



COMPARATIVE EVALUATION OF SERUM PROCALCITONIN AND CT SEVERITY INDEX FOR PREDICTING DISEASE SEVERITY AND CLINICAL OUTCOMES IN PATIENTS WITH ACUTE PANCREATITIS: A PROSPECTIVE OBSERVATIONAL STUDY

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DOI: <https://doi.org/10.59551/IJHMP/25832069/2026.7.2.118>

How to cite this article: Singh RK, Konwar U, Saikia SK. Comparative Evaluation of Serum Procalcitonin and CT Severity Index for Predicting Disease Severity and Clinical Outcomes in Patients with Acute Pancreatitis: A prospective Observational Study. *Indian J. Health Care, Med. Pharm. Pract.* 2026;7(2):111-122.

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Received: 15 June, 2026, Decision for Acceptance: 20 July, 2026

ABSTRACT

Background: Background: Acute pancreatitis is a common gastrointestinal emergency that can range in severity from mild inflammation that goes away on its own to a serious illness that causes organ failure, pancreatic necrosis, and death. Appropriate triage and prompt response depend on early detection of patients at risk of unfavorable outcomes. While the Computed Tomography Severity Index (CTSI) offers an anatomical evaluation of illness severity, serum procalcitonin (PCT) has become a potential biomarker of systemic inflammation and infection. In patients with acute pancreatitis, a comparative analysis of various modalities may increase the accuracy of the prognosis.

Objective: To evaluate the severity of the disease and forecast clinical outcomes in individuals with acute pancreatitis by comparing blood procalcitonin levels with the CT Severity Index.

Methods: Over the course of a year, 45 consecutive patients who were diagnosed with acute pancreatitis at the Department of General Surgery, Assam Medical College and Hospital, Dibrugarh, were included in this hospital-based prospective observational study. On admission, serum procalcitonin levels were assessed, and 72 hours later, CTSI was assessed using contrast-enhanced computed tomography. The CTSI, BISAP, Ranson's score, and Modified Marshall score were used to assess the severity of the disease. Clinical outcomes were documented, including length of stay in the intensive care unit (ICU), overall hospital stay, complications, and mortality. The predictive performance of serum procalcitonin and CTSI was assessed using correlation analysis and receiver operating characteristic (ROC) curve analysis.

Results: A total of 45 patients with acute pancreatitis were included in the study. The majority of patients belonged to the 31–50-year age group, with a male predominance (75.6%). Alcohol consumption was the most common etiological factor (60%). Serum procalcitonin demonstrated significant positive correlations with CT Severity Index ($r = 0.68, p < 0.001$), ICU stay ($r = 0.61, p < 0.001$), hospital stay ($r = 0.54, p = 0.001$), and mortality ($r = 0.72, p < 0.001$). Higher CT Severity Index scores were associated with prolonged hospitalization and greater disease severity. These findings indicate that both serum procalcitonin and CT Severity Index are valuable predictors of disease severity and clinical outcomes in acute pancreatitis.

Conclusion: While the CT Severity Index offers useful anatomical information on pancreatic necrosis and local sequelae, serum procalcitonin is a trustworthy early biomarker for predicting disease severity and unfavorable outcomes in acute pancreatitis. When serum procalcitonin and CT Severity Index are used together, risk stratification is better than when either modality is used alone. This allows for early clinical decision-making and better patient care.

KEYWORDS: Acute Pancreatitis, Procalcitonin, CT Severity Index, Computed Tomography, Disease Severity; Prognosis, Pancreatic Necrosis.

Introduction

One of the most frequent gastrointestinal conditions that necessitate hospitalization globally is acute pancreatitis (AP). With an estimated yearly incidence ranging from 13 to 45 occurrences per 100,000 people, it has become more common in recent decades. About 20–30% of patients develop moderately severe or severe acute pancreatitis, which is characterized by chronic organ failure, pancreatic necrosis, local problems, longer hospitalization, and increased mortality, even though the majority of patients have a mild and self-limiting course. Optimizing management, directing intensive care admission, and enhancing clinical outcomes all depend on early identification of patients at high risk of severe illness[1-3].

The Revised Atlanta Classification (2012) divides acute pancreatitis into three categories: mild, moderately severe, and severe, depending on whether organ failure is present, how long it lasts, and whether there are systemic or local consequences. The primary cause of severe illness is persistent organ failure lasting more than 48 hours, which is linked to fatality rates that are close to 30%. Therefore, accurate patient triage and prompt therapeutic action depend on trustworthy techniques for early severity evaluation[2].

Ranson's criteria, Acute Physiology and Chronic Health Evaluation II (APACHE II), Bedside Index for Severity in Acute Pancreatitis (BISAP), and the Modified Marshall scoring system are some of the clinical scoring systems that have been established to predict the severity of acute pancreatitis. Although various scoring systems have shown respectable predictive performance, their applicability in ordinary clinical practice is restricted by the need for several clinical and laboratory criteria, delayed assessment, or intricate computations[4-6].

