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Serum Lipase and Serum Amylase Levels in Non-Pancreatic Abdominal Pain versus Acute Pancreatitis in A Hospital in Eastern UP

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Abstract

Background: Acute pancreatitis is a life-threatening condition, quite often associated with gastrointestinal distress, and many complications can arise. Early diagnosis relies heavily on biochemical markers like serum amylase or lipase often in quite obscure clinical contexts. Diagnostic accuracy between these markers remains debated, especially when distinguishing AP from other causes of severe abdominal pain.

Objectives: To assess and compare the serum lipase and serum amylase diagnostic value in distinguishing acute pancreatitis from non-pancreatic acute abdominal pain.

Methods: In Eastern Uttar Pradesh, a tertiary care facility conducted prospective observational research on adult patients who presented with acute abdominal discomfort. Based on clinical, biochemical, and imaging criteria, patients were categorized into AP and non-pancreatic pain groups. Serum lipase and amylase levels were assessed 12–38 hours after the beginning of symptoms. The diagnostic accuracy was assessed using the sensitivity, specificity, and receiver operating characteristic (ROC) curves.

Results: The mean age was 41.30 ± 14.96 years in the AP group and 44.87 ± 17.52 years in the non-pancreatic group ($p = 0.144$). Vomiting (24.39% vs 13.59%, $p = 0.049$) and constipation (18.29% vs 0%, $p < 0.001$) were significantly more common in the AP group. Mean serum amylase and lipase levels were significantly elevated in AP patients (amylase: 300.92 ± 265.70 U/L vs 84.45 ± 113.36 U/L; lipase: 177.44 ± 145.68 U/L vs

57.79 ± 36.09 U/L; both $p < 0.001$). ROC analysis showed serum amylase had an AUC of 0.847 (cut-off: 81 U/L, sensitivity 84.1%, specificity 65.5%) and serum lipase had an AUC of 0.823 (cut-off: 56 U/L, sensitivity 80.5%, specificity 62.1%).

Conclusion: Both serum amylase and lipase are valuable diagnostic markers in acute pancreatitis, with amylase showing slightly better diagnostic performance in this cohort. Serum lipase remains a reliable and non-invasive tool, particularly when used in conjunction with clinical and imaging findings.

Keywords: Acute Pancreatitis, Serum Amylase, Serum Lipase, Diagnostic Accuracy, ROC Curve, Abdominal Pain

Introduction

An inflammatory process involving the pancreas, known as pancreatitis, can be categorized as either acute or chronic and may present in one of many ways (Ashraf et al., 2021). There is currently no specific targeted therapy for acute pancreatitis (AP), one of the most common gastrointestinal ailments with a rising global frequency. Nearly all patients with AP experienced abdominal pain, which warrants prompt analgesia, and this is one of the main management priorities in the early management of AP (Cai et al., 2021).

Acute pancreatitis can be difficult to diagnose because of its vague symptoms and the wide range of test results. A combination of the patient's history and physical examination, abnormal test results, and radiographic evidence of pancreatic inflammation are usually used to make the diagnosis. An increase in serum lipase or amylase is a crucial component of the diagnosis, although it must be evaluated carefully. Other possible reasons for the increased levels of these enzymes could exist. The underlying etiology of the pancreatitis and the timing of the test also have an impact on the test's sensitivity. Although serum amylase was the primary diagnostic marker, serum lipase is now the preferred test (Basnayake and Ratnam, 2015).

Many health care centers use either serum amylase, lipase or both to diagnose acute pancreatitis without considering which one could provide a better diagnostic accuracy (Ismail and Bhayana, 2017). Serum amylase activity increases in acute pancreatitis 5–8 hours after symptoms appear, and by the third or fourth day, activities are back to normal. Typically, amylase activity is four to six times higher than the upper reference limit, reaching its maximum concentration after 12 to 72 hours. The likelihood of acute pancreatitis increases with the extent of the spike in serum enzyme activity, although this rise is unrelated to the degree of pancreatic involvement. After an attack of acute pancreatitis, serum lipase activity increases within 4–8 h, peaks at about 24 h, and decreases within 8–14 days (Batra et al., 2015).

At the moment, smaller hospitals only have amylase facilities, but tertiary care centers have both lipase and amylase facilities. Therefore, the study's objective is to examine the relative efficacy of serum lipase and amylase in terms of sensitivity for diagnosing acute pancreatitis and non-pancreatic acute abdominal pain, as well as specificity for both conditions.

Material and methods

Study Design and Setting

The Department of Surgery at Baba Raghav Das Medical College in Gorakhpur, a tertiary care facility, conducted this prospective, observational study for a year. An institution serving urban and semi-rural populations in Eastern Uttar Pradesh. To distinguish acute pancreatitis from non-pancreatic causes of acute

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abdominal discomfort, the study aims to assess and compare the diagnostic accuracy of serum lipase and serum amylase.

Study Population and Sample Size

A total of 185 patients presenting with acute abdominal pain to the emergency department were recruited based on the inclusion and exclusion criteria. The formula was used to determine the sample size:

$n=Z^2 P(1-P)/d^2$

Where Z = 1.96 for 95% confidence interval, P = prevalence (14.2%), and d = precision (5%). 185 was the estimated sample size.

Inclusion Criteria

- Adults aged 18 years and above
- Amylase and/or lipase levels in the serum are higher than the recommended range.
- Diagnosed patients of non-pancreatic acute abdominal pain and acute pancreatitis

Exclusion Criteria

- Pregnant women and patients with gynecological or obstetric pathology
- Elective surgical cases
- Recent abdominal trauma
- Refusal to consent

Clinical Evaluation and Diagnostic Criteria

All patients underwent comprehensive clinical assessment that includes a history and physical examination, and basic laboratory investigations. Serum amylase and lipase levels were assessed within 12 to 38 hours of pain onset using standard automated analyzers. Imaging studies such as ultrasonography and CT abdomen were employed to support or confirm clinical diagnosis.

Ethical Considerations

All participants provided written informed consent. The study was carried out in compliance with the Declaration of Helsinki and authorized by the institutional ethics committee.

Statistical Analysis

The data was collected using Microsoft Excel, and the analysis was conducted using SPSS version 23.0. Continuous variables were displayed as means with standard deviation, whereas categorical variables were displayed as percentages. Groups were compared using independent t-tests for continuous variables and chi-square testing for categorical data. To evaluate the diagnostic performance of lipase and amylase, Receiver Operating Characteristic (ROC) curves were produced. Calculations were made for sensitivity, specificity, and area under the curve (AUC). P-values less than 0.05 were regarded as statistically significant.

Results

Demographic Characteristics

Out of the 185 patients, 82 (44.32%) were diagnosed with acute pancreatitis, while 103 (55.68%) were diagnosed with non-pancreatic causes of acute abdominal pain. The mean age of patients in the acute pancreatitis group was 41.30 ± 14.96 years compared to 44.87 ± 17.52 years in the non-pancreatic group (p = 0.144), which was not statistically significant.

Table 1: Demographic Distribution

Group	n	Mean Age (years) ± SD	Male (%)	Female (%)
Acute Pancreatitis	82	41.30 ± 14.96	67 (81.7%)	15 (18.3%)
Non-Pancreatic Pain	103	44.87 ± 17.52	57 (55.3%)	46 (44.7%)
p-value		0.144	<0.001	<0.001

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Clinical Symptoms

Vomiting was significantly more common in the acute pancreatitis group (24.39%) than in the non-pancreatic group (13.59%) ($p = 0.049$). Constipation (absence of stool passage) was reported exclusively in the acute pancreatitis group (18.29%, $p < 0.001$). Abdominal distension, however, was more prevalent in the non-pancreatic group (13.59% vs 2.44%, $p = 0.002$).

Table 2: Clinical Symptom Comparison

Symptom	Acute Pancreatitis (%)	Non-Pancreatic (%)	p-value
Vomiting	24.39	13.59	0.049
Constipation	18.29	0.00	<0.001
Abdominal Distension	2.44	13.59	0.002
Nausea	2.44	2.91	0.872
Fever	4.88	2.91	0.543

Biochemical Marker Comparison

The acute pancreatitis group's mean serum amylase and lipase levels were noticeably higher than those of the non-pancreatic group:

- Serum Amylase: 300.92 ± 265.70 U/L vs. 84.45 ± 113.36 U/L ($p < 0.001$)
- Serum Lipase: 177.44 ± 145.68 U/L vs. 57.79 ± 36.09 U/L ($p < 0.001$)

Table 3: Comparison of Enzyme Levels

Enzyme	Acute Pancreatitis (Mean ± SD)	Non-Pancreatic (Mean ± SD)	p-value
Serum Amylase (U/L)	300.92 ± 265.70	84.45 ± 113.36	<0.001
Serum Lipase (U/L)	177.44 ± 145.68	57.79 ± 36.09	<0.001

Diagnostic Performance

ROC analysis demonstrated good diagnostic accuracy for both enzymes. Serum amylase showed an AUC of 0.847, and serum lipase showed an AUC of 0.823. The cut-off value for serum amylase was 81 U/L (sensitivity 84.1%, specificity 65.5%) and for serum lipase was 56 U/L (sensitivity 80.5%, specificity 62.1%).

Table 4: ROC Analysis for Diagnostic Accuracy

Enzyme	Cut-off (U/L)	Sensitivity (%)	Specificity (%)	AUC (95% CI)	p-value
Serum Amylase	81	84.1	65.5	0.847 (0.788–0.906)	<0.001
Serum Lipase	56	80.5	62.1	0.823 (0.763–0.883)	<0.001

These findings underscore the diagnostic utility of serum amylase and lipase in the early identification of acute pancreatitis, with serum amylase showing slightly better sensitivity and AUC. Nevertheless, the enzymes should be interpreted alongside clinical findings and imaging for accurate diagnosis.

