated with increased short-term mortality, suggesting elevated mortality rates. However, most of the studies that evaluated markers' predictive function included too many exclusion criteria that do not represent real life, thereby restricting the utility of those markers. Furthermore, most of the variables were validated in only one study without independent validation.[25]

The most commonly observed scores were CURB65 (confusion, urea > 7 mmol / L, respiratory rate > 30 / min, systolic blood pressure < 90 mm Hg and age > 65 years), and BAP65 (urea, confusion, heart rate, age > 65 years).[26–29] The predictive value of the current scores, however, was moderate (area under the curve, 0.7–0.8), indicating that more predictive tools are needed.[30]

The PSI prediction rule awards points based on age, comorbidity, abnormal physical findings (e.g. pulse 125 / min or systolic blood pressure < 90 mm Hg) and abnormal laboratory findings (e.g. hematocrit < 30 percent, partial blood oxygen pressure < 60 mm Hg or blood glucose level 250 mg / dl (14 mmol/litre)) when presented.[31] Yoon K Loke and colleagues conducted a meta-analysis to assess the ability of PSI to correctly predict mortality in pneumonia patients and demonstrated that PSI performed well in identifying pneumonia patients with low risk of death.[32] Another system review[33] also showed that PSI could predict

the 30 day mortality of CAP, with an area under the sROC curve of 0.8. The PSI score more comprehensively reflects the real-life clinical situation, and is an significant indicator of CAP prognosis. Often shows substantial differences in the clinical presentation of COPD exacerbation and pneumonia. Moreover, many of the variables in the PSI system proved to be prognostic factors for AECOPD. To date, however, no study has measured the PSI score's prognostic importance regarding the admission of patients with AECOPD. We therefore investigated whether the PSI score could effectively predict in-hospital mortality in AECOPD patients, and compared its usefulness with the mortality prediction CURB65 and BAP65 indexes.

2. Material and Methods

Site of study
Tertiary care centre, Kolkata a multi-specialty tertiary care hospital.

Study population
In this study 100 patients of COPD coming to the emergency department with signs and symptoms of acute exacerbation were included.

Study design
Prospective, Observational and Hospital based study of 100 patients.

Sample size
N (sample size) = $z_{\alpha}^2 p(1-p)/e^2$ where p is proportion, e is precision
Here α= 5% hence z_{α} = 1.96, p = 7%, e = 5%, n is coming as 100.

Duration of Study
The study was conducted for a period of 1 year (December2015 - November2016).

Eligibility criteria

Inclusion criteria: All diagnosed cases of COPD presenting to the Emergency Department of tertiary care centre,Kolkata with acute exacerbation with signs and symptoms suggestive of pneumonia were the subjects of present study.

Exclusion criteria: Acute Exacerbation of COPD patients with History of hospital admission in the last 14 days. History of antibiotic ingestion in the last one month. Patient who does not want to be a part of the report.

2.1 Methodology

Demographics, clinical signs and symptoms, co-morbidities and laboratory and radiographic findings of patients coming with Acute Exacerbation of COPD (chronic obstructive pulmonary disorder).

2.2 Statistical Methods

Categorical variables are expressed as Patient number and percentage of patients and compared across groups using Pearson's Chi Square Independence of Attributes / Fisher's Exact Test as necessary. Continuous variables are expressed as Mean and Standard Deviation and compared as appropriate in the groups using Mann-Whitney U test / Kruskal Wallis Test. Association of duration of hospital stay and other Continuous variables are analyzed using Spearman's Rank correlation coefficient. For the study the statistical programme SPSS version 20 was used. An alpha level of 5 percent was taken, i.e. if any p value is less than 0.05 it was considered as important.

