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Research Article

Assessment of Severity of Acute Pancreatitis by Complete Blood Count, Serum Amylase and Serum Lipase: A Single Center Study

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Abstract

Background: Acute pancreatitis is an inflammatory disease of highly variable severity, ranging from mild cases with low mortality to severe cases with high mortality. Numerous biomarkers have been studied as potential early predictors of the severity of this disease so that treatment can be optimally tailored to prevent complications. We aim to present and discuss the most relevant biomarkers for early severity assessment in acute pancreatitis.

Aim of the Study: The aim of this study was to assess the severity of acute pancreatitis by complete blood count, serum amylase and serum lipase.

Methods: This was a prospective observational study. The study was conducted on 35 admitted patients with diagnosis of acute pancreatitis at BIRDEM General Hospital, Dhaka, Bangladesh during the period from October 2016 to April 2017. Complete blood count, serum amylase, serum lipase, C-reactive protein and serum procalcitonin values were observed. Data were collected from history, clinical findings and investigations. A predesigned questioner was used in data collection. All data were processed, analyzed and disseminated by using MS Excel and SPSS version 23 program as per necessity.

Results: In this study, heamoglobin were found >10 g/dl in 11 patients out of 14 with severe acute pancreatitis and 18 patients out of 21 with mild acute pancreatitis. Total WBC count were markedly elevated in patients with severe pancreatitis (range: 8.1-38.3) comparatively higher than mild cases (range: 6.04-22.3). The ranges of the neutrophil count were 58-79% in mild and 62-82% in severe acute pancreatitis. The range of lymphocyte count was 12-41% in mild and 17-37% in severe acute pancreatitis. Monocyte, eosinophil and basophil count were found within the normal limit in both groups. The sensitivity of serum amylase was 62% and specificity was 42% with the cut of value of 400U/L. Positive predictive value was 45% and negative predictive value of serum amylase was 88%. With the cut-off of 240 U/l, the specificity of serum lipase to detect a patient with acute pancreatitis was 88%, but the sensitivity was 79%. Serum lipase determination is recommended as a confirmatory test. But lipase has poor predictive value.

Conclusion: Complete blood count provided some hints on the severity of acute pancreatitis only. On the other hand, serum amylase and serum lipase values were found high in both groups. Serum amylase and serum lipase have significant p values for the diagnosis of acute pancreatitis but no role for the prediction of severity of acute pancreatitis. The magnitude of the elevation of amylase and lipase does not predict disease severity.

