To Study the Association of Total Serum Calcium Level in Assessing the Severity of Pancreatitis

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

| Original Research Article |

ABSTRACT

Background: Pancreatitis is an inflammatory condition that affects the pancreas and may also affect other tissues or distant organ. In this study our aim is to see if blood calcium level can be used as a prognostic marker in determining the severity of acute pancreatitis because hypocalcaemia is linked to higher mortality and hospitalization.
Method: A retrospective study was conducted in the medical records department of a tertiary care health facility. A total of 75 participants were included in the research. .demographic details of all patients were collected .Patients above 18 years who presented with of epigastric pain, pre-Diagnosed gallstones, alcoholism were included int this study. The lowest total calcium levels were collected in order to examine total calcium as a predictive factor for severity. All of these information were collected and analyzed to get the appropriate findings.
Results: A total of 75 patients were included in the research. The age of patients in each severity grade did not differ significantly (p value>0.05). The gender distribution of the two groups did not differ. (P >0.05). For mild and severe acute pancreatitis, mean total calcium levels were 7.98 and 6.67, respectively, which was statistically significant (p< 0.05).
Conclusion: The total serum calcium level is a useful indicator for assessing pancreatitis.

1. INTRODUCTION

Pancreatitis is an inflammatory condition that affects the pancreas and may also affect other tissues or distant organ system [1,2,3]. It manifests in both acute and chronic forms. Acinar cell necrosis and parenchymal inflammatory infiltrate are histological features of acute pancreatitis [4]. Usually, the condition resolves on its own. However, the disease can be severe in 10–15 percent of cases, causing multiorgan dysfunction with a high mortality rate. Alcoholism and gallstones are the most common causes of acute pancreatitis [5]. In order to reduce mortality rate, early diagnosis and intervention with appropriate treatment is necessary. Acute pancreatitis is diagnosed clinically and through imaging techniques. In this study, the severity of pancreatitis is assessed using Ranson criteria, with total calcium levels used as a prognostic marker because severe hypocalcemia is linked to higher mortality and hospitalization [6].

2. METHODOLOGY

A retrospective study was conducted in the medical records department of a tertiary care health facility in Saveetha Medical College and Hospital, Saveetha Nagar, Thandalam, to collect data. The sample size was calculated using a statistical technique and the number of pancreatitis cases evaluated in prior researches. A total of 75 cases were collected over the course of six months, from September 2020 to March 2021.Demographic details of all cases were collected .

2.1 Inclusion Criteria

Patients above 18 years who presented with of epigastric pain, pre-diagnosed gallstones, alcoholism, abdominal trauma.

2.2 Exclusion Criteria

Patients above 70 years of age, complaints of hyperparathyroidism, pancreatic malignancy. The lowest total calcium levels were collected in order to examine total calcium as a predictive factor for severity. The data analysis was done using Ranson criteria and sensitivity(S), specificity(SP), positive predictive value(PPV) ,negative predictive value (NPV) for serum calcium was calculated at various cut off levels of hypocalcemia. Ranson criteria was calculated based on 11 clinical parameters, and for each positive criteria one point is given ,score≤ 3 was considered to be mild pancreatitis and more >3 was considered as severe pancreatitis.

Ranson's criteria: At admission/diagnosis:

- ✓ Age >55 years
- ✓ WBC >16,000/mm3
- ✓ Blood Glucose >200 mg/dl
- ✓ Serum LDH >350 U/L
- ✓ AST >250 U/L

At 48 hours:

- ✓ Hematocrit decrease >10%
- ✓ Blood Urea Nitrogen increase >5 mg/dL
- ✓ Serum Calcium <8 mg/dL
- ✓ Base deficit >4 mmol/L
- ✓ Fluid Sequestration >6000 mL
- ✓ PaO2 <60 mm Hg

3. RESULTS

The study included seventy-five patients who met the inclusion and exclusion criteria. The patients' ages ranged from 18 to 69 years. The average age of acute pancreatitis patients was 34.24+/-12.64 years. There were no significant association between age group of patients and severity of Acute Pancreatitis. Fifty patients(66.6%) with acute pancreatitis were male, while twenty-five(33.3%) were female. In which 61 patients had mild pancreatitis and 14 patients had severe pancreatitis. Gender distribution in the two groups showed no differences. (P less than 0.05). Out of 75 patients, 36 had biliary pancreatitis, 30 had ethanol-induced pancreatitis, and 9 had other causes of pancreatitis (Table1). There was no significant link between etiology and illness severity (p value > 0.05). For mild and severe acute pancreatitis, the mean total calcium was 7.98 and 6.67, respectively, which was statistically significant (p<0.05) (Table 2). Sensitivity and specificity of serum calcium below 7.5mg/dl were 74 and 82 and below 6.5 mg/dl had 55 and 94 (Table 3).