3. Result and Analysis

Table 1: The relation between age and mortality

		Age			Total	p Value	Significance
		50-65	66-80	>80			
Death	No	29(96.67)	38(71.7)	12(70.59)	79(79)	0.009	Significant
	Yes	1(3.33)	15(28.3)	5(29.41)	21(21)		
Total		30(100)	53(100)	17(100)	100(100)		

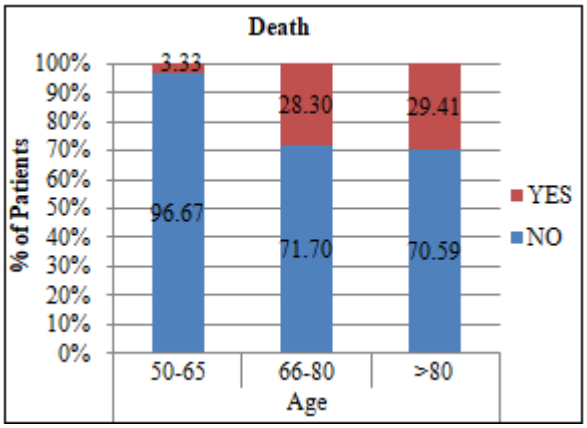

Figure 1: The relation between age and mortality

In our study overall mortality was 21%, while mortality in age groups 50-65, 66-80 and >80 were respectively 3.3%, 28.3% and 29.41%.Hence advanced age showed significant increase in mortality (Table 1 and Figure 1).

Table 2: The relation between gender and mortality

		Gender		Total	p Value	Significance
		Female	Male			
Death	No	1(50)	78(79.59)	79(79)	0.378	Not Significant
	Yes	1(50)	20(20.41)	21(21)		
Total		2(100)	98(100)	100(100)		

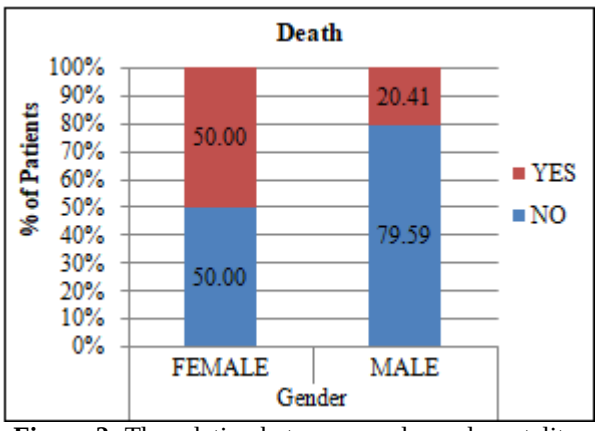

Figure 2: The relation between gender and mortality

In our study 2 out of 100 patients were female and mortality for males and females was 50% and 20.41% respectively, the relation between gender and death was not significant (Table 2 and Figure 1).

Table 3: The relation between fever and mortality

		Fever		Total	p Value	Significance
		No	Yes			
Death	No	45(76.27)	34(82.93)	79(79)	0.422	Not Significant
	Yes	14(23.73)	7(17.07)	21(21)		
Total		59(100)	41(100)	100(100)		

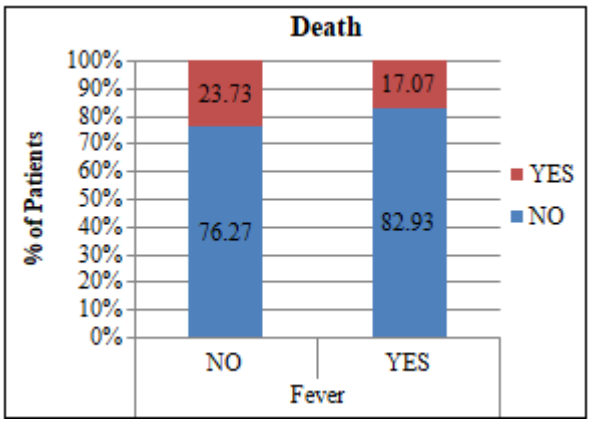

Figure 3: The relation between fever and mortality

There were less number of deaths among patients who had fever, p value = 0.422, hence not significant (Table 3 and Figure 3).