Keywords: Acute Pancreatitis; Complete Blood Count; Serum Amylase; Serum Lipase

Introduction

Acute pancreatitis is an inflammatory disease of highly variable severity, ranging from mild cases with low mortality to severe cases with high mortality. In 1992, the Atlanta International Symposium classified acute pancreatitis into mild acute pancreatitis like edematous or interstitial pancreatitis, which has a mortality rate of 1% and severe acute pancreatitis like necrotizing pancreatitis, which usually constitutes about 20% - 30% of the acute pancreatitis with a mortality rate around 20%-30% [1]. Early identification of potentially severe acute pancreatitis is of utmost importance. Acute pancreatitis patients with delayed transfer to intensive care have higher mortality to those admitted directly, and mortality even increases when transfer is delayed. There is evidence for benefits of early intensive monitoring and support, enteral feeding, prophylactic antibiotics and emergency endoscopic sphincterotomy in patients with biliary aetiology in severe acute pancreatitis. one of the main problems with acute pancreatitis has been the lack of accurate predictors of disease severity and the development of organ failure in the early stages of the disease. On admission, clinical assessment of severity has been shown to be unreliable and the severity of acute pancreatitis is independent of the level of serum amylase and lipase. On account of the difference in outcome between patients with mild and severe disease, it is important to define that group of patients who will develop severe pancreatitis. Various scoring systems have been introduced, such as the Ranson and Glasgow scoring systems [2]. In a study, it was reported that, the first classification system for acute pancreatitis was reported by Fitz in 1889 [3]. In 1901, Opie described the association of gallstones to acute pancreatitis [4]. Alcohol was firmly established as an important pathogenic factor in 1917 [5]. More than 100 years ago, Chiari (1896) proposed that, intra-pancreatic activation of zymogens leads to pancreatic auto-digestion and is a key factor in the pathogenesis of acute pancreatitis. The association of hyperamylasaemia with acute pancreatitis has been recognized since 1929. In the history of radiography, the pancreas was a hidden structure seen only indirectly through studies exploring the surrounding organs, such as barium examinations of the upper gastrointestinal tract. Sonography was the first method that permitted direct imaging of the pancreas [6]. Pancreatic imaging essentially developed further with the introduction of computed tomography (CT) [7]. The rationale for surgery in severe acute pancreatitis has evolved over the last 50 years. Initially, total pancreatectomy was often recommended but it resulted in very high mortality rates [8]. The current thinking is that, the patients with infected pancreatic necrosis benefit from surgical debridement and drainage of the infected and devitalized tissue [9]. Further, surgery is often necessary if aggressive organ support in an intensive care unit seems inadequate for an acute pancreatitis patient with organ dysfunction. Acute pancreatitis is a common emergency presentation, being responsible for 3% of all hospital admissions with acute abdominal pain in the UK [10]. The incidence rate of acute pancreatitis varies considerably in different countries. According to Keim., *et al*. simultaneous determination of amylase as well as lipase marginally improved the diagnosis of acute pancreatitis among patients with acute abdominal pain [11]. But, checking of daily enzymes has no role in the management of pancreatitis [12]. Along with amylase, lipase is considered as the first-line laboratory test for diagnosing acute pancreatitis [13]. Lipase usually rises within 4 to 8 hours of onset of pancreatitis, peaks at 24 hours, and normalizes within 8 to 14 days [14]. The advantage of lipase assessment over amylase assessment is that, it is more sensitive in alcoholic pancreatitis cases and in patients, present 24 hours after onset of pancreatitis [15]. The main objective of this study was to assess the severity of acute pancreatitis by complete blood count, serum amylase and serum lipase.

Methodology

This was a prospective type of observational study. The study was conducted on 35 admitted patients with diagnosis of acute pancreatitis at BIRDEM General Hospital, Dhaka, Bangladesh during the period from October 2016 to April 2017. Complete blood count, serum amylase, serum lipase, C-reactive protein and serum procalcitonin values were observed. The whole intervention was conducted in accordance with the principles of human research specified in the Helsinki Declaration [16] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [17]. The study was approved by the ethical committee of the mentioned hospital. Proper written consents were taken from all the participants before data collection. As per the inclusion criteria of this study, only patients with acute pancreatitis were included. On the other hand, according to the exclusion criteria of this study, patient who were suffering from acute pancreatitis with multiple comorbidities like cerebrovascular diseases, CKD etcetera were excluded. Data were collected from history, clinical findings and investigations. After collection, data were prepared for data entry and analysis by using Statistical Package for Social Science (SPSS) software.