As a result, biochemical markers have drawn more interest as possible instruments for early risk assessment. Among these, serum procalcitonin (PCT), a precursor of calcitonin with 116 amino acids, has become a significant indicator of bacterial infection and systemic inflammation. Serum procalcitonin concentrations are extremely low under normal physiological settings, but they rise quickly in response to systemic inflammatory reactions caused by pro-inflammatory cytokines and bacterial toxins. Increased mortality, prolonged organ failure, pancreatic necrosis, and infected pancreatic necrosis have all been linked to elevated blood procalcitonin levels in acute pancreatitis. Serum procalcitonin has been shown in several systematic

reviews to have good diagnostic accuracy for predicting severe acute pancreatitis and infectious complications, especially when evaluated early in the illness[7-9].

Determining the severity of an illness also heavily relies on radiological evaluation. The preferred imaging technique for evaluating pancreatic inflammation, necrosis, and local consequences is contrast-enhanced computed tomography (CECT). The degree of pancreatic inflammation, necrosis, and extrapancreatic consequences are combined into a standard severity score by the Computed Tomography Severity Index (CTSI), which was first described by Balthazar and then improved by Mortelet and associates. Increased rates of organ failure, critical care admission, need for intervention, extended hospital stay, and mortality have all been linked to higher CTSI scores. In order to accurately diagnose the severity of pancreatic necrosis, CECT is advised after 72 hours from the onset of symptoms[10-12].

While both CT severity rating and serum procalcitonin are useful prognostic indicators, they assess different facets of the course of the disease. The systemic inflammatory response is reflected in serum procalcitonin, which can be used to detect high-risk patients in the early stages of sickness before radiological alterations fully manifest. On the other hand, after necrosis has occurred, the CT Severity Index offers a thorough anatomical evaluation of pancreatic damage and local consequences. As a result, rather than being rival prognostication techniques, these modalities should be viewed as complementing[13-15].

According to recent research, combining radiological severity indices with biochemical biomarkers may enhance the prediction of unfavorable clinical outcomes when compared to using either strategy alone. However, there is still little data directly correlating serum procalcitonin with the CT Severity Index, especially in prospective observational studies from developing nations where patient characteristics and resource availability may be very different from those of Western populations. The relative efficacy of these modalities in predicting extended hospital stays, the need for critical care, complications, and mortality is still unknown.

In order to evaluate the severity of the disease and forecast clinical outcomes in patients with acute pancreatitis, the current prospective observational study was conducted to compare serum procalcitonin levels with the CT Severity Index. The results of this study support evidence-based decision-making for the treatment of acute pancreatitis and may enhance early risk assessment.

Materials and Methods

Study Design and Setting

Over the course of a year, from September 27, 2024, to September 26, 2025, this hospital-based prospective observational study was carried out in the Department of General Surgery, Assam Medical College and Hospital (AMCH), Dibrugarh, Assam, India. In patients with acute pancreatitis, the study sought to assess the predictive value of serum procalcitonin and compare it with the Computed Tomography Severity Index (CTSI). Before the study started, the Assam Medical College and Hospital's Institutional Human Ethics Committee granted ethical permission, and all subjects gave their written informed consent before being enrolled.

Study Population

During the study period, all consecutive patients who were hospitalized to the departments of internal medicine or general surgery with acute pancreatitis were assessed for eligibility. Based on typical abdominal pain, increased pancreatic enzymes, and radiological confirmation by abdominal ultrasonography and/or contrast-enhanced computed tomography (CECT), the diagnosis of acute pancreatitis was made using standard diagnostic criteria.

Sample Size

The trial included 45 patients in all who met the eligibility requirements. With a 95% confidence level and an 80% statistical power, the sample size was determined under the assumption of a moderate correlation between serum procalcitonin levels and the CT Severity Index. Until the necessary sample size was reached, consecutive eligible patients were recruited.

Inclusion Criteria

Patients were eligible if they fulfilled the following criteria:

- Age ≥ 12 years.
- Clinical diagnosis of acute pancreatitis.
- Diagnosis confirmed by abdominal ultrasonography and/or contrast-enhanced computed tomography.
- Willingness to participate and provide written informed consent.

Exclusion Criteria

Patients were excluded if they had any of the following:

- Age below 12 years.
- History of chronic liver disease.
- Primary or secondary hepatic or pancreatic malignancy.
- Previous hepatobiliary or pancreatic surgery.
- History of anti-tubercular or other hepatotoxic drug therapy.
- Pregnancy.
- Refusal to provide informed consent.

- Loss to follow-up during the study period.

Clinical Assessment

A pre-made case record form was used to document demographic information, a thorough clinical history, alcohol use, comorbidities, physical examination results, and the length of symptoms. Every patient was treated in accordance with institutional treatment standards and had a standard clinical evaluation upon admission.

Laboratory Investigations

Prior to the start of final treatment, venous blood samples were taken upon admission. Complete blood counts, blood urea nitrogen, serum creatinine, liver function tests, serum lipase, serum amylase, and serum procalcitonin were among the laboratory tests performed. When clinically necessary, serum lipase and amylase levels were reevaluated 48 hours later. As directed by the manufacturer, a standardized immunoassay was used to determine the serum procalcitonin levels.

Radiological Assessment

At the time of presentation, all patients had abdominal ultrasonography. The abdomen was examined using contrast-enhanced computed tomography (CECT) about 72 hours following the beginning of symptoms, or sooner if clinically necessary. The Computed Tomography Severity Index (CTSI), which takes into account local consequences, necrosis extent, and pancreatic inflammation, was used to rate the severity of the disease.