Table 4: The relation between cough and mortality

		Cough		Total	p Value	Significance
		No	Yes			
Death	No	57(78.08)	22(81.48)	79(79)	0.711	Not Significant
	Yes	16(21.92)	5(18.52)	21(21)		
Total		73(100)	27(100)	100(100)		

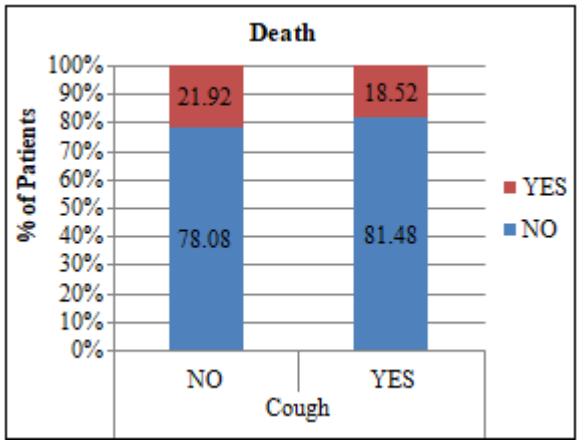

Figure 4: The relation between cough and mortality

The relation between cough and mortality was found to be not significant (p value = 0.711) (Table 4 and Figure 4).

Table 5: The relation between Chest discomfort/Pain and mortality

		Chest discomfort/Pain		Total	p Value	Significance
		No	Yes			
Death	No	77(79.38)	2(66.67)	79(79)	0.511	Not Significant
	Yes	20(20.62)	1(33.33)	21(21)		
Total		97(100)	3(100)	100(100)		

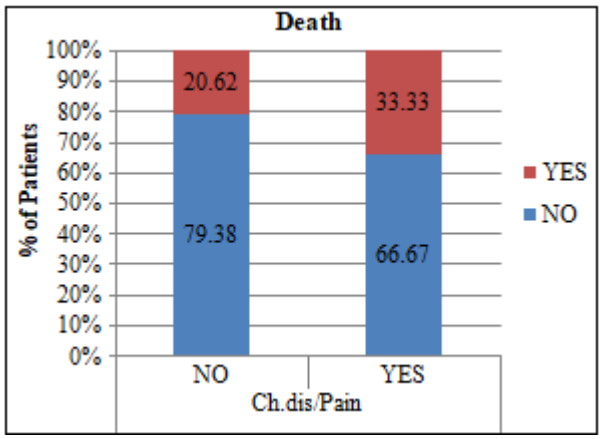

Figure 5: The relation between Chest discomfort/Pain and mortality

No significant relationship was found between chest pain/discomfort and death (p value=0.511) (Table 5 and Figure 5).

Table 6: The relation between confusion and mortality

		Confusion		Total	p Value	Significance
		No	Yes			
Death	No	78(78.79)	1(100)	79(79)	0.790	Not Significant
	Yes	21(21.21)	0(0)	21(21)		
Total		99(100)	1(100)	100(100)		

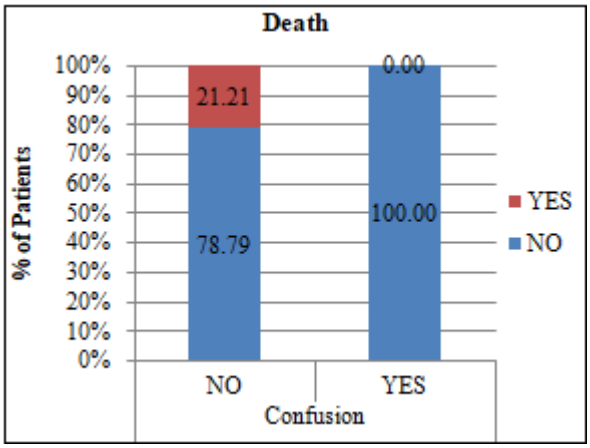

Figure 6: The relation between confusion and mortality

There were no deaths among patients with confusion, p value=0.790, hence not significant (Table 6 and Figure 6).

