

Original Research Article

Systemic Inflammatory Response Syndrome and Disease Severity Prediction via Admission Serum Lipase-Amylase Ratio in Acute Alcoholic Pancreatitis: A Prospective Observational Study

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ABSTRACT

Background: Acute alcoholic pancreatitis (AAP) presents a significant clinical challenge because of its potential to induce systemic inflammatory response syndrome (SIRS), multi-organ dysfunction, and increased mortality. Early identification of high-risk patients at admission is essential for timely intervention and resource allocation. Conventional pancreatic biochemical markers, specifically serum amylase and lipase, have limited prognostic utility when considered individually.

Methods: A prospective observational study was conducted in the Department of General Surgery at Mandya Institute of Medical Sciences (MIMS), Mandya, from November 2024 to October 2025. Sixty adult patients admitted within 24 hours of symptom onset with confirmed AAP were enrolled through consecutive non-probability sampling. Baseline demographic, clinical, and laboratory parameters, including serum amylase and lipase, were evaluated at admission to calculate the lipase-amylase ratio (LAR). Patients were prospectively monitored for SIRS development and disease severity. Statistical analysis was performed using SPSS version 26.0; independent-samples t-test, Chi-square test, Fisher's exact test, and receiver operating characteristic (ROC) curve analysis were used, with $p < 0.05$ considered statistically significant.

Results: Among 60 patients, 53 (88.30%) were male and the mean age was 45.83 ± 13.87 years. Abdominal pain was present in all patients (100.00%), vomiting in 38 (63.30%), and fever in 36 (60.00%). SIRS developed in 8 patients (13.30%), while 15 (25.00%) developed severe pancreatitis. Mean LAR was higher in patients with SIRS than in those without SIRS (3.73 ± 2.75 vs. 2.35 ± 1.98), but the difference was not statistically significant ($p = 0.086$). Mean LAR was significantly higher in severe than non-severe pancreatitis (4.77 ± 2.91 vs. 1.78 ± 1.03 ; $p < 0.001$). For prediction of severe disease, the reported sensitivity, specificity, PPV, NPV, and overall accuracy were 73.00%, 100.00%, 100.00%, 91.80%, and 93.00%, respectively.

Conclusion: Admission serum LAR showed a strong association with overall disease severity in AAP. Its performance for isolated early SIRS prediction was limited. An elevated LAR was associated with severe clinical outcomes and may serve as an adjunctive biochemical marker for early risk stratification.

Keywords: Acute Alcoholic Pancreatitis, Lipase-Amylase Ratio, Systemic Inflammatory Response Syndrome, Disease Severity, Biomarker.

INTRODUCTION

Acute alcoholic pancreatitis (AAP) is an important cause of acute abdominal pain and hospital admission. Alcohol-related pancreatic

injury involves direct toxic effects of ethanol and its metabolites, oxidative stress, disturbed intracellular calcium signalling, and premature

activation of digestive enzymes, contributing to acinar-cell injury and inflammation.^[1,2,4,5,6]

Pancreatic inflammation may trigger the release of inflammatory mediators and a systemic response, leading to systemic inflammatory response syndrome (SIRS), microvascular dysfunction, and distant organ failure. Early SIRS and persistent organ failure have been associated with adverse outcomes in acute pancreatitis, supporting the need for early clinical risk assessment.^[3,5,7-9]

Severity assessment may use clinical scores such as APACHE II, Ranson's criteria, and BISAP, alongside the Revised Atlanta Classification. These tools and their comparative performance have been evaluated in acute pancreatitis cohorts.^[10-13] Serum amylase and lipase are useful diagnostic tests, but enzyme concentrations alone have limitations as prognostic markers; lipase may also be elevated in conditions other than pancreatitis.^[10,14,15] The admission serum lipase–amylase ratio (LAR) is therefore assessed in this study as a readily calculated candidate marker, without assuming that it replaces established severity assessment.

Aim and Objectives

Aim

To evaluate the role of the admission serum lipase–amylase ratio (LAR) as an early predictor of Systemic Inflammatory Response Syndrome (SIRS) and overall disease severity in patients with acute alcoholic pancreatitis.

Objectives

- To determine the utility of the serum lipase–amylase ratio measured at admission as a predictor of SIRS in patients with acute alcoholic pancreatitis.
- To evaluate the efficacy of the serum lipase–amylase ratio as a biochemical marker for identifying severe acute pancreatitis.
- To describe the overall prognostic significance and diagnostic performance (sensitivity, specificity, and accuracy) of the lipase–amylase ratio in early clinical risk stratification.

MATERIALS AND METHODS

Study Design, Duration and Setting

This was a prospective observational cohort study conducted in accordance with the STROBE framework. The study was carried out over 12 months, from November 2024 to

October 2025, in the Department of General Surgery, Mandya Institute of Medical Sciences (MIMS), Mandya, Karnataka.

Participant Eligibility

Inclusion Criteria

- Clinically diagnosed acute pancreatitis based on typical upper abdominal pain.
- Biochemical confirmation by ≥ 3 -fold elevation above the upper limit of normal in serum lipase and/or amylase, or radiological confirmation by abdominal ultrasonography/CECT.
- Confirmed history of alcohol consumption as the primary etiology.
- Presentation within 24 hours of symptom onset.
- Age ≥ 18 years.
- Written informed consent in Kannada or English.

Exclusion Criteria

- Acute pancreatitis secondary to non-alcoholic etiologies, including gallstones, hypertriglyceridemia, trauma, post-ERCP pancreatitis, hypercalcemia, drug-induced, or idiopathic causes.
- Presentation beyond 24 hours from symptom onset.
- Acute exacerbation of established chronic pancreatitis.
- Inability or refusal to provide informed consent.

Sample Size

The minimum sample size was calculated to be 60 participants. This calculation was achieved by the formula for estimating a sample proportion for a descriptive study: $n = [Z^2 \times p \times (1-p)] / d^2$, where, n is the sample size, Z is the standard normal deviate (1.96 for a 95% confidence level), P is the expected prevalence (taken as 0.69 or 69% from a previous study by Kemparaj et al. (2018) on the clinical outcome of alcoholic pancreatitis in a similar setting), and d is the relative precision (set at 20% of P , i.e., $0.2 \times 0.69 = 0.138$). Plugging in the values yielded a sample size of approximately 60.

Study Groups

- SIRS vs. non-SIRS, based on fulfilment of SIRS criteria.
- Severe vs. non-severe pancreatitis, classified according to the Revised Atlanta Criteria.

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Data Collection and Clinical Work-Up

At admission, socio-demographic data, alcohol history, clinical symptoms, and vital signs were recorded. Venous blood samples were obtained at presentation before major resuscitation. Investigations included complete hemogram, random blood sugar, renal function tests, liver function tests, serum amylase, and serum lipase.

Lipase–Amylase Ratio

LAR was calculated as: Serum lipase (U/L) ÷ Serum amylase (U/L).

Definition of SIRS

SIRS was defined by fulfilment of ≥ 2 of the following criteria:

- Temperature $>38.0^{\circ}\text{C}$ or $<36.0^{\circ}\text{C}$.
- Heart rate >90 beats/min.
- Respiratory rate >20 breaths/min or $\text{PaCO}_2 <32$ mmHg.
- Total WBC count $>12,000/\mu\text{L}$, $<4,000/\mu\text{L}$, or $>10\%$ immature band forms.

Definition of Severe Acute Pancreatitis

Severe acute pancreatitis was defined by persistent organ failure (>48 hours) involving

the cardiovascular, respiratory, or renal systems, or by local necrotizing complications, according to the Revised Atlanta Criteria.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Continuous variables were summarized as mean $\pm$ SD and range. Categorical variables were expressed as frequencies and percentages. Two-tailed independent-samples t-tests were used for continuous variables between independent groups. Pearson's Chi-square test or Fisher's exact test was used for categorical variables. ROC analysis was used to assess diagnostic performance. A two-tailed $p < 0.05$ was considered statistically significant.

RESULTS

A total of 60 patients with confirmed acute alcoholic pancreatitis were analyzed. Age ranged from 20 to 69 years, with a mean age of 45.83 ± 13.87 years. There was a marked male predominance, with 53 males (88.30%) and 7 females (11.70%).

Parameter	Minimum	Maximum	Mean	SD
Age (years)	20	69	45.83	13.87

Table 1. Age Distribution of Study Participants

Gender	Frequency (n)	Percentage (%)
Female	7	11.70
Male	53	88.30
Total	60	100.00

Table 2. Gender Distribution

Clinical Feature	Present, n	Absent, n	Present (%)
Abdominal pain	60	0	100.00
Vomiting	38	22	63.30
Fever	36	24	60.00
Constipation	19	41	31.70
Abdominal distension	19	41	31.70
Bleeding per rectum	9	51	15.00

Table 3. Presenting Clinical Symptoms (N=60)

Abdominal pain was present in all patients (100.00%). Vomiting was reported in 38 patients (63.30%) and fever in 36 (60.00%). Constipation and abdominal distension were

each reported in 19 patients (31.70%), while bleeding per rectum was documented in 9 patients (15.00%).

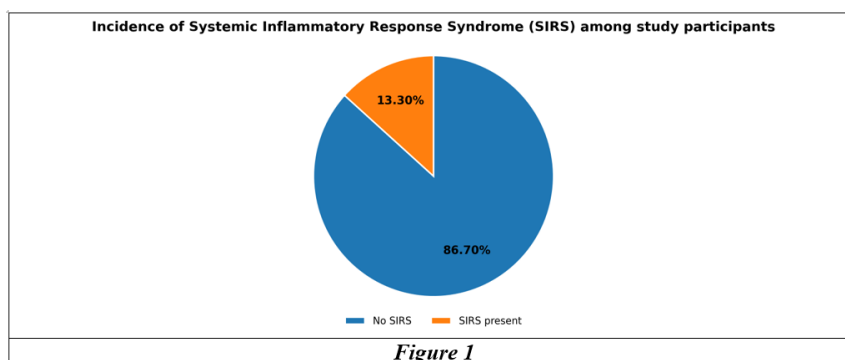
Parameter	Minimum	Maximum	Mean	SD
Hemoglobin (g/dL)	10.1	16.0	12.90	1.66
Total WBC count (cells/mm ³)	4,281	21,582	11,932.45	5,075.02

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Random blood sugar (mg/dL)	92	243	165.87	47.43
Serum creatinine (mg/dL)	0.6	2.5	1.69	0.52
ALT (IU/L)	23	199	113.20	53.95
AST (IU/L)	20	198	96.45	51.61
Total bilirubin (mg/dL)	0.5	3.89	2.25	1.07
Table 4. Baseline Laboratory Parameters (N=60)				

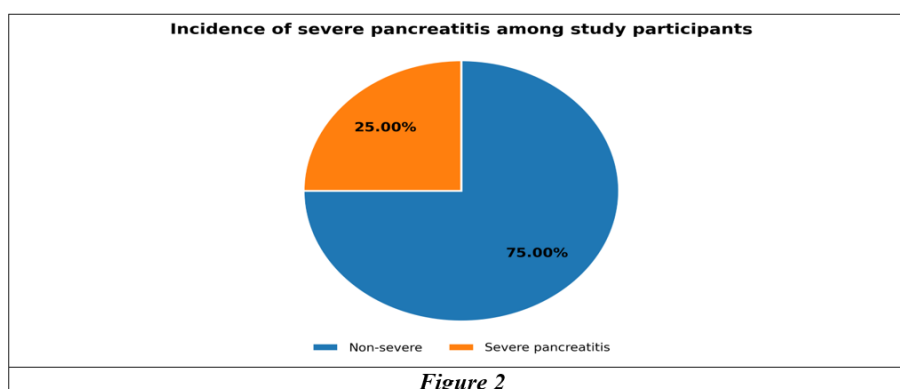
Parameter	Minimum	Maximum	Mean	SD
Serum lipase (U/L)	151	1,474	834.80	440.68
Serum amylase (U/L)	100	795	444.67	213.53
Lipase–amylase ratio (LAR)	0.19	11.59	2.53	2.12
Table 5. Enzymatic Values and LAR (N=60)				

Outcome	Category	n	%
SIRS	No SIRS	52	86.70
SIRS	SIRS present	8	13.30
Disease severity	Non-severe	45	75.00
Disease severity	Severe pancreatitis	15	25.00
Table 6. Incidence of SIRS and Disease Severity (N=60)			



Eight patients (13.30%) developed SIRS during hospitalization, while 52 (86.70%) did not. Severe acute pancreatitis was present in 15

patients (25.00%), while 45 (75.00%) had non-severe disease.



Association of LAR with SIRS

Mean LAR was higher among patients who developed SIRS than among those without SIRS (3.73 ± 2.75 vs. 2.35 ± 1.98), but this

difference was not statistically significant ($p=0.086$). Based on the reported classification matrix, LAR did not identify any of the 8 SIRS cases.

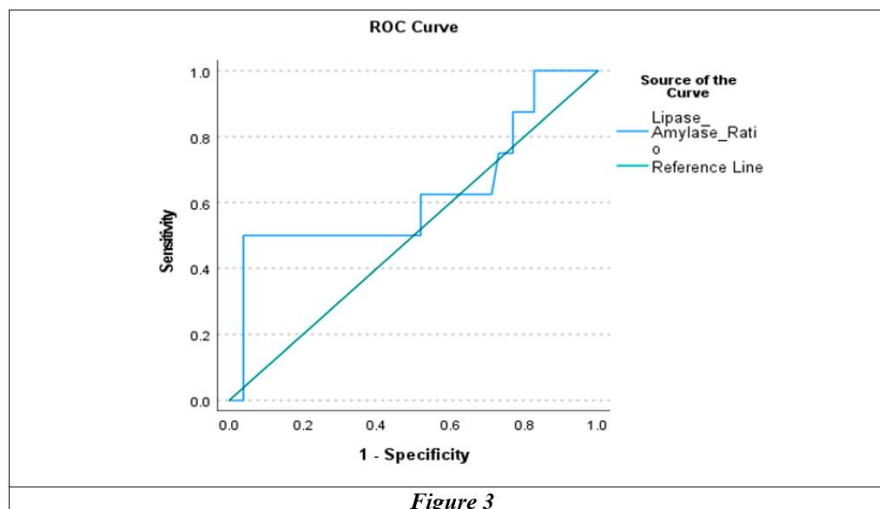
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SIRS Status	n	Mean LAR	SD	p-value
No SIRS	52	2.35	1.98	0.086
SIRS present	8	3.73	2.75	

Table 7. Comparison Of Lar According to Sirs Status

Observed SIRS	Predicted: No SIRS	Predicted: SIRS	Total
No SIRS	51	1	52
SIRS present	8	0	8

Table 8. Observed Versus Predicted SIRS Classification Based on LAR



Measure	Reported Value (%)
Sensitivity	0.00
Specificity	98.10
Positive predictive value (PPV)	0.00
Negative predictive value (NPV)	86.40
Overall accuracy	85.00

Table 9. Diagnostic Performance of LAR for Predicting SIRS

Association of LAR with Disease Severity
Mean LAR was significantly higher in severe pancreatitis than in non-severe pancreatitis (4.77 ± 2.91 vs. 1.78 ± 1.03 ; $p < 0.001$). Eleven of 15 severe cases were classified as positive and

all 45 non-severe cases were classified as negative. The reported diagnostic performance was sensitivity 73.00%, specificity 100.00%, PPV 100.00%, NPV 91.80%, and overall accuracy 93.00%.

Disease Severity	n	Mean LAR	SD	p-value
Non-severe pancreatitis	45	1.78	1.03	<0.001
Severe pancreatitis	15	4.77	2.91	

Table 10. Comparison of LAR According to Disease Severity

Observed Severity	Predicted: Non-Severe	Predicted: Severe	Total
Non-severe	45	0	45
Severe	4	11	15

Table 11. Observed Versus Predicted Severe Pancreatitis Classification Based on LAR

Measure	Reported value (%)
Sensitivity	73.00
Specificity	100.00

Positive predictive value (PPV)	100.00
Negative predictive value (NPV)	91.80
Overall accuracy	93.00
Table 12. Diagnostic Performance of LAR for Predicting Severe Acute Pancreatitis	

DISCUSSION

In this cohort of 60 patients with acute alcoholic pancreatitis, mean LAR was numerically higher among patients who developed SIRS than among those without SIRS, but the difference did not reach statistical significance ($p=0.086$). The classification matrix also showed that none of the eight SIRS cases was identified by the study's reported LAR threshold. This result should be interpreted cautiously because early SIRS is associated with severity in acute pancreatitis, but a single biochemical measure may not capture the evolving inflammatory response.^[3,6,7-9]

By contrast, LAR was significantly higher in severe than non-severe pancreatitis (4.77 ± 2.91 vs. 1.78 ± 1.03 ; $p < 0.001$), suggesting an association with disease severity in this cohort. This finding is consistent with the broader literature emphasizing early severity assessment and the use of combined clinical, laboratory, and imaging-based approaches rather than reliance on a single marker.^[10-14] Interpretation of enzyme-based markers also requires care because serum lipase and amylase primarily support diagnosis and may have limitations when used in isolation.^[14,15] Alcohol-related pancreatic injury and inflammatory mediator pathways provide biological context for the observed association, but do not establish LAR as a causal or independently validated predictor.^[1-5] The study is limited by its single-centre design, small sample size, and the small number of SIRS events; larger prospective studies are needed to validate a reproducible LAR threshold and assess its incremental value over established scoring systems.^[10-13]

CONCLUSION

Admission serum lipase–amylase ratio showed a strong association with disease severity in acute alcoholic pancreatitis, while its performance for isolated early SIRS prediction was limited. LAR may therefore serve as a simple adjunctive biochemical marker for early risk stratification, subject to validation in larger prospective cohorts.

Declarations

Ethics approval: The study was approved by the Institutional Ethics Committee of Mandya Institute of Medical Sciences, Mandya (IEC No. MIMS/IEC/2024/877 dated 25 January 2024).

Informed Consent: Written informed consent was obtained from participants

Funding: Nil

Conflict of Interest: Nil

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