Results

In this study, among total 35 participants, 54% were male whereas the rest 46% were female. So male participants were dominating in number and the male-female ratio was 1.2:1. Age distribution of all patients ranged from 28-76 years old, where the youngest patient was 28 years and the eldest was 76 years. Among total patients, 10 (29%) patients were within 46-55 year's age and 8(23%) patients were within 56-65 years. The largest group patients were aged between 46-55 years and was comprised of 10 patients, which was 29% of the total study population. In this study, total WBC count was found as high in both mild and severe acute pancreatitis patients and markedly higher in severe group. Haemoglobin values showed no significant differences between two groups of patients. Serum amylase and serum lipase values were high in both groups. Study showed, serum amylase and serum lipase have significant P values for the diagnosis of acute pancreatitis but no role for the prediction of severity of acute pancreatitis. The magnitude of the elevation of amylase and lipase does not predict disease severity. The diagnostic accuracy of lipase appears to be better than that of amylase. Both serum amylase and serum lipase raised in 28(80%) patients with acute pancreatitis. Serum amylase and lipase was higher in severe acute pancreatitis ($p< 0.05$) but a high degree of overlap between values was found. The serum lipase values did not correlate with the severity of acute pancreatitis. Thus, both serum amylase and serum lipase were poor predictor of severity of acute pancreatitis. Complete blood count was done in all admitted patient with acute pancreatitis. Heamoglobin were more than 10g/dl in 11 patients out of 14 patients with severe acute pancreatitis and 18 patients out of 21 patients with mild acute pancreatitis. Total white blood cells count showed, leucocytosis in 27 patients out of 35 patients. Total white blood count was markedly elevated in a group of patients with severe pancreatitis as range between 8.1-38.3 comparatively higher than mild group where the range was 6.04-22.3. Differential count showed elevated neutrophil count in 11 patients out 14 patients with severe acute pancreatitis. The ranges of the neutrophil count were 58-79% in mild group of patients and 62-82% in a group of patients with severe acute pancreatitis. Lymhocytopenia developed in 6 patients out of 14 patients with severe acute pancreatitis. The range of lymphocyte count was 12-41% in patients with mild acute pancreatitis and 17-37% in a group of patients with severe acute pancreatitis. Monocyte, eosinophil and basophil count were found within the normal limit in both groups of patients. The baseline characteristics showed no significant difference between the two groups. Among total 35 cases, serum amylase was significantly raised in 19(54.28%) patients and serum lipase was elevated in 32 (91.4%) patients. Raised lipase and amylase found in 28(80%) patients, raised lipase with normal amylase levels found in 4(11.4%) patients. The sensitivity of serum amylase was 62% and specificity was 42% with the cut of value of 400U/L. Positive predictive value was 45% and negative predictive value of serum amylase was 88%. With the cut-off of 240 U/l, the specificity of serum lipase to detect a patient with acute pancreatitis was 88%, but the sensitivity was 79%. Serum lipase determination is recommended as a confirmatory test. But lipase has poor predictive value. Noted that, besides assessing the complete blood count, serum amylase and serum lipase, as predictors, in this study, we evaluate the PTC and CRP also. The values of PCT showed high sensitivity of 91% and specificity of 81% in predicting severe acute pancreatitis. The negative predictive value was high (90%) indicating that with a negative test result severe acute pancreatitis can be excluded with a high probability.

Parameters	Group of patients	Frequency (n)	Median	Range	P values
Haemoglobin (g/dl)	Mild	18	10.1	8-13.9	0.0735
	Severe	11	11.4	8.9-16.6	
Total WBC Count (x 10^9/L)	Mild	16	14	6.04-22.3	0.1002
	Severe	11	21.6	8.1-38.2	
Serum Amylase (U/L)	Mild	9	617	34-1223	0.0916
	Severe	10	825	34-1480	
Serum Lipase (U/L)	Mild	27	678	13-1463	0.0016
	Severe	5	1219	618-1613	
C-reactive Protein (CRP) (mg/L)	Mild	16	47.6	3.7-101	0.0474
	Severe	12	78.7	6.0-113.6	
Procalcitonin (PCT) (ng/ml)	Mild	3	0.062	0.035-1.423	0.0323
	Severe	11	0.386	0.040-8.486	

Table 1: Results of Mann Whitney U test obtained by comparing parameters between mild and severe acute patient groups (N = 35).

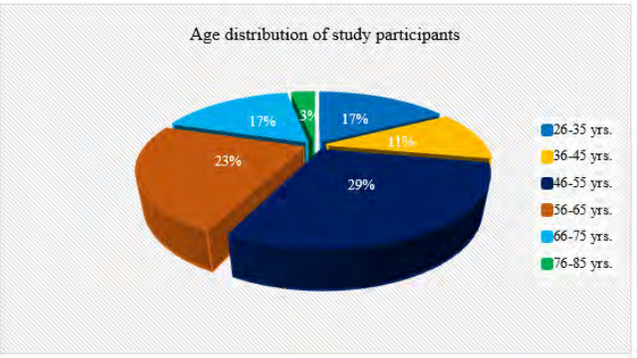

Figure 1: Pie chart showed Age wise distribution of participants (N = 35).

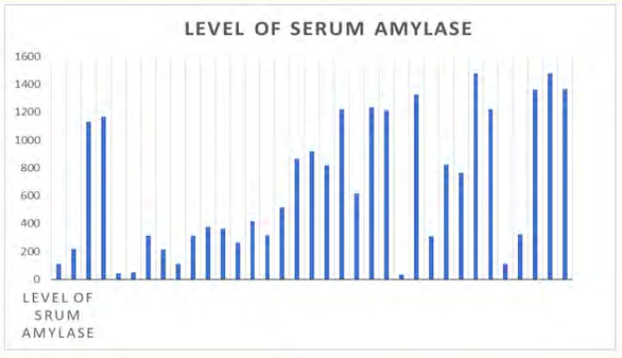

Figure 2: Distribution of study population by serum amylase (N = 35).

