

An Observational Study to Assess Severity of Acute Pancreatitis on the Basis of Procalcitonin and CRP in Pancreatitis Cases Admitted at SMS Medical College and Attached Hospitals Jaipur

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Abstract:

Background: Acute pancreatitis is a sudden and potentially life-threatening condition marked by inflammation of the pancreas due to the premature activation of pancreatic digestive enzymes within the organ itself. This pathologic process leads to autodigestion, triggering a systemic inflammatory response and a spectrum of clinical presentations ranging from mild abdominal discomfort to severe multi-organ dysfunction. This study was aimed to evaluate the levels of serum Procalcitonin and CRP in patients diagnosed with acute pancreatitis and correlate these levels with the CT Severity Index to determine their effectiveness in predicting disease severity.

Aims & Objectives: The aim of this study was to Study the Assess of severity of acute pancreatitis on the basis of Procalcitonin and C-reactive protein among pancreatitis cases.

Methods: This study was a Hospital Based Observational study in which clinically diagnosed cases of Acute pancreatitis from OPD/IPD of Dept of Gastroenterology at SMS Super Specialty Hospital, Jaipur were taken as cases.

Results: 90 cases of Acute pancreatitis were analyzed in this study. The participants' ages ranged from 18.00 to 70.00 years, with a mean age of 43.30 ± 14.20 years. The majority of cases were classified as mild acute pancreatitis (61.11%), followed by moderate (22.22%) and severe (16.67%) forms. Mean serum Procalcitonin levels were markedly higher in severe cases (03.75 ± 02.70 ng/mL) compared to moderate (00.97 ± 00.63 ng/mL) and mild (00.24 ± 00.10 ng/mL) cases. Serum CRP levels also showed a progressive increase with disease severity, peaking in severe acute pancreatitis cases (30.29 ± 05.99 mg/dL).

Conclusion: Acute pancreatitis remains a major cause of gastrointestinal morbidity, with disease severity closely linked to systemic inflammation and multi-organ involvement. Elevated levels of these biomarkers were significantly associated with moderate and severe pancreatitis, reflecting both local pancreatic injury and systemic inflammatory response.

Keywords: Acute Pancreatitis, Procalcitonin, CRP, CT Severity Index.

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Introduction

Acute pancreatitis is a sudden inflammatory disorder of the pancreas that varies from mild, self-limiting illness to severe, potentially life-threatening disease with multiorgan failure. It results from premature activation of pancreatic enzymes, leading to autodigestion and tissue inflammation. The most common causes are gallstones and chronic alcohol intake, though hypertriglyceridemia, trauma, certain drugs, and infections can also trigger it. Acute pancreatitis is characterized by the interplay between the innate

immune system and the coagulation cascade.[1] Damage to acinar cells results in the release of digestive enzymes, which provoke tissue necrosis and inflammation. The ensuing immune response is marked by the release of pro-inflammatory cytokines, endothelial activation, vascular permeability, and thrombotic events.[2]

Globally, the incidence of acute pancreatitis varies by region and underlying etiology, with gallstones and alcohol consumption being the most common causative factors in India.[3] In Indian populations,

the reported prevalence is approximately 7.9 cases per 100,000 individuals. While the majority of patients experience mild disease with self-limiting symptoms, nearly 20% progress to severe acute pancreatitis (SAP), which carries a mortality risk of up to 30%.[4] Early risk stratification is therefore essential for guiding treatment decisions, preventing complications, and reducing mortality.

While imaging modalities such as contrast-enhanced computed tomography (CECT) and the CT Severity Index (CTSI) remain gold standards for classifying disease severity, their reliance on advanced infrastructure, high costs, and delayed detectability limit their utility in time-sensitive clinical scenarios.[5] Therefore, a shift towards biochemical biomarkers that can be rapidly assessed at the bedside is critical in improving early clinical decision-making.

Procalcitonin (PCT) [6] is a 116-amino-acid peptide precursor of calcitonin, normally undetectable in healthy individuals. In pathological states such as systemic infection, organ failure, and severe inflammatory syndromes, PCT is synthesized by multiple tissues, including the pancreas, liver, and colon. Recent studies have demonstrated its potential role in predicting complications and prognosis in SAP. C-reactive protein (CRP) [7] is a hepatic acute-phase reactant produced in response to cytokine signaling, particularly IL-6. Elevated CRP levels are indicative of systemic inflammation and have shown correlation with pancreatic necrosis and persistent organ failure in SAP. CRP peaks approximately 48–72 hours after symptom onset and has been widely studied as a predictive marker of disease severity.

The study aimed to evaluate the association of serum PCT and CRP levels with disease severity and to explore their potential role as early prognostic biomarkers in acute pancreatitis, thereby contributing to timely risk stratification and improved clinical decision-making.

Materials and Methods

After taking Necessary permissions from the institute ethical committee and Research Review Board, the study was conducted at the Immunoassay Lab & Central Lab (Department of Biochemistry) and the Department of Gastroenterology at SMS Medical College and attached hospitals, Jaipur. This study was a hospital based Observational Analytical study and sampling for the study was done from the period of December 2023 to November 2024.

Clinically diagnosed cases of Acute pancreatitis from OPD/IPD of Dept of Gastroenterology at SMS Super Specialty Hospital, Jaipur were taken as cases. Diagnosed cases of Acute pancreatitis

between age group of 18-70 years willing to participate were included in this study.

Patients not meeting the age criteria, having any known immunodeficiency, or Acute perforation of a peptic ulcer, Acute intestinal obstruction, Traumatic injuries, Acute gastroenteritis, Acute myocardial infarction, Malignant pancreatic tumors, pregnant women and those using immunosuppressive therapy were excluded from the study.

A total of 90 acute pancreatitis cases were included. The sample size was calculated to provide 80% study power and a significance level (alpha) of 0.05. CT imaging was performed, and severity was assessed using the CT Severity Index (CTSI). In addition, the clinical severity of acute pancreatitis was classified according to the Revised Atlanta Classification (2012): Mild acute pancreatitis – no organ failure and no local or systemic complications. Moderately severe acute pancreatitis – presence of transient organ failure (48 hours), involving single or multiple organs. Severe acute pancreatitis – persistent organ failure (>48 hours), involving single or multiple organs.

Blood samples were collected under aseptic conditions. Plain Vials were Used for Procalcitonin, CRP and routine biochemistry. Samples were allowed to clot for one hour and then centrifuged at 3500 rpm for 10 minutes. Serum and plasma were aliquoted and stored at -20°C until analysis.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) software, version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation (SD), while categorical variables were presented as frequencies and percentages. Associations between categorical variables and disease severity were examined using the chi-square (χ^2) test. The relationship between biomarker concentrations and CTSI scores was evaluated using Spearman's rank correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

Results

The participants' ages ranged from 18.00 to 70.00 years, with a mean age of 43.30 ± 14.20 years. The largest proportion of patients fell within the 41–50-year age group (27.78%), followed by the 18–30-year group (21.11%) and 31–40-year group (20.00%). Patients aged over 60 years constituted 15.56% of the sample, which was equal to the proportion aged 51–60 years. The age distribution showed no statistically significant deviation from uniformity ($\chi^2 = 4.56$, $df = 4$, $p = 0.336$). The majority of cases were classified as mild acute pancreatitis (61.11%), followed by moderate

