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Role of Serum Amylase and Serum Lipase for the Diagnosis of Acute Pancreatitis: A Comparative Study

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Abstract

Background: Acute pancreatitis is among the most common diseases required surgery in emergency throughout the world. There is still lake of any gold standard for acute pancreatitis diagnosis. Since 1920 serum amylase has been evaluated for the diagnosis of acute pancreatitis. Sensitivity of serum lipase has been reported less than 85%. Different studies recorded low sensitivity up to 63% for serum amylase compare to high sensitivity up to 99% for serum lipase, whereas, approximately equal specificity serum amylase and lipase. Therefore, the present study was planned to assess the diagnostic accuracy of serum amylase and lipase individually. Moreover, the current study would try to find the single marker for acute pancreatitis diagnosis especially in smaller centres where facilities of diagnosis are limited. **Subjects and Methods:** Total 498 patients with pain in abdomen were included in the study. Among these patients 102 patients were diagnosed as acute pancreatitis patients. The diagnosis of acute pancreatitis was made according to following criteria: i) Characteristic of abdominal pain. ii) Three times increase of serum levels of amylase or lipase, or both. iii) Computed tomography findings. **Results:** Results of the current study showed that among 498 patients with abdomen pain 102 patients were diagnosed for acute pancreatitis on the basis of CT scan. Among these acute pancreatitis patients all 58 patients showed high level of both serum amylase and lipase; all 102 patients showed higher level of serum lipase while, 72 patients recorded high serum amylase level. **Conclusion:** Findings of the present study suggested that diagnostic accuracy of both serum amylase and serum lipase was excellent for the acute pancreatitis. Nevertheless, serum lipase has as an edge in accuracy over serum amylase for the diagnosis of acute pancreatitis. Therefore, we strongly suggest that measurement of serum lipase might be helpful in the diagnosis of acute pancreatitis in smaller centres where diagnostic facilities are limited.

Keywords: Acute Pancreatitis, Pain Abdomen, Serum Amylase, Serum Lipase.

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Introduction

Acute pancreatitis is among the most common diseases required surgery in emergency throughout the world. Acute pancreatitis is a reversible type of inflammation with a mortality rate less than 6%. However, this mortality rate can be raised high up to 25% in case of severe complications.[1,2]

Evaluation of serum amylase and lipase besides CT scan findings have been considered essential for the diagnosis of acute pancreatitis. Numerous smaller hospitals and remote area hospitals do not have CT scan and advanced lab facilities. Moreover, financial burden of patients increases in assessment of serum amylase and lipase together. Acute pancreatitis can be diagnosed individually vie serum amylase or lipase or CT scan or combination of either two markers.[3]

There is still lake of any gold standard for acute pancreatitis diagnosis. Since 1920 serum amylase has been evaluated for the diagnosis of acute pancreatitis. It is well known technique due to low cost as well easy assay.[4] Although, Sensitivity of serum lipase has been reported less than 85%. 4-8 In addition, on occasions chronic pancreatitis is not diagnosed by serum amylase which may be either due to minimal pancreatic tissue or little half-life of the amylase. Moreover, there are various differential diagnoses in patients with hyperamylasemia.[8,9]

Serum lipase activity enhanced from 4 to 8 hours after the onset of acute pancreatitis, further, it goes to highest level up to 24 hours. Whereas, level of serum amylase start to decrease after 8 days to 14 days in acute pancreatitis patients.[10]

Sensitivity of serum lipase has been reported less than 85%. Different studies recorded low sensitivity up to 63% for serum amylase compare to high sensitivity up to 99% for serum lipase, whereas, approximately equal specificity serum amylase and lipase.[11]

Therefore, the present study was planned to assess the diagnostic accuracy of serum amylase and lipase individually. Moreover, the current study would try to find the single marker for acute pancreatitis diagnosis especially in smaller centres where facilities of diagnosis are limited.

Subjects and Methods

Total 498 patients with abdominal pain were studied out of

which 102 patients were diagnosed acute pancreatitis at Rajshree Medical Research Institute, Bareilly between January 2017 and June 2018and were included in the study. Data collectedincluded full particulars of patients with biochemicalparameters and radio-imaging findings. Samples were takenwithin 12–38 h of onset of abdominal pain. Patients with various other pathologies which can interfere with normal range of either serum amylase or lipase were excluded eg. chronic renal failure, hepatitis and intracranial haemorrhage etc.

Biochemicalanalyses recorded were serum amylase, lipase, urea, andcreatinine and liver enzymes.

Estimated on autoanalyzer Erba- XL-600 by commerciallyavailable kits from TransasiaBiomedicals.

