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Original Research Article

CORRELATION OF SERUM C-REACTIVE PROTEIN, ERYTHROCYTE SEDIMENTATION RATE, AND RANDOM BLOOD GLUCOSE WITH COMPUTED TOMOGRAPHY SEVERITY INDEX IN ACUTE PANCREATITIS: A CROSS-SECTIONAL STUDY

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ABSTRA

Background: Acute pancreatitis has a variable clinical course, ranging from mild self-limiting disease to severe disease with pancreatic necrosis and organ failure. Early severity assessment is important for appropriate monitoring and management. This study evaluated the relationship of serum C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and random blood glucose (RBS) with the computed tomography severity index (CTSI).

Materials and Methods: This hospital-based cross-sectional study included 54 patients aged 20–60 years with acute pancreatitis treated at Victoria Hospital and Bowring and Lady Curzon Hospital, Bangalore Medical College and Research Institute. CRP, ESR, and RBS were recorded at presentation. Contrast-enhanced computed tomography was performed within 72 hours of symptom onset and CTSI was recorded. Pearson correlation and multiple linear regression were used to assess associations between the biomarkers and CTSI. The patient-level master chart was independently reanalysed for this manuscript.

Results: The mean age was 38.07 ± 10.54 years; 51 (94.4%) patients were male. Mean CRP, ESR, RBS, and CTSI were 95.23 ± 75.62 mg/L, 20.98 ± 10.57 mm/h, 161.19 ± 66.98 mg/dL, and 6.00 ± 2.93, respectively. CRP ($r=0.734$, $p<0.001$), ESR ($r=0.735$, $p<0.001$), and RBS ($r=0.533$, $p<0.001$) showed significant positive correlations with CTSI. In multiple linear regression, all three biomarkers remained independently associated with CTSI; the model explained 67.9% of the variance (adjusted $R^2=0.659$; $F(3,50)=35.19$, $p<0.001$).

Conclusion: CRP, ESR, and RBS showed significant positive associations with CT severity in this cohort. These readily available laboratory parameters may have value as adjuncts to early severity assessment, although they should not replace clinical assessment or appropriate imaging. Larger prospective studies are required to validate clinically useful thresholds and determine their effect on patient outcomes.

Keywords: Acute pancreatitis; C-reactive protein; erythrocyte sedimentation rate; random blood glucose; computed tomography severity index; severity assessment.

INTRODUCTION

Acute pancreatitis is a common gastrointestinal emergency with a heterogeneous clinical course. Most patients experience a mild, self-limiting episode, whereas a clinically important minority develop local complications, systemic inflammatory response, persistent organ dysfunction, or pancreatic

necrosis. Early recognition of patients likely to develop severe disease is therefore an important component of initial management. Current approaches use clinical assessment, laboratory parameters, prognostic scores, and imaging, with severity classification informed by the revised Atlanta framework.

Computed tomography provides objective information regarding pancreatic inflammation and necrosis. The original CT Severity Index (CTSI), described by Balthazar and colleagues, combines the extent of pancreatic inflammation with the degree of pancreatic necrosis and has been used as a radiological measure of disease severity. However, CT is not required routinely for every patient at presentation, and contemporary guidance generally reserves CT for diagnostic uncertainty or failure to improve during the initial 48–72 hours. Thus, simple laboratory markers that can provide early information about disease severity remain clinically attractive.

CRP is an acute-phase reactant that increases in response to systemic inflammation and has been extensively investigated as a marker of severity in acute pancreatitis. Previous studies have demonstrated associations between higher CRP concentrations and severe or necrotizing disease. ESR is less specific and is influenced by several non-inflammatory factors, but it is inexpensive and widely available. Hyperglycaemia may reflect the physiological stress response and pancreatic endocrine dysfunction and has also been associated with adverse outcomes in critically ill populations.

Although CRP has been studied extensively, comparatively less attention has been given to evaluating CRP, ESR, and RBS together against a radiological severity score in an Indian tertiary-care setting. The present study therefore assessed the correlation of these three readily available biomarkers with CTSI in patients with acute pancreatitis and evaluated their combined association with radiological severity.

MATERIALS AND METHODS

Study design and setting: A hospital-based cross-sectional study was conducted in the Department of General Surgery at Victoria Hospital and Bowring and Lady Curzon Hospital, Bangalore Medical College and Research Institute, Bengaluru, India.

