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Original Research Article

Correlation Between PSI Score and Clinical Outcome in Patients with Viral Pneumonia

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Abstract:

Introduction: Viral pneumonia is an important aetiology of morbidity and mortality globally. Accurate prognostic evaluation is important in directing clinical management and consumption of available resources. The Pneumonia Severity Index (PSI) is a validated scoring system designed to predict outcome in pneumonia patient's however the correlation of PSI with the mortality of viral pneumonia has not been explored in depth. This study attempted to find the correlation between PSI score and in-hospital mortality of viral pneumonia patients admitted.

Methods: This cross-sectional study was carried out in the Department of Pulmonology, Liaquat National Hospital, Karachi during a six month span. Ninety patients, between 16 and 70 years, with confirmed viral pneumonia were recruited using non-probability consecutive sampling. Demography and comorbidities, laboratory parameters and PSI scores were recorded. In-hospital death within 30 days of admission was used as the clinical outcome measure. Data was analysed using statistical software such as [Statistical Package for Social Science (SPSS version 26.0)] and correlation coefficient (Karl Pearson) was applied to test the association of the PSI score with In-hospital mortality along with p-value of less than equal to 0.05 being considered as significant.

Results: The mean age of patients was 43.0 ± 16.37 years, with 60% males. The mean PSI score was 74.0 ± 30.47, and overall in-hospital mortality was 20%. A strong, statistically significant negative correlation was observed between PSI score and in-hospital mortality ($r = -0.792$, $p < 0.001$).

Conclusion: PSI score was found to have a significant inverse relationship with in-hospital mortality in viral pneumonia, supporting the reliability of the score in predicting disease prognosis and early risk stratification for clinical decision-making.

Keywords: Viral Pneumonia, Pneumonia Severity Index, PSI, In-Hospital Mortality, Prognostic Factors, Clinical Outcome.

INTRODUCTION

Viral pneumonia is a leading cause of global respiratory morbidity and mortality, especially among the elderly, immunocompromised, and with chronic comorbidities.1 Viral pneumonia accounts for a rising proportion of hospitalizations due to lower respiratory tract infections, especially in the context of large-scale outbreaks such as the 2009 H1N1 influenza pandemic and the current critical situation caused by the pandemic of coronavirus (bearing the name of its virus).2-3 This events increased attention in the importance of developing risk stratification tools to facilitate effective early clinical decision-making and optimise the outcome of patients with viral pneumonia.4-5

The Pneumonia Severity Index (PSI) or PORT score,

was initially conceived to identify patients with low risk of disease progression in community-acquired pneumonia (CAP) who could be safely managed as an outpatient.6 PSI uses 20 different variables such as age, comorbid conditions, vital signs and laboratory findings to determine 5 different risk classes with progressively increasing 30-day mortality.7-8 While PSI has undergone extensive validation in bacterial cases of CAP, the prognostic significance of PSI in viruses (influenza and coronavirus in general) and seasonal influenza cases and in the case of a novel coronavirus.9-10

Several studies have suggested PSI to have predictive value for mortality and clinical deterioration in viral pneumonia and seems to do so more often than other scoring systems, such as CURB-65 and qSOFA, in patients with Covid-19, often to a better extent.11-12 However, questions remain about its use in persons who are younger and without comorbidities - who may score low despite abundant viral pathology - and in settings where rapid lab diagnostics are not readily available.13

In a study, in-hospital mortality was noted in 15.9% and the correlation between PSI and clinical outcome (in-hospital mortality) was 0.95.14 In another study, the mortality rate was 16% and the length of hospital stay was 10.6±6.4 day. Mortality showed a moderate inverse correlation with PSI score ($r = –0.333$, $p = 0.044$) indicating that higher scores are associated with earlier in-hospital mortality.15

Given the growing numbers of cases of viral pneumonia and the need to have scalable triage tools during viral outbreaks, the evaluation of the correlation between the PSI score and clinical outcome such as in-hospital mortality is timely and clinically relevant. A better understanding of this relationship could refine existing protocols to better predict early risk stratification and ultimately use more efficient resources and show improvements in patient outcomes.

METHODOLOGY:

The study was conducted in the Department of Pulmonology at Liaquat National Hospital, Karachi, over a period of three months (11/7/25 to 10/10/25) following the approval of the synopsis. It employed a cross-sectional study design with a non-probability consecutive sampling technique. A total of 90 patients were included in the study, with the sample size determined through statistical power analysis, considering a 5% significance level for Type I error and a 10% significance level for Type II error. The calculation also accounted for an anticipated correlation coefficient of 0.95 between the Pneumonia Severity Index (PSI) score and in-hospital mortality among patients with viral pneumonia.14

Patients aged between 16 and 70 years of both sexes, who presented with clinical features consistent with viral pneumonia, were included in the study. Viral pneumonia was defined based on the presence of pulmonary infiltrates on chest radiography or computed tomography within the first 48 hours of admission, accompanied by either productive or non-productive cough, a body temperature greater than 37.8 °C or below 36 °C, and at least one systemic inflammatory biomarker such as leukocytosis greater than 10,000/mm³, leukopenia below 4,000/mm³, elevated C-reactive protein, or raised procalcitonin levels. Patients were excluded if they had bacterial or fungal co-infections diagnosed at admission, were pregnant or breastfeeding, or had immunocompromised states due to hematological malignancies or ongoing chemotherapy. Cases with missing or incomplete clinical records, including data required for PSI calculation or outcome assessment, as well as those who died or were discharged within 24 hours of admission, were also excluded.

After ethical clearance of the institutional review board and the College of Physicians and Surgeons Pakistan (CPSP), the written informed consent of all the eligible participants was obtained. Demographic and clinical characteristics (including name, age, and gender, body mass index (BMI), history of diabetes and smoking status (>5 pack years), hypertension [defined as blood pressure >140/90 mmHg], and duration of pneumonia symptoms] were documented at a detailed level at the time of data collection. Laboratory investigation performed within the first 24 hours of admission included complete blood count, neutrophil-lymphocyte ratio (NLR), serum ferritin, D-dimers and lactate level.

The Pneumonia Severity Index (PSI) was determined for the individual patients with the standard scoring system, which includes several demographic, clinical, and laboratory variables such as age, comorbidities, physiologic variables, and other pertinent findings. Patients were then divided into five PSI risk classes (I-V) with Class I having the least risk and Class V having the greatest risk. Outcome data was obtained from the hospitalisation records, including length of hospitalisation and hospital death. And in case the patient died, the number of days between admission and death was recorded too. All data were entered in a standardised spreadsheet and independently checked by two researchers to ensure the accuracy and consistency of data entry.

Data analysis was carried out by using the version 26.0 of the software for statistical analysis (SPSS). Quantitative variables, such as age, BMI, duration of symptoms, and PSI score, were reported as mean +- standard deviation and qualitative variables, such as gender, diabetes, smoking, hypertension, and in-hospital mortality, were reported as frequencies and percentages. The relationship between the PSI score and the mortality in hospital was analysed using Karl Pearson's correlation coefficient (r). The data were also stratified according to age, gender, BMI, duration of symptoms, diabetes, smoking and hypertension and Pearson's correlation test was re-applied after stratification. P-value of <=0.05 was determined as statistically significant.

RESULTS

Table 1 shows the distribution and descriptive results for demographic characteristics and clinical characteristics divided between 90 patients diagnosed with viral pneumonia. Of the total studied population 54 (60%) were male and 36 (40%) were female and the mean age was 43.0 +- 16.37 years. The majority of patients (38.9%) were in the age group of 51-70 years followed by 32.2% were aged (31-50 years) and 28.9% were in (16-30 years) age group.

About body mass index (BMI), 49 (54.4%) patients were normal BMI, 34 (37.8%) patients were overweight and 7 (7.8%) patients were obese (mean (SD) BMI was 25.36 +- 3.29 kg/m2). The mean duration of symptoms before admission was found to be 6.49 asser plus and 3.51 asser; 56 patients (62.2%) presented within 7 days of the onset of symptoms and 34 (37.8%) had symptoms for longer than 7 days.

Among the comorbidities, 15 patients (16.7%) had diabetes mellitus. 19 (21.1%) were smokers and 14 (15.6%) had hypertension. The mean score of total PSI in the whole cohort was 74.0 (+30.47) indicating moderate to high severity level in most of the patients. In regards to clinical outcomes, two thirds (80%) of the patients survived and were discharged successfully, and one third (20%) died in the hospital.

Table 2 summarises the correlation of the Pneumonia Severity Index (PSI) score to the in-hospital mortality for patients with viral pneumonia. The Pearson correlation coefficient (r) was found to be -0.792 and the p-value was 0.0001. This result apparently shows a high and significant negative correlation between PSI score and in-hospital mortality. In practical terms this meant that as the PSI score rose, the likelihood of survival decreased and would therefore suggest that the higher the score in the PSI, the more risk associated with death during hospitalisation.

Stratified Analysis of Relationship Between Pneumonia Severity Index (PSI) Score and In-Hospital Death

Stratified analysis was done to analyse the correlation of PSI score and in-hospital death for various demographic and clinical variables is presented in Table 3. A strongly negative correlation was found in all the subgroups, indicating that higher PSI scores were linked with increased in-hospital death, regardless of gender, age, BMI, and comorbid conditions. All correlation was statistically significant (p-value <= 0.001).

The stratified analysis confirmed that the PSI score did not lose its strong and significant predictive relationship with in-hospital mortality among all the populations, highlighting the clinical utility in patients with viral pneumonia or the estimate of this score as a reliable prognostic indicator.

Table-1: Frequency distribution of different variables (n=90)

Variables		**Frequency**	**Percent**
Gender	Male	54	60.0
	Female	36	40.0
Age groups	16-30 years	26	28.9
	31-50 years	29	32.2
	51-70 years	35	38.9
	Mean age (years)	43.0±16.37	
BMI	Normal	49	54.4
	Overweight	34	37.8
	Obese	7	7.8
	Mean BMI (kg/m^2)	25.36±3.29	
Duration of symptoms	≤7 days	56	62.2
	>7 days	34	37.8
	Mean duration (days)	6.49±3.51	
Diabetes mellitus	Yes	15	16.7
	No	75	83.3
Smoking	Yes	19	21.1
	No	75	78.9
Hypertension	Yes	14	15.6
	No	76	84.4
PSI score	74.0±30.47		
In-hospital mortality	Yes	18	20.0
	No	72	80.0

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Table-2: Correlation between PSI score and in-hospital mortality

Correlation between PSI score and in-hospital mortality	
r	-0.792
p-value	0.0001
n	90

Table-3: Stratification of correlation between PSI score and in-hospital mortality with respect to different variable

Variables	Correlation between PSI score and in-hospital mortality		
Gender	Male	r	-0.725
		p-value	0.001
	Female	r	-0.876
		p-value	0.001
Age groups	16-30 years	r	-0.728
		p-value	0.001
	31-50 years	r	-0.808
		p-value	0.001
	51-70 years	r	-0.810
		p-value	0.001
BMI	Normal	r	-0.758
		p-value	0.001
	Overweight	r	-0.803
		p-value	0.001
	Obese	r	-0.907
		p-value	0.001
Duration of Disease	≤7 days	r	-0.825
		p-value	0.001
	>7 days	r	-0.722
		p-value	0.001
Diabetes mellitus	Yes	r	-0.897
		p-value	0.001
	No	r	-0.738
		p-value	0.001
Smoking	Yes	r	-0.756
		p-value	0.001
	No	r	-0.806
		p-value	0.001
Hypertension	Yes	r	-0.847
		p-value	0.001
	No	r	-0.792
		p-value	0.001

DISCUSSION

The results of this study found that a strong and statistically significant negative correlation was observed with Pneumonia Severity Index (PSI) score and the in-hospital mortality among the patients with viral pneumonia ($r = -0.792$, $p < 0.001$). This suggests that patients who had worse PSI scores were more likely to suffer from adverse clinical outcomes (such as death during hospitalisation). These results are consistent with the known predictive value of PSI in the prognosis of mortality among patients with community-acquired and viral pneumonia.

Similar results were consistently reported in previous research. Sarin et al determined a strong correlation between PSI score and death in the case of patients with coronaviruses, and they concluded that the higher classes of PSI were correlated with poorer survival and greater radiological involvement of the disease.16 Similarly, a multicenter study by Lama et al demonstrated the predictive value of PSI in evaluating

30-day survival of pneumonia patients including viral subgroups.17 Studies conducted by Zaki et al also showed the predictive role of PSI in forecasting mortality from viral pneumonia cases, especially in cases of influenza A (H1N1).18

Add that in studies comparing PSI against other severity scores, PSI was often able to measure up at least as well as the other-recorded in terms of mortality prediction. For example, Kaal et al. found a higher correlation of PSI with in-hospital death than with CURB-65 in patients with viral pneumonia.19 Similarly, studies in the pandemic H1N1 flu period between Anurag et al. and Kim et al. showed an inverse association between number of PSI classes and fatality rates as well as ICU admissions.20-21

However, some authors implied that PSI may underestimate risk in younger patients with severe viral pneumonia, because of the high weight given to age and comorbidity.22 On the other hand, others have reported that the performance of PSI remains robust in different age and gender strata.23 Our stratified results were consistent with them as we found that PSI was significant in all the different demographic and clinical subgroups.

The present study also goes to the importance of PSI in resource-limited settings. As an accessible and cheap scoring system, PSI can be used very well for triage of viral pneumonia patients at the time of admission, in order to decide whether they should be admitted and referred to intensive care. This is particularly useful in the event of a pandemic when healthcare systems are constrained in capacity.

Future implications of this study include the integration of PSI with biomarker-based models—such as CRP, procalcitonin, and D-dimer—to enhance prognostic accuracy in viral pneumonia. Additionally, incorporating radiological findings or artificial intelligence–assisted imaging analytics may refine mortality prediction models.

Limitations of this study include its single-center design, relatively small sample size, and the lack of long-term follow-up beyond hospitalization. Furthermore, viral subtype identification was not included, which may have influenced outcome variability. Future multicenter studies with larger, pathogen-specific cohorts and multivariate regression analyses are recommended to confirm these findings.

CONCLUSION:

PSI score showed a significant inverse correlation with in-hospital death among patients with viral pneumonia, which validates the use of this scoring system as an appropriate prognostic tool for early risk stratification and clinical decision-making.

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