Table 7: The relation between risk class and mortality

		Risk Class				Total	p Value	Significance
		II	III	IV	V			
Death	No	6(100)	35(100)	35(77.78)	3(21.43)	79(79)	<0.001	Significant
	Yes	0(0)	0(0)	10(22.22)	11(78.57)	21(21)		
Total		6(100)	35(100)	45(100)	14(100)	100(100)		

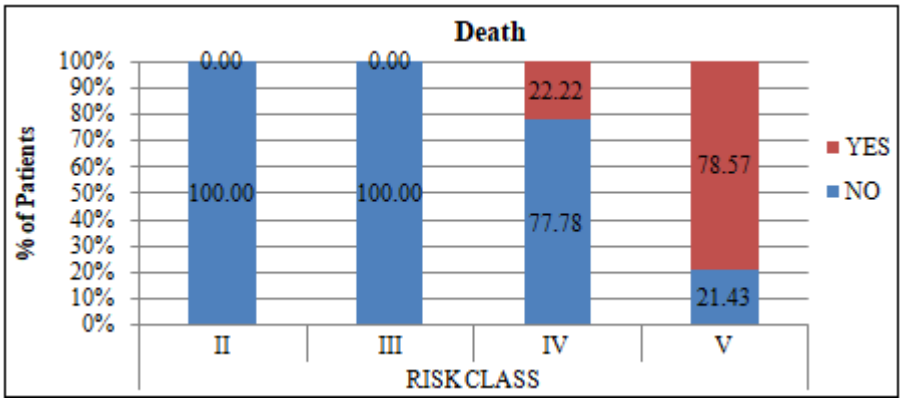

Figure 7: The relation between risk class and mortality

The mortality among risk class of PSI like II, II, IV and V was respectively 0%, 0%, 22.22% and 78.57% respectively. The % of mortality increased significantly as the PSI score increase (p value = <0.001) (Table 7 and Figure 7).

Table 8: The relation betweenCURB-65 and mortality

		CURB-65			Total	p Value	Signif-icance
		Low	Intermediate	High			
Death	No	23(95.83)	50(78.13)	6(50)	79(79)	0.006	Signif-icant
	Yes	1(4.17)	14(21.88)	6(50)	21(21)		
Total		24(100)	64(100)	12(100)	100(100)		

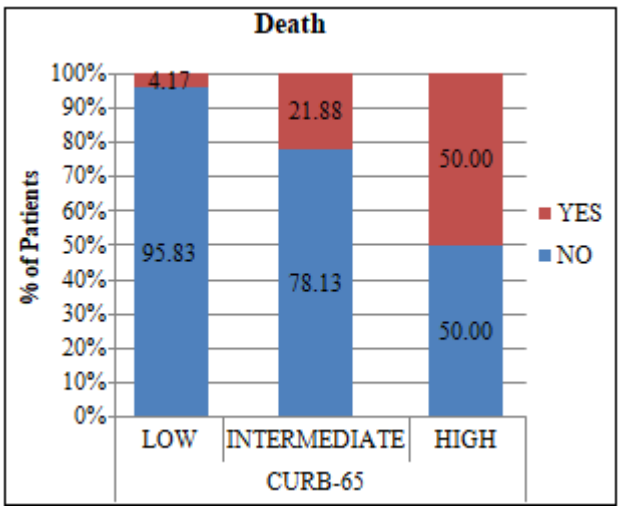

Figure 8: The relation betweenCURB-65 and mortality

The mortality among the low, intermediate and high risk classes of CURB-65 was respectively 4.17%, 14% and 50%, mortality increased as the score increased hence the relationship between these two is significant (p value = 0.006) (Table 8 and Figure 8).

