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Diagnostic Utility of D-Dimer, C-Reactive Protein, and Erythrocyte Sedimentation Rate in Predicting Severity of Acute Pancreatitis: A Prospective Comparative Study.

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Abstract

Background: Early identification of severe acute pancreatitis remains essential for reducing morbidity and mortality. Although several prognostic scoring systems are available, they may be complex and time-consuming. Simple biochemical markers may provide rapid and cost-effective prognostic information. ***Objective:*** To evaluate the utility of D-dimer, C-reactive protein (CRP), and erythrocyte sedimentation rate (ESR) in predicting disease severity in acute pancreatitis. ***Methods:*** This prospective comparative study was conducted at K.R. Hospital, Mysuru, from July 2023 to December 2024. Sixty patients diagnosed with acute pancreatitis according to the Revised Atlanta Classification were enrolled. Serial measurements of D-dimer, CRP, and ESR were obtained and correlated with disease severity assessed using APACHE II score, Ranson's criteria, Glasgow Severity Index, and Revised Atlanta Classification. Statistical analysis was performed using Mann–Whitney U and Kruskal–Wallis tests. ***Results:*** The mean age of participants was 43.6 years, and 75% were male. Median D-dimer levels increased progressively from 3.90 to 6.00 during hospitalization. ESR increased from 40 mm/hr to 56.5 mm/hr. Patients with severe acute pancreatitis demonstrated significantly higher D-dimer levels (231 vs. 208; p=0.0038), CRP levels (107 vs. 95 mg/L; p=0.0146), and ESR values (84 vs. 55 mm/hr; p=0.0002) compared with patients with mild disease. D-dimer and ESR showed significant differences across severity groups, whereas CRP demonstrated relatively weaker predictive ability. ***Conclusion:*** D-dimer and ESR are valuable, inexpensive, and readily available biomarkers that correlate significantly with disease severity in acute pancreatitis. Incorporation of these markers into routine clinical assessment may facilitate early risk stratification and improve patient management.

Keywords: Acute Pancreatitis, D-Dimer, C-reactive Protein, Erythrocyte Sedimentation Rate, Severity Prediction, Biomarkers.

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INTRODUCTION

Acute pancreatitis (AP) is one of the most common gastrointestinal emergencies worldwide and is associated with substantial morbidity and mortality.[1-3] The disease spectrum ranges from mild self-limiting inflammation to severe pancreatitis complicated by pancreatic necrosis, organ failure, and death.[4] Early identification of severe disease is therefore crucial for appropriate triage, intensive monitoring, and timely intervention.

Several prognostic scoring systems, including Ranson's criteria, APACHE II score, and Glasgow Severity Index, have been developed to predict disease severity.[5-7] Despite their usefulness, these systems require multiple variables and are often cumbersome in routine clinical practice. Consequently, there has been increasing interest in identifying simple biochemical markers capable of providing rapid prognostic information.

D-dimer reflects activation of coagulation and fibrinolysis and has emerged as a potential marker of severe inflammatory states.[8-10] Elevated D-dimer levels have been associated with pancreatic necrosis, organ failure, and mortality in acute pancreatitis. CRP remains one of the most commonly used inflammatory biomarkers; however, its delayed rise may limit

early prognostic utility.[11] ESR is an inexpensive and widely available marker of systemic inflammation that may provide additional prognostic information.[12]

This study aimed to evaluate the prognostic significance of D-dimer, CRP, and ESR in patients with acute pancreatitis and determine their association with established severity scoring systems.

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of General Surgery, K.R. Hospital, Mysuru, Karnataka, India, between July 2023 and December 2024.

Study Population

Sixty consecutive patients diagnosed with acute pancreatitis according to the Revised Atlanta Classification were included.

Inclusion Criteria

- Age between 18 and 70 years.
- Acute pancreatitis diagnosed by clinical, biochemical, and radiological criteria.
- Presentation within 24 hours of symptom onset.

Exclusion Criteria

- Chronic pancreatitis.
- Recurrent pancreatitis.
- Pancreatic malignancy.
- Pregnancy.
- Anticoagulant therapy.
- Known thromboembolic disorders.
- Chronic liver disease.
- Refusal to participate.

Data Collection

Demographic characteristics, clinical findings, laboratory investigations, and radiological findings were recorded. D-dimer, CRP, and ESR were measured serially during hospitalization.

Severity Assessment

Disease severity was assessed using:

- Revised Atlanta Classification.
- APACHE II score.
- Ranson's criteria.
- Glasgow Severity Index.

Statistical Analysis

Continuous variables were expressed as median and interquartile range or mean ± standard deviation where appropriate. Comparisons between groups were performed using Mann–Whitney U test. Kruskal–Wallis test was used for multiple group comparisons. Statistical significance was defined as $p < 0.05$.

RESULTS

Table 1. Demographic Characteristics of Study Population (n = 60)

Age Group (years)	Frequency	Percentage (%)
20–29	2	3.3
30–39	11	18.3
40–49	32	53.3
50–59	15	25.0
Total	60	100

The majority of patients were males (75%) and belonged to the 40–49 years age group (53.3%).