Table 1. Factors for acute pancreatitis

Etiology	No of Patients %
Biliary	36 (48%)
Alcoholic	30 (40%)
Others	9 (12%)

4. DISCUSSION

Acute pancreatitis is still a prevalent condition, with severe bouts having a fatality rate of 30 to

50 percent [1]. This vulnerable category of patients' needs immediate diagnosis and severity rating in order to provide aggressive treatment and avoid morbidity and fatality. Furthermore, early detection of mild disease prevents unnecessary overtreatment, thus lowering treatment costs. One of the components of Ranson's criteria for determining the severity of pancreatitis is hypocalcemia [1]. Hypocalcaemia is more common during severe pancreatitis attacks than during moderate attacks [6] (86 percent versus 39 percent) . Depending on the environment and cut-offs utilized, the prevalence of hypocalcaemia in critically ill patients ranges from 15 to 88 percent [6,7,8].

Break down of mesenteric fat by pancreatic enzymes releases fatty acids which generate calcium salts, temporary hypoparathyroidism, and hypomagnesemia are proposed reasons for causing hypocalcaemia in the early stages [9,10,11]. In sepsis, higher levels of circulating catecholamines trigger a movement of calcium from the extracellular compartment to the intracellular compartment, resulting in relative hypocalcemia. As a result of the negative feedback loop, PTH secretion is increased, resulting in increased intracellular calcium accumulation, which finally leads to cell death due to oxidative stress [12]. The function of parathyroid hormone in the pathophysiology of hypocalcemia in Acute Pancreatitis has lately been re-examined, with the hypothesis that this condition is caused by an insufficient parathyroid response [3]. Some of the other causes include hypomagnesaemia-induced decreased PTH secretion and activity, relative deficiency in PTH, and vitamin D deficiency.

Patients with hypocalcemia can have CNS and CVS manifestations. Severe hypocalcemia, such as that seen in some Severe Acute Pancreatic

patients, could conceivably aggravate shock by lowering cardiac contractility. So, Hypocalcemia can cause QT prolongation, which can lead to torsade de pointes in those who are at risk [7,13]. In intensive care units, calcium concentrations of less than 0.8 mmol/L were identified to be an independent factor for mortality ,this was supported by a research work done In Australia's biggest multicenter study, which included 7024 patients from four institutions [1,14]. In a retrospective single-center observational study of 1038 critically sick patients, it was discovered that 55.2 percent had hypocalcemia (Ca 1.1 mmol/L) at the time of admission. By the fourth day, most patients' calcium level usually returns to normal. Normalization of calcium levels did not differ between patients who received calcium supplements and those who did not. Patients who had severe hypocalcemia (0.9 mmol/L) and calcium levels not getting normalised within 4 days, had a higher mortality rate (38 percent vs. 19 percent), however the differences were not statistically significant [1].

In this study, severity of Acute pancreatitis was not connected to the patient's age . Further, there was no correlation between gender and the severity of AP. Similarly, there was no link between the cause of AP and its severity. we found that the specificity and sensitivity values for total serum calcium with a cut-off point of 7.5 mg/dl were 74 percent and 82 percent, respectively, for total serum calcium . The sensitivity of total calcium with a cutoff of 6.5 mg/dl dropped to 55%, but the specificity increased to 94%. Percentage of sensitivity and PPV varies in different studies as cutoff points taken in each study differs. When comparing the sensitivity, specificity, and predictive values of Total calcium to those of [3] we found that our sensitivity was significantly greater. The higher cutoff value could explain the improved

Table 2. Correlation of total serum calcium and Ranson score

Patients	Total Serum calcium	Ranson score	Percentage
Mild	7.98+/- 0.91	61(≤ 3)	81.3
Severe	6.67+/- 0.86	14(> 3)	18.6

Table 3. Of Sensitivity, specificity, predictive value to assess the progression of severity in acute pancreatitis

Factors	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Total serum calcium < 7.5mg/dl	74	82	33	90
Total serum calcium < 6.5mg/dl	55	94	56	94

sensitivity and positive predictive value [15]. Patients with mild acute pancreatitis had a total serum calcium content of less than 7.5 mg/dl and they had a 60% chance of developing severe acute pancreatitis when their total serum calcium fell below 6.5 mg/dl.

Although many health care centers have access to Total Calcium, fewer have the resources needed to use higher scoring systems and other AP severity markers like CRP, IL-6, or procalcitonin .But recently, Total calcium level are identified as emerging potential biomarkers for predicting AP severity [16,15]. so, determination of serum calcium levels is a direct biochemical measure that is regularly performed in the majority of hospital settings. Even at the main and secondary care centre levels, their usage as prognostic markers of severity in AP might be useful for identifying those who require intensive care.

5. CONCLUSION

The severity of acute pancreatitis can be predicted using serum calcium measured within the first 24 hours of hospital admission. This will not replace existing scoring systems, but these are simple markers can be simply measured, calculated, and interpreted for routine investigations and identifying the patients for intensive care support.

6. LIMITATIONS

Other scoring methods are superior in either sensitivity or specificity, which is one of Ranson criteria's limitations.

The second constraint is that acute pancreatitis score and severity cannot be assessed until 48 hours after admission.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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