Participants: Fifty-four patients aged 20–60 years diagnosed with acute pancreatitis were included. The thesis protocol specified diagnosis using clinical features together with serum amylase/lipase elevation and ultrasonographic or radiological findings. Patients presenting within 72 hours of symptom onset were eligible.

Exclusion Criteria: Patients with chronic pancreatitis, previous pancreatic surgery, known diabetes mellitus receiving antidiabetic medication, and those unable to provide informed consent were excluded.

Data collection: After informed consent, demographic variables were recorded. ESR, CRP, and RBS were measured using standard laboratory techniques. Contrast-enhanced CT was performed within 72 hours of symptom onset and the CT Severity Index was recorded. The thesis used CTSI categories of mild (0–3), moderate (4–6), and severe (8–10); the observed dataset contained CTSI values of 2, 4, 6, 8, and 10.

Statistical Analysis: The patient-level master chart was reanalysed for the present manuscript using Python-based statistical analysis. Continuous variables are reported as mean ± standard deviation and categorical variables as frequency and percentage. Pearson correlation was used to evaluate associations between CRP, ESR, RBS, and CTSI. Multiple linear regression was performed with CTSI as the dependent variable and CRP, ESR, and RBS as independent variables. Two-sided $p<0.05$ was considered statistically significant.

Ethics: The study protocol was approved by the Institutional Ethics Committee of Bangalore Medical College and Research Institute and written informed consent was obtained from participants.

RESULTS

Study population: Fifty-four patients were included. The mean age was 38.07 ± 10.54 years (range 22–60 years). Fifty-one patients (94.4%) were male and three (5.6%) were female. The mean CTSI was 6.00 ± 2.93.

Table 1

Characteristic	n (%) / Mean ± SD
Age, years	38.07 ± 10.54
20–30 years	16 (29.6%)
31–40 years	19 (35.2%)
41–50 years	11 (20.4%)
51–60 years	8 (14.8%)
Male sex	51 (94.4%)
Female sex	3 (5.6%)
CRP, mg/L	95.23 ± 75.62
ESR, mm/h	20.98 ± 10.57
RBS, mg/dL	161.19 ± 66.98
CTSI	6.00 ± 2.93

Biomarkers according to CTSI category: CRP, ESR, and RBS increased across the observed CTSI severity categories. Patients classified as mild had mean CRP 22.44 ± 20.72 mg/L, ESR 11.15 ± 4.78 mm/h, and RBS 108.69 ± 31.14 mg/dL. Corresponding values in the moderate group were 86.19 ± 53.14 mg/L, 18.84 ± 7.83 mm/h, and 158.42 ± 55.82 mg/dL, while severe disease was associated with 146.05 ± 75.53 mg/L, 28.64 ± 9.53 mm/h, and 194.59 ± 72.22 mg/dL, respectively.

Table 2

CTSI category	n	CRP mg/L, mean ± SD	ESR mm/h, mean ± SD	RBS mg/dL, mean ± SD
Mild (0–3)	13	22.44 ± 20.72	11.15 ± 4.78	108.69 ± 31.14
Moderate (4–6)	19	86.19 ± 53.14	18.84 ± 7.83	158.42 ± 55.82
Severe (8–10)	22	146.05 ± 75.53	28.64 ± 9.53	194.59 ± 72.22

Correlation analysis: CRP showed a strong positive correlation with CTSI (r=0.734, p<0.001). ESR demonstrated a similarly strong positive correlation (r=0.735, p<0.001). RBS showed a moderate positive correlation with CTSI (r=0.533, p<0.001).

Table 3

Biomarker	Pearson r with CTSI	p value
CRP	0.734	<0.001
ESR	0.735	<0.001
RBS	0.533	<0.001

Multiple linear regression: A model incorporating CRP, ESR, and RBS was statistically significant ($F(3,50)=35.19$, $p<0.001$) and explained 67.9% of the variability in CTSI ($R^2=0.679$; adjusted $R^2=0.659$). CRP (β=0.0139, p=0.003), ESR (β=0.1089, p=0.001), and RBS (β=0.0104, p=0.010) were independently associated with CTSI in the model.