Discussion

The objective of the current investigation was to assess and compare the diagnostic precision of serum lipase and serum amylase in distinguishing acute pancreatitis (AP) from non-pancreatic causes of acute abdominal discomfort. Patients in the acute pancreatitis group were

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slightly younger on average (41.30 ± 14.96 years) than those in the non-pancreatic group (44.87 ± 17.52 years); however, the difference was not statistically significant ($p = 0.144$). This is consistent with findings from Judal et al. (2022), who also reported no significant age difference between the AP and control groups. Similarly, Kandasami et al. (2002) observed a comparable mean age of 43.5 ± 14.7 years among AP patients, while Chauhan et al. (2012) noted the highest prevalence of AP in the 50–59 years age group, indicating that AP affects a wide age range without a sharply defined peak.

Clinical presentation played a key role in distinguishing between AP and non-pancreatic abdominal conditions. Vomiting was significantly more prevalent in patients with AP (24.39%) compared to those with non-pancreatic pain (13.59%), with a p-value of 0.049. This trend corroborates previous studies, including Judal et al. (2022), who reported vomiting in 78% of AP patients, and Naik et al. (2016), who observed it in 66% of their cohort. Additionally, constipation was uniquely reported in the AP group (18.29%), further supporting its diagnostic significance ($p < 0.001$), while abdominal distension was more common in non-pancreatic cases, suggesting symptom patterns can aid in clinical differentiation.

Biochemical evaluation revealed a significant difference in enzyme levels between the two groups. The mean serum lipase level in the AP group was markedly elevated at 177.44 ± 145.68 U/L, compared to 57.79 ± 36.09 U/L in the non-pancreatic group ($p < 0.001$). Serum lipase provided a sensitivity of 80.5% and specificity of 62.1% at a diagnostic cut-off of 56 U/L, according to ROC analysis, with an area under the curve (AUC) of 0.823 (95% CI: 0.763–0.883, $p < 0.001$). These results are consistent with those of Judal et al. (2022), who observed an even higher mean lipase level (around 399 U/L) in AP patients and reported an outstanding diagnostic performance with an AUC of 0.945, sensitivity of 98.82%, and specificity of 96.53%. Feher et al. (2024) further substantiated the role of lipase, documenting median levels of 1331 U/L in AP compared to 278 U/L in non-pancreatic hyperlipasemia (NPHL), with an AUC of 0.866—superior to that of amylase (AUC 0.756).

Although our study found serum amylase to have slightly better sensitivity (84.1%) and AUC (0.847) than lipase, the overall clinical utility of lipase remains strong, especially given its longer duration of elevation post-onset. However, it is crucial to consider that the diagnostic accuracy of serum lipase may decline in specific clinical scenarios, such as systemic infections or renal impairment. Feher et al. (2024) proposed that in such cases, adjusted higher cut-off values ranging between 861 to 1587 U/L may improve the predictive performance of lipase.

Taken together, our findings and those of previous literature confirm that serum lipase is a reliable, quick, and non-invasive biomarker for the early evaluation of acute pancreatitis. Nevertheless, no single test should be interpreted in isolation. Clinical features, biochemical parameters, and radiological imaging must be integrated to establish a definitive diagnosis, especially in complex or atypical presentations. This multifactorial approach ensures both timely diagnosis and optimal management in patients presenting with acute abdominal pain

Conclusion

This study shows that patients with acute pancreatitis have considerably higher levels of serum lipase and serum amylase than those with non-pancreatic causes of abdominal discomfort. While serum amylase exhibited

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slightly better sensitivity and diagnostic accuracy in this cohort, serum lipase still provided a reliable and practical diagnostic tool, especially in the early evaluation phase. Clinical symptoms such as vomiting and constipation also served as important indicators distinguishing AP from other abdominal pathologies. The ROC analysis confirmed the diagnostic relevance of both enzymes, with serum amylase showing an AUC of 0.847 and serum lipase an AUC of 0.823. Findings underscore importance of enzyme levels used alongside clinical presentation and imaging studies for remarkably enhanced diagnostic precision nowadays. Further diagnostic accuracy can be achieved by exploring adjusted enzyme cut-off values in populations with renal issues or severe sepsis. Serum lipase stays a fairly dependable test for diagnosing acute pancreatitis in pretty resource-limited settings and various tertiary care facilities.

Limitations

There were various restrictions on this investigation. Because it was only carried out at one location, the results might not be as broadly applicable. The sample size, although adequate, may not capture the full spectrum of non-pancreatic abdominal conditions. Clinical judgment without confirmatory imaging may have influenced some diagnoses in the non-pancreatic group, potentially introducing misclassification bias. Additionally, serial measurements of serum amylase and lipase were not performed, which could have provided insights into enzyme kinetics. Lastly, other potential biomarkers and imaging modalities were not evaluated, which may have further enhanced diagnostic accuracy and clinical correlation.

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