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MEAN PLATELET VOLUME AND RED CELL DISTRIBUTION WIDTH AS MARKERS IN COMMUNITY ACQUIRED PNEUMONIA

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ABSTRACT

Background: Community-acquired pneumonia (CAP) remains a significant cause of morbidity and mortality globally. Conventional scoring systems such as CURB-65 and PSI help assess severity but have limitations. This study evaluated the role of Delta Mean Platelet Volume (DELTA MPV) and Red Cell Distribution Width (RDW) as prognostic markers in CAP. **Objectives:** To assess the utility of DELTA MPV and RDW in predicting CAP severity and correlate these with established scoring systems. **Methods:** A prospective observational analytical study was conducted on 120 consecutive CAP patients at the Institute of Respiratory Diseases, S.M.S. Medical College, Jaipur, over a 12 month period. Data on clinical parameters, laboratory values (DELTA MPV, RDW), CURB-65 and PSI scores were collected. Outcomes were compared between survivors and non-survivors. **Results:** The mean age of non-survivors was significantly higher than that of survivors (60 vs. 48 years). DELTA MPV and RDW were significantly elevated in non-survivors. DELTA MPV showed stronger correlation with CURB-65 (r=0.40) and PSI (r=0.38) compared to RDW. Multivariate analysis revealed DELTA MPV as the most significant independent predictor of mortality (OR 3.29), followed by PSI and RDW. ROC analysis confirmed DELTA MPV >3.13 fL as a strong predictor of mortality (AUC 0.87). **Conclusion:** DELTA MPV and RDW are cost-effective, readily available hematological parameters that enhance prognostic accuracy in CAP. Integration of DELTA MPV with clinical scores may improve early risk stratification.

KEYWORDS : Community-acquired Pneumonia, Mean Platelet Volume, Red Cell Distribution Width, CURB-65, PSI, Prognostic marker

INTRODUCTION

Community-acquired pneumonia (CAP) represents a major health burden, particularly among the elderly and immunocompromised. Despite advancements in diagnostics and antimicrobial therapy, CAP continues to exhibit significant mortality. Severity assessment tools such as PSI and CURB-65 have been widely used but are often cumbersome or insensitive to dynamic changes.

Recent studies have highlighted the potential of hematological indices like Mean Platelet Volume (DELTA MPV) and Red Cell Distribution Width (RDW) as prognostic biomarkers in infectious diseases. MPV, a marker of platelet activation, and RDW, a measure of red cell heterogeneity, may reflect the underlying inflammatory and thrombotic milieu of severe infections.

This study was undertaken to evaluate DELTA MPV and RDW as accessible biomarkers in CAP and their correlation with established severity indices and outcomes.

MATERIALS AND METHODS

This prospective observational analytical study was conducted at the Institute of Respiratory Diseases, S.M.S. Medical College, Jaipur, over a period of one year, from August 1,2023 to July 31, 2024. A total of 120 patients were enrolled in the study.

The inclusion criteria comprised patients above 18 years of age who were diagnosed with community-acquired pneumonia (CAP) in accordance with the British Thoracic Society (BTS) guidelines and had provided written informed consent to participate in the study.

Patients were excluded if they had a history of hospitalization within the preceding 30 days, suffered from immunosuppressive conditions such as HIV or malignancy, or had chronic pulmonary infections like tuberculosis.

Data Collection

- Clinical assessment including CURB-65, PSI scores
- Laboratory investigations including RDW, DELTA MPV (baseline and serial), CBC, RFT, LFT
- Imaging: Chest X-ray or CT where applicable

Statistical Analysis

SPSS 25.0 was used. Quantitative data expressed as mean ± SD. Chi-square and t-tests used. Logistic regression assessed predictors of mortality. ROC curves determined cut-off values.

RESULTS

Out of 120 CAP patients, 78 (65%) recovered while 42 (35%) succumbed during hospitalization. Non-survivors were significantly older (60 ± 9 years vs. 48 ± 10 years, p<0.01).

Delta MPV and RDW were significantly elevated in non-survivors:

- Delta MPV: 2.42 vs. 1.69 fL (p<0.01)
- RDW: 16.49% vs. 14.71% (p<0.01)

Both parameters positively correlated with PSI and CURB-65. Delta MPV had stronger correlation (r=0.40 with CURB-65, r=0.38 with PSI) than RDW (r=0.32, r=0.31 respectively).

Multivariate analysis revealed delta MPV (OR 3.29, CI 2.05-7.87, p<0.01) and RDW (OR 1.25, CI 1.08-1.39, p=0.02) as significant mortality predictors.

