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Original Research Article

A CLINICAL STUDY OF SEVERITY OF ACUTE PANCREATITIS AND IT'S RELATION TO SERUM PROCALCITONIN

U. Bhaskar Rao[1], Venkat Nikhil Adusumalli[2], Dutta Ramakrishna[3], Karthik Sadanakari[4], Balaji Nallapati[5]

[1]*Associate Professor, Department of Medical Gastroenterology, Dr. PSIMS & RF, Chinaoutapalli, Gannavaram, Andhra Pradesh, India.*
[2]*Postgraduate, Department of General Medicine, Dr. PSIMS & RF, Chinaoutapalli, Gannavaram, Andhra Pradesh, India.*
[3]*Postgraduate, Department of General Medicine, Dr. PSIMS & RF, Chinaoutapalli, Gannavaram, Andhra Pradesh, India.*
[4]*Postgraduate, Department of General Medicine, Dr. PSIMS & RF, Chinaoutapalli, Gannavaram, Andhra Pradesh, India.*
[5]*Tutor, Department of Anatomy, Dr. PSIMS & RF, Chinaoutapalli, Gannavaram, Andhra Pradesh, India.*

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Corresponding Author:
Dr. Venkat Nikhil Adusumalli,
Postgraduate, Department of General Medicine, Dr. PSIMS & RF, Chinaoutapalli, Gannavaram, Andhra Pradesh, India.
Email: avenkatnikhil@gmail.com

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ABSTRACT

Background: Acute pancreatitis (AP) severity ranges from mild to life-threatening, with severe cases often leading to multi-organ failure and mortality. Early severity prediction is crucial for effective management. This study aimed to characterize AP clinical profiles and assess the utility of serum procalcitonin (PCT) as a severity marker, given existing debate.

Materials and Methods: This was a prospective observational study involving 60 patients (≥18 years) admitted with acute pancreatitis to Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation. AP severity was classified using the Revised Atlanta Criteria (2012). Serum PCT levels were measured, and their predictive accuracy, including sensitivity and specificity for severity, was statistically analyzed.

Results: The cohort (mean age 41.51 ± 13.2 years; 81.7% male) predominantly had alcohol-induced AP (60%), particularly in males. Common complications observed included hypocalcemia (53.3%), respiratory failure (31.7%), and pancreatic necrosis (20%). AP severity distribution was 40% mild, 28.3% moderate, and 31.7% severe. Mean serum PCT levels significantly increased with disease severity: mild (0.239 ng/mL), moderate (0.951 ng/mL), and severe (4.265 ng/mL) ($p < 0.001$). PCT demonstrated excellent predictive accuracy (Area Under the Curve [AUC] 0.955), with an optimal cut-off of 1.81 mcg/L (sensitivity 84.9%, specificity 88.1%) for severity prediction. C-reactive protein (CRP) also correlated significantly with severity, unlike amylase and lipase. Overall, 93.7% of patients recovered, with 6.7% mortality.

Conclusion: Serum procalcitonin is a reliable biomarker for early AP severity assessment, demonstrating a strong correlation with disease progression and outcomes. Its high diagnostic performance supports its valuable role in guiding early management decisions.

Keywords: Acute Pancreatitis, Procalcitonin, C-Reactive Protein, Disease Severity.

INTRODUCTION

Acute pancreatitis (AP) is an inflammatory condition varying from mild to life-threatening, with severe cases often causing multi-organ failure and mortality. Early severity prediction is crucial for effective management and preventing complications. While diagnosis typically relies on pancreatic enzymes and clinical signs, a need exists for practical, affordable biochemical tests to identify patients at risk of pancreatic infections and severity. Serum procalcitonin (PCT) has emerged as a promising biomarker for bacterial infections and predicting severity in AP. However, its role in forecasting acute pancreatitis progression and seriousness remains inconsistent and debated across various research efforts. This study aimed to assess PCT's potential in this regard.

MATERIALS AND METHODS

This prospective, hospital-based, single-center observational study was conducted over two years (April 2023 to March 2025) at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, affiliated with Dr. NTR University of Health Sciences, Andhra Pradesh. Ethical approval was obtained, and informed consent was taken from all participants. Adults aged ≥18 years with a first episode of acute pancreatitis, presenting within 48 hours of symptom onset, and showing elevated serum amylase or lipase levels along with radiological confirmation were included. Patients with chronic/recurrent pancreatitis, trauma, burns, cardiogenic shock, chronic kidney disease, certain cancers, or unrelated sepsis were excluded. Convenience sampling was used, and the final sample size was 60.