Table 4

Predictor	B	95% CI	p value
CRP (mg/L)	0.0139	0.005 to 0.023	0.003
ESR (mm/h)	0.1089	0.045 to 0.173	0.001
RBS (mg/dL)	0.0104	0.003 to 0.018	0.010
Constant	0.7114	−0.667 to 2.090	0.305

DISCUSSION

This study demonstrated significant positive relationships between CRP, ESR, and RBS and radiological severity measured by CTSI in 54 patients with acute pancreatitis. In the reanalysis of the patient-level master chart, CRP and ESR had very similar correlation coefficients (0.734 and 0.735, respectively), while RBS showed a moderate correlation (0.533). A multivariable model containing all three biomarkers explained approximately two-thirds of the variability in CTSI. The association between CRP and severity is biologically plausible and consistent with earlier literature. CRP is an acute-phase protein produced in response to inflammatory cytokines and has long been evaluated as a marker of severe acute pancreatitis. Puolakkainen et al. reported higher CRP concentrations in severe disease, while Mayer et al. showed that CRP could discriminate severity later in the early course of illness. Pongprasobchai et al. found that both ESR and CRP were useful for predicting severe acute pancreatitis, with CRP performing somewhat better than ESR and combined measurements improving diagnostic performance. These observations support the direction of the present findings.

ESR demonstrated a correlation with CTSI comparable to that of CRP in the present dataset. ESR is less specific than CRP and is affected by age, sex, anaemia, and other conditions; consequently, its role should be considered complementary rather than definitive. Nevertheless, its low cost and broad availability may make it useful when interpreted alongside clinical findings and other laboratory parameters.

RBS also correlated positively with CTSI. Hyperglycaemia during acute illness can reflect catecholamine and cortisol-mediated stress responses, insulin resistance, and, in pancreatic disease, impaired endocrine function. Previous critical-care literature has linked admission hyperglycaemia with adverse outcomes in selected populations. In the present study, RBS had a weaker correlation than CRP or ESR, suggesting that it may provide additional rather than dominant information about radiological severity.

The multivariable analysis is noteworthy because CRP, ESR, and RBS each retained a statistically significant association with CTSI after adjustment for the other two biomarkers. The model explained 67.9% of the variance in CT severity score. This finding should be interpreted as an association rather than proof that the three biomarkers can replace imaging or established clinical severity assessment. The sample size is modest, and the model requires

external validation before it can be used to generate a clinical prediction rule.

The findings have potential practical relevance. CRP, ESR, and RBS are inexpensive and routinely obtainable investigations. A patient presenting with acute pancreatitis and markedly elevated values may warrant particularly careful clinical reassessment and monitoring while the overall severity picture is being established. Current guidelines, however, do not support using these biomarkers as a substitute for appropriate clinical assessment and selective imaging. In particular, CT is generally reserved for diagnostic uncertainty or failure to improve during the initial 48–72 hours.

The study has several strengths, including the use of patient-level data, simultaneous assessment of three readily available biomarkers, and an objective radiological endpoint. However, several limitations should be acknowledged. The study was conducted at a single tertiary-care centre and included only 54 patients, limiting generalisability and statistical power. The analysis was cross-sectional and did not establish whether the biomarkers predict clinically important outcomes such as persistent organ failure, necrosis, ICU admission, length of stay, or mortality. The manuscript also relies on CTSI as the radiological endpoint rather than the revised Atlanta classification as the primary clinical severity outcome. Finally, the timing of biomarker measurement relative to symptom onset may influence CRP and other values, and this should be considered in future studies.

Future multicentre prospective studies should validate these findings, evaluate serial biomarker measurements, incorporate clinical severity outcomes, and determine whether adding these biomarkers to established clinical prediction systems improves discrimination and calibration. ROC-based threshold analysis should also be performed in a larger cohort before specific clinical cut-offs are recommended.

CONCLUSION

In this 54-patient cohort, serum CRP, ESR, and RBS were significantly and positively associated with CT Severity Index in acute pancreatitis. CRP and ESR demonstrated the strongest correlations, while RBS showed a moderate association. A combined linear regression model incorporating all three biomarkers explained 67.9% of the variability in CTSI. These findings support further evaluation of inexpensive admission biomarkers as adjuncts to early severity assessment, but they should not be interpreted as replacements for clinical assessment or appropriate radiological evaluation.

Ethics

Institutional Ethics Committee approval was obtained from Bangalore Medical College and Research Institute.

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