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Research Article

Serum Enzymes and Inflammatory Mediators as Predictors of Severity in Acute Pancreatitis

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ABSTRACT

Background: Acute pancreatitis (AP) is an inflammatory disorder of the pancreas with a wide clinical range from mild self-limiting disease to severe necrotizing forms associated with multiorgan failure. Early identification of severe cases is crucial to improve outcomes. Conventional biomarkers like serum amylase and lipase are diagnostic but limited in assessing severity. Novel inflammatory markers, including interleukin-10 (IL-10) and procalcitonin (PCT), have emerged as potential prognostic indicators.
Objectives: To evaluate and compare the diagnostic and prognostic utility of serum amylase, lipase, IL-10, and procalcitonin levels among healthy individuals, patients with mild acute pancreatitis, and those with severe acute pancreatitis.
Methods: A hospital-based, observational case–control study was carried out at J.L.N. Medical College, Ajmer, including 330 participants divided equally into three groups: healthy controls (n=110), mild AP (n=110), and severe AP (n=110), classified according to the Revised Atlanta Criteria. Serum amylase and lipase were determined using enzymatic assays, IL-10 by ELISA, and PCT by chemiluminescent assay. Statistical analyses included ANOVA, t-tests, correlation, and post-hoc comparisons, with significance set at $p<0.001$.
Results: Serum amylase and lipase levels were markedly increased in both mild and severe AP groups relative to controls ($p<0.001$), with significantly higher values in severe cases (amylase: 1482.44 ± 437.04 U/L; lipase: 879.65 ± 52.92 U/L). IL-10 levels showed a progressive decline with disease severity (controls: 6.06 ± 0.31 pg/mL; severe AP: 3.91 ± 0.31 pg/mL; $p<0.001$). Procalcitonin levels rose proportionally with disease progression (controls: 0.33 ± 0.06 ng/mL; severe AP: 2.90 ± 0.92 ng/mL; $p<0.001$). These findings underscore the prognostic significance of IL-10 and PCT in differentiating mild from severe disease.
Conclusion: While serum amylase and lipase remain reliable diagnostic tools for acute pancreatitis, their prognostic value is limited. Reduced IL-10 and elevated procalcitonin levels are strongly associated with severe forms of the disease, suggesting their combined use may enhance early risk stratification and management of acute pancreatitis.

Keywords: *Acute pancreatitis, Procalcitonin, Interleukin-10, Amylase, Lipase, Disease severity, Biomarkers..*

INTRODUCTION

Acute pancreatitis (AP) is a potentially life-threatening inflammatory disorder of the pancreas characterized by autodigestion of pancreatic tissue and variable systemic complications [1,2]. The disease exhibits a broad clinical spectrum ranging from mild, self-limiting illness to severe necrotizing pancreatitis with multiorgan failure and high mortality [3]. The global incidence of AP ranges between 13 and 73 per 100,000, and the prevalence in India is approximately 7.9 per 100,000 [4,5]. Alcohol and gallstones constitute the leading etiological factors, while genetic, metabolic, and idiopathic cases account for the remainder [6,7]. The pathophysiology involves premature activation of digestive zymogens, acinar

cell injury, and release of inflammatory mediators, resulting in systemic inflammatory response syndrome (SIRS) and multiorgan dysfunction [8,9]. Biochemical markers play an essential role in the early diagnosis and prognosis of AP. Serum amylase and lipase are classical diagnostic markers, though they do not always correlate with disease severity [10]. Cytokines such as interleukin-10 (IL-10), with its potent anti-inflammatory properties, and procalcitonin (PCT), a marker of systemic inflammation, are recognized as promising severity predictors [11,12]. This study was conducted to compare serum amylase, lipase, IL-10, and PCT levels in healthy controls, mild AP, and severe AP, and to explore their prognostic significance.

METHODOLOGY

This observational case-control study was conducted at J.L.N. Medical College & Associated Group of Hospitals, Ajmer. A total of 330 participants were included: 110 healthy controls, 110 patients with mild acute pancreatitis, and 110 with severe acute pancreatitis, classified using the Revised Atlanta Classification. Acute pancreatitis diagnosis was based on clinical features, elevated amylase or lipase (>3 times the upper limit of normal), and radiological findings. Exclusion criteria included chronic pancreatitis, pancreatic malignancy, major comorbidities, and recent infections. Blood samples were collected within 48 hours of admission. Serum amylase and lipase were estimated using enzymatic methods. IL-10 levels were measured by enzyme-linked immunosorbent assay (ELISA), and procalcitonin was determined by chemiluminescent assay. Statistical analysis was performed using ANOVA, independent t-test, Pearson correlation and post-hoc tests, with $p < 0.001$ considered significant. The study acquired consent from all participants has taken also with ethical permission.

RESULTS

Serum amylase and lipase levels were significantly elevated in mild and severe AP compared to controls ($p<0.001$), with higher mean values in severe AP (Table 1, Figure 1). IL-10 levels showed a significantly decrease in severe AP in comparison with mild AP & healthy controls (Table 1, Figure 2). Procalcitonin levels were minimal in controls, moderately elevated in mild AP, and markedly elevated in severe AP ($p<0.001$), as shown in (Table 1 and Figure 3). These findings highlight the diagnostic value of amylase and lipase and the prognostic utility of IL-10 and procalcitonin.

Table 1: Comparison of serum biomarkers among study groups.

Parameter	Control (n=110)	Mild AP (n=110)	Severe AP (n=110)	p-value
Amylase (U/L)	42.88 ±7.15	530.32 ±117.66	1482.44 ±437.04	<0.001*
Lipase (U/L)	35.73 ±5.73	256.07± 55.32	879.65 2±52.92	<0.001*
IL-10 (pg/mL)	6.06 ±0.31	5.08 ±0.30	3.91 ±0.31	<0.001*
Procalcitonin (ng/mL)	0.33 ± 0.06	1.05 ± 0.27	2.90 ± 0.92	<0.001*

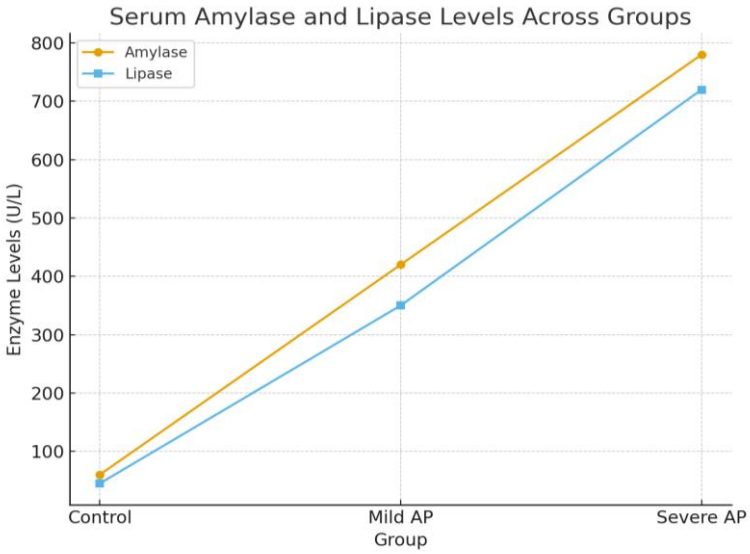

Figure 1: Serum amylase and lipase levels across groups.

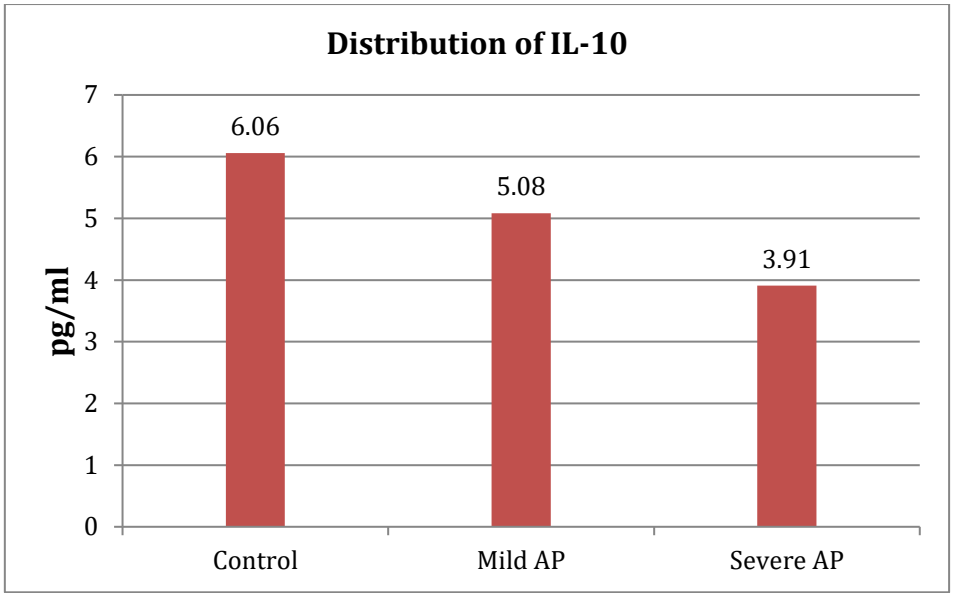

Figure 2: Serum IL-10 levels across groups.

