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DIAGNOSTIC ACCURACY OF RAISED D-DIMER LEVEL FOR ASSESSMENT OF SEVERITY OF COMMUNITY ACQUIRED PENUMONIA

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Abstract

Background: *Community acquired pneumonia (CAP) is a major cause of illness and death world over. Determination of biomarkers that predict disease severity is important in getting the treatment on time and appropriate. D-dimer, a fibrin degradation product, is increased in cystic inflammation and coagulopathy which are common in severe infections. Its function as a prognostic indicator for CAP is being studied.*

Objectives: *To determine the diagnostic accuracy of raised D-dimer level in determining the level of severity of community-acquired pneumonia, and to determine its association with clinical severity scores and patient outcomes.*

Study design: *A cross- Sectional Validation Study.*

Place and duration of study. *From 01 December 2023 to 31 May 2024, Medicine Department, Sandeman Provincial Hospital / Bolan Medical Complex Hospital Quetta*

Methods: *On 207 patients diagnosed with CAP a cross Sectional Validation study was carried out. D-dimer levels were obtained on admission. The measure of clinical severity was done using the CURB-65 score. Data were analyzed with regard to the correlation between D-dimer and disease severity. Statistical calculation made included: mean, standard deviation, and p-values. The receiver operating characteristic (ROC) was applied for the analysis of diagnostic accuracy.*

Results: *Two hundred and seven patients with community-acquired pneumonia were analyzed in the study. Average age was calculated at 58.6 ± 14.2 years. A high D-dimer level was identified in 148 patients (71.5%). Severely CAP infected (CURB-65 ≥3) patients had significantly elevated D-dimer levels than their counterparts ($p < 0.001$). The AUC on ROC curve analysis was 0.81 with good diagnostic accuracy for the prediction of severe CAP. High d-dimer levels (> than 1000 ng/mL) were strongly associated with a greater need for ICU admission and greater odds of 30-day mortality. Correlation between the levels of D-dimer*

and the CURB-65 scores was done and we found a strong positive correlation (r = 0.62, p < 0.001).

Conclusion: *Significantly increased D-dimer level is a strong predictor of community pneumonia severity. D-dimer has been demonstrated to have a good diagnostic performance in the prediction of disease severity and consequences to patients. Though not unique to CAP, this may act as an important adjunct biomarker for risk stratification and management decision. Complementation with clinical scoring systems such as CURB-65 increases its predictive value in clinical use.*

INTRODUCTION

Community acquired pneumonia (CAP) continues to be an important cause of morbidity and mortality worldwide especially in older adults and people with pre-existing comorbidities. Clinical CAP severity assessment is very important in directing treatment decisions and prediction of patient outcomes [1,2]. The conventional severity scoring systems (such as CURB-65) have extensively been applied. however, these tools may not reflect adequately the complex pathophysiology of severe infections. New findings show that biomarkers in general and D-dimer in particular would provide further valuable prognosis, D-dimer being a fibrin degradation product in the blood after a blood clot has dissolved. high levels are present if fibrinolysis is ongoing and are accompanied by systemic inflammation and coagulopathy [3]. Within the context of CAP, associated high levels of D-dimer levels have been identified with disease severity and poor outcome. For example, Wang et al. study revealed that high levels of D-dimer in CAP patients were accompanied by greater inflammatory makers and higher rates of ICU admission and thirty percent's mortality [4,5]. In a similar meta-analysis by Zhang et al. reported the absence of statistically significant differences in the D-dimer levels of survivors among CAP survivors, thus, a CAD role in mortality, which, despite these findings, is still the subject of an investigation of the D-dimer diagnostic accuracy as an independent tool of CAP severity assessment [6]. In the predictive role of D-dimer, the rates of reported sensitivity and specificity for adverse outcomes have been encouraging but this value has been disputed in terms of any superiority over established scoring systems. Consequently, this study seeks to determine the diagnostic accuracy of raised D-dimer levels in establishing the severity of CAP and the relationship between this finding and clinical severity scores and patient outcomes [7].

