ISSN:0975-3583,0976-2833 VOL13,ISSUE01,2022

Serum calcium level as a prognostic marker in acute pancreatitis – one year hospital based cross-sectional study

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Abstract
Introduction:
There is no simple biomarker which can serve as the single parameter to determine the severity and prognosis in patients with Acute Pancreatitis. Hence this study was aimed to determine the role of serum calcium level as a prognostic marker in Acute Pancreatitis.
Methodology:
This study was conducted in the medical wards of a tertiary care hospital. 100 patients with diagnosis of acute pancreatitis were enrolled. This was a one year cross-sectional study from January 2018 to December 2018.
Results:
In this study male preponderance was more (86%) than females and the ratio was 6.14:1. The commonest age group was between 20 to 40 years (64%) and the mean age was 39.21 ± 14.08 years. Ethanol (68%) was the commonest etiology followed by gall bladder calculi (24%). Abdominal pain was the common clinical presentation (80%) and epigastric tenderness the common clinical sign (70%). Maximum patients had moderate CT Severity Index(CTSI) score (64%). Serum calcium <8.5 mg/dl was found in 64 patients of which 45 had moderate pancreatitis, 14 had severe pancreatitis and 5 had mild pancreatitis. On comparing the serum calcium level with the CTSI, there was decrease in value of serum calcium in patients who had higher CTSI. A significant inverse co-relation (p=0.0001) was observed between CTSI and serum calcium levels indicating that hypocalcemia was associated with poor prognosis of Acute Pancreatitis.
Conclusion:
Serum calcium level can be used as simple marker to assess the severity and prognosis of Acute Pancreatitis and helps determine need for intensive care management as it is easily available in primary and secondary care centers.
Keywords: Acute pancreatitis; CT Severity Index;calcium;Hypocalcemia

Introduction:

Acute Pancreatitis is a relatively common and potentially life-threatening disease.It is defined as an inflammatory process of pancreas with possible peripancreatic tissue involvement and multi organ dysfunction syndrome with increasing mortality rate. Computed tomography is the gold standard investigation.In primary and secondary care centres facility of Computed Tomography (CT) is not available which makes it difficult to assess the severity of Acute Pancreatitis.

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Hypocalcemia is a frequent finding in Acute Pancreatitis and has been associated with its severity. But very few studies have been conducted to assess serum calcium as an individual marker for severity and prognosis of acute pancreatitis. Hence, we studied the serum calcium level in Acute Pancreatitis in comparison with CT Severity Index (CTSI) as a prognostic marker.

Materials and Methods:

Ethical clearance was granted by the Institutional Ethics Committee on Human Subjects Research. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki declaration of 1975, as revised in 2000.

This was a one year cross-sectional study from January 2018 to December 2018. This study was conducted in the patients admitted in the Department of Medicine in a tertiary care hospital. 100 patients were included in the study. The sample included only the patients with diagnosis of Acute Pancreatitis.

All Acute Pancreatitis patients above 18 years were included in the study. Old cases of pancreatitis, patients of Chronic Kidney Disease, patients receiving calcium supplements, patients undergoing chemotherapy, patients with parathyroid disorders were excluded from this study.

Results:

Most of the patients were males (86%) and male to female ratio was 6.14:1. The commonest age group was between 20 to 40 years (64%) and the mean age was 39.21 ± 14.08 years. Ethanol (68%) was the commonest etiology for acute pancreatitis followed by gall bladder calculi (24%). Abdominal pain was the common clinical presentation (80%). Most of the patients had epigastric tenderness as the most common clinical sign (70%). 68% patients had pulse rate of >100 /minute, 28% of the patients had temperature of $\geq 98.6^0$F.

As shown in Table 1, Based on the CT abdomen appearance Edematous pancreatitis (32%) was the most common finding, followed by Necrotizing pancreatitis (28%). Serum calcium <8.5 mg/dl was found in 64 patients of which 45 patients had moderate pancreatitis, 14 patients had severe pancreatitis and 5 patients had mild pancreatitis as seen in table 2. Maximum patients were found to have moderate severity on the CTSI score (64%) (table 3).

On comparison of CT abdomen appearance with respect to serum calcium level it was observed that more hypocalcemia was observed with more severe CT abdomen appearance of pancreatitis and necrosis. In the present study, on comparing the serum calcium level of all the patients with the CT severity index we observed that there was decrease in the value of serum calcium of patients who had higher CT Severity Index (Figure 1). A significant inverse co-relation (P=0.0001) was observed between the CT Severity Index and serum calcium levels (table 5).

In the present study, it was observed that there was no correlation between serum amylase and serum calcium (P=0.8638) and serum lipase and serum calcium (P=0.4694).

Also, comparison of CT abdomen appearance with respect to serum amylase (P=0.3112) and serum lipase (P=0.0748) did not show any significant correlation.

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Table 1: CT abdomen appearance wise distribution of acute pancreatitis patients

CT abdomen appearance	No of acute pancreatitis patients	% of acute pancreatitis patients
Diffuse pancreatic enlargement	20	20.00
Edematous pancreatitis	32	32.00
Focal pancreatic enlargement	7	7.00
Necrotizing pancreatitis	28	28.00
Peri-pancreatic fat stranding	8	8.00
Peri-pancreatic fluid collection	5	5.00
Total	**100**	**100.00**

Table 2: Serum calcium level wise distribution in Acute Pancreatitis patients.