Table 9: The relation between NHR and mortality

		NHR		Total	p Value	Significance
		No	Yes			
Death	No	77(78.57)	2(100)	79(79)	0.622	Not Significant
	Yes	21(21.43)	0(0)	21(21)		
Total		98(100)	2(100)	100(100)		

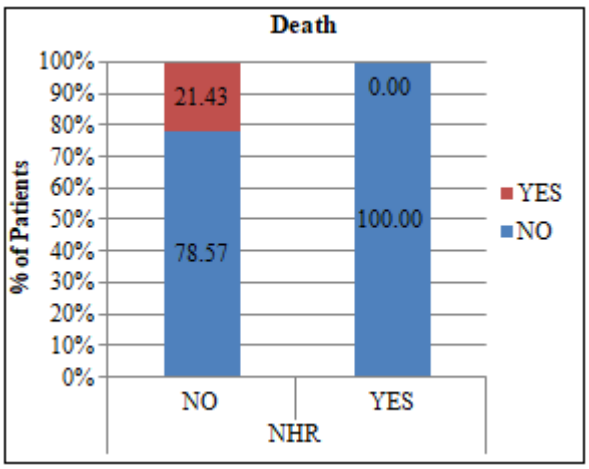

Figure 9: The relation between NHR and mortality

Two patients were admitted from nursing home and rest were from their own home, there was no significant relation between mortality and nursing home residency (p value = 0.622) (Table 9 and Figure 9).

Table 10: Overall the relation between Death and Age, Respiratory rate, Arterial pH, Urea levels, BUN, Blood glucose level, Hematocrit, pO2, PSI score and CURB-65 score

	Death			
	No	Yes		
	Mean ± Std. Deviation	Mean ± Std. Deviation	p Value	Significance
Age	69.84 ± 9.81	76.05 ± 6.4	0.004	Significant
Pulse	100.96 ± 13.79	107.19 ± 23.19	0.101	Not Significant
SBP	139.43 ± 25.11	138.57 ± 19.57	0.702	Not Significant
DBP	77.72 ± 11.2	76.67 ± 8.56	0.936	Not Significant
RR	25.33 ± 3.68	27.19 ± 4.2	0.035	Significant
Temp	99.09 ± 1.31	99.13 ± 1.37	1.000	Not Significant
Art.pH	7.38 ± 0.07	7.27 ± 0.09	<0.001	Significant
Urea	36.41 ± 13.16	52.68 ± 18.89	<0.001	Significant
BUN	17.01 ± 6.15	24.62 ± 8.83	<0.001	Significant
Na	133.28 ± 6.01	130.9 ± 6.49	0.107	Not Significant
Glu	137.04 ± 35.76	178.81 ± 68.57	0.010	Significant
PCV	38.29 ± 5.25	34.81 ± 4.73	0.009	Significant
pO2	64.77 ± 11.76	54.06 ± 6.03	<0.001	Significant
PSI	91.72 ± 18.31	134.33 ± 17.81	<0.001	Significant
CURB-65	1.75 ± 0.65	2.29 ± 0.64	0.002	Significant

Overall the relation between Death and Age, Respiratory rate, Arterial pH, Urea levels, BUN, Blood glucose level, Hematocrit, pO2, PSI score and CURB-65 score was found

to be significant with association PSI score, pO2, Arterial pH, BUN, Urea level being more significant amongst them (Table 10).

4. Discussion

COPD morbidity and mortality are important and on the rise. By 2020 COPD is expected to become the world's third leading cause of death (only surpassed by heart disease and stroke).

In the study a total of 100 (n = 100) patients were selected from COPD patients coming to the emergency department of tertiary care centre, Kolkata for an observational assessment of the severity of disease with the help of an elaborated history.

Our study prospectively assessed the role of PSI and CURB-65 in AECOPD patients to demonstrate that the PSI and CURB-65 score at hospital admission were predictors for duration of hospital stay, morbidity and mortality.

There were several studies done before to study the role of PSI and CURB-65, In CAP patients.