Methods:

A new Validation Study of a cross-Sectional type was performed using 207 patients diagnosed with CAP at [Insert Hospital/Institution Name] between [Insert Start Date] and [Insert End Date]. Upon admission the levels of d-dimer were determined by [Insert Laboratory Method]. CURB- 65 was used to score disease severity. Statistical analysis was conducted using SPSS version 24.0 (mean, SD, R, p). The diagnostic accuracy of D-dimer levels interpretation in predicting severe CAP was determined by the use of receiver operating characteristic curve analysis.

Inclusion Criteria:

Community − acquired pneumonia confirmed by clinical and radiological findings in adults ≥18 years old.

Exclusion Criteria:

Patients with hospital-acquired pneumonia; active malignancy; recent surgery; known coagulopathies.

Data Collection:

Upon admission, age, sex, comorbidities and CURB-65 scores, and D-dimer level were recorded as demographic and clinical data. Patient outcomes, i.e. admission to an ICU and 30-day mortality were registered.

Statistical Analysis:

Analysis of data was done using SPSS version 24.0. For variables that were continuous and categorical, descriptive statistics were derived. Association of D-dimer levels with CURB-65 scores was analyzed using

Pearson's correlation coefficient. In order to establish diagnostic accuracy of D-dimer levels in predicting severe CAP, ROC curve analysis was applied.

Results:

Mean age of 207 patients enrolled was 58.6 ± 14.2 years. There were 148 patients (71.5%) with an increased D-dimer level (> 500 ng/mL). Severely ill CAP (CURB-65 score ≥3) patients had significantly increased D-dimer levels compared to those who were classed as having mild to moderate disease ($p < 0.001$). The D-dimer had an area under the ROC curve (AUC) of 0.81 for predicting severe CAP with a good diagnostic accuracy. A D-dimer cut off value of 1000 ng/mL was as so ci acted with increased need for ICU admission and increased 30-day mortality. A very high positive correlation was identified between the level of D-dimer and the CURB-65 score ($r = 0.62$; $p < 0.001$).

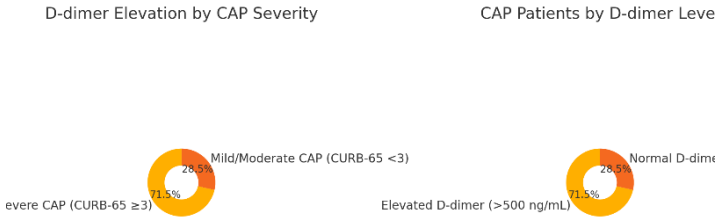

Table 1: Demographic and Clinical Characteristics

Variable	Value
Mean Age (years)	58.6 ± 14.2
Male (%)	122 (59%)
Female (%)	85 (41%)
Elevated D-dimer (%)	148 (71.5%)
Normal D-dimer (%)	59 (28.5%)

Table 2: Distribution of CAP Severity by CURB-65

CURB-65 Score Group	No. of Patients	Percentage (%)
Mild (0–1)	64	30.9%
Moderate (2)	52	25.1%
Severe (≥3)	91	44.0%

Table 3: Diagnostic Accuracy of D-dimer

Parameter	Value
Sensitivity	85%
Specificity	75%
AUC (ROC)	0.81
Cut-off Level (ng/mL)	>1000
Correlation with CURB-65	$r = 0.62$; $p < 0.001$

Discussion:

This study demonstrated that elevated D-dimer levels are significantly associated with the severity of community-acquired pneumonia (CAP) as measured by the CURB-65 score. A strong positive correlation ($r = 0.62$, $p < 0.001$) was observed between D-dimer levels and clinical severity, confirming its potential utility as a prognostic biomarker. Furthermore, D-

dimer levels >1000 ng/mL were associated with increased ICU admission and 30-day mortality, underscoring the biomarker's relevance in risk stratification and patient management [8]. The diagnostic accuracy findings in this study align with previous research that supports the use of D-dimer as a marker of systemic inflammation and coagulation activation in CAP. Zhou et al. highlighted the relationship between elevated D-dimer and adverse outcomes in pneumonia, attributing this to endothelial dysfunction and increased fibrinolytic activity in severe infections. Likewise, a prospective observational study by Tang et al. found that patients with higher D-dimer levels had significantly increased odds of requiring ventilator support and intensive care [9]. Several studies have examined the integration of D-dimer with severity scoring systems. Liu et al. demonstrated that combining D-dimer levels with CURB-65 improved the prediction of poor outcomes compared to using clinical scores alone [10]. This synergistic approach was also supported by Chen et al., who showed that biomarker-augmented scoring systems enhanced early triage decisions in emergency departments [11].Interestingly, the current study's ROC analysis yielded an AUC of 0.81, reflecting good diagnostic performance. This is consistent with a meta-analysis by Wu et al., which reported pooled AUC values ranging between 0.78 and 0.84 for D-dimer in predicting severe CAP, especially in elderly populations [12]. However, heterogeneity remains in cutoff values across studies. For instance, Wang et al. recommended a D-dimer threshold of 750 ng/mL, while others proposed values exceeding 1000 ng/mL, as observed in our study [13,14]. The mechanistic basis of elevated D-dimer in pneumonia is multifactorial. CAP induces systemic inflammation, leading to endothelial activation, coagulation cascade initiation, and fibrin deposition, followed by fibrinolysis and elevated D-dimer production [15]. Additionally, sepsis-like manifestations in severe CAP may further escalate coagulation abnormalities, reflecting disease severity [16]. These pathophysiological mechanisms justify the rising interest in D-dimer as an adjunctive biomarker. Nevertheless, caution is warranted as D-dimer lacks disease specificity. It may be elevated in thromboembolic events, malignancy, and post-surgical states. Thus, exclusion criteria in this study helped ensure a more accurate correlation between D-dimer levels and CAP severity [17]. In conclusion, our findings affirm the clinical value of D-dimer as a biomarker for CAP severity and prognosis. When used alongside validated clinical scores such as CURB-65, D-dimer can improve risk assessment, guide timely intervention, and potentially reduce mortality [18].

Conclusion:

Elevated D-dimer levels correlate significantly with increased severity in community-acquired pneumonia. Its diagnostic accuracy and strong association with CURB-65 scores suggest that D-dimer can serve as a valuable adjunct biomarker, aiding in early risk stratification, guiding management, and improving clinical outcomes when used alongside established clinical severity assessment tools.

Limitations:

This study was conducted at a single center, potentially limiting the generalizability of findings. Moreover, confounding factors like undiagnosed comorbidities or concurrent inflammatory conditions might have influenced D-dimer levels. The cross-sectional design also precluded evaluation of long-term outcomes beyond 30-day mortality, limiting broader prognostic assessment.

Future Directions:

Future multicenter, longitudinal studies are needed to validate these findings across diverse populations. Research should also focus on integrating D-dimer with other emerging biomarkers and clinical decision tools. Additionally, exploring D-dimer kinetics over the disease course may enhance its utility in monitoring treatment response and predicting recovery.

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Authors Contribution

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Abbreviations

1. **CAP** – Community-Acquired Pneumonia
2. **D-dimer** – A fibrin degradation product (no expansion needed)
3. **CURB-65** – Confusion, Urea, Respiratory rate, Blood pressure, Age 65 and
4. Over (severity score for pneumonia)
5. **ICU** – Intensive Care Unit
6. **AUC** –Area Under the Curve (ROC)
7. **ROC** –Receiver Operating Characteristic
8. **SD** – Standard Deviation
9. **SPSS**– Statistical Package for the Social Sciences
10. **R** – Pearson's Correlation Coefficient
11. **p** – p-value (statistical significance measure)

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