Parameter	Group of Patients	Frequency (n)	Median	Range	Standard Deviation (SD)
Haemoglobin (g/dl)	Mild	18	10.1	8-13.9	1.75
	Severe	11	11.4	8.9-16.6	
White Blood Cells					
Total Count (/L)	Mild	16	14	6.04-22.3	10.97
	Severe	11	21.6	8.1-38.2	
Differential count (%)					
Neutrophil	Mild	5	69	58-79	6
	Severe	11	75	62-82	
Lymphocyte	Mild	15	29	12-41	8
	Severe	6	27	17-37	
Monocyte	Mild	21	3.1	1.7-5.6	1.09
	Severe	14	3.1	1.8-6.6	
Eosinophil	Mild	21	2.2	0.03-5	1.52
	Severe	14	2.2	0.05-6	
Basophil	Mild	21	0.4	0.01-0.7	0.33
	Severe	14	0.4	0.03-0.9	

Table 2: Distribution of study population by complete blood count.

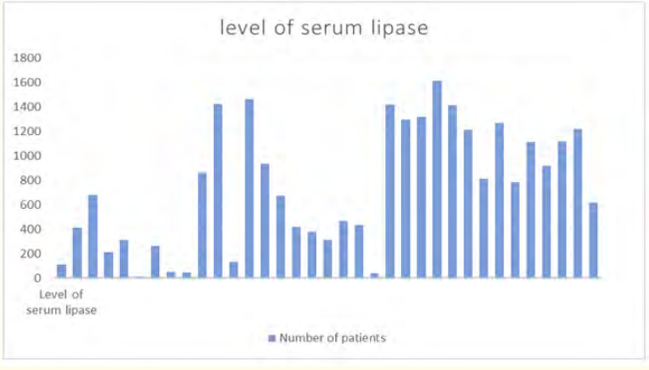

Figure 3: Distribution of study population by serum lipase (N = 35).

Parameter	n	Median	Range	Standard Deviation (SD)
Serum amylase	19	514	34-1480	490.32
Serum lipase	32	785	13-1613	534.8

Table 3: Distribution of the patient's serum amylase and serum lipase values (N = 35).

Variables	Cut of value	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Serum Amylase	400U/l	62	42	45	88
Serum Lipase	240 U/l	79	88	58	91
C-Reactive Protein	100 mg/L	78	69	47	89
Procalcitonin	2mg	91	81	53	90

Table 4: Comparison among the biochemical parameters (N = 35).

Discussion

The aim of this study was to assess the severity of acute pancreatitis by complete blood count, serum amylase and serum lipase. Acute pancreatitis is a frequently seen disease with a wide clinical spectrum ranging from mild to severe. Most acute pancreatitis progress mildly and is self-limiting, however, 10%-20% of the cases progress severely and 29%-43% of severe cases progress fatally [18,19]. In our study we analyzed the role of complete blood counts, serum amylase and serum lipase levels for the assessment of severity of acute pancreatitis in 35 patients. From the analysis and observation of the age distribution of patients showed that, all patients ranged from 28 - 76 years where the youngest patient was 28 years and the eldest patient was 76 years. The median age of the study population of 48 years appears significantly lower compared to other studies in which the median age of acute pancreatitis was in the six decades [20,21]. In our study, P values of total white blood cell counts was not significant to predict the severity of the acute pancreatitis between two groups of patients. In other study it was found that, the total WBC count was not significantly different in the two groups of the patients. Serum amylase and lipase were markedly raised in severe acute pancreatitis ($P < 0.05$) but a high degree of overlap between values was found. As P values were less significant, so these enzymes were unable to predict severity of acute pancreatitis. Total White blood count were markedly elevated in a group of patients with severe pancreatitis as range between 8.1-38.3/L comparatively higher than mild group where the range was 6.04-22.3/L. Differential count showed elevated neutrophil count in 11 patients out 14 patients with severe acute pancreatitis. Lymhocytopenia developed in 6 patients out of 14 patients with severe acute pancreatitis. Leucocytosis is often seen in cases of acute pancreatitis and third spacing of fluids in the peripancreatic region can lead to dehydration and hemoconcentration. A study by Takeyama in Japan assessed the lymphocyte count that showed reduction of lymphocyte count in severe acute pancreatitis [22]. In our study, serum amylase was significantly raised in 19 patients and serum lipase was elevated in 32 patients. Serum lipase and amylase measurement are both commonly used in patients presenting with clinical features suspicious of acute pancreatitis, as a means of either confirming or excluding the diagnosis of acute pancreatitis. It is well known that, other intra-abdominal disorders, such as peptic ulcer perforation, mesenteric ischaemia and intestinal obstruction, may present with raised serum lipase/amylase values [23,24]. These elevations are usually mild. Although these extra pancreatic elevations may on occasion be very high, many authors have suggested that a cut-off level of three times the ULN be used, thereby increasing the specificity of the enzymes for acute pancreatitis [25]. These data showed that, in line with other published data [26], lipase and amylase are both very specific laboratory tests for the diagnosis of acute pancreatitis when the suggested cut-off level is used. Published experience has also shown that, acute pancreatitis is less likely to present with normal serum lipase than serum amylase values and this becomes more common with late presentations, when amylase levels tend to return to normal [27,28]. Our study was conducted in accordance to some previous studies, which showed that, serum lipase in a case of acute pancreatitis is better diagnostic marker than serum amylase. In a similar study done by Dhanwant Gomez., *et al*. showed that, majority of patients with acute pancreatitis had raised levels of both amylase and lipase (97%), however, raised lipase levels were seen between 95% and 100 % of patients based on the aetiology [29]. Our study showed that, serum amylase was significantly raised in 19(54.28%) patients and mildly raised in 9 patients. Normal amylase level was found in 7 patients. According to few studies, amylase levels may remain within normal ranges in 19 % of patients admitted with acute pancreatitis [30]. Serum lipase was elevated in 32(91.42%)