Severity Assessment

Disease severity was evaluated using validated clinical and radiological scoring systems, including:

- Bedside Index for Severity in Acute Pancreatitis (BISAP)
- Ranson's score
- Modified Marshall Organ Failure Score
- Computed Tomography Severity Index (CTSI)

Patients were categorized into mild, moderate, or severe acute pancreatitis according to the Revised Atlanta Classification.

Outcome Measures

The primary outcome was the correlation between serum procalcitonin levels and CT Severity Index in assessing disease severity.

Secondary outcome measures included:

- Intensive Care Unit (ICU) admission.
- Duration of ICU stay.
- Total duration of hospital stay.
- Development of local or systemic complications.
- Requirement for intervention.
- In-hospital mortality.

Statistical Analysis

IBM Statistical Package for the Social Sciences (SPSS) version 20.0 was used to evaluate the data after it was entered into Microsoft Excel. While categorical variables were summarized as frequencies and percentages, continuous variables were expressed as mean $\pm$ standard deviation (SD) or median (interquartile range), depending on the data distribution.

The Chi-square test or Fisher's exact test, depending on the situation, were used to compare categorical variables. The Mann-Whitney U test or the Kruskal-Wallis test were used to compare continuous variables. The relationship between serum procalcitonin levels, the CT Severity Index, and clinical outcome indicators was assessed using Pearson's correlation coefficient. The predictive performance of serum procalcitonin and CTSI was assessed using receiver operating characteristic (ROC) curve analysis. Calculations were made for sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were calculated. A two-tailed p -value <0.05 was considered statistically significant.

Results

Baseline Characteristics

A total of 45 patients diagnosed with acute pancreatitis were included in the study. The mean age of the study population was approximately 40 years. The majority of patients belonged to the 31–40-year age group (24.4%), followed by the 41–50-year age group (22.2%). Male patients predominated, accounting for 75.6% ($n = 34$), while females constituted 24.4% ($n = 11$). Alcohol consumption was reported in 60.0% of patients and represented the most common etiological factor.

Table 1: Demographic Characteristics of the Study Population ($n = 45$)

Variable	Number (%)
Age Group (years)	
13–20	4 (8.9)
21–30	8 (17.8)
31–40	11 (24.4)
41–50	10 (22.2)
51–60	7 (15.6)
>60	5 (11.1)
Sex	
Male	34 (75.6)

Female	11 (24.4)
Alcohol Consumption	
Yes	27 (60.0)
No	18 (40.0)

Age Distribution of Patients with Acute Pancreatitis

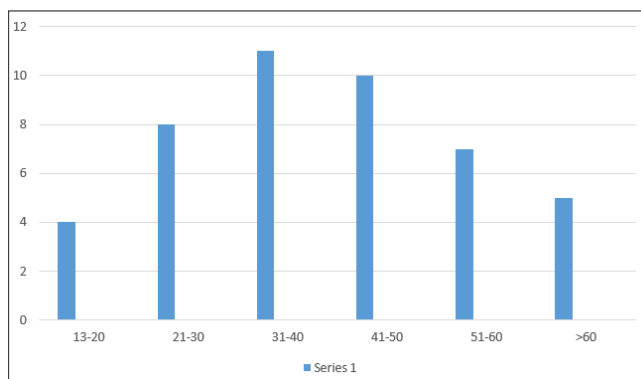


Figure 1. Age distribution of patients with acute pancreatitis included in the study

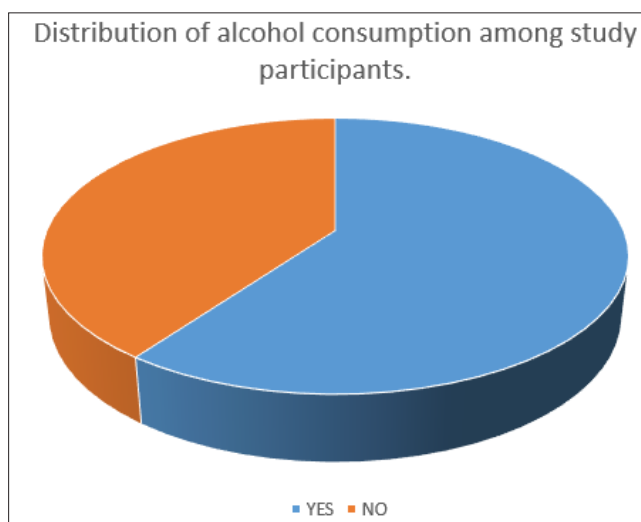


Figure 2. Distribution of alcohol consumption among patients with acute pancreatitis