Lipase: (3rd Generation Assay)

Advanced homogenous micelle technology.

Description of Kit

Within run CV 1.16 with mean value of QC 34 andbetween run CV 0.65 with mean value of QC 35.

Principle of the Test

The chromogen lipase substrate 1,2-0-dilauryl-rac-glycero-3-glutaric acid ester is cleaved by the catalytic action ofalkaline lipase solution to form1,2-0-dilauryl-rac-glyceroland an unstable intermediate, glutaric acid-ester. Thisdecomposes spontaneously in alkaline solution to formglutaric acid and methylresorufin. The color intensity of thered dye formed is directly proportional to the lipase activityand can be determined photometrically.

Normal range is: 13–60 U/L. AmylaseCNP-G3 Kinetic–ready to use kits from Transasia
Biomedicals.

Description of Kit

Within run CV 1.52 % with mean value of QC 93.2 andrun to run CV 1.8 % with mean value of QC 95.2.

Principle of the Test

2-Chloro-4-nitrophenyl-a-maltotriose (CNP-G3) is a direct substrate for determination of a-amylase activity, which does not require the presence of ancillary enzymes.

$$10\ \text{CNP-G3} \xrightarrow{\text{alpha-amylase}} \text{9-CNP} + \text{CNP-G2} + \text{9maltotriose} + \text{glucose}$$

The rate of 2-Chloro-4-nitrophenol formation can be monitored at 450 nm and is proportional to the a-amylase activity in the specimen.

Normal range: Up to 80 U/L.

Diagnosis of Acute Pancreatitis

The diagnosis of acute pancreatitis was made according to following criteria:

i) Characteristic of abdominal pain. ii) Three times increase of serum levels of amylase or lipase, or both. iii) Computed tomography findings.[1]

Results

Results of the current study showed that among 498 patients with abdomen pain 102 patients were diagnosed for acute pancreatitis on the basis of CT scan. Among these acute pancreatitis patients all 58 patients showed high level of both serum amylase and lipase; all 102 patients showed higher level of serum lipase while, 72 patients recorded high serum amylase level. [Figure 1]

A total of 102 patients had positive radiological evidence of acute pancreatitis. These patients were considered as "radiological pancreatitis" patients. Two patients clinically diagnosed as acute pancreatitis reported complaints of severe abdomen pain although; these patients did not show any increase in serum amylase or lipase level. Further, gradual increase of amylase and lipase levels was recorded in these patients. However, pancreas showed insignificant changes in CT scan.

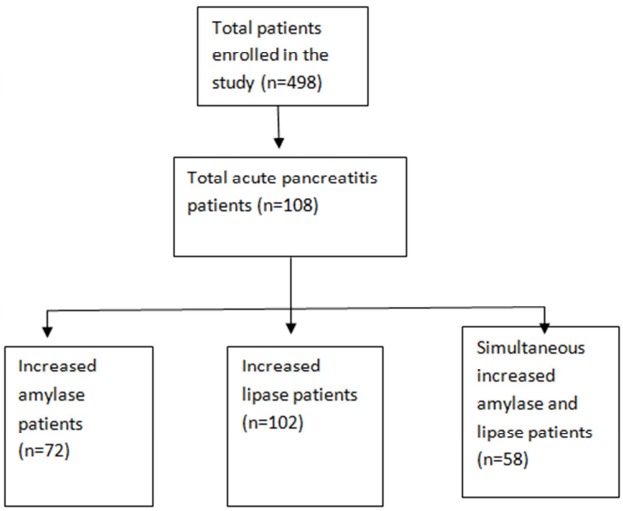

Figure 1: Frequency of patients as per different groups.

[Table 1] shows that Sensitivity of amylase in our study is 70.58 % with confidence interval 7.74–9.34%, whereas, sensitivity of lipase is 100 % for the serum lipase.

Table 1: Numbers of patients at different result levels

	Amylase	Lipase
Above normal limit (amylase >141 U/L, lipase >51 U/L)	72 (70.58%) (CI: 7.47-9.34%)	102 (100%) (CI: 11.59-13.81)
Between upper limit and 2-times elevation (indeterminate)	58 (56.86%) (CI: 5.99-7.70%)	78 (78.47%) (CI: 9.54-11.62%)
Above 2-times elevation (amylase >282 U/L or lipase >102 U/L)	8 (7.8%) (CI: 1.18-2.04%)	24 (23.52%) (CI: 1.66-2.65%)
Above 3-times elevation (amylase >423 U/L or lipase >153)	6 (5.8%) (CI: 0.66-1.34%)	10 (9.8%) (CI: 1.08-1.91%)

Serum amylase was more than three times in 6 and more than two times in 8 patients while it was above normal level in 58 patients with acute pancreatitis. On the other hand,

serum lipas was more than 3 times and 2 times respectively in 10 and 24 patients. Whereas, it was above normal level in 68 acute pancreatitis patients.

Table 2: Comparison of 2 times and 3 times increase of serum amylase and serum lipase with positive acute pancreatitis diagnosis based radiological findings.

	Acute pancreatitis Positive (+ ve)	Acute pancreatitis Negative (– ve)	Total
Amylase (>423)	3	0	6
Amylase (≤423)	3	0	204
Amylase (>282)	8	0	35
Amylase (≤282)	58	0	58
Total	72	0	72
Lipase (>153)	6	0	6
Lipase (≤153)	4	0	4
Lipase (>102)	24	0	24
Lipase (≤102)	68	0	68
Total	102	0	102

Discussion

Findings of the present study evaluated the individual accuracy of serum amylase or lipase for acute pancreatitis diagnosis. Serum amylase is considered as an esteemed marker for the acute pancreatitis. Previous studies have shown that sensitivity of serum amylase ranged from 55-84%.[4-7] However, there may be numerous other factors responsible for the hyperamylasemia.[8,9] On the other hand, assessment of serum lipase was started in USA in 1986. They recorded 80% sensitivity and 60% specificity of serum lipase in acute pancreatitis diagnosis.[7] Since then numerous studies have been done to evaluate the accuracy of serum lipase and amylase for acute pancreatitis diagnosis.

Previously, oily substance was used for the measurement of serum amylase which was not appropriate for automation; however, it is not used now days. Serum amylase has been known to have a poor specificity for acute pancreatitis. In addition, it has been shown in the studies that decreased serum amylase level is associated with hypertriglyceridemia. That is why it is advisable to assess together serum lipase and amylase level for the acute pancreatitis diagnosis as both of them complement each other.[9]

Findings of the present study recorded that serum amylase and serum lipase were founded extremely sensitive as well as specific for the diagnosis acute pancreatitis. However, results of our study suggested that serum amylase was less specific and sensitive than serum lipase. These findings are very similar to the findings of the earlier studies of Thomson HJ et al and Smith RC et al.[12,13]

Thomson et al recorded the sensitivities as high as up to 100% for serum lipase and amylase. In addition, they recorded more than 90% specificities for serum lipase and amylase. 12 Alike, Smith et al,[13] observed 69% sensitivity of serum lipse and 90% specificity of serum amylase.

Further, results of the present study revealed that all acute pancreatitis patients had increased serum lipase whereas, higher level of serum amylase was observed in 84% acute pancreatitis patients. These findings are consistent with the findings of the previous studies of Frank B et al and Toouli J et al.[14,15] Frank B et al,[14] observed raised serum lipase as well amylase level were the hall mark for the acute pancreatitis patients. In the same way, Toouli J et al,[15] reported that diagnosis of acute pancreatitis may be made if there is increase in serum amylase and lipase by three times. In contrast to this, Thomson HJ et al,[12] suggested that evolution of serum lipase and serum amylase is not required at the same time for the acute pancreatitis diagnosis. Though, for the diagnosis of acute pancreatitis, clinicians primarily rely on combine picture of CT scan findings along with estimation of serum amylase and serum lipase.

Contradictory to it various other studies reported that serum amylase was recorded in normal range among more than 15% of patients suffering with acute pancreatitis.[16,17]

Results of our study showed that serum lipase was a better marker in comparison of serum amylase in acute pancreatitis patients. These findings are in agreement with the previous studies of Apple F et al,[8] and Agarwal N et al,[18] as they suggested that serum lipase has an advantage compare to serum amylase for the diagnosis of acute pancreatitis.

Similarly, Gomez D et al,[19] recorded high level of serum amylase as well as serum lipase in most of the patients in their study. All the patients of acute pancreatitis showed raised level of serum lipase (100%). Similarly, British Society of Gastroenterology as they directed to assess the serum lipase for the diagnosis of acute pancreatitis.[20]

Conclusion

Findings of the present study suggested that diagnostic accuracy of both serum amylase and serum lipase was excellent for the acute pancreatitis. Nevertheless, serum lipase has an edge in accuracy over serum amylase for the diagnosis of acute pancreatitis. Therefore, we strongly suggest that measurement of serum lipase might be helpful in the diagnosis of acute pancreatitis in smaller centres where diagnostic facilities are limited.

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