patients out of 35 patients and lipase was raised up to twenty-six times of its upper limit of normal range. Lipase has been shown to remain elevated longer than amylase after the onset of acute pancreatitis [31]. According to British Society of Gastroenterology guidelines for the management of acute pancreatitis, lipase is the main focus towards the diagnosis of acute pancreatitis [32]. The ranges of the PCT were between 0.035 ng/ml and 8.486 ng/ml in 35 patients of acute pancreatitis. In severe acute pancreatitis, the range was 0.040-8.486 ng/ml. Another study shows, in cases of severe inflammations and sepsis, the plasma concentration ranges between 1 ng/ml and 1000 ng/ml, possible sources of this PCT are neuroendocrine cells in the lungs and kidneys [33]. In our study, the sensitivity of serum amylase was 62% and specificity was 42% with the cut of value of 400 U/L. Positive predictive value was 45% and negative predictive value of serum amylase was 88%. With the cut-off of 240 U/l, the specificity of serum lipase to detect a patient with acute pancreatitis was 88%, but the sensitivity was 79%. Serum lipase determination is recommended as a confirmatory test. But lipase has poor predictive value. Negative predictive value of serum lipase was 91%. Both enzymes may be elevated in various conditions other than pancreatitis. Neither is useful in monitoring the disease course or predicting severity in adults. Our data shows a considerable difference in sensitivity between the two enzymes when a cutoff level is utilized to diagnose acute pancreatitis. Our study is in agreement with the study done by Agrawal., *et al*. [34] and Thomson., *et al*. [35], who reported higher sensitivity and specificity of serum lipase in diagnosis of acute pancreatitis compared to serum amylase. The serum amylase and serum lipase values did not correlate with severity of acute pancreatitis. Thus, both were poor predictor of severity of acute pancreatitis. Early prediction of severity is an important goal in acute pancreatitis, in order to identify the 20% of patients who are likely to have a severe course. Such patients have an expected mortality of 15%-20% and may benefit from early admission to high dependency or intensive care unit [36].

Limitation of the Study

This was a single centered study with small sized samples. Moreover, the study was conducted at a very short period of time. So, the findings of this study may not reflect the exact scenario of the whole country.

Conclusion and Recommendation

Complete blood count provided some hints on the severity of acute pancreatitis only. On the other hand, serum amylase and serum lipase values were high in both groups. Study showed, serum amylase and serum lipase have significant p values for the diagnosis of acute pancreatitis but no role for the prediction of severity of acute pancreatitis. The magnitude of the elevation of amylase and lipase does not predict disease severity. For getting more specific result, we would like to recommend for conducting similar more studies in several places with larger sized samples.

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