ROC analysis showed:

- Delta MPV >3.13 fL: AUC 0.87, Se 70.05%, Sp 80.21%, NPV 90.24%
- RDW >17.5%: AUC 0.68, Se 42.81%, Sp 87.86%

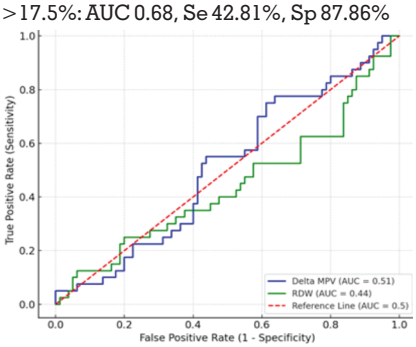

Table 1. Clinical Characteristics of Study Population

Parameter		Improved	Died
Age (years, mean)		48.48	60.02
Sex – Male (%) {n=76}		72.9%(n=55)	23.34(n=18)
Sex – Female (%){n=44}		34.22(n=15)	26.9(n=12)
Smoking (%)	Current{n=44}	34.54	18.31
	No	37.8	20.84
	Stopped	17.01	8.37
	Ex	8.36	3.22
CURB-65 score(mean)		3.38	4.16
PSI score (mean)		127.5	130.7
- PSI Class II (%)		13.85	4.68
- PSI Class III (%)		34.41	12.35
- PSI Class IV (%)		31.6	13.87
- PSI Class V (%)		22.9	19.73
Hospital stay (days, mean)		12.54	13.82
Need for mechanical ventilation (%)		38.68	21.07
Transfer to ICU (%)		48.06	31.23
Unilobar pneumonia (%)		65.74	30.39
Multilobar pneumonia (%)		21.5	32.29

Table 2: Laboratory & Microbiological Profile

Parameter	Improved	Died
RDW (%)	14.71	16.49
Δ DELTA MPV (fL)	1.69	2.42

Score	Delta DELTA MPV	RDW r	p value
PSI	0.38	0.31	< 0.001
CURB-65	0.4	0.32	< 0.001

DISCUSSION

In this prospective observational study involving 120 patients diagnosed with community-acquired pneumonia (CAP), 65% (n=78) showed clinical improvement and were discharged, whereas 35% (n=42) died during hospitalization. Patients who succumbed to illness had a notably higher mean age (~60 years) than those who improved (~48 years), underscoring age as a significant risk factor. This observation is consistent with prior studies by Gorelik et al.[1] and Farghly et al.[2], both of which identified advanced age as a key predictor of mortality in CAP. Gender-based differences were also observed: a male predominance was noted among survivors (approximately 73%), while female patients comprised a greater proportion of non-survivors. Falcone et al.[3] and Zhou et al.[4] similarly reported higher mortality in females with CAP after adjusting for comorbidities.

Although smoking status was slightly higher among those who died, the difference was not statistically significant, suggesting that while smoking contributes to respiratory vulnerability, its isolated role in determining mortality in CAP may be limited. Comorbid conditions such as diabetes, cardiovascular disease, and chronic kidney disease were more frequent in non-survivors (30%) compared to survivors (20%), supporting prior findings by Restrepo et al.[5] and Viasus et al.[6] that comorbidity clustering increases mortality risk. Moreover, patients who died had higher CURB-65 and PSI scores, reaffirming these tools' reliability in identifying high-risk patients. The CURB-65 score, with an odds ratio (OR) of 1.42 ($p = 0.03$), and PSI score, with an OR of 1.93 ($p = 0.03$), remained statistically significant predictors of death, consistent with earlier validations by Lim et al.[7] and Chalmers et al.[8]

Two key haematological markers, RDW and Delta Mean Platelet Volume (ΔDELTA MPV), emerged as valuable prognostic indicators. Patients who died had significantly higher RDW (16.49%) and increase in ΔDELTA MPV (2.42 fL) compared to survivors (RDW: 14.71%, ΔDELTA MPV: 1.69 fL). ΔDELTA MPV showed stronger correlation with CURB-65 ($r = 0.40$, $p < 0.001$) and PSI ($r = 0.38$, $p < 0.001$) than RDW, highlighting its potential as a dynamic marker of disease severity. Biologically, increasing DELTA MPV reflects heightened platelet activation, systemic inflammation, and prothrombotic states — key contributors to CAP progression. These findings align with those of Takahashi et al.[9] and Cho et al.[10], who found that serial increases in DELTA MPV predicted worsening clinical status and higher mortality.

In terms of diagnostic performance, ΔDELTA MPV demonstrated superior predictive value for in-hospital mortality with an AUC of 0.87, sensitivity of 70.05%, and specificity of 80.21% at a cut-off >3.13. Its high negative predictive value (90.24%) suggests that a low ΔDELTA MPV can reliably rule out high-risk patients, making it a practical tool for early triage. In comparison, RDW had a modest AUC of 0.68, with lower sensitivity (42.81%) but high specificity (87.86%) at a cut-off >17.5. These results echo studies by Lee et al.[11] and Braun et al.[12], which showed that RDW, though less dynamic, serves as a supplementary prognostic marker reflecting chronic inflammation and erythropoietic stress.

Lastly, radiological findings such as multilobar involvement and pleural effusion were more common in non-survivors, indicating extensive disease burden and poor prognosis — a pattern consistent with prior studies by Reissig et al.[13] and Jain et al.[14] Overall, integrating ΔDELTA MPV and RDW into routine assessments, alongside CURB-65 and PSI scores, offers a cost-effective, rapid, and clinically valuable strategy for improving early risk stratification and management of CAP, especially in resource-limited settings (Ma et al.[15]; Neto et al.[16]).

CONCLUSION

Delta MPV and RDW correlate significantly with CAP severity and in-hospital mortality. Delta MPV, in particular, serves as a strong independent predictor and should be considered in clinical decision-making. Their incorporation into standard assessment tools may improve outcomes by enabling early identification of high-risk patients.

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