Statistical Analysis

Data was collected using a structured proforma. Investigations included CBC, RFT, LFT, serum amylase, lipase, CRP, BUN (on admission and after 48 hours), and serum procalcitonin. Severity was classified using the Revised Atlanta Criteria (2012). Statistical analysis was performed using SPSS version 23.0, with $p < 0.05$ considered significant.

RESULTS

The study included a total of 60 participants diagnosed with acute pancreatitis. The mean age of the patients was 41.51 ± 13.2 years, with an age range of 18 to 65 years. The most commonly affected age group was 31–40 years, comprising 28.3% (17 cases) of the total sample. A significant male predominance was observed, with 81.7% (49 patients) being male and 18.3% (11 patients) female.

Table 1: Etiology of Acute Pancreatitis

Cause	Frequency (%)
Alcohol	36 (60.0%)
Leptospirosis	7 (11.7%)
Unknown	7 (11.7%)
Gallstones	4 (6.7%)
Hypertriglyceridemia	2 (3.3%)
Organophosphorus poisoning	2 (3.3%)
Dengue fever	2 (3.3%)

Table 2: Clinical Presentation and Findings

Clinical Feature	Frequency (%)
Atypical abdominal pain	43 (71.7%)
Nausea and vomiting	27 (45.0%)
Breathlessness	21 (35.0%)
Typical abdominal pain	17 (28.3%)
Epigastric tenderness	60 (100.0%)
Guarding and rigidity	23 (38.3%)
Icterus	17 (28.3%)
Ascites	8 (13.3%)

Table 3: Systemic and Local Complications

Type	Complication	Frequency (%)
Systemic	Hypocalcemia	32 (53.3%)
	Respiratory failure	19 (31.7%)
	Acute Kidney Injury (AKI)	18 (30.0%)
	Hypotension	7 (11.7%)
Local	Necrosis	12 (20.0%)
	Acute necrotic collection	8 (13.3%)
	Peripancreatic fluid collection	6 (10.0%)
	Thrombosis (splenic/portal/mesenteric)	4 (6.7%)

Based on imaging and the Revised Atlanta Criteria (2012), interstitial pancreatitis was more commonly observed, accounting for 63.3% (38 cases), while necrotizing pancreatitis was seen in 36.7% (22 cases).

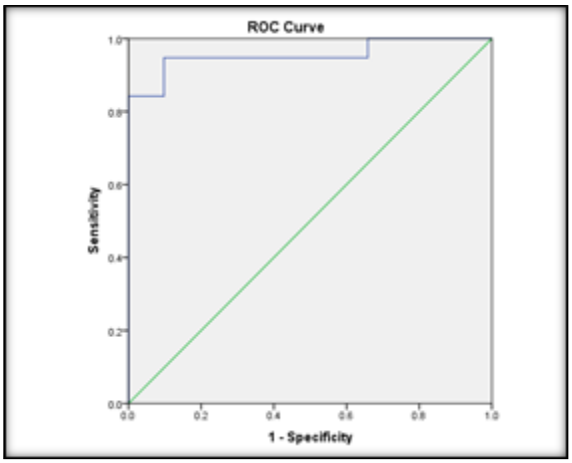
In terms of severity classification, mild acute pancreatitis was present in 40.0% (24 patients), moderate in 28.3% (17 patients), and severe in 31.7% (19 patients).

Table 4: Evaluating Serum Procalcitonin levels as Predictor of severity in Acute Pancreatitis

Severity	N	Mean	SD	Min	Max	p-value a	Significant Difference (p-value b)
Mild	24	0.239	0.13	0.09	0.78	<0.001*	Mild vs. Moderate: 0.26
Moderate	17	0.951	0.61	0.21	3.04		Mild vs. Severe: <0.001*
Severe	19	4.265	3.31	0.46	13.18		Moderate vs. Severe: <0.001*

Area Under the Curve			
Test Result Variable(s): Serum Procalcitonin			
Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval

			Lower Bound	Upper Bound
.955	.035	.000	.887	1.000
a. Under the nonparametric assumption				
b. Null hypothesis: true area = 0.5				



ROC curve was plotted for true positive rate against the false positive rate for the different possible cut-off points of serum-procalcitonin levels. The Area Under the Curve (AUC) for the study was 0.955 and the Best Cut-off value for serum-procalcitonin levels was found to be 1.81 mcg/lit. For the Cut-off of 1.81 mcg/lit the Sensitivity was 84.9% and the Specificity was 88.1%.

In this study, 93.7% (56/60) of patients with acute pancreatitis recovered, while 6.7% (4/60) succumbed to the illness, indicating a high recovery rate.

Patients with a hospital stay of ≥8 days had significantly higher mean serum procalcitonin levels (2.13 ± 0.64 ng/mL) compared to those who stayed <8 days (1.58 ± 0.72 ng/mL). The difference was statistically significant ($p < 0.001$), highlighting that elevated PCT levels are strongly associated with prolonged hospitalization and greater disease severity.

The laboratory profile of the study participants revealed the following mean ± standard deviation (SD) values: hemoglobin was 13.18 ± 1.24 g/dL, hematocrit was 31.37 ± 3.6%, WBC count stood at 12,364.55 ± 1,587.3/µL, and platelet count averaged 176,410.3 ± 24,615.2/µL. Regarding renal function, urea levels were 45.15 ± 8.9 mg/dL and creatinine was 3.263 ± 0.74 mg/dL. Electrolyte levels showed sodium at 130.83 ± 4.25 mmol/L, potassium at 4.632 ± 0.63 mmol/L, and calcium at 7.182 ± 0.72 mg/dL. Liver function tests revealed total bilirubin at 2.89 ± 0.91 mg/dL, direct bilirubin at 2.14 ± 0.77 mg/dL, AST at 99.55 ± 28.7 U/L, ALT at 95.75 ± 26.3 U/L, and ALP at 114.6 ± 20.8 U/L. These values provide insights into the systemic involvement and organ dysfunction associated with acute pancreatitis in the study population.

DISCUSSION

The present study offers a comprehensive evaluation of the clinical characteristics, etiological profile, systemic and local complications, and biomarker dynamics, particularly serum procalcitonin (PCT), in patients with acute pancreatitis (AP). The findings are contextualized with those of previous studies to delineate similarities and differences, as well as to underscore the significance of regional and demographic variations.

The mean age of the study population was 41.51 ± 13.2 years, with a range from 18 to 65 years, and more than half of the patients belonged to the 31–50 years age group. This suggests that AP predominantly affects the economically productive age group. The gender distribution revealed a marked male predominance, with 81.7% males and only 18.3% females, a trend that aligns with multiple prior studies. For instance, Mann et al,[1] reported a similar gender bias (67% male), though with a slightly older mean age of 46.19 years. Likewise, Duda AG et al,[2] found a median age of 47.45 years with 67.5% males. Rau BM et al,[3] observed a 70% male prevalence with a median age of 50 years, and Mowery NT et al,[4] reported 78% males with a mean age of 46.8 years, closely mirroring the current study. In contrast, Su Mi Woo et al,[5] and Kim BG et al,[6] had older populations (61.05 and 59.5 years respectively), suggesting geographic or healthcare access-related differences in patient demographics. The gender-balanced cohort in Osman Simsek et al,[7] study (22 males and 22 females) contrasts with the present findings, highlighting potential regional or referral bias.

In terms of etiology, alcohol was the leading cause of AP, responsible for 60.0% of cases, followed by leptospirosis (11.7%), gallstones (6.7%), and unknown causes (11.7%). Other less common etiologies included hypertriglyceridemia, organophosphorus poisoning, and dengue fever. The predominance of alcohol-induced pancreatitis in this study is in agreement with Kamareddy S. et al,[8] who reported alcohol as the cause in 58.7% of cases and Venkatesh et al,[9] who observed alcohol in 70% of patients. Dias B. H. et al,[10] and Riche F. C. et al,[11] also reported alcohol as the most frequent cause. However, some studies, such as Shera I. A. et al,[12] and Cho J. H. et al,[13] noted gallstones as the most common etiology (53.9% and 49.7%, respectively). The present study's high incidence of leptospirosis-associated AP (11.7%) is notable and reflects the endemic nature of leptospirosis in the region. This finding is rare in global literature but significant in tropical settings, emphasizing the need for region-specific diagnostic awareness. Gender-based analysis indicated that alcohol was the predominant cause among males (71.4%), while gallstone-related and infectious etiologies were relatively more common in females.

