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Role of amylase and lipase in diagnosis of acute pancreatitis

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Abstract

The study is carried out to establish utility of single enzymatic marker for the diagnosis of acute pancreatitis (AP). This is a retrospective study and suspected cases of acute pancreatitis (n = 127) admitted in the hospital between January 2017 - December 2017 were included in the study. Serum amylase and lipase were performed along with many other analytes. All relevant data including serum lab values and imaging were collected. Out of 127 suspected cases, 110-patients had both amylase and lipase raised, 14 patients had amylase normal, lipase raised. One patient has lipase normal and amylase raised and two patients have both lipase and amylase normal. It was found that alcoholics were more in 41-60 years age group. The results show that among 127 studied patients, 100 (78.74%) were men and 27 (21.26 %) were women. Study shows that in patients with AP, amylase average was 1971.5 IU/L and lipase average was 2470 IU/L. In smaller hospitals, where limited lab and radiological facilities are available, estimation of serum lipase will be a better choice over serum amylase in diagnosis of acute pancreatitis.

Keywords: amylase; lipase; acute pancreatitis

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Introduction

Acute pancreatitis is a painful, life-threatening inflammatory disease that accounts for more than a quarter million hospital admissions each year in the United States and has a 20% recurrence rate [1, 2]. Pancreatitis is associated with the premature activation of digestive enzymes within the pancreas and auto-digestion of the gland [3, 4]. It can recur intermittently, contributing to ongoing insult, referred to as 'Chronic Pancreatitis' (CP) [5]. Severe acute pancreatitis (SAP) develops in about 25% of patients with AP. The average mortality rate in SAP approaches 2–10 % [6]. The incidence of AP is much higher in USA, Finland, and Scotland (49.3, 46.6 and 41.9 per 100,000 populations, respectively) [7]. In 2009, it led to approximately 2,75,000 hospitalizations per year in the US [8].

Hospitalization rates due to AP are found to increase progressively with age [9]. For people aged 35-75 years, the rates double for males and quadruple for females [10]. The incidence of acute pancreatitis is rising in the developed world [11]. Common causes of pancreatitis include gallstones, excessive alcohol consumption, medications, and blunt trauma to the abdomen [11]. So, early detection of severe pancreatitis is essential for proper care and management and to limit its complications.

According to revised Atlanta classification, diagnosis of acute pancreatitis requires two of the following three criteria [12, 13]: (1) Abdominal pain characteristic of AP (acute onset of a persistent, severe, epigastric pain often radiating to back). (2) Serum lipase (or amylase) activity at least three times greater than the upper limit of the reference interval. (3) Characteristic imaging findings of AP on contrast enhanced computed tomography (CECT) (gold standard) and less commonly magnetic resonance imaging (MRI) or transabdominal ultrasonography. Lipase and amylase activity is crucial to the diagnosis of AP [13]. Serum lipase typically increases 3–6 h after the onset of acute pancreatitis and usually peaks at 24 h, unlike amylase which can rise rapidly within 3–6 h of the onset of symptoms, and may remain elevated for up to five days. However, it has a short half-life of 12 h so the concentration can normalise within 24 h, but lipase has significant reabsorption in the renal tubules so the serum concentrations remain elevated for 8–14 days. This means it is far more useful than amylase when the clinical presentation or testing has been delayed by more than 24 h. Serum lipase also has a greater sensitivity than amylase [14].

This present study is aimed to show that serum lipase is a single better marker than serum amylase for the diagnosis of acute pancreatitis.

Materials and methods

A retrospective study with cross sectional design was undertaken based on available medical records of patients admitted between January 2017 and January 2018 at KIMS Hospital, Secunderabad (n = 127). Patients admitted with physician-assigned suspected cases of AP with age group of 20-80 years were enrolled and followed up. Paediatric age group and patients with acute abdomen due to other causes were excluded from the study.

Samples were taken within 12–38 h of onset of abdominal pain. Samples were estimated for serum amylase and serum lipase parameters by commercially available kits from Beckman coulter in UNICEL DXC860i, an automated analyser.

Methodology for serum amylase

Amylase reagent is used to measure amylase activity by an enzymatic rate method. In the reaction, amylase catalyzes the hydrolysis of the defined substrate, maltotetraose, to maltose. The rate of formation of maltose is measured. Through the use of three coupled reactions catalyzed by maltose phosphorylase (MP), β-phosphoglucomutase (PGM), and glucose-6-phosphate dehydrogenase (G6PDH) which results in the production of reduced β-nicotinamide adenine dinucleotide (NADH) from β-nicotinamide adenine dinucleotide (NAD). Biological reference interval: 27 -131 U/L (for serum).

Methodology for serum lipase

The lipase reagent is used to measure pancreatic lipase activity by a timed enzymatic rate method.

A 1,2-diglyceride substrate is hydrolyzed by pancreatic lipase in the sample to 2-monoglyceride and fatty acid. A sequence of four coupled enzymatic steps using monoglyceride lipase (MGLP), glycerol kinase (GK), glycerophosphate oxidase (GPO), and horseradish peroxidase (HPO) causes the oxidative coupling of N-ethyl-N-(2-hydroxy-3-sulfopropyl)-m-toluidine (TOOS) with 4-aminoantipyrine (4-AAP) to form a red quinone diimine dye. Biological reference interval: 7 -58 U/L (for serum).

Standard operative procedures and quality control as described by the manufacturer were followed. Values of both were analyzed and recorded.

Statistical analysis

The data was entered into an excel sheet and analyzed. Descriptive statistics such as tables were used to describe the data. Age specific data, median age, sensitivity and specificity values were calculated wherever necessary.

Results

During the study period, a total of 127 patients were assessed with suspicion of acute pancreatitis by ultra-sonography irrespective of aetiology. However,

out of 127 patients, 110 patients had both amylase and lipase raised. Of the 127 patients, 27(21.26 %) were female and 100 (78.74%) male. Among 100 males, 62 were assigned to 'alcohol' (62%) & 38 to 'non-alcohol' group (38%).

According to age specific data analysis of 51 patients with age group between 21-40 (Table 1), males are more affected than females with AP, in 47 patients both lipase and amylase are raised, three patients has Amylase normal and lipase raised, one patient has both amylase and lipase normal. Moreover non alcoholics are more than alcoholics.

Table 1: Factors affecting amylase and lipase in the age group of 21-40 years.

	Amylase	*Lipase*
Age (20-40)	51	51
Male	46	46
Female	5	5
Alcoholic	23	23
Non-Alcoholic	28	28
Normal	4	1
Abnormal	47	50

According to age specific data analysis of 57 patients with age group between 41-60 (Table 2), males are more affected than females with AP, in 49 patients both lipase and amylase are raised seven patients has Amylase normal and lipase raised, one patient has both amylase and lipase normal and alcoholics are more than non-alcoholics.

Table 2: Factors affecting amylase and lipase in the age group of 41-60years.

	Amylase	*Lipase*
Age (41-60)	57	57
Male	41	41
Female	16	16
Alcoholic	40	40
Non-Alcoholic	17	17
Normal	8	1
Abnormal	49	56

According to age specific data analysis of 19 patients with age group between 61-80 (Table 3), males are more affected than females with AP, in 15 patients both lipase and amylase are raised, three patients has Amylase normal and lipase raised, one patient has both amylase and lipase normal. Moreover in this age group alcoholics are more than non-alcoholics. Table 4 shows the total of 127 suspected cases of AP

Table 3: Factors affecting amylase and lipase in the age group of 61-80 years.

	Amylase	*Lipase*
Age (61-80)	19	19
Male	13	13
Female	6	6
Alcoholic	16	16
Non-alcoholic	3	3
Normal	4	1
Abnormal	15	18

Table 4: In total of 127 suspected cases of AP.

	Amylase raised	*Amylase normal*
Lipase raised	110	14
Lipase normal	1	2

Chi-square statistics is 8.15
p-value is 0.004, so, the result is significant at $p < 0.05$

It says that lipase is more significant than amylase estimation. On calculation, sensitivity of amylase is 88.71% and specificity of amylase is 66.67%. The sensitivity of lipase is 95.59% and specificity of lipase is 67%.

Discussion

According to British Society of Gastroenterology guidelines for the management of acute pancreatitis, lipase is the main focus towards the diagnosis of AP [15].

In our study 86.6% of patients of acute pancreatitis had both amylase and lipase raised and 97.6% of AP patients had lipase raised, irrespective of aetiology which is similar to Gomez et al., where majority of patients with AP 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 [16].

Our study is in agreement with the study done by Agawal et al. and Thomson et al., who reported higher sensitivity of serum lipase in diagnosis of AP compared to serum amylase [17, 18]. In our study 86.6% of patients of AP had both amylase and lipase raised and 97.6 % of AP patients had lipase raised, irrespective of aetiology which is similar to a study done by Batra et al., where 84 % of patients of AP had both amylase and lipase raised and 100 % of AP patients had lipase raised, irrespective of aetiology. This positive correlation may be due to similar age group collection of samples [19]. The median age in our study is 47 years which is in positive correlation with a study done by Reid et al., where median age of population was 44 year [20].

Sensitivities and specificities of lipase and amylase are 95.59% and 67%, and 88.71% and 66.70% in our study (Tables 1 & 2) which are in correlation with all the published studies on this topic, in which the sensitivity of lipase and amylase tests in diagnosing AP ranges between 64% to 100% and 45% to 87%, respectively and the specificities for lipase and amylase tests are similar and in the range of 92% to 99% [21].

The median age of females (55%) is more than median age of males (41.5%) in our study which is not in positive correlation with the study done by Gail where he stated that significantly higher median age of males compared to females. this negative correlation may be due to exclusion of paediatric age group in our study [20].

Limitations of our study include: (1) the study was unicentric, and therefore may not be representative in a wider context; (2) the data used for this study came from a cohort of a managed care population, thus, results are applicable primarily to the prevalence of outcomes in managed care settings; although there was only a small number of patients analysed in this single-centre study, to our knowledge, this work provides the usage of single marker lipase instead of using both in concern with cost effectiveness.

Conclusion

Serum concentrations of amylase and lipase rise within hours of an episode of AP. In the concept of cost-benefit, cost-effectiveness, cost-utility analysis, sensitivity and r longer life than amylase in serum, lipase is a better choice, over serum amylase in smaller hospitals where limited lab and radiological facilities are available. Our recommendation would be, to use serum lipase first in a patient who presents with abdominal pain consistent with AP, before proceeding for imaging studies like CT scan of the abdomen or MRI/MRCP or Ultrasound.

Conflict of interest

The authors declare no conflict of interest.

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