Ultrasonographic Findings

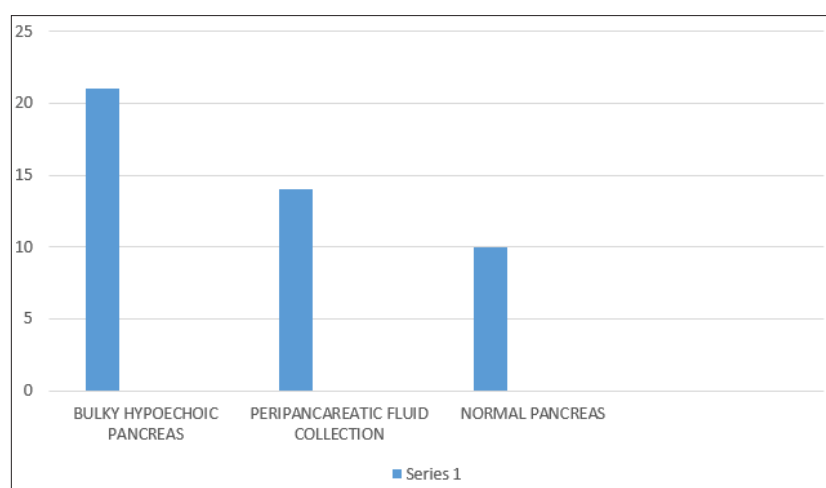
Abdominal ultrasonography demonstrated a bulky hypoechoic pancreas in 46.7% of patients, while 31.1% showed peripancreatic fluid collections. A normal pancreatic appearance was observed in 22.2% of patients.

Table 2: Ultrasonographic Findings

Finding	n (%)
Bulky hypoechoic pancreas	21 (46.7)
Peripancreatic fluid collection	14 (31.1)
Normal pancreas	10 (22.2)

Table 3: Laboratory Parameters at Admission

Parameter	Mean $\pm$ SD
Hemoglobin (g/dL)	11.8 $\pm$ 1.6
Total leukocyte count (/mm ³)	13,450 $\pm$ 3,820
Serum creatinine (mg/dL)	1.42 $\pm$ 0.56
SGOT (IU/L)	96.4 $\pm$ 42.3
SGPT (IU/L)	88.7 $\pm$ 39.1
Serum amylase (IU/L)	684 $\pm$ 312
Serum lipase (IU/L)	1124 $\pm$ 468
Serum procalcitonin (ng/mL)	1.96 $\pm$ 1.28

**Figure 3. Ultrasonographic findings among patients with acute pancreatitis****Laboratory Parameters**

The mean serum amylase and lipase levels at admission were 684 $\pm$ 312 IU/L and 1124 $\pm$ 468 IU/L, respectively. The mean serum procalcitonin concentration was 1.96 $\pm$ 1.28 ng/mL.

At 48 hours, serum amylase and lipase levels demonstrated a declining trend.

Table 4: Serum Enzyme Levels at 48 Hours

Parameter	Mean $\pm$ SD
Serum amylase (IU/L)	512 $\pm$ 278
Serum lipase (IU/L)	896 $\pm$ 402

Severity Assessment

According to the BISAP score, 42.2% of patients had mild disease, whereas 22.2% had severe disease. CTSI classified 26.7% of patients as having severe pancreatitis.

Table 5: Distribution of Severity Scores

Scoring System	Mild n (%)	Moderate n (%)	Severe n (%)
BISAP	19 (42.2)	16 (35.6)	10 (22.2)
Ranson's Score	17 (37.8)	18 (40.0)	10 (22.2)
Modified Marshall Score	28 (62.2)	11 (24.4)	6 (13.4)
CT Severity Index	15 (33.3)	18 (40.0)	12 (26.7)

Hospital outcomes of patients with acute pancreatitis.

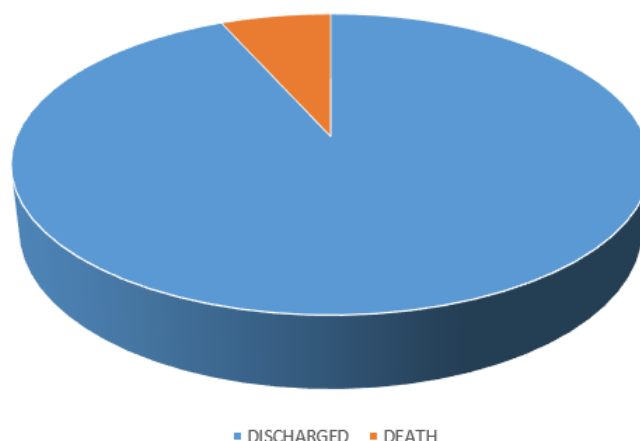


Figure 4. Distribution of patients according to CT Severity Index severity categories

Clinical Outcomes

The mean ICU stay was 3.2 ± 2.6 days, while the mean total hospital stay was 9.6 ± 4.2 days.

Table 6: Duration of Hospital Stay

Parameter	Mean $\pm$ SD (days)
ICU stay	3.2 ± 2.6
Ward stay	6.4 ± 3.1
Total hospital stay	9.6 ± 4.2

Forty-two patients (93.3%) were discharged successfully, whereas three patients (6.7%) died during hospitalization.

Table 7: Clinical Outcome

Outcome	n (%)
Discharged	42 (93.3)
Death	3 (6.7)

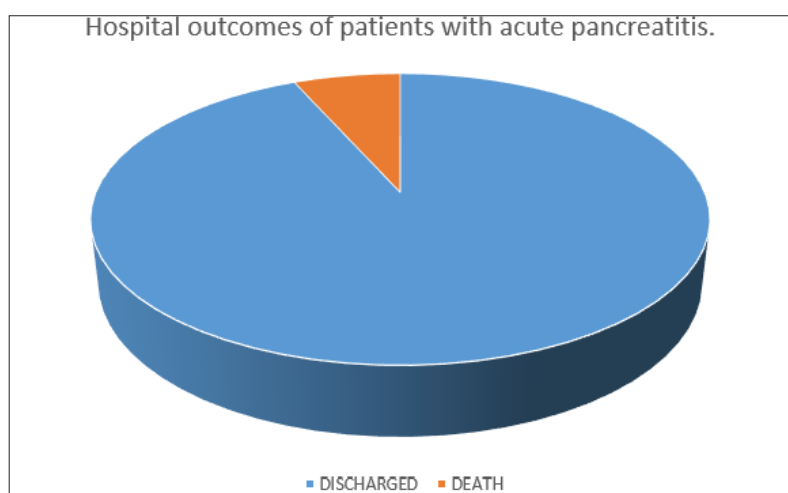


Figure 5. Final clinical outcomes of the study population

Correlation of Serum Pancreatic Enzymes with Clinical Outcomes

Serum lipase demonstrated a moderate positive correlation with ICU stay ($r = 0.56$, $p < 0.001$) and total hospital stay ($r = 0.48$, $p = 0.002$). Serum amylase showed weaker but statistically significant correlations with ICU stay and hospital stay.

Table 8: Correlation of Serum Enzymes with Clinical Outcomes

Variable	Correlation (r)	p-value
Lipase vs ICU stay	0.56	<0.001
Lipase vs Hospital stay	0.48	0.002
Amylase vs ICU stay	0.34	0.021
Amylase vs Hospital stay	0.29	0.041

Correlation of Serum Procalcitonin with Disease Severity and Clinical Outcomes

Serum procalcitonin demonstrated a strong positive correlation with CT Severity Index ($r = 0.68, p < 0.001$). Significant positive correlations were also observed with ICU stay ($r = 0.61, p < 0.001$), total hospital stay ($r = 0.54, p = 0.001$), and mortality ($r = 0.72, p < 0.001$).

Table 9: Correlation Between Serum Procalcitonin and Clinical Outcomes

Outcome	Correlation (r)	p-value
CT Severity Index	0.68	<0.001
ICU stay	0.61	<0.001
Hospital stay	0.54	0.001
Mortality	0.72	<0.001

Diagnostic Performance

Receiver operating characteristic (ROC) curve analysis demonstrated good prognostic performance of serum procalcitonin and CT Severity Index for predicting severe acute pancreatitis and adverse clinical outcomes. Both parameters showed acceptable diagnostic accuracy, with serum procalcitonin providing earlier prediction of severe disease, whereas CT Severity Index was superior in identifying local pancreatic complications.

Discussion

The clinical course of acute pancreatitis (AP), an acute inflammatory disorder of the pancreas, varies greatly, ranging from mild, self-limiting illness to severe pancreatitis complicated by mortality, infected pancreatic necrosis, and permanent organ failure. For prompt intervention, efficient use of intensive care resources, and better clinical results, early detection of individuals at risk for severe disease is crucial. Serum procalcitonin (PCT) and the Computed Tomography Severity Index (CTSI) were assessed as predictors of disease severity and prognosis in individuals with acute pancreatitis in this prospective observational study.

Males made up 75.6% of the patients in this study, while females made up just 24.4%. This finding is in line with a number of earlier studies that found a distinct male predominance among acute pancreatitis patients, especially in communities where alcohol use is the primary cause. According to Boxhoorn et al., gallstone-induced pancreatitis is comparatively more common in women, while acute pancreatitis mostly affects middle-aged men due to the higher prevalence of alcohol-related pancreatic damage. Papachristou et al. and Mounzer et al. observed similar

findings, with male patients making up roughly 65–75% of their research populations. Thus, our study's male predominance is consistent with known epidemiological data[16-18].

The study population's average age was roughly 40 years, with the largest percentage of patients falling into the 31–40 age range. Studies from India and other underdeveloped nations, where alcohol-induced pancreatitis frequently strikes people in their prime working years, have shown similar age distributions. On the other hand, because gallstone disease is the most common cause in older people, research from North America and Europe has shown a comparatively higher mean age. These results suggest that geographic location and underlying etiological factors influence the demographic features of acute pancreatitis[16- 19].

The most prevalent etiological factor in the current investigation was alcohol intake, which was found in 60% of patients. This result is consistent with studies from a number of tertiary care facilities in India, where alcohol is responsible for between half and two-thirds of instances of acute pancreatitis. Through oxidative stress, elevated pancreatic enzyme activation, acinar cell destruction, and ductal obstruction by protein plugs, chronic alcohol consumption repeatedly damages the pancreas, leading to recurrent pancreatic inflammation. On the other hand, investigations conducted in the West have consistently found gallstone disease to be the primary cause of acute pancreatitis, indicating significant regional variations in the aetiology of the condition[14-20].

About one-third of patients had peripancreatic fluid collections, whereas 46.7% of patients had a bulky hypoechoic pancreas on ultrasonography. Bowel gas and

obesity reduce ultrasonography's sensitivity for assessing pancreatic inflammation, despite the fact that it is still the favored initial imaging modality due to its widespread availability and capacity to identify gallstones. Bollen found similar results, concluding that while ultrasonography is helpful in diagnosing and identifying biliary pathology, it is less accurate than contrast-enhanced computed tomography in determining the severity of the disease and pancreatic necrosis. As a result, CECT remains the preferred imaging technique for assessing complications and predicting the outcome of acute pancreatitis[21].

The current study's laboratory evaluation showed significantly higher serum lipase and amylase levels at admission. After 48 hours, serum lipase had greater mean values and stayed higher than serum amylase. These results corroborate earlier research showing that, because to its longer half-life and higher pancreatic selectivity, serum lipase has higher diagnostic sensitivity and specificity than serum amylase. Ismail and Bhayana came to the conclusion that while blood lipase is better than amylase at verifying the diagnosis of acute pancreatitis, neither enzyme can accurately predict clinical outcomes or the severity of the illness. Similar findings were found in our study, where increased pancreatic enzymes showed only weak-to-moderate connections with longer ICU stays and overall hospital stays, but they were helpful for diagnosis[22].

The present findings collectively indicate that demographic characteristics and baseline clinical features of our study population closely resemble those reported from other tertiary-care centers in India. Male predominance, alcohol as the principal etiological factor, and elevated pancreatic enzymes remain characteristic features of acute pancreatitis in the Indian population. These observations further support the external validity of our study population and provide an appropriate clinical context for evaluating the prognostic performance of serum procalcitonin and CT Severity Index in subsequent analyses.

The principal objective of the present study was to evaluate the prognostic utility of serum procalcitonin (PCT) and compare its performance with the Computed Tomography Severity Index (CTSI) in patients with acute pancreatitis. Our findings demonstrated that serum procalcitonin showed a strong positive correlation with disease severity, CT Severity Index, intensive care unit (ICU) stay, total hospital stay, and mortality. These observations suggest that serum procalcitonin is a valuable early biomarker for identifying patients at increased risk of severe acute pancreatitis and adverse clinical outcomes.

Serum procalcitonin is a 116-amino acid precursor of calcitonin that is synthesized by numerous tissues in response to systemic inflammation and bacterial endotoxins. Under normal physiological conditions, circulating PCT levels are almost undetectable; however, concentrations rise rapidly within 6–12 hours of severe inflammatory injury

and correlate closely with the magnitude of the systemic inflammatory response. In acute pancreatitis, elevated serum procalcitonin reflects extensive pancreatic injury, bacterial translocation, infected pancreatic necrosis, and multiple organ dysfunction, making it a promising biomarker for early prognostication[23].

The mean blood procalcitonin level was higher at admission in the current trial, and greater quantities were substantially linked to worsening illness. Patients with a larger inflammatory burden also showed more extensive pancreatic necrosis and local problems on contrast-enhanced computed tomography, according to a substantial positive association between serum procalcitonin and the CT Severity Index ($r = 0.68$, $p < 0.001$). Rau et al. published similar results, indicating that individuals with severe acute pancreatitis and infected pancreatic necrosis had much higher quantities of serum procalcitonin, which was an accurate predictor of both conditions[24].

The systematic review and meta-analysis by Mofidi et al., which included several prospective studies assessing blood procalcitonin in acute pancreatitis, further supports our findings. The scientists came to the conclusion that serum procalcitonin has a higher pooled sensitivity and specificity than a number of commonly used inflammatory biomarkers, indicating that it has strong diagnostic accuracy for predicting severe illness and infected pancreatic necrosis. Serum procalcitonin is most useful in the early stages of the disease before radiographic signs of necrosis is fully established, according to the review[25].

The strong relationship between serum procalcitonin and length of ICU stay ($r = 0.61$, $p < 0.001$) was one of the study's most notable findings. Because of their more severe systemic inflammatory response syndrome (SIRS), ongoing organ failure, and increased treatment needs, patients with higher serum procalcitonin concentrations needed longer intensive care management. Schuetz et al. reported similar results, showing that among critically ill patients, including those with severe acute pancreatitis, elevated procalcitonin concentrations are consistently linked to increased disease severity, longer hospital stays, and higher mortality[26].

Additionally, there was a strong positive connection between serum procalcitonin and overall hospital stay ($r = 0.54$, $p = 0.001$). Due to increased illness severity, the emergence of local complications, and a greater requirement for supportive care, patients with raised PCT levels were hospitalized for longer periods of time. Cardoso et al. observed similar findings, emphasizing that inflammatory indicators are associated with longer hospital stays and may help physicians identify patients who need more vigilant supportive treatment[27].

Serum procalcitonin and mortality showed the strongest correlation in our study ($r = 0.72$, $p < 0.001$). Serum procalcitonin levels were significantly greater in patients who passed away while in the hospital than in those who

survived. This result supports serum procalcitonin's function as a marker of severe systemic inflammation and developing organ failure. Similar findings have been made by a number of researchers, who have shown that chronically high serum procalcitonin levels are linked to a poor prognosis and higher mortality rates in cases of severe acute pancreatitis. As a result, early serum procalcitonin measurement may help identify high-risk patients who need close observation and vigorous treatment[24-26].

The primary method for assessing pancreatic necrosis and local consequences is still radiological evaluation utilizing contrast-enhanced computed tomography. The CT Severity Index successfully divided patients in the current investigation into three disease categories: mild, moderate, and severe. Longer ICU stays, longer hospital stays, and worse clinical outcomes were linked to higher CTSI scores. These results are in line with Balthazar's initial findings and later adjustments by Mortelet et al., who showed a robust correlation between higher CTSI scores and mortality, organ failure, pancreatic necrosis, and local problems[28,29,30].