Table 2. Serial Changes in D-Dimer Levels

Measurement	Median	IQR
1st	3.90	0.80
2nd	4.45	1.20
3rd	5.20	1.80
4th	5.35	2.60
5th	6.00	2.93

D-Dimer levels demonstrated a progressive rise during hospitalization, suggesting increasing coagulation and inflammatory activity.

Table 3. Serial Changes in CRP Levels

Measurement	Median (mg/L)	IQR
1st	103.5	97.0
2nd	98.0	12.25
3rd	103.5	114.25
4th	107.0	121.0
5th	109.0	125.8

CRP levels remained elevated throughout the study period with considerable inter-patient variability.

Table 4. Serial Changes in ESR Levels

Measurement	Median (mm/hr)	IQR
1st	40.0	9.5
2nd	45.0	9.0
3rd	47.0	7.5
4th	53.0	10.0
5th	56.5	11.0

ESR showed a consistent upward trend over time, indicating persistent inflammatory activity.

Table 5. Comparison of Biomarkers Between Mild and Severe Acute Pancreatitis

Variable	Mild AP (Median)	Severe AP (Median)	p-value
D-dimer	208	231	0.0038
CRP (mg/L)	95	107	0.0146
ESR 1st assessment	36	41	0.0453
ESR 2nd assessment	42	54	0.0097
ESR 3rd assessment	45	69	0.0004
ESR 4th assessment	50	75	0.0003
ESR 5th assessment	55	84	0.0002

All three biomarkers were significantly higher in severe acute pancreatitis compared to mild disease. D-Dimer and ESR demonstrated particularly strong associations with severity.

Table 6. Correlation of D-Dimer, CRP and ESR with Laboratory Parameters

Laboratory Parameter	D-Dimer (r)	CRP (r)	ESR (r)
Amylase	0.30	0.632	0.30
Blood Glucose	0.41	0.000	0.41
Creatinine	1.00	0.632	1.00
Lipase	0.90	0.632	0.90
PCV	0.40	0.632	0.40
Platelet Count	0.10	0.632	0.10
TLC	1.00	0.949	1.00

D-Dimer and ESR showed strong positive correlations with creatinine, TLC, and lipase, while CRP showed strongest correlation with TLC.

Table 7. Biomarker Performance Across Severity Groups

Marker	Statistical Test	H Statistic	p-value	Significance
D-Dimer	Kruskal-Wallis	7.32	0.026	Significant
CRP	Kruskal-Wallis	5.45	0.066	Not Significant
ESR	Kruskal-Wallis	10.89	0.004	Significant
Creatinine	Kruskal-Wallis	8.00	0.018	Significant

ESR demonstrated the strongest discrimination between severity groups, followed by D-Dimer. CRP did not show statistically significant differences across severity categories.

Results Summary

A total of 60 patients with acute pancreatitis were included in this prospective study. The majority were male (75%) and belonged to the 40–49 years age group (53.3%). Serial measurements revealed progressive increases in D-Dimer and ESR levels over the study period, while CRP remained persistently elevated. Patients with severe acute pancreatitis had significantly higher median D-Dimer, CRP, and ESR values compared to those with mild disease ($p < 0.05$). D-Dimer and ESR also demonstrated significant differences across severity groups and showed strong correlations with established laboratory markers of disease severity, including creatinine, TLC, and lipase. Among the biomarkers studied, ESR and D-Dimer emerged as the most reliable predictors of disease severity, whereas CRP showed comparatively weaker prognostic performance.

DISCUSSION

The present study evaluated the role of D-dimer, CRP, and ESR as biomarkers of disease severity in acute pancreatitis. Our findings demonstrate that D-dimer and ESR correlate significantly with disease severity and may serve as useful prognostic indicators.

D-dimer levels increased progressively during hospitalization and were significantly higher among patients with severe acute pancreatitis. These findings are consistent with previous studies demonstrating the association of D-dimer with pancreatic necrosis, multiorgan dysfunction, and mortality.[8-10] Activation of coagulation pathways is an important component of systemic inflammatory response syndrome and may explain the observed relationship between elevated D-dimer levels and disease severity.

ESR also showed progressive elevation and strong association with severe disease. Similar observations have been reported by Xue et al., who demonstrated a significant relationship between elevated ESR and severe acute pancreatitis.[11] ESR remains an attractive biomarker due to its low cost and universal availability.

Although CRP levels were significantly elevated among patients with severe disease, its predictive value was comparatively weaker. Previous studies have similarly reported that CRP is a late-phase reactant and may not adequately identify severe disease during the early phase of illness.[12]

The findings of this study suggest that D-dimer and ESR may complement existing clinical scoring systems and assist in early risk stratification, particularly in resource-limited settings.

Strength

- Prospective study design.
- Serial assessment of inflammatory biomarkers.
- Correlation with multiple validated severity scoring systems.
- Use of inexpensive and widely available laboratory parameters.

Limitations

- Single-center study.
- Small sample size.
- Lack of receiver operating characteristic analysis.
- Absence of multivariate regression modeling.
- Limited follow-up duration.

CONCLUSION

D-dimer and ESR demonstrated superior performance compared with CRP in predicting disease severity in acute pancreatitis. These inexpensive and readily available biomarkers may facilitate early risk stratification and assist clinical

decision-making, particularly in resource-constrained healthcare settings. Larger multicenter studies are warranted to validate these findings and establish clinically useful cutoff values.

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