Clinical presentation was varied, with atypical abdominal pain being the most frequent symptom (71.7%), surpassing the more commonly expected typical epigastric pain, which was observed in only 28.3% of patients. Nausea and vomiting (45.0%) and breathlessness (35.0%) were other common symptoms. Universally present epigastric tenderness (100%) reinforces its diagnostic importance and aligns with the IAP/APA 2013 working group's diagnostic criteria. Guarding and rigidity were reported in 38.3% of cases, and icterus was present in 28.3%, suggesting biliary or hepatic involvement. These findings mirror the work of Shera I. A. et al,[12] who also observed jaundice in more severe cases. Compared to Mounzer et al,[14] who reported nausea and vomiting in 60–80% of patients, the present study showed a lower frequency. Respiratory symptoms observed in a third of patients indicate early systemic involvement, consistent with observations by Bradley et al,[15] who emphasized fever and respiratory compromise in severe AP.

Systemic complications were common, with hypocalcemia seen in 53.3% of patients, followed by respiratory failure (31.7%) and acute kidney injury (AKI) (30.0%). Hypotension was less frequent (11.7%), possibly due to early resuscitative measures. These complications point towards a significant systemic inflammatory response. Local complications included pancreatic necrosis (20.0%), acute necrotic collection (13.3%), and peripancreatic fluid collection (10.0%). Thrombosis involving the splenic, portal, or mesenteric veins was seen in 6.7% of cases, similar to the 8.64% reported by Venkatesh et al.[9] Although not quantified in the study, pleural effusion, known to occur in 10–15% of moderate to severe AP cases per Banks et al,[16] may also have been present. The absence of pancreatic pseudocyst assessment is acknowledged, although these are typically delayed complications as described by Bradley et al,[15] Severe AP was diagnosed in 35.6% of participants, which is lower than the 63.4% reported by Venkatesh et al,[9] possibly reflecting earlier detection or differences in referral practices. An important observation was the significant elevation of PCT in patients with leptospirosis-induced AP, indicating the dual role of PCT in identifying both disease severity and etiology.

Serum biomarkers played a critical role in this study. CRP levels were elevated in cases of severe AP, reinforcing its value as an inflammatory marker. However, due to its lack of specificity in distinguishing between infectious and non-infectious causes, the study focused more heavily on the utility of serum procalcitonin. PCT was found to correlate significantly with disease severity. The ROC curve analysis for PCT yielded an AUC of 0.955, indicating excellent diagnostic accuracy. The optimal cut-off value was 1.81 ng/mL, offering 84.9% sensitivity and 88.1% specificity. These results compare favorably with those of Dias B H et al,[10] who reported 100% sensitivity and specificity for PCT >2 ng/mL. Kylanpaa-Back et al. found that PCT outperformed clinical scoring systems such as APACHE-II and Ranson, with high sensitivity (92%) and specificity (84%) at a lower cut-off of 0.5 ng/mL. Similarly, Liang et al,[17] reported 84.62% sensitivity and 89.11% specificity at a cut-off of 1.8 ng/mL, nearly identical to the current findings. Tian et al,[18] with a higher cut-off (2.29 ng/mL), also demonstrated strong performance with 77.8% sensitivity and 94% specificity. Studies like Venkatesh et al,[9] reported even higher specificity (100%) for a cut-off of 1.5 ng/mL. However, not all studies uniformly support PCT's predictive capacity. Frasquet et al,[19] found limited sensitivity (26.7%) and modest specificity (77.7%). Shera I. A. et al,[12] noted variable accuracy depending on the disease stage, while Kim BG et al,[6] found that the BISAP score marginally outperformed PCT. Despite these variations, most evidence, including the present study, supports PCT's utility, particularly when measured early. The additional observation of markedly elevated PCT levels in leptospirosis-associated AP further enhances its diagnostic relevance in endemic areas.

Finally, clinical outcomes in this study were favorable, with a recovery rate of 93.3% and a mortality rate of only 6.7%. All deaths occurred among patients with severe AP. This low mortality rate compares well with findings by Yadav et al,[20] for mild to moderate AP. However, Isenmann et al. reported significantly higher mortality rates (up to 30%) in necrotizing pancreatitis, especially in cases with delayed treatment or multi-organ failure. The comparatively better outcomes in this study may be attributed to timely diagnosis, early intervention, and the use of biomarkers like PCT to stratify severity and guide management.

CONCLUSION

This study reinforces the multifaceted nature of acute pancreatitis, emphasizing demographic, etiological, clinical, and biochemical variations. It confirms the central role of serum procalcitonin in assessing disease severity and adds valuable data on the unique challenges posed by infectious etiologies such as leptospirosis in tropical regions.

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