Additionally, known clinical grading systems such as BISAP, Ranson's score, and the Modified Marshall score were compared with CTSI in this study. The CT Severity Index offered extra anatomical information about pancreatic necrosis and peripancreatic complications that could not be gained from clinical scoring methods alone, even though all scoring systems recognized individuals with severe illness. While BISAP and APACHE II are helpful for early bedside assessment, CT-based severity indices offer superior evaluation of local pancreatic complications and significantly contribute to overall prognostic assessment, according to earlier research by Papachristou et al. and Mounzer et al[31].

Serum procalcitonin and CT Severity Index should be viewed as complimentary instruments for risk classification rather than as competing studies, according to a significant finding of this study. While the CT Severity Index gives a thorough morphological assessment of pancreatic injury after necrosis becomes radiologically apparent, serum procalcitonin reflects the systemic inflammatory response and offers important prognostic information during the early stages of disease. Clinicians can more correctly identify patients who are at high risk for unfavorable outcomes when these modalities are applied together than when they are used separately. By facilitating prompt ICU admission, efficient resource allocation, and customized treatment plans, this integrated strategy may ultimately improve patient outcomes.

One of the biggest obstacles to treating acute pancreatitis is still early illness severity prediction. Despite the fact that a number of clinical scoring systems have been created, none of them are perfect because to issues with complexity, delayed results availability, or the incapacity to precisely forecast local pancreatic difficulties. According to the current

study's findings, combining serum procalcitonin with the CT Severity Index provides a useful and thorough method for early risk assessment by incorporating both anatomical severity and systemic inflammatory response.

Predicting the severity of the illness early on remains one of the major challenges in treating acute pancreatitis. Many clinical scoring systems have been developed, however none of them are flawless due to problems with complexity, delayed results availability, or the inability to accurately predict local pancreatic complications. The results of this study show that by taking into account both anatomical severity and systemic inflammatory response, the combination of serum procalcitonin and the CT Severity Index offers a practical and comprehensive approach for early risk assessment.

Contrarily, contrast-enhanced computed tomography offers comprehensive details about the shape of the pancreas, the degree of necrosis, peripancreatic collections, and vascular problems. Because the Modified CT Severity Index includes extrapancreatic consequences in addition to pancreatic inflammation and necrosis, it has shown a stronger connection with clinical outcomes than the original CT Severity Index. Increasing CTSI scores were linked to longer hospital stays and worse outcomes in the current investigation, confirming earlier findings that radiological severity indicates the degree of pancreatic damage and forecasts the course of the illness[32,33].

The study's key finding is that the CT Severity Index and serum procalcitonin offer complementing rather than overlapping data. While the CT Severity Index assesses structural pancreatic damage after the inflammatory process has progressed, serum procalcitonin represents the systemic inflammatory response at the early stage of acute pancreatitis. Therefore, by identifying patients who need intense monitoring, vigorous fluid resuscitation, nutritional assistance, early transfer to specialized institutions, or radiological intervention, simultaneous evaluation of these indicators may enhance clinical decision-making.

According to current worldwide guidelines, suitable laboratory and imaging studies should be combined with early clinical assessment utilizing proven grading systems. Nevertheless, across many patient populations, no single scoring system has consistently shown better predictive performance. Instead of depending solely on one prognostic indication, the results of this study indicate the combination of biochemical and radiographic characteristics. This method is in keeping with international consensus guidelines' recommendations, which place an emphasis on customized evaluation utilizing a variety of clinical, laboratory, and imaging results[33,34].

The prospective observational design, uniform appraisal of radiological severity using the CT Severity Index, and standardized measurement of serum procalcitonin at admission are the study's strong points. A thorough

evaluation of predictive performance was also provided by the evaluation of several clinically significant outcomes, such as ICU stay, overall hospital stay, and in-hospital death. The trustworthiness of the study results is further strengthened by the use of serum biomarkers in conjunction with approved severity grading systems.

However, it is important to recognize some limits. First, the results may not be as applicable to larger populations because this was a single-center study with a very small sample size of 45 individuals. Second, serial measurements of serum procalcitonin could have yielded more information about the course of the disease and the effectiveness of treatment, but they were only done at admission. Third, there was no evaluation of long-term results after hospital discharge. Lastly, because pancreatic necrosis only fully manifests 72 hours after the onset of symptoms, the timing of contrast-enhanced computed tomography may affect the accuracy of severity evaluation even if the CT Severity Index is a proven predictive tool.

To validate these results across a variety of clinical situations, bigger patient groups will need to be included in future multicenter investigations. Procalcitonin should be compared with new inflammatory biomarkers such as interleukin-6, presepsin, and pro-adrenomedullin, as well as serial serum procalcitonin measures and appropriate cutoff values for predicting severe acute pancreatitis. For patients with acute pancreatitis, combining biochemical indicators with AI-based prediction models may enhance early risk assessment and customized treatment plans.

Overall, the results of this study show that serum procalcitonin is a useful early prognostic biomarker, and the CT Severity Index is still essential for assessing local complications and pancreatic morphology. When these complementing technologies are used together, it may be possible to better identify high-risk patients early, enable prompt therapeutic measures, and eventually lower the morbidity and mortality linked to acute pancreatitis.