SERUM CALCIUM	No of Acute Pancreatitis patients	% of Acute Pancreatitis patients
Below Normal (<8.5)	64	64
Normal (8.5-10.5)	35	35
Above Normal (>10.5)	1	1
TOTAL	**100**	**100.00**

Table 3: CT severity Index wise distribution of acute pancreatitis patients

CT severity Index	No of acute pancreatitis patients	% of acute pancreatitis patients
Mild	21	21.00
Moderate	64	64.00
Severe	15	15.00
Total	**100**	**100.00**

Table 4: CT severity Index wise distribution of serum calcium in acute pancreatitis patients

CT Severity Index	SERUM CALCIUM (mg/dl)			TOTAL
	<8.5	8.5-10.5	>10.5	
MILD (2)	5	15	1	21
MODERATE (4,6)	45	19	0	64
SEVERE (8,10)	14	1	0	15
TOTAL	64	35	1	100

Table 5: Correlation between CT severity Index and calcium scores by Spearman's rank correlation method

Variables	Correlation between CT severity Index scores with			
	N	Spearman R	t-value	p-level
Calcium scores	100	-0.7108	-10.0027	**0.0001***

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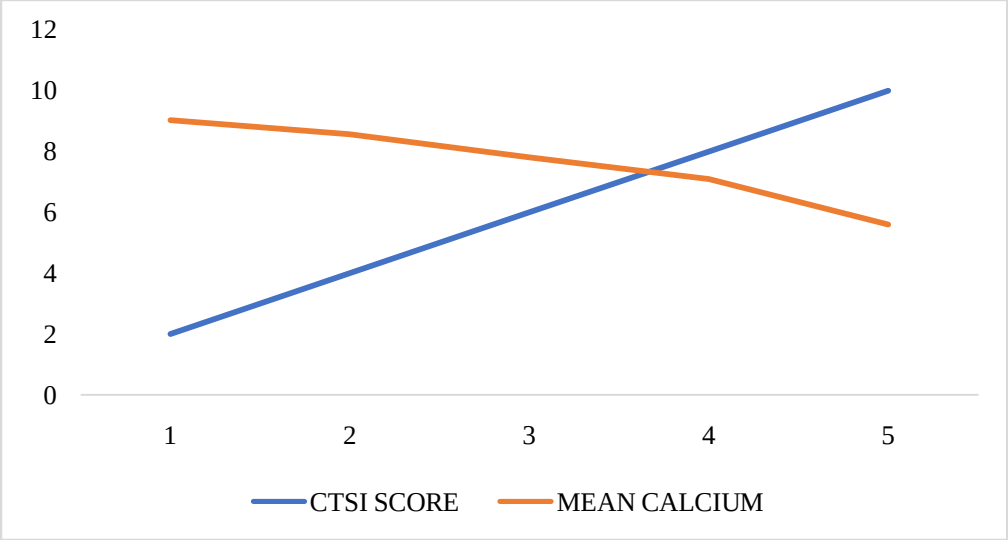
Figure 1: Correlation between CT severity Index and calcium scores



Discussion:

Acute pancreatitis is a common disease which has a broad range of illness. Severe acute pancreatitis has a high mortality and morbidity rate.Early hospitalization and management according to disease severity maybe helpful to identify patients who are at risk and need aggressive interventions to prevent the severe complications of pancreatitis.There are many scoring systems to determine the severity of the disease but they are usually cumbersome to determine. Some of the investigations are not easily available at the primary and secondary health centers.

Hence in the present study our objective was to analyze a simple lab parameter i.e. the level of serum calcium as a severity and prognostic marker in acute pancreatitis in comparison with the CT Severity Index.

Based on the CT abdomen appearance, Edematous pancreatitis (32%) was the most common finding, followed by Necrotizing pancreatitis (28%), Diffuse pancreatic enlargement (20%) patients, focal pancreatic enlargement (7%) patients, peri-pancreatic fat (8%), peri-pancreatic fluid collection (5%) patients.39 patients(39%) showed evidence of pancreatic necrosis, of these 23 patients had <30% necrosis and 16 patients had >30% necrosis.

"A study conducted in 90 patients by Wongnai*et al* showed similar results. A study by Bollen*et al* and Casas *et al* identified necrosis in 18 % and 15 % patients with Acute Pancreatitis respectively."

The patients severity were given scores 2, 4, 6, 8 and 10 based on the CT Severity Index. We grouped the CTSI scores into mild (grade 2), moderate (grade 4 & 6) and severe (grade 8 & 10).

The maximum number i.e. 64 patients were seen to fall in the moderate category (64%), 21 patients in mild category (21%) and minimum patients i.e. 15 (15 %) were seen in severe category.

"According to the study by Bollen*et al* the morphologic severity of pancreatitis was graded as mild in 86 (44%), moderate in 75 (38%), and severe in 35 (18%) cases."

In the present study, it was observed that 64 patients (64%) had serum calcium <8.5 mg/dl, 35 patients (35%) had calcium between 8.5-10.5 mg/dl and only 1 patient (1%) had calcium above 10.5 mg/dl. The minimum calcium level was 4.7 mg/dl and maximum was 11.1 mg/dl. The mean calcium was 8.21±1.10 mg/dl.

ISSN:0975-3583,0976-2833 VOL13,ISSUE01,2022

The mean serum amylase level was 755.60 U/L. The minimum amylase level was 22 U/L and maximum was 5118 U/L.

The mean serum lipase level was 997.66 U/L. The minimum lipase level was 21 U/L and maximum was 5888 U/L.

In the present study, it was observed that there was no correlation between serum amylase and serum calcium (p=0.8638) and serum lipase and serum calcium (p=0.4694).

Also, comparison of CT abdomen appearance with respect to serum amylase (p=0.3112) and serum lipase (p=0.0748) did not show any significