COMPARATIVE STUDY OF PNEUMONIA SEVERITY INDEX (PSI) & CURB-65 SCORE IN ASSESSING SEVERITY OF COMMUNITY ACQUIRED PNEUMONIA

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ABSTRACT
INTRODUCTION:
Community acquired pneumonia (CAP) is a common disorder with an incidence of about 20% to 30% in developing countries compared to an incidence of 3% to 4 % in developed countries. It is very difficult to find causative organism of community acquired pneumonia in every patient despite aggressive laboratory investigation and blood or sputum culture and it takes few days for it. It is believed that definite prognostic score will be very useful for stratifying patients at high risk and require critical care unit treatment. Pneumonia severity index (PSI) score and CURB-65 Score are two prognostic scoring systems that can stratify patients requiring intensive care unit treatment. Each prognostic score has individual pros and cons and both can be used supplementary to each other. So here we want to study the reliability and validity of PSI and CURB 65 score in Indian population with pneumonia.
MATERIAL & METHOD:
A hospital based comparative observational study included total 50 patients with pneumonia based on inclusion and exclusion criteria. Complete clinical history and physical examination done. At the time of initial evaluation, chest radiograph was done and repeated after 48 hours. ECG, ABGA, serum electrolyte measurement, sputum for gram staining and culture, blood cultures (in selected patients), complete blood counts, blood urea nitrogen and serum creatinine and fasting blood glucose were measured in every patient. Analysis was done with help of SPSS software and using Microsoft Excel 2012.
RESULTS:
In our study, total 50 patients were enrolled among them 34 patients were male while 16 patients were female. Most common organism cultured was klebsiella species that was in 18 (36%) patients while 18 patients had no organisms seen in sputum culture. In our study, 8(16%) patients were died out of 50 patients admitted. PSI class 4 showed highest sensitivity in predicting mortality 50%, while specificity was highest for class 2 with 90.4%, followed by class 5 with 73.8%. The PPV was highest for class 4 22%, and NPV was highest for class 4 87.5%. Among CURB 65 score, class 4 showed highest sensitivity in predicting mortality 50%, while specificity was highest for class 4 with 92.8%, followed by class 3 with 85.7%. The PPV was highest for class 4= 57.1%, and NPV was highest for class 4= 90.6%.
CONCLUSION:
It is observed that PSI has better specificity and negative predictive value (NPV) but less sensitivity and positive predictive value (PPV). This is because impact of age is observed in PSI which leads to lower estimation of severity of CAP mostly in young patients who have no other comorbidities. The two scoring CURB-65 and PSI approaches have to be viewed at the most as being complementary as each has different strengths and weaknesses. With help of CURB-65 and PSI Score, we can better understand the prognosis and classify patients on basis of severity and adequate utilization of resources and proper treatment to improve outcome in developing countries like India.

KEYWORDS:
Community Acquired Pneumonia (CAP), Pneumonia Severity Index (PSI), CURB-65,

INTRODUCTION

Community acquired pneumonia (CAP) is a common disorder with an incidence of about 20% to 30% in developing countries compared to an incidence of 3% to 4 % in developed countries.[1-2] The incidence varies markedly with age, being much higher in the very young and the elderly.

It is very difficult to find causative organism of community acquired pneumonia in every patient despite aggressive laboratory investigation and blood or sputum culture and it takes few days for it. Even with the use of extensive laboratory testing and invasive procedures, aetiological confirmation being achieved in no more than 45% to 70% of patients.

The reported mortality of adults admitted to hospital with CAP has varied widely (4%–21%). In developing country like India, CAP is still one of the major causes of death. It is most commonly observed among patients admitted in intensive care unit with high severity. It is believed that definite prognostic score will be very useful for stratifying patients at high risk and require critical care unit treatment. Pneumonia severity index (PSI) score developed in USA and CURB-65 Score which includes confusion, elevated BUN, increased Respiratory rate, low blood pressure and age more than 65 years are two prognostic scoring system that can stratify patients requiring intensive care unit treatment. Each prognostic score has individual pros and cons and both can be used supplementary to each other.

As we know, burden of pneumonia in terms of morbidity and mortality is very high in developing countries like India. But there is little task done to study the prognostic and adverse events associated with community acquired pneumonia. India has different population demographics and health care system and limited health resources. So here we want to study the reliability and validity of PSI and CURB 65 score in Indian population with pneumonia.

AIMS & OBJECTIVES:

- To evaluate the clinical profile of community acquired pneumonia.
- To study and compare CURB-65 Score and Pneumonia Severity Index (PSI) in stratifying the severity of community acquired pneumonia and its prognosis.

MATERIAL & METHOD:

The study was conducted in Department of General Medicine, C. U. Shah Medical College & Hospital, Surendranagar, Gujarat. A total 50 patients with pneumonia were included in study.

Study design- A hospital based comparative observational study

Inclusion criteria
- Age more than 18 years (for both male/female)
- Patients of pneumonia on basis of clinical diagnosis and confirmed with chest radiograph

Exclusion criteria
- Patients infected with HIV
- Chronically immunosuppressed patients (e.g., patients on steroids, immunosuppressive agents, CRF, Neutropenic patients,)
- Patients who are pregnant.
- Patient with active pulmonary tuberculosis

On the basis of above inclusion and exclusion criteria, total 50 patients were enrolled in our study. The written informed consent was obtained. Complete clinical history and physical examination done as per proforma. At the time of initial evaluation, chest radiograph (postero-anterior and/or lateral views) was done and repeated after 48 hours. Electrocardiogram, arterial blood gas analysis, serum electrolyte measurement, sputum for gram staining and culture, blood cultures (in selected patients), complete blood counts, blood urea nitrogen and serum creatinine and fasting blood glucose were measured in every patient.

Analysis was done with help of SPSS software and using Microsoft Excel 2012. For the comparison of Severity index MANN WHITNY (non-parametric test) Test was used. To interpret the other results, Mean, SD, percentage and Chi square Test were used.
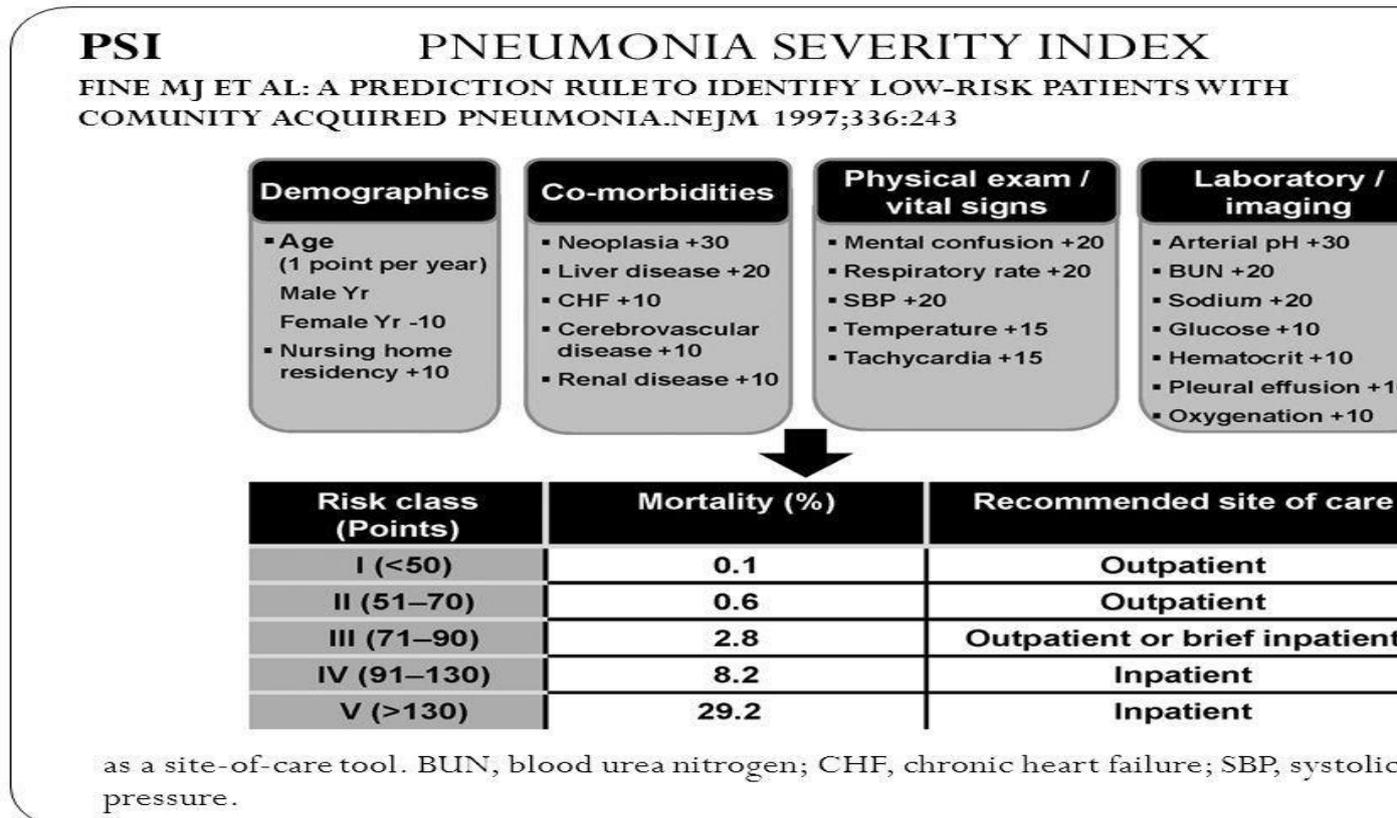
CURB – 65 SCORE:

CURB-65	Clinical Feature	Points
C	Confusion	1
U	Urea > 7 mmol/L	1
R	RR ≥ 30	1
B	SBP ≤ 90 mm Hg OR DBP ≤ 60 mm Hg	1
65	Age > 65	1

CURB-65 Score	Risk group	30-day mortality	Management
0 -1	1	1.5%	Low risk, consider home treatment
2	2	9.2%	Probably admission vs close outpatient management
3-5	3	22%	Admission, manage as severe

PNEUMONIA SEVERITY INDEX (PSI) SCORE:

PSI   PNEUMONIA SEVERITY INDEX

FINE MJ ET AL: A PREDICTION RULE TO IDENTIFY LOW-RISK PATIENTS WITH COMUNITY ACQUIRED PNEUMONIA. NEJM 1997;336:243

Demographics
- Age (1 point per year) Male Yr Female Yr -10
- Nursing home residency +10

Co-morbidities
- Neoplasia +30
- Liver disease +20
- CHF +10
- Cerebrovascular disease +10
- Renal disease +10

Physical exam / vital signs
- Mental confusion +20
- Respiratory rate +20
- SBP +20
- Temperature +15
- Tachycardia +15

Laboratory / imaging
- Arterial pH +30
- BUN +20
- Sodium +20
- Glucose +10
- Hematocrit +10
- Pleural effusion +1
- Oxygenation +10

Risk class (Points)	Mortality (%)	Recommended site of care
I (<50)	0.1	Outpatient
II (51–70)	0.6	Outpatient
III (71–90)	2.8	Outpatient or brief inpatient
IV (91–130)	8.2	Inpatient
V (>130)	29.2	Inpatient

as a site-of-care tool. BUN, blood urea nitrogen; CHF, chronic heart failure; SBP, systolic pressure.

RESULTS:

TABLE 1: AGE AND SEX WISE DISTRIBUTION OF PATIENTS WITH PNEUMONIA

Age Group	Sex		Total
	Male	Female	
25-35	3 (6%)	3(6%)	6(12%)
35-45	5(10%)	2(4%)	7(14%)
45-55	10(20%)	3(6%)	13(26%)
55-65	8(16%)	6(12%)	14(28%)
65-75	8(16%)	2(4%)	10(20%)
Total	34(68%)	16(32%)	50(100%)

In our study, total 50 patients were enrolled among them 34 patients were male while 16 patients were female. Maximum patients 14 (28%) were in 55-65 years age group.

TABLE 2: SYMPTOMS IN PATIENTS

	Frequency	Percentage (%)
Cough	47	94
Expectoration	47	94
Dyspnoea	43	86
Fever	40	80
Confusion	8	16
Chest pain	4	8

Among the respiratory symptoms, cough was present in 47(94%) patients, expectoration in 47(94%) patients, fever in 40(80%) patients, dyspnoea in 43(86%), pleuritic chest pain in 4(8%) patients.

TABLE 3: SPUTUM CULTURE

Sputum	Frequency	Percent (%)
CANDIDA	3	6.0
KLEBSIELLA SPECIES	18	36.0

PSEUDOMONAS SPECIES	6	12.0
S. AUREUS	3	6.0
STREPTOCOCCOUS SPECIES	2	4.0
NIL	18	36.0
Total	50	100.0

In our study, most common organism cultured was klebsiella species that was in 18 (36%) patients while 18 patients had no organisms seen in sputum culture.

TABLE 4: MORTALITY FREQUENCY

Outcome	Frequency	Percent (%)
DEATH	8	16.0
IMPROVED	42	84.0
Total	50	100.0

In our study, 8(16%) patients were died out of 50 patients admitted.

TABLE 5: FREQUENCY OF DEATH IN EACH CLASS OF PSI AND CURB-65 SCORE

	PSI Score	CURB 65 Score
Class-1	0	1
Class-2	0	1
Class-3	1	2
Class-4	4	4

Class-5	3	0
Total	8	8

Total 8 patients died in our study. Mortality was seen in class 4(50%) and 5(37.5%) of PSI, while in CURB most patients who died were in class 4(50%).

TABLE 6: SENSITIVITY, SPECIFICITY, PPV, NPV & ACCURACY OF PNEUMONIA SEVRITY INDEX FOR PREDICTING MORTALITY IN STUDY POPULATION

PSI	Sensitivity	Specificity	PPV*	NPV*
Class-I	-	-	-	-
Class-II	0	90.4	0	82.6
Class-III	12.5	71.4	7.6	81.08
Class-IV	50	66.6	22.2	87.5
Class-V	37.5	73.8	21.4	86.1

In our study class 4 showed highest sensitivity in predicting mortality 50%, while specificity was highest for class 2 with 90.4%, followed by class 5 with 73.8%. The Positive predictive value was highest for class 4 22%, and Negative predictive value was highest for class 4 87.5%.

TABLE 7: SENSITIVITY, SPECIFICITY, POSITIVE PREDICTIVE VALUE, NEGATIVE PREDICTIVE VALUE & ACCURACY OF CURB – 65 SCORE

CURB	Sensitivity	Specificity	PPV	NPV
Class-I	12.5	54.7	5	76.6
Class-II	12.5	71.4	7.6	81.1
Class-III	25	85.7	25	85.7
Class-IV	50	92.8	57.1	90.6

In our study, among CURB 65 score, class 4 showed highest sensitivity in predicting mortality 50%, while specificity was highest for class 4 with 92.8%, followed by class 3 with 85.7%. The Positive predictive value was highest for class 4= 57.1%, and Negative predictive value was highest for class 4= 90.6%.

TABLE 8: **SENSITIVITY, SPECIFICITY, PPV, NPV & ACCURACY OF PSI AND CURB65 FOR MORTALITY IN STUDY POPULATION**

	Highest class	Sensitivity	Specificity
PSI	>4.0	37.5	73.8
CURB	>1.0	87.5	54.7

CURB was more sensitive in predicting mortality than PSI with sensitivity of 87.5% and 54.7% respectively while PSI was more specific with specificity of 73.8%.

DISCUSSION:

The mean age of males in our study was 55.25± (13.13) years while that of Shah BA et al[3] study was 60.8 (±13.6) years, similarly mean age of females in our study was 52.5± (15.02) years while in study done by Shah BA et al[3] it was 48.3 (±17.0) years. It is proven that incidence of community acquired pneumonia increases with extremes of age.

In our study, there were 68% male patients and 32% female patients. In a study done by Metleyet al[4] male to female ratio was 4:1. Males were most commonly affected compared to females due to habits of cigarette smoking and alcoholism as well as underlying respiratory disease like COPD and occupational hazards.

In our study among the presenting symptoms, 47 (94%) patients had cough, 40 (80%) patients had fever and 4 (8 %) patients had pleuritic chest pain, 8(16%) had confusion. In study done by Shah BA ET al[3] (n=150) among the presenting symptoms, 135 (89.9%) patients had cough, 94 (62.66%) patients had fever and 61 (45%) patients had pleuritic chest pain, 47(31.3%) had confusion.

In our study it is found that 18 patients had sputum culture of normal commensal and 18 patients had Klebsiella pneumonia being more common pathogen on culture accounting for 36%. Next common is Pseudomonas which accounts for 12%. In the study done by S. Bansal(n=70)[2] found that Streptococcal was about 35.8% and Staphylococcal 17%, Klebsiella was 22.6%.

In our study 8 patients died, 4(50%) were in PSI class IV and 3 (37.5%) were in PSI class V and one patient in class III died. Among CURB 65 group, 4(50%) patients in class IV group died, while 2 (25%) in class III and one patient in each class I and class II were expired. In a study done by Shah BA[3] et al mortality was 10.7%. It was observed that all patients who were died belongs to PSI class > IV and it's zero in those who were in PSI class I to III. Among CURB – 65, maximum mortality was observed in class IV (68.7%) followed by class V (18.8%).

In our study PSI class IV has sensitivity of 50% in predicting mortality and class II has specificity of 90.4. PSI class V has sensitivity of 37.5% and specificity of 73.8% in predicting mortality. PSI class V has positive predictive value of 21.4 and negative predictive value of 86.1. CURB65 class IV has sensitivity of 50% in predicting mortality and class IV has specificity of 92.8%. CURB65 class IV has positive predictive value of 57.1 and negative predictive value of 90.6. It is observed that Pneumonia severity Index (PSI) has better specificity and negative predictive value but poor sensitivity and positive predictive value. This is because impact of age is observed in PSI which leads to lower estimation of severity of CAP mostly in young patients who have no other comorbidities.

In a study done by Ananda-Rajah MR ET al[5] retrospectively reviewed the records of all patients admitted to the institution with confirmed community acquired pneumonia (CAP) forthe 12 months from January 2002. In his study overall 30-day mortality was 15.4% and ICU admission of 10.5% among 408 episodes. CURB 65 score ≥3

had worse prognosis compare to PSI class ≥4 in terms of 30-day mortality and ICU admission. It is also observed that CURB 65 score is very easy to calculate but it is not sensitive or specific in terms of predicting death in community acquired pneumonia patients.

A study conducted by Drahomir A et al[6] on 3181 patients with community acquired pneumonia concluded that the more complex pneumonia severity index has a higher discriminatory power for short-term mortality, defines a greater proportion of patients at low risk, and is slightly more accurate in identifying patients at low risk than either CURB65 score.

A study conducted by Man SY ET al[7] on 1016 patients concluded that all three predictive rules have a similar performance in predicting the severity of CAP, but CURB65 is more appropriate than the other two for use in because of its simplicity of application and ability to identify low-risk patients.

A study by Jung-Hsiang Chen ET al[8], he observed that elderly patients have worse outcomes and chances of atypical infections are more compared to younger patients. The poor performance of pneumonia severity index in old age patient is based on inappropriate weight to the age variable. If it's cut off point to define pneumonia is modified, it can give appropriate performance even in old age patients.

A study conducted by Buising, Thursky, Black, ET al[9] on 392 patients concluded that different severity scores have different strengths and weaknesses as prediction tools. It should be properly validated in appropriate clinical and demographical settings to ensure the severity and prognosis of severe CAP that leads perfect utilization of health resources.

CONCLUSION:

It is observed that in our study and all previous studies, mortality rates in different classes increases progressively with increasing risk scores in both PSI and CURB-65 risk classes.

It is observed that Pneumonia severity Index (PSI) has better specificity and negative predictive value (NPV) but less sensitivity and positive predictive value (PPV). This is because impact of age is observed in PSI which leads to lower estimation of severity of CAP mostly in young patients who have no other comorbidities.

The two scoring CURB-65 and PSI approaches have to be viewed at the most as being complementary as each has different strengths and weaknesses.

With help of CURB-65 and PSI Score, we can better understand the prognosis and classify patients on basis of severity and adequate utilization of resources and proper treatment to improve outcome in developing countries like India.

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