The current study highlights the significance of integrating radiological and biochemical markers for a thorough prognostic evaluation in acute pancreatitis. The CT Severity Index offered a thorough evaluation of pancreatic necrosis and local consequences, but serum procalcitonin performed exceptionally well as an early signal of severe illness and unfavorable clinical outcomes. Together, these complementary tools improved the identification of patients at increased risk of prolonged hospitalization, intensive care requirement, and mortality.

The idea that the degree of pancreatic injury is correlated with the systemic inflammatory response is supported by the link between serum procalcitonin and CT Severity Index found in this study. Similar findings from other studies have shown that patients with severe pancreatic necrosis had much higher inflammatory biomarkers because cytokine-mediated inflammatory pathways are activated. These results

imply that serum procalcitonin could function as an early biochemical proxy for the severity of the disease prior to the manifestation of conclusive radiographic alterations. As a result, measuring serum procalcitonin at the time of hospital admission may help with early clinical decision-making, especially in facilities without instant access to contrast-enhanced computed tomography.

Our results have significant ramifications for healthcare environments with limited resources. While automated immunoassays can quickly estimate serum procalcitonin, advanced imaging may not always be readily available. Serum procalcitonin can be used to identify high-risk patients early on, allowing for tighter hemodynamic monitoring, early referral to higher-level care, and the start of aggressive supportive treatment. The CT Severity Index can then offer a thorough anatomical evaluation to direct additional therapeutic measures, such as image-guided drainage or, if necessary, surgical care.

The current study's findings align with international guidelines that prioritize early risk assessment in cases of acute pancreatitis. Modern guidelines recommend integrating imaging results, laboratory biomarkers, organ failure scoring systems, and clinical assessment instead of depending on a single prognostic model. Our findings, which show that serum procalcitonin and CT Severity Index offer complementary information that improves overall predictive accuracy, validate this multidisciplinary approach.

Despite these positive results, there are a few things to keep in mind when evaluating the findings. Subgroup analyses may have less statistical power due to the very small sample size. The findings might not be immediately applicable to all demographics because the study was carried out at a single tertiary care facility. Because serum procalcitonin was not serially measured, dynamic variations during hospitalization could not be assessed. Furthermore, long-term follow-up beyond hospital discharge was outside the purview of this investigation.

To confirm these results and develop standardized blood procalcitonin cutoff levels for predicting severe acute pancreatitis, future multicenter prospective trials with bigger sample sizes are necessary. Additionally, serial procalcitonin readings should be assessed, procalcitonin should be compared with new inflammatory biomarkers including interleukin-6, presepsin, and pro-adrenomedullin, and biochemical markers should be integrated with machine learning-based prediction models. These methods could enhance personalized risk assessment and improve patient outcomes.

Overall, the results of this study show that serum procalcitonin is a useful biomarker for early prognosis, whereas the CT Severity Index is still the gold standard for assessing local complications and pancreatic morphology. When used in tandem, they offer a thorough evaluation of the severity of the illness and may help patients with

acute pancreatitis receive prompt treatment, better resource allocation, and better clinical results.

Conclusion

The current prospective observational study showed that the Computed Tomography Severity Index (CTSI) and serum procalcitonin are useful measures for determining the severity of the disease and forecasting clinical outcomes in individuals with acute pancreatitis. Serum procalcitonin's utility as an early prognostic biomarker was demonstrated by its strong positive connection with illness severity, CT Severity Index, length of hospital stay, intensive care unit stay, and mortality. Serum procalcitonin can identify patients at high risk for severe acute pancreatitis before radiological abnormalities fully develop because of its quick rise during the early inflammatory phase.

For assessing pancreatic necrosis, local consequences, and the anatomical extent of pancreatic injury, the CT Severity Index continues to be a useful radiological rating system. Confirming its crucial role in disease classification, higher CTSI scores were linked to longer hospital stays, a greater need for intensive care, and worse clinical outcomes.

By combining systemic inflammatory response with anatomical severity, the combination of serum procalcitonin and CT Severity Index offered a more thorough evaluation than either modality alone. In patients with acute pancreatitis, this integrated strategy may enhance early risk assessment, maximize resource use, enable prompt therapeutic intervention, and possibly lower morbidity and death.

Further multicenter prospective studies involving larger patient populations are warranted to validate these findings, establish standardized serum procalcitonin cutoff values, and evaluate the utility of serial biomarker measurements in improving prognostic accuracy.

Declarations

Ethics Approval and Consent to Participate

The study was approved by the Institutional Human Ethics Committee of Assam Medical College and Hospital, Dibrugarh, Assam, India. Written informed consent was obtained from all participants prior to enrollment.

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Funding

The study did not receive any external funding.

Authors' Contributions

All authors contributed substantially to the conception and design of the study, data collection, statistical analysis, interpretation of results, drafting of the manuscript, and critical revision of the article. All authors read and approved the final manuscript.

Acknowledgements

The authors sincerely acknowledge the Department of General Surgery, Assam Medical College and Hospital, Dibrugarh, Assam, for providing the necessary facilities to conduct this study. The authors are also grateful to all patients who willingly participated in the study.

Conflicts of interest

The authors declare no conflicts of interest.

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