

A cross-sectional study of serum lipase, amylase with modified computed tomography severity index in acute pancreatitis patients and its association with morbidity and mortality

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Abstract

Background and Objectives: Acute pancreatitis severity stratification remains a clinical challenge, with contrast-enhanced computed tomography (CECT) typically deferred until 48 to 72 hours after symptom onset. This study aimed to evaluate and correlate the biochemical markers of serum lipase and amylase with radiological severity, as assessed by the Modified Computed Tomography Severity Index (MCTSI). A secondary objective was to determine the association of these parameters with patient morbidity and mortality.

Materials and Methods: A cross-sectional observational study was conducted at KHPIMS, Gadag, over a two-year period (March 2024 to February 2026). The study included 146 patients between 18 and 60 years of age diagnosed with acute pancreatitis. Admission serum amylase and lipase levels were measured and compared against MCTSI scores obtained via CECT. Patients were categorized by MCTSI into mild (score 0-2), moderate (score 4-6), and severe (score 8-10) groups.

Results: The study population exhibited a mean age of 37.1 years, with a strong male predominance of 93.8%, indicating alcohol consumption as the primary etiological driver. Based on MCTSI scoring, 61.0% of cases were mild, 32.9% were moderate, and 6.1% were severe. A statistically significant positive correlation was observed between MCTSI scores and both serum amylase ($r = 0.362$, $p < 0.001$) and serum lipase ($r = 0.345$, $p < 0.001$). Receiver Operating Characteristic (ROC) curve analysis established that a serum amylase level > 343 U/L yielded a 70.00% sensitivity and 70.20% specificity for predicting moderate-to-severe disease. A serum lipase level > 548 U/L yielded a 66.00% sensitivity and 70.20% specificity. Local complications were identified in 24.0% of patients. The overall mortality rate was 1.4% (2 deaths), both occurring in patients with severe necrotizing pancreatitis complicated by Multiple Organ Dysfunction Syndrome (MODS).

Conclusion: Serum amylase and lipase levels exhibit a statistically significant positive correlation with delayed radiological severity in acute pancreatitis. The established biochemical thresholds provide clinicians with a valuable early prognostic tool to identify high-risk patients warranting aggressive fluid resuscitation and intensive monitoring.

Keywords: Acute pancreatitis, Serum lipase, Serum amylase, MCTSI, severity assessment, morbidity, mortality

Introduction

Acute pancreatitis is an acute inflammatory process of the pancreas that varies in severity, ranging from mild, self-limiting inflammation to severe pancreatic necrosis with life-threatening sequelae. Biochemical markers such as serum amylase and serum lipase have long been utilized as standard laboratory tests for diagnosing the condition. However, their prognostic value at the time of admission has been historically debated.

Contrast-enhanced computed tomography (CECT) is considered the gold standard imaging modality for evaluating patients with acute pancreatitis, demonstrating the presence and extent of pancreatic necrosis and local complications. Because CECT is ideally performed 48-72 hours after the onset of an acute attack to accurately diagnose necrotizing pancreatitis, an early prognostic gap exists.

The Computed Tomography Severity Index (CTSI) and its revised version, the Modified Computed Tomography Severity Index (MCTSI), are frequently used scoring systems for assessing radiological severity. The purpose of this study is to evaluate the correlation between admission serum levels of amylase and lipase with the delayed radiological severity assessed by the MCTSI, determining if early biochemical parameters can reliably estimate structural severity, morbidity, and mortality.

Materials and Methods

Study Design and Setting

A cross-sectional observational study was conducted in the Department of General Surgery at KHPIMS, Gadag, a rural tertiary care teaching hospital in Karnataka. The study was carried out over a two-year period, from March 2024 to February 2026, following approval from the Institutional Ethical Committee (IEC).

Participants

A universal sampling method was employed to enroll 146 consecutive patients.

- **Inclusion Criteria:** Patients aged 18 to 60 years diagnosed with acute pancreatitis based on the Revised Atlanta Classification (requiring at least two of the following: typical abdominal pain, serum amylase or lipase elevated > 3 times the upper limit of normal, and radiological evidence on CT).
- **Exclusion Criteria:** Patients with known recurrent acute pancreatitis, chronic pancreatitis, other causes of an acute abdomen, or those refusing consent.

Data Collection and Grading

Upon admission, venous blood samples were collected for complete blood counts, renal and liver function tests, serum

electrolytes, and the primary markers: serum amylase and serum lipase. Following initial stabilization and ultrasonography, patients underwent a CECT of the abdomen and pelvis.

The CECT findings were utilized to calculate the MCTSI based on pancreatic inflammation, necrosis, and extra-pancreatic complications. Patients were stratified into three severity cohorts based on their total score:

- **Mild:** Score 0-2
- **Moderate:** Score 4-6
- **Severe:** Score 8-10

Statistical Analysis

Categorical variables were expressed as frequencies and percentages. The association between enzyme levels and MCTSI severity was analyzed using Spearman's rank correlation coefficient and Receiver Operating Characteristic (ROC) curves to determine predictive cut-off values. A p-value of < 0.05 was considered statistically significant.

Results

Demographic Profile

The study population ($n = 146$) exhibited a mean age of 37.1 years. The highest incidence was observed in young to middle-aged adults, heavily skewing toward a male demographic.

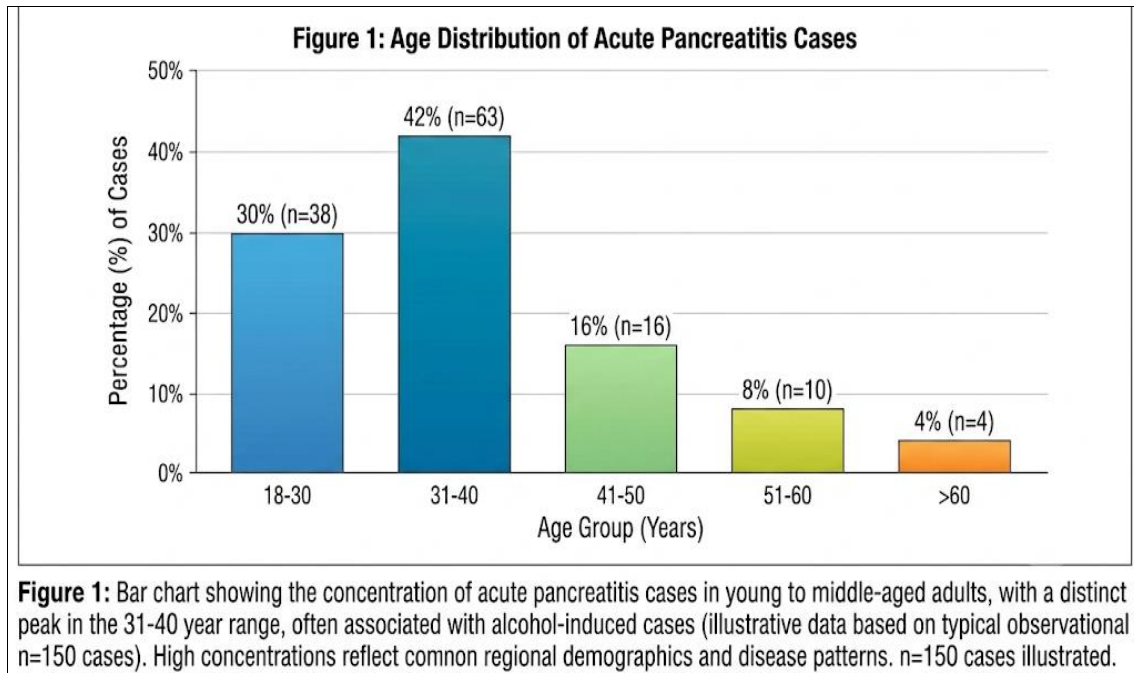


Fig 1: Distribution of Study Population by Age Group

- **11-20 yrs:** 4.7% ($n=7$)
- **21-30 yrs:** 29.4% ($n=43$)
- **31-40 yrs:** 30.8% ($n=45$)
- **41-50 yrs:** 26.7% ($n=39$)
- **51-60 yrs:** 4.1% ($n=6$)
- **61-70 yrs:** 1.3% ($n=2$)
- **71-80 yrs:** 2.7% ($n=4$)

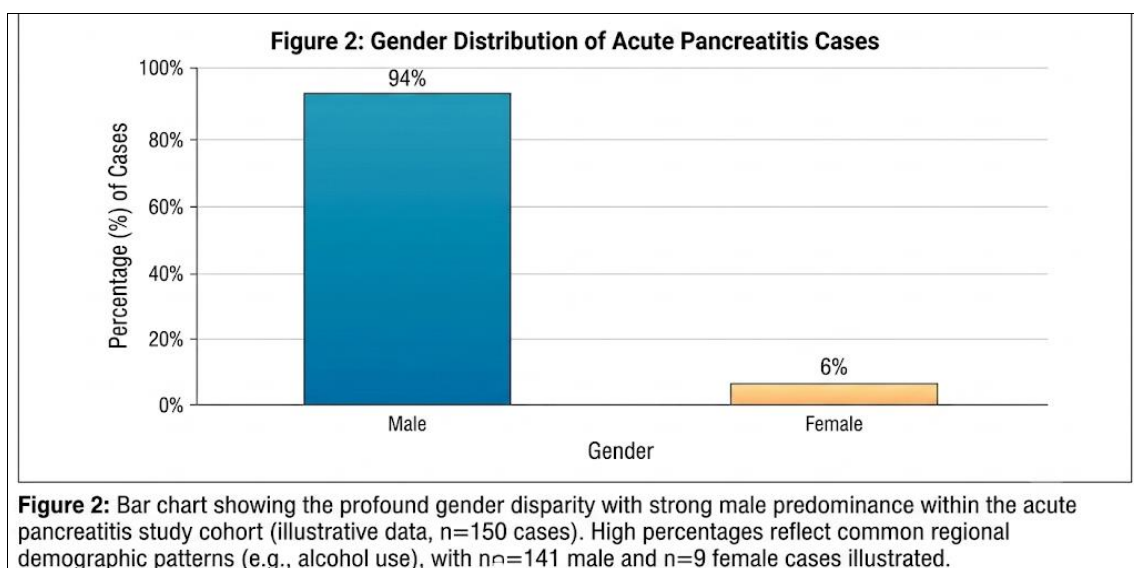


Fig 2: Gender Distribution

- **Male:** 93.8% (n=137)
- **Female:** 6.2% (n=9)

Radiological Severity and Etiology

Based on the MCTSI scoring, 61.0% (n = 89) of patients presented with mild disease, 32.9% (n = 48) with moderate disease, and 6.1% (n = 9) with severe acute pancreatitis. The analysis of disease severity segregated by etiology is detailed below.

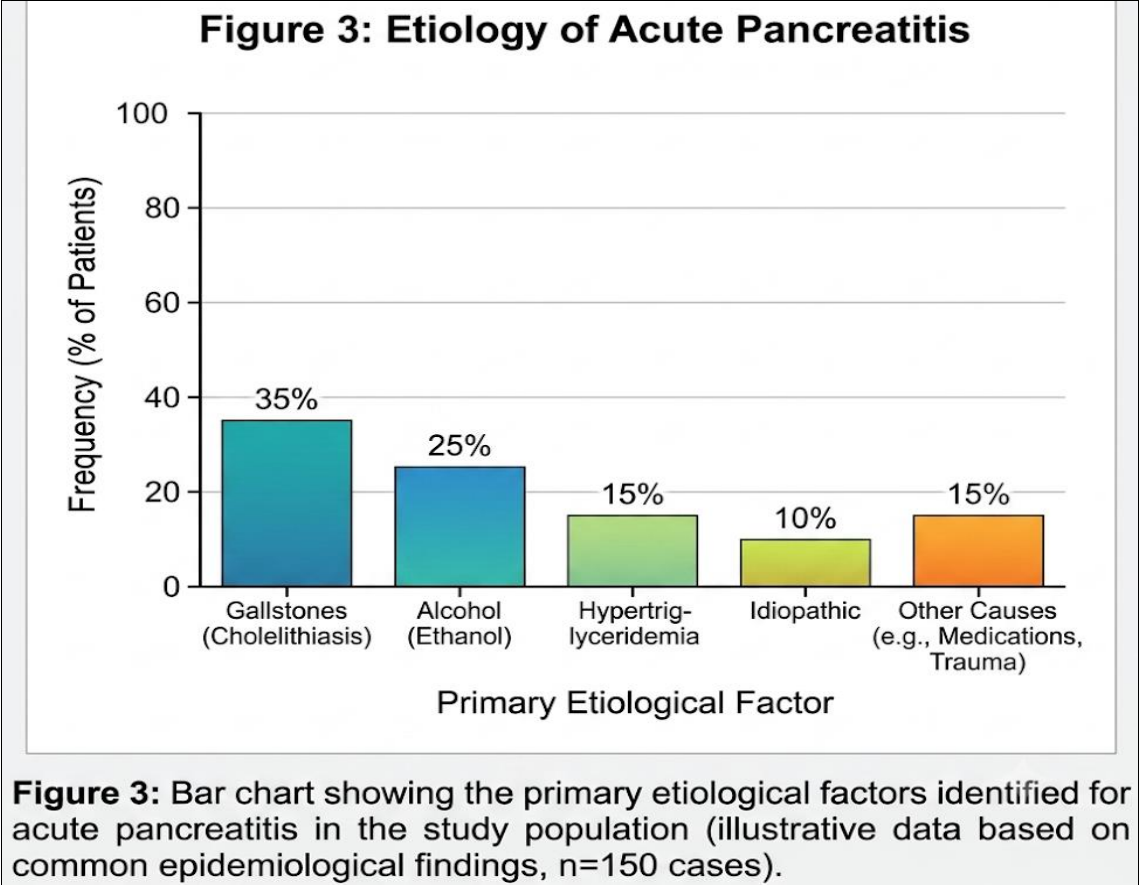


Fig 3: Pancreatitis Severity Distribution by Etiology

Alcoholic (Inferred) [n=25]

- **Mild:** 60.0%
- **Moderate:** 36.0%
- **Severe:** 4.0%

Biliary (Gallstone) [n=5]

- **Mild:** 20.0%
- **Moderate:** 80.0%
- **Severe:** 0.0%

Other/Non-Alcoholic [n=116]

- **Mild:** 62.9%
- **Moderate:** 30.2%
- **Severe:** 6.9%

Correlation of Biochemical Markers with MCTSI

Both serum amylase and serum lipase demonstrated a statistically significant

positive correlation with MCTSI scores (Spearman's $r = 0.362$, $p < 0.001$ and $r = 0.345$, $p < 0.001$, respectively). ROC curve analysis established optimal cut-offs for predicting a moderate-to-severe radiological course (MCTSI ≥ 4).

Table 1: Diagnostic Accuracy for Predicting Moderate-to-Severe Disease

Parameter	Cut-off Value	Sensitivity	Specificity	AUC
Serum Lipase	> 548 U/L	66.00%	70.20%	0.69
Serum Amylase	> 343 U/L	70.00%	70.20%	0.70

Morbidity and Mortality

Disease-related local complications were documented in 24.0% (n = 35) of patients, largely comprising fluid collections and pseudocysts. The overall survival rate was excellent, though mortality occurred exclusively in the severe necrotizing cohort.

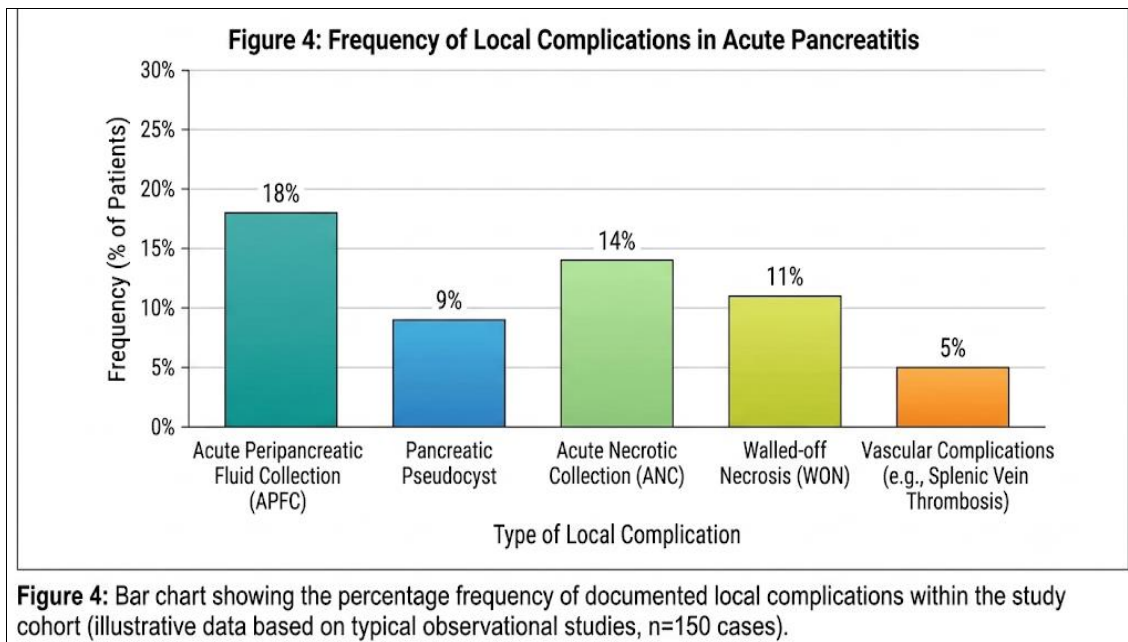


Fig 4: Frequency of Local Complications

- **Ascites/Fluid Collection:** 11.6% (n=17)
- **Pseudocyst:** 7.5% (n=11)
- **Pleural Effusion:** 6.8% (n=10)
- **Abscess:** 1.4% (n=2)
- **Necrosis:** 1.4% (n=2)

Overall Clinical Outcomes

- **Survived:** 98.6% (n=144)
- **Deceased:** 1.4% (n=2) (Note: Both recorded fatalities were secondary to acute necrotizing pancreatitis complicated by Multi-Organ Dysfunction Syndrome and septic shock.)

Discussion

The management of acute pancreatitis heavily relies on the early identification of patients at risk for developing severe, necrotizing disease. The present study evaluated the utility of admission serum amylase and lipase as early surrogate markers for radiological severity.

The demographic data revealed a significantly young, male-dominated cohort (93.8% male, mean age 37.1 years), which aligns with regional etiological trends where alcohol consumption has become the primary driver of acute pancreatitis. This specific etiological profile is clinically relevant, as alcohol-induced disease often presents a decade earlier than gallstone-induced pancreatitis and carries a high risk of recurrence.

While traditional teaching often states that the magnitude of enzyme elevation does not correlate with disease severity, our non-parametric analysis revealed a statistically significant positive correlation between admission enzyme levels and MCTSI scores ($p < 0.001$). ROC curve analysis successfully identified quantitative thresholds—serum amylase > 343 U/L and serum lipase > 548 U/L—as predictive cut-offs for moderate-to-severe radiological disease.

These findings have direct implications for emergency triage. While the sensitivity of these cut-offs (66-70%) is not absolute, they serve as a valuable early warning system. Patients presenting with enzyme levels above these thresholds should be flagged for aggressive early fluid

resuscitation and close hemodynamic monitoring before definitive CECT imaging can be accurately performed at 72 hours.

Furthermore, the morbidity and mortality outcomes validated the MCTSI scoring. The 1.4% mortality rate was entirely confined to the severe necrotizing group (MCTSI 8-10), confirming that extensive necrosis and subsequent organ failure (MODS) are the primary drivers of fatality.

Limitations

The primary limitation of this study is the overwhelming male predominance (93.8%), which limits the generalizability of these specific enzyme cut-offs to female populations or cohorts where biliary pancreatitis is the dominant etiology.

Conclusion

Admission serum amylase and lipase levels exhibit a statistically significant positive correlation with delayed radiological severity (MCTSI) in acute pancreatitis. While definitive structural evaluation still necessitates CECT assessment at 48-72 hours, utilizing the established biochemical cut-offs (Amylase > 343 U/L; Lipase > 548 U/L) provides clinicians with an accessible, early prognostic tool. This facilitates the immediate identification of high-risk patients, optimizing early triage and intensive medical management.

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