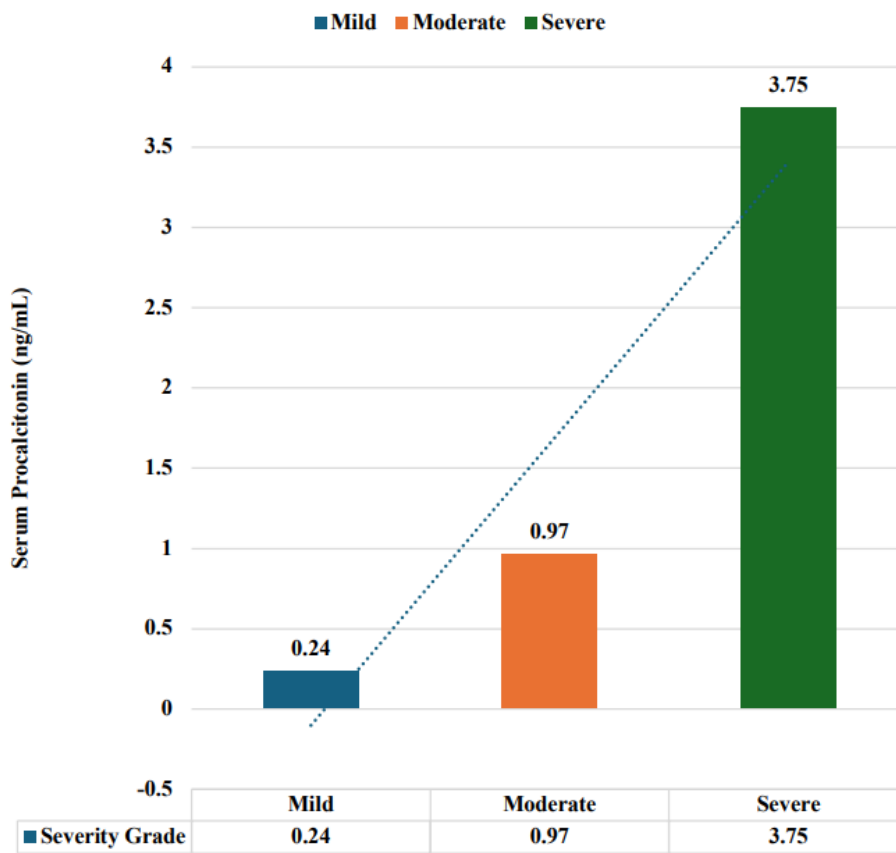
(22.22%) and severe (16.67%) forms. The distribution differed significantly from an equal spread across categories ($\chi^2 = 31.70$, $df = 2$, $p < 0.001$), indicating that mild cases predominated in the study population.

The Mean serum Procalcitonin levels were markedly higher in severe cases (03.75 ± 02.70

ng/mL) compared to moderate (00.97 ± 00.63 ng/mL) and mild (00.24 ± 00.10 ng/mL) cases. The difference was statistically significant ($p < 0.001$), suggesting Procalcitonin as a strong biomarker for severity assessment in acute pancreatitis. (Table 1, Graph 1)

Table 1: Comparison of serum Procalcitonin (ng/mL) levels across severity grades of acute pancreatitis