Sr. No	Series	Year	Total patients	COPD patients
1.	Restrepo MI et al.[34]	2006	744	215
2.	Liapikou A et al.[35]	2011	1379	212
3.	Hu G et al.[36]	2015	752	752
4.	Present study	2016	100	100

Similar to the study of Hu G et al. where all the patients had underlying COPD, our study also was conducted similarly on patients with baseline COPD. We selected 100 patients. Most of the studies quoted above concentrated only on patients with CAP. The presence of associated COPD was not a regular or defining feature.

Sr. No	Series	Year	Male	Female
1.	Restrepo MI et al.[34]	2006	582	162
2.	Liapikou A et al.[35]	2011	826	553
3.	Hu G et al.[36]	2015	212	540
4.	Present study	2016	98	2

In our study 2 out of 100 patients were females, probably due to smaller sample size as compared to other studies. Smoking is not usual among females in the state of West Bengal. 30 (30%) patients belonged to the 50-65 year age group, 53 (53%) patients belonged to the 65-80 year age group and 17 (17%) patients were more than 80 years of age. 2 patients were admitted from the nursing home and the rest of the patients from their own home. 6 (6%) patients belonged to risk class II of PSI, 35 (35%) belonged to class III, while 45 (45%) and 14 (14%) belonged to class IV and V respectively. 24 (24%) were from the low risk group of CURB-65, 64 (64%) and 12 (12%) were from the intermediate and high risk group respectively.

All (100%) patients were having shortness of breath, 41 (41%) were having fever, 27 (27%) had cough, 3 (3%) were having chest pain/discomfort and one (1%) patient presented with confusion. 39 (39%) patients had coexisting renal failure, 14 (14%) had heart failure and 7 (7%) had coexisting liver disease while none of the patients had neoplasm or concurrent cerebrovascular disease. 7 (7%) patients were having pleural effusion.

Comparison between mortalities of different risk classes of PSI and CURB-65

Series	Mortality PSI				Mortality CURB-65		
	II	III	IV	V	Low	Intermediate	High
Hu G et al.	0%	1.3%	8.7%	33.1%	4.2%	13.3%	62.5%
Present study	0%	0%	22.22%	78.57%	4.17%	21.88%	50%

In our study, overall in hospital mortality was 21%, while mortality in age groups 50-65, 66-80 and >80 were respectively 3.3%, 28.3% and 29.41%. Hence advanced age was associated with significant increase in mortality. A rather low in-hospital mortality of 9.7% was reported by Hu G et al.

The mortality among risk classes of PSI like II, III, IV and V was respectively 0%, 0%, 22.22% and 78.57% respectively. The percentage of mortality increased significantly as the PSI score increases (p value $\leq$ 0.001). In the study by Hu G et al. mortalities in PSI risk class II, III, IV and V was 0%, 1.3%, 8.7% and 33.1% respectively.

The mortality associated with the low, intermediate and high risk classes of CURB-65 was respectively 4.17%, 14% and 50%. Mortality increased with increase in score demonstrating a significant relation between the two (p value = 0.006). In the study by Hu G et al. mortalities among low, intermediate and high risk class were 4.2%, 13.3% and 62.5% respectively.

The risk of in hospital mortality was significantly different between the groups and increases with higher PSI as well as a higher CURB-65 score.

A PSI score of >130 i.e. risk class V as well as CURB-65 score of more than equal to 3 i.e. group 3, were strong predictors of in hospital mortality.

Limitations of our study were - We only assessed the role of PSI and CURB-65 score in hospital mortality for AECOPD, We did not study the effect of the PSI and CURB-65 score on the long term mortality of COPD patients.

5. Conclusion

Chronic obstructive pulmonary disease (COPD) is a global public health problem and a significant cause of chronic morbidity and mortality worldwide. At least 75-80% of acute exacerbations of COPD are infectious. In our study a total of 100 patients of COPD with acute exacerbation were included in the study from tertiary care centre, Kolkata for a period of 12 months from December 2015 to November 2016. Our study detected 21% in-hospital mortality. A PSI score of >130 i.e. risk class V as well as CURB-65 score of more than equal to 3 i.e. group 3, were strong predictors of in hospital mortality.

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