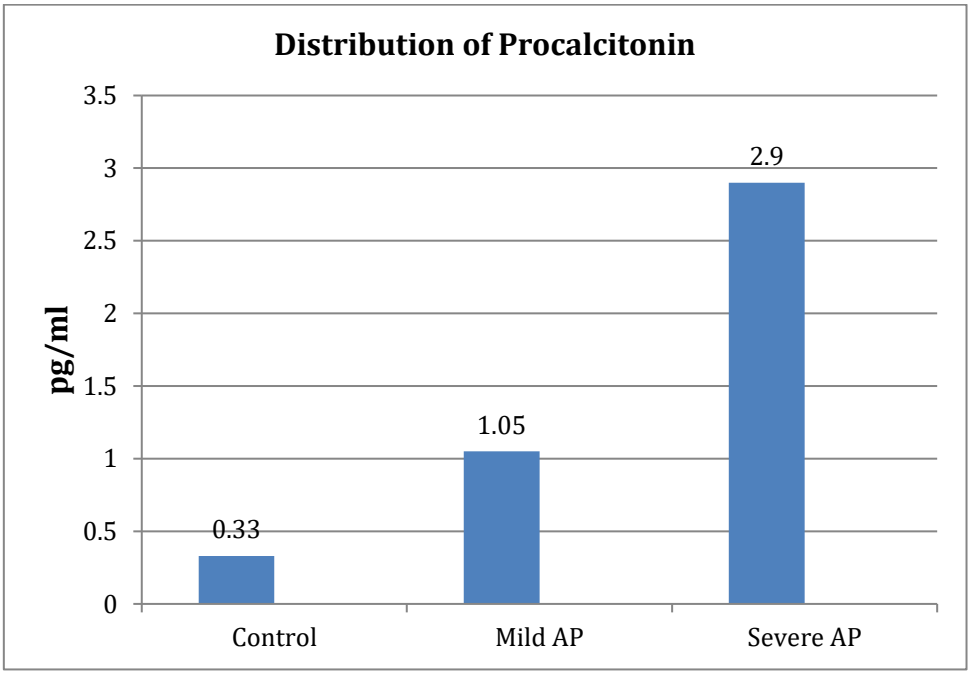

Figure 3: Serum procalcitonin levels across groups.

DISCUSSION

The present study demonstrates that while serum amylase and lipase are useful for diagnosing AP, they lack specificity in predicting severity. Our findings corroborate previous studies indicating that procalcitonin is a highly sensitive and specific marker for identifying severe cases [13,14]. Our study is consistent with the study conducted by Fisic E et al (2006) [15] , Berney T et al (1999) [16], Rongione AJ et al (1997) and various studies which reported a significant decrease in the level of IL-10 in patients with mild AP& severe AP subjects in comparison with health controls. Berney T et al (1999) study showed IL-10 on day 0 to be an extremely good marker for predicting the progression to severity AP. IL-10 is an anti-inflammatory cytokine which inhibits the release of pro-inflammatory cytokines (i.e., IL-1 β, IL-6, and tumor necrosis factor-α) from monocytes/macrophages thus preventing subsequent tissue damage. Studies have correlated lower levels of IL-10 with a higher severity of pancreatitis.[16] Procalcitonin, by contrast, rises proportionally with severity and correlates well with clinical scoring systems such as Ranson and APACHE II [17,18]. Thus, combining classical enzymatic markers with cytokine and inflammatory biomarkers may improve early risk stratification.

Limitations

The sample size was modest, and the study was conducted at a single center, which may limit generalizability. Serial measurements of biomarkers were not performed, which could provide better insights into dynamic changes. Advanced imaging correlations with biomarkers were limited.

CONCLUSION

Serum amylase and lipase remain diagnostic cornerstones of acute pancreatitis, but their prognostic utility is limited. IL-10 and procalcitonin provide additional insights into disease severity, with procalcitonin emerging as a reliable biomarker for early identification of severe acute pancreatitis. IL-10 can be also used therapeutically in patients of AP.

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