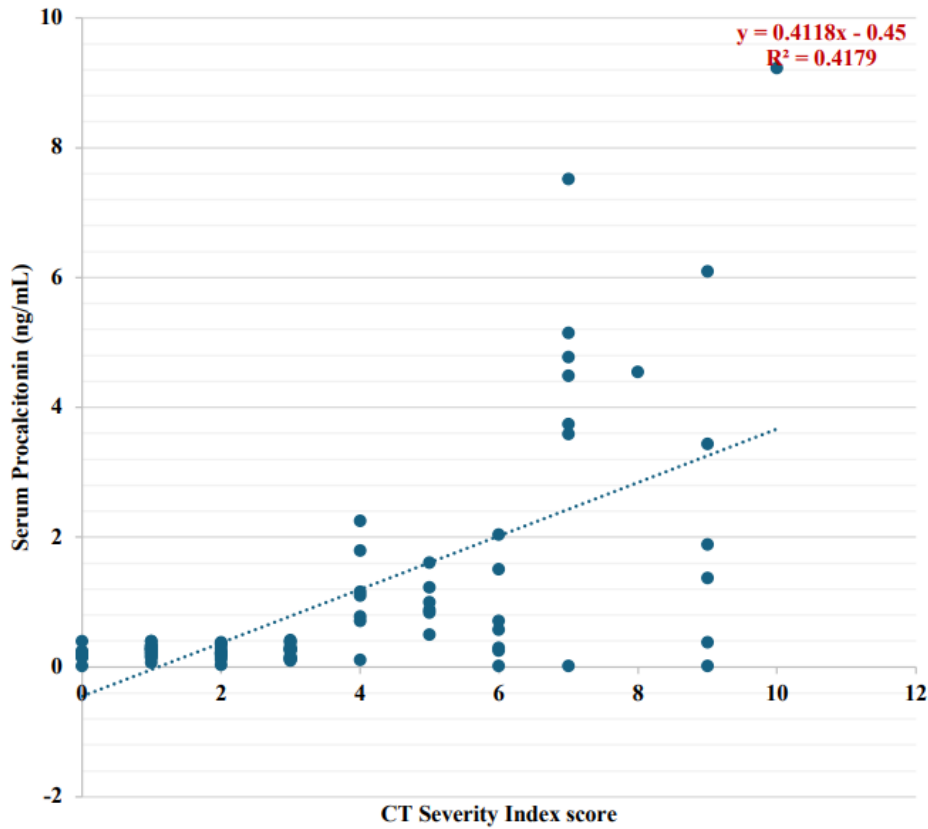
Severity Grade	Mean \pm SD	Range
Mild	00.24 \pm 00.10	00.08 – 00.50
Moderate	00.97 \pm 00.63	00.30 – 02.50
Severe	03.75 \pm 02.70	01.50 – 08.00
F = 25.30, df = 2, p < 0.001		



Graph 1: Comparison of serum Procalcitonin (ng/mL) levels across severity grades of acute pancreatitis

There was a statistically significant positive correlation ($r = 0.65$, $p < 0.001$) between serum Procalcitonin levels and CT Severity Index score. The regression equation ($y = 0.4118x - 0.45$)

indicates that each unit increase in CT Severity Index score predicts a 0.41 ng/mL rise in PCT concentration. (Graph 2)



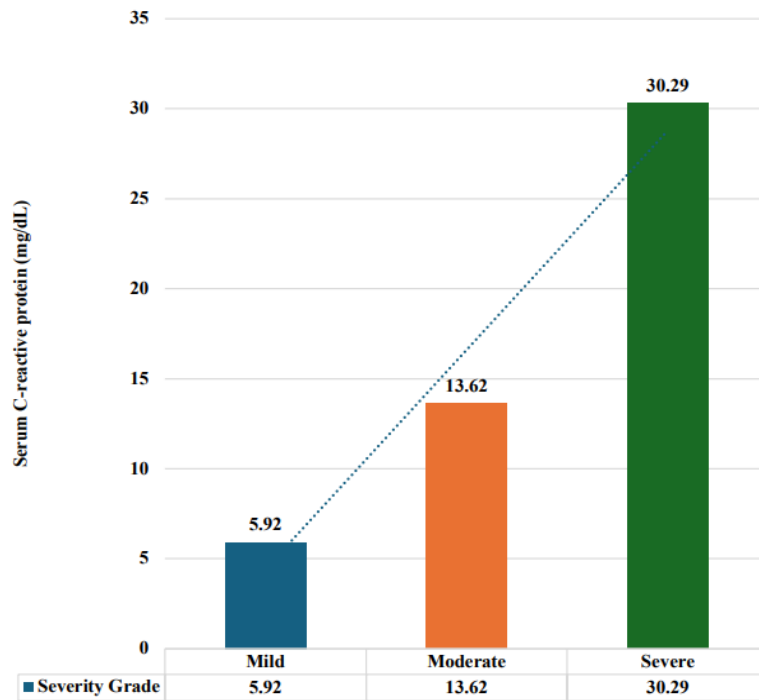
Graph 2: Pearson correlation and regression equation between serum Procalcitonin levels and CT Severity Index score in acute pancreatitis

Serum CRP levels showed a progressive increase with disease severity, peaking in severe acute pancreatitis cases (30.29 ± 05.99 mg/dL). The difference between severity groups was highly

significant ($p < 0.001$), highlighting CRP as a reliable indicator of systemic inflammation and severity classification. (Table 2, Graph 3)

Table 2: Comparison of serum C-reactive protein (mg/dL) levels across severity grades of acute pancreatitis

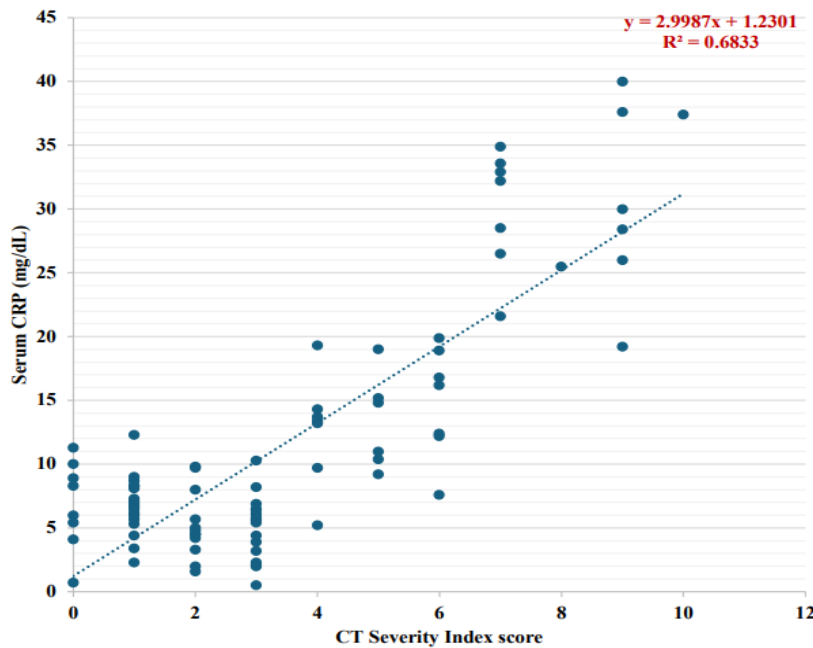
Severity Grade	Mean \pm SD	Range
Mild	05.92 \pm 02.68	02.00 – 12.00
Moderate	13.62 \pm 04.06	07.00 – 22.00
Severe	30.29 \pm 05.99	22.00 – 40.00
F = 136.00, df = 2, p < 0.001		



Graph 3: Comparison of serum C-reactive protein (mg/dL) levels across severity grades of acute pancreatitis

There was a statistically significant strong positive correlation ($r = 0.81, p < 0.001$) between serum CRP levels and CT Severity Index score. The regression model ($y = 2.9987x - 1.2301$) indicates

that each unit rise in CT Severity Index score is associated with an approximate increase of 3.00 mg/dL in CRP levels. (Graph 4)



Graph 4: Pearson correlation and regression equation between serum CRP levels and CT Severity Index score in acute pancreatitis

Discussion

Acute pancreatitis is a complex inflammatory disorder with a highly variable clinical course, making early severity prediction critical for guiding

timely intervention and improving patient outcomes. In the present study, we evaluated the role of serum Procalcitonin and C-reactive protein (CRP) as potential biomarkers for severity assessment in patients admitted with acute

pancreatitis, using the CT Severity Index (CTSI) as the reference standard.

In the present study, the mean age of patients with acute pancreatitis was 43.30 ± 14.20 years, ranging from 18 to 70 years. These findings are consistent with previous epidemiological reports suggesting that acute pancreatitis most commonly affects adults in the fourth and fifth decades of life (Sternby et al., 2017 [8]; Kayani et al., 2025 [9]). Several studies have reported similar trends. For instance, Hoque et al. (2023) [10] observed a mean patient age of 45.1 ± 13.8 years, while Ganesh RA (2024) [11] found the majority of cases in the 40–49 year bracket. This age predilection may be attributed to cumulative exposure to risk factors such as gallstone disease, chronic alcohol intake, and metabolic disorders (Bikkumalla, 2024). [12] Additionally, lifestyle and dietary patterns in middle-aged adults may predispose to pancreatic injury and inflammatory responses.

Based on CTSI-derived cut-offs, 61.11% of patients in the present study had mild disease, 22.22% had moderate disease, and 16.67% had severe disease. Sternby et al. (2017) [8] and Hoque et al. (2023) [10] also reported that mild acute pancreatitis forms the majority of cases at presentation, with severe forms comprising 15–25%, a figure closely matching our observations.

In the present study, mean serum procalcitonin (PCT) levels showed a clear stepwise increase with disease severity, being lowest in mild cases (0.24 ± 0.10 ng/mL), intermediate in moderate cases (0.97 ± 0.63 ng/mL), and highest in severe cases (3.75 ± 2.70 ng/mL). This progressive rise in PCT with severity parallels the findings of Hoque S (2023) [10], who reported significantly higher PCT values in severe AP compared to mild forms ($p = 0.032$), with superior diagnostic accuracy compared to CRP. Similarly, Han M (2024) [13] and Kayani BA (2025) [9] documented that PCT increases proportionally with severity and can be used for early prognostication. In the present study, serum PCT demonstrated a strong positive correlation with CTSI ($r = 0.78$, $p < 0.001$). This finding is consistent with Ganesh RA (2024) [11], who observed significant positive correlations between PCT and CT-based severity scores, suggesting that systemic inflammatory response, as reflected by PCT, parallels the extent of pancreatic and peripancreatic injury. Similarly, Mann BK (2024) [14] reported that elevated PCT levels were associated with increased multi-organ failure rates and guided decisions regarding antibiotic initiation and duration.

In the present study, mean serum CRP levels exhibited a statistically significant increase with disease severity, being lowest in mild cases (5.92 ± 2.68 mg/L), higher in moderate cases (13.62 ± 4.06

mg/L), and markedly elevated in severe cases (30.29 ± 5.99 mg/L). These findings are in concordance with Ganesh BN (2020) [15], who found that CRP levels were significantly higher in patients with severe AP, correlating with Ranson's score and systemic complications. Similarly, Kayani BA (2025) [9] observed a progressive rise in CRP levels from mild to severe AP, with severe cases showing marked elevation over 72 hours. In our study, CRP levels showed a strong positive correlation with CTSI ($r = 0.72$, $p < 0.001$). This is in agreement with Ganesh RA (2024) [11] and He Q (2022) [16], both of whom reported significant positive correlations between CRP and CT-based severity scores. The current correlation findings are also supported by Tarján D (2024) [17], who emphasized that persistent CRP elevation after 72 hours strongly indicates severe disease and possible infected necrosis. This underlines the value of CRP not only as an early biomarker but also for ongoing severity monitoring.

The strong correlations observed in our study suggest that integrating these biomarkers with CTSI could enhance early risk stratification, facilitate timely intervention, and potentially improve patient outcomes in acute pancreatitis. The results demonstrated significant differences in biomarker levels across severity categories and revealed meaningful correlations with CTSI scores, supporting their utility as adjunctive tools for early risk stratification.

Conclusion

Acute pancreatitis remains a major cause of gastrointestinal morbidity, with disease severity closely linked to systemic inflammation and multi-organ involvement. This study demonstrates the utility of serum CRP and Procalcitonin as reliable markers of disease severity, showing strong positive correlations with clinical severity scores and CT Severity Index. Among the inflammatory markers, Procalcitonin exhibited the strongest correlation with CT Severity Index, making it particularly valuable for prognostication.

Given the availability and relatively low cost of these assays, their integration into early evaluation protocols for acute pancreatitis could improve risk stratification, guide timely interventions, and potentially reduce complications. Future studies should focus on validating these findings in larger cohorts and exploring the combined use of inflammatory biomarkers with imaging and clinical scores for comprehensive severity assessment.

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