



## Full Length Research Article

### STUDY OF THE OUTCOME WITH RESPECT TO PNEUMONIA SEVERITY INDEX (PSI) SCORING SYSTEM IN COMMUNITY ACQUIRED PNEUMONIA

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#### ABSTRACT

Community-acquired pneumonia (CAP) remains a common and serious illness despite the availability of potent new anti-microbial agents and effective vaccines. In these study 200 cases of community acquired pneumonia. The cases included were patients aged more than 14 years admitted to the Dept. of Medicine, Dr. BRAM Hospital, Raipur fulfilling the specified inclusion criteria. It was found that CAP is one of the common infections of the respiratory tract. It occurs in all age groups, but the incidence is more with advancing age. Mortality rates progressively increase with increasing risk class in Pneumonia Severity Index (PSI) severity scoring system. By using the knowledge of these criteria, patients of CAP can be better prognosticated as regards severity of their illness with consequently better triaging of patients, utilization of resources and appropriate treatment to improve the outcome in this disease.

**Key words:** Mortality, Community aquired pneumonia, Pneumonia Severity Index (PSI).

#### INTRODUCTION

Community-acquired pneumonia (CAP) remains a common and serious illness despite the availability of potent new anti-microbial agents and effective vaccines. The mortality rate of pneumonia patients in out-patient settings is low, in the range of one to five per cent, but among patients who require admissions to ICU it approaches 25% (Fang *et al.*, 1990, Torres *et al.*, 1990). It is hoped that the knowledge of relevant prognostic factors might be useful for early identification of patients at high risk requiring intensive care treatment. Prognostic scoring systems for CAP have been developed to address these issues. The two prominent tools for this purpose are the pneumonia severity index (PSI), developed in the USA after pneumonia outcome research trial (PORT), and the BTS rule, which has recently been modified to the CURB-65 rule "confusion, elevated blood urea nitrogen, elevated respiratory rate, low systolic or diastolic blood pressure (BP), and age over 65 years (CURB-65)" rule (Fine *et al.*, 1997, Lim *et al.*, 2003). To determine the PSI, points are given for 20 variables, including age, coexisting illness, and abnormal physical and laboratory findings. On the basis of the resulting score, patients are assigned to one of five classes with the following

Mortality rates: class 1, 0.1%; class 2, 0.6%; class 3, 2.8%; class 4, 8.2%; and class 5, 29.2%. Clinical trials demonstrate that routine use of the PSI results in lower admission rates for class 1 and class 2 patients. Patients in classes 4 and 5 should be admitted to the hospital, while those in class 3 should ideally be admitted to an observation unit until a further decision can be made. The CURB-65 criteria include five variables: confusion (C); urea >7 mmol/L (U); respiratory rate 30/min (R); blood pressure, systolic 90 mmHg or diastolic 60 mmHg (B); and age 65 years (65). Patients with a score of 0, among whom the 30-day mortality rate is 1.5%, can be treated outside the hospital. With a score of 2, the 30-day mortality rate is 9.2%, and patients should be admitted to the hospital.

Among patients with scores of 3, mortality rates are 22% overall; these patients may require admission to an ICU. It is not clear which assessment tool is superior. The PSI is less practical in a busy emergency room setting because of the need to assess 20 variables. While the CURB-65 criteria are easily remembered, they have not been studied as extensively. Whichever system is used, these objective criteria must always be tempered by careful consideration of factors relevant to individual patients, including the ability to comply reliably with an oral antibiotic regimen and the resources available to the patient outside the hospital. In fact, neither the PSI nor CURB-65 is ideal for determining the need for ICU care. The severity criteria proposed by the Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS)

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in their guidelines for the management of CAP are better suited to this purpose.

### Pneumonia Severity Scores CURB-65 (Lim *et al.*, 2003)

The Agency for Healthcare Research and Quality (AHRQ) - funded Pneumonia PORT Pneumonia Patient Outcomes Research Team (PORT) developed and tested the PSI in 1996

### Pneumonia Severity Index (Fine *et al.*, 1997)

PSI Risk Class 1 : Age >50 & NO Malignancy, CCF, Cerebrovasc, Renal or Liver disease & Normal Mental state, P<125, Resp <30, Syst BP >90, Temp 35-40C. Patients in Risk class III, IV & V are treated as inpatients.

### Sample size

200 cases of community acquired pneumonia.

### Selection of cases

The cases included were patients aged more than 14 years admitted to the Dept. of Medicine, Dr. BRAM Hospital, and Raipur fulfilling the specified inclusion criteria.

### Inclusion criteria

Patients with new or progressive pulmonary infiltrates on chest radiograph with at least two of the following four:

	Predictor	Score
C	Confusion	1
U	Urea > 7 mmol/l	1
R	Respiratory rate > 30/min	1
B	Systolic Blood pressure < 90 mmHg or Diastolic Blood pressure < 60 mmHg	1
65	Age > 65 years	1
CURB-65 score	Risk Group	30-day mortality
CURB-65 Score		Management
0-1	1	1.5% Home
2	2	9.2% Likely to need admission
3-5	3	22% Admit. Manage as severe

Score	PSI Risk class	30-day mortality
≤70	1	0.1%
71-90	2	0.6%
91-130	3	0.9%
>130	4	9.3%
	5	27%

Risk Factors	Patient Characteristics	Points
Demographic factors	Male	Age in yrs
	Female	Age in yrs-10
Co-morbid illnesses	Nursing home resident	10
	Neoplastic disease	30
	Liver disease	20
	Congestive heart failure	10
	Cerebrovascular disease	10
Physical examination	Renal disease	10
	Altered mental status	20
	Respiratory rate 30/min or more	20
	Systolic blood pressure less than 90 mm Hg	20
	Temperature 35C (95F) or less, or 40C (104F) or more	15
Laboratory	Pulse 125/min or more	10
	Arterial pH less than 7.35	30
	BUN 30 mg/dl (10.7 mmol/l) or more	20
	Sodium less than 130 mEq/l (mmol/l)	20
	Glucose greater than 250 mg/dl (13.88mmol/l)	10
	Hematocrit less than 30% (0.30)	10
	Arterial pO <sub>2</sub> less than 60mmHg (8.0kPa) or SaO <sub>2</sub> less than 90 percent	10
	Plural effusion	10

## MATERIALS AND METHODS

### Place of study

Department of Medicine, Pt. JNM Medical college & Dr. B.R. Ambedkar Memorial Hospital, Raipur

- \* Fever
- \* Cough
- \* Purulent sputum production
- \* Leucocytosis over 10,000/mm<sup>3</sup>.

### Exclusion Criteria

- Patients with radiographic evidence of tuberculosis
- AIDS

- Patients on immunosuppressive therapy
- Patients hospitalised within previous 14 days
- Pulmonary infarction
- Patients with an alternate diagnosis during follow-up

**Methodology**

- Selection of cases: All patients who were admitted in the dept. of medicine fulfilling the inclusion criteria for the study.
- Informed consent from patients was taken.
- A detailed history regarding presence of fever, cough, purulent sputum production and pleuritic chest pain was noted.
- Blood samples for complete hemogram, renal and liver function tests, electrolytes and random/fasting blood sugar, serum albumin, total protein were sent at the time of admission.
- Chest X-ray P/A view
- ECG
- ABG
- Sputum collection was done for gram staining , AFB staining and culture / sensitivity
- Blood culture and sensitivity
- Throat swab culture

**Sample Collection**

**Sputum collection for staining & culture was done at the time of admission for**

- Gram staining and AFB staining.
- Sputum containing more than 25 polymorph nuclear cells and less than 10 epithelial cells per low power field was subjected to gram staining. (Mandell and Wunderink, 2012)
- Sputum was also subjected to bacterial culture on blood agar and Mac Conkey’s agar media.
- In patients who could not expectorate sputum spontaneously, sputum induction was done by three per cent hypertonic saline nebulisation.

**Blood collection for culture**

- Two samples for blood culture were drawn from two different sites 30 minutes apart and were inoculated over blood agar and Mac Conkey’s Agar media respectively at 37°C for 24-48 hours.

**All above mentioned investigations were performed using following equipments**

- 1) I Lab 650 Clinical Chemistry System, fully automated analyzer was used for renal function test, liver function test and random blood sugar examination.
- 2) Gem Premier 3000, fully automated analyzer from I Lab was used for ABG Analysis.
- 3) I-Lyte, Na KCl System was used for serum electrolyte(Na, K, Cl) Analysis.
- 4) Lab life (RFCL)H3D and Abacus(ARK) automated hematological analyzers were used for CBC Analysis.
- 5) Gibson’s pulse oximeter was used for analysis of oxygen saturation.

6) Blood Urea Nitrogen (BUN) = Blood Urea/2.14

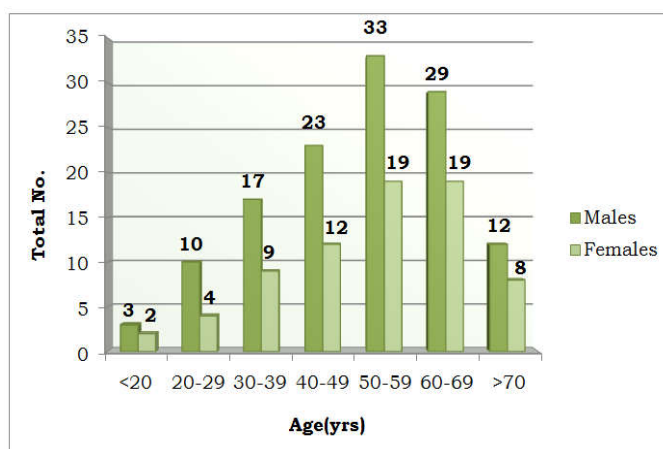
**Observations and Results**

1. Most number of CAP cases were in the 50-59yrs age group (26%) followed by 60-69 yrs (24%) and 40-49 yrs (17.5%). The least number of patients were in the <20 yrs age group (2.5%). Mean age of the patients was calculated to be 51.7 ± 14.809 years. (Mean ± S.D) 60% of the cases are in ≥ 50 years of age.
2. 63.5% of cases are males and 36.5% cases were females.

Male: Female = 1.73:1

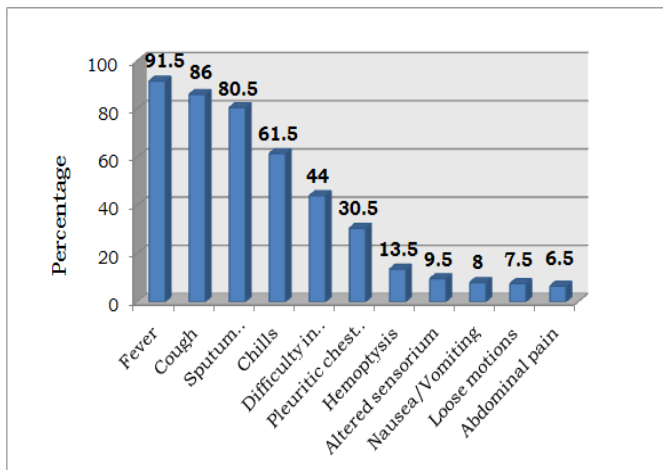
Mean age of male patients suffering from CAP = 51.060 ± 14.606 yrs.

Mean age of female patients suffering from CAP = 52.808 ± 14.809 yrs.



3. The most common presenting symptoms in cases of CAP were fever (91.5%) followed by cough (86%) and sputum production (80.5%).

Other presenting symptoms in cases of CAP were Chills (61.5%); Difficulty in breathing (44%); Pleuritic chest pain (30.5%); Hemoptysis (13.5%) ; Altered sensorium (9.5%) ; Nausea/Vomiting (8%) ; Loose motions (7.5%) & Abdominal pain(6.5%).



**Assessment of severity of pneumonia by PSI**

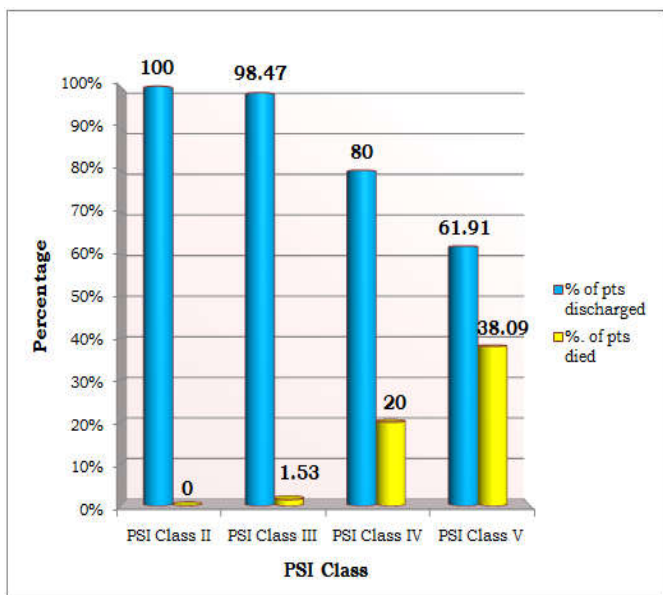
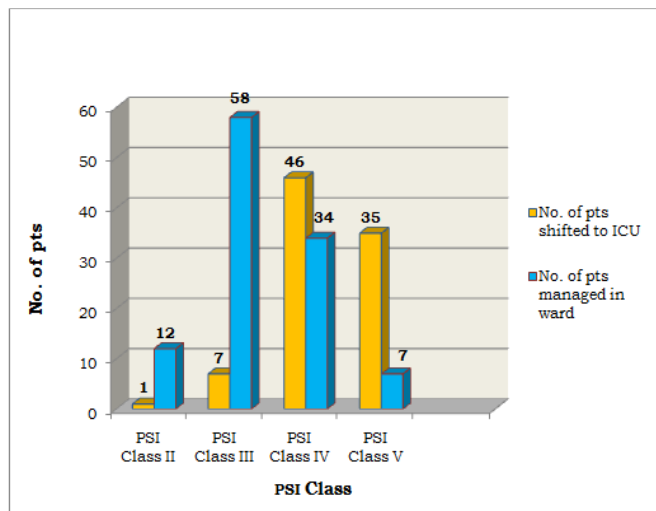
**Death of CAP patients in each PSI Class**

PSI Class	No. of cases	No. of deaths	% of pts died	No. of pts discharged	% of pts discharged
I	0	0	0	0	0
II	13	0	0	13	100
III	65	1	1.53%	64	98.47
IV	80	16	20%	64	80
V	42	16	38.09%	26	61.91

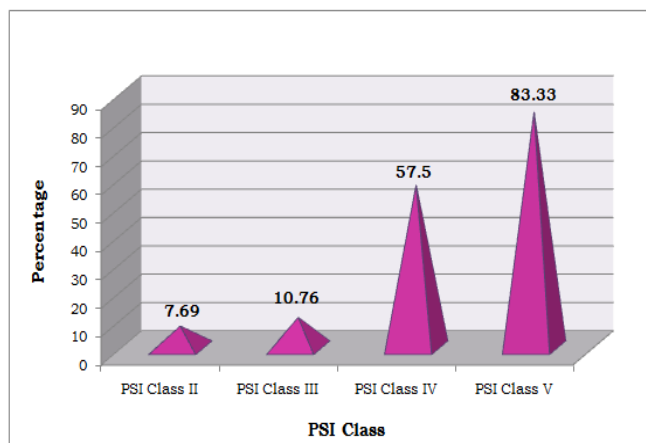
This table shows the no. of deaths and discharges in each PSI risk class. There were a total 33 deaths in the study. Majority of deaths of CAP patients belonged to PSI risk class V (38.09%; 16 out of 42) and IV (20%; 16 out of 80) and 1 death out of 65 cases occurred in PSI risk class II.

8. That the duration of hospital stay ranged from 5-17 days with a mean of 8.03 days. The average hospital stay increases with increasing PSI risk class with a minimum of 5 days for class II and a maximum of 17 days for PSI risk class V. The average hospital stay was 11 days for PSI risk class III and 14 days for PSI risk class IV.

10. For PSI Class V, 35 patients out of 42 ; for PSI Class IV, 46patients out of 80 ; for PSI Class III, 7 patients out of 58; for PSI Class II, 1 patient out of 13 were managed in the ICU.

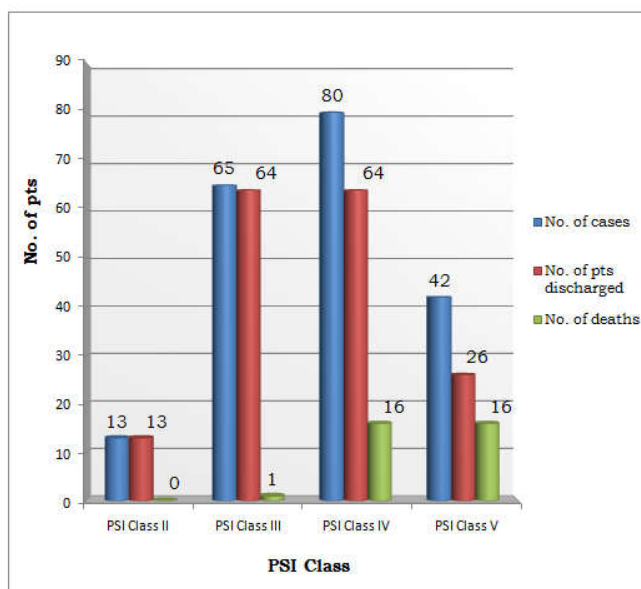


9. That 83.33% (35 out of 42) of PSI class V cases were shifted to ICU followed by 57.5% (46 out of 80) of PSI class IV cases; 10.76% (7 out of 65) of PSI class III cases; 7.69% (1 out of 13) of PSI class II cases.



11. The percentage of deaths of CAP patients is very high for patients admitted in the ward than in the ICU for PSI risk class V (100% v/s 25.71%) and IV(35.29% v/s 8.69%).

12. Mortality amongst the total no. of patients admitted for CAP, the maximum number fall into PSI class IV (80 cases; 40%) followed by class III (65 cases;32.5%) and V(42 cases;21%).It also shows the number of discharges and deaths in each class.



**DISCUSSION**

**In our study**

Out of 200 patients, 127 patients (63.5%) were male while 73 patients (36.5%) were female. Male to female ratio was 1.73:1

Most number of CAP cases were in the 50-59yrs age group (n=52; 26%) followed by 60-69 yrs (24%) and 40-49 yrs (17.5%). In the 50-59 yrs age group there were 33 males and 19 females followed by 60-69 yrs age group which had 29 males and 19 females and 40-49 yrs which had 23 males and 12 females. Mean age was  $51.7 \pm 14.809$  years (range 18-83 yrs). Our gender wise distribution was similar to the study by Oberoi A *et al.*, 2006, where they studied 233 patients of CAP out of which 60.5% were males and 39.5% females.

In the study by Madhulatha CK S *et al.*, 2013, the mean age of patients was  $53.36 \pm 17.42$  years (range 18-90 years). There were 73 males and 27 females. Male to female ratio was 2.7:1. The maximum number of cases of CAP was in the more than 50 years of age group (60%), which is similar to our study. In the study by Shah *et al.*, 2010 the mean age of patients was  $53.36 \pm 17.42$  years (range 18-90 years). There were 73 males and 27 females. Male to female ratio was 2.7:1. The maximum number of cases of CAP was in the more than 50 years of age group (60%).

In a study of Yasemin *et al.*, 2010, a total of 77 adult patients, 54 male (70.1%), with pneumonia were enrolled in the study. Mean age was calculated to be  $54.67 \pm 16.99$  years (range 20-83). Thirty five (45.5%) patients were older than 60 which was similar to our study. In a study by Khattab *et al.*, 2010, two hundred and ten elderly cases were included in the period of October 2009 to April 2010. The age range of the patients was from 60 to 88 years old with mean age 65.366 years old. 61.4% were males and 38.6% were females. This sex distribution was very similar to our study. In a study by Moghaddam *et al.*, 2013 two hundred patients with community-acquired pneumonia were enrolled (122 males, 78 females). Their mean age was  $68 \pm 18$  years, ranging from 18 to 68 years. The gender wise distributions of cases was very similar to our study.

In the study by Shah *et al.*, 2010, 150 cases of community acquired pneumonia were included, 89 (59.3%) were males. The mean age ( $\pm$ SD) of males [ $60.8 (\pm 13.6)$  years] was higher than that of females [ $48.3 (\pm 17.0)$  years]. Irfan *et al.*, 2009 analyzed data on 329 cases, 187 (56.8%) males and 142 (43.2%) females, in the final study group. The mean age of the study group was  $62 \pm 16.3$  years (range: 18 to 92 years).

### Assessment of severity of pneumonia by PSI

#### Death of CAP patients in each PSI Class

In our study there were 33 deaths (16.5%) out of the 200 patients included. Majority of deaths of CAP patients belonged to PSI risk class V (38.09%; 16 out of 42) and IV (20%; 16 out of 80). In a study by Shah BA *et al.*, 2010 which was conducted on 150 patients, 16 patients (10.7%) had died. All the patients who died were in PSI class IV or V. Mortality in PSI class I to III was 0%; in class IV, 14.1% and Class V, 34.8 percent. In a study by Moghaddam *et al.*, 2013 Two hundred patients with community-acquired pneumonia were enrolled (122 males, 78 females). Overall, 36 patients died (18%) during the study period; of those, six had been hospitalized in different wards and the remaining 30 were admitted to ICUs. These results were very similar to our study.

In a study by Irfan *et al.*, 2009 the overall mortality was 36 (11%), 283 patients were discharged (86%) and 10 (3%) patients were transferred to Another hospital.

#### Average hospital stay for CAP patients in each PSI Class

In our study the duration of hospital stay ranged from 5-17 days with a mean of 8.03 days. The average hospital stay increases with increasing PSI risk class with a minimum of 5 days for class II and a maximum of 17 days for PSI risk class V. In the study of Bansal *et al.*, 2010 the duration of hospital stay ranged from 2-21 days with a mean of 9.11 days.

#### Site of management of CAP patients

83.33% (35 out of 42) of PSI class V cases followed by 57.5% (46 out of 80) of PSI class IV cases; 10.76% (7 out of 65) of PSI class III cases; 7.69% (1 out of 13) of PSI class II cases were managed in the ICU. In the study by Shah *et al.*, 2010 conducted on 150 patients; for PSI Class V, 17 pts out of 23 (73.91%) and for PSI Class IV, 18 pts out of 57 (31.57%) were managed in the ICU.

#### Mortality rates progressively increase with increasing risk class in PSI severity scoring system

By using the knowledge of these criteria, patients of CAP can be better prognosticated as regards severity of their illness with consequently better triaging of patients, utilization of resources and appropriate treatment to improve the outcome in this disease.

#### Conclusion

To conclude, CAP is one of the common infections of the respiratory tract. It occurs in all age groups, but the incidence is more with advancing age. Mortality rates progressively increase with increasing risk class in PSI severity scoring system. By using the knowledge of these criteria, patients of CAP can be better prognosticated as regards severity of their illness with consequently better triaging of patients, utilization of resources and appropriate treatment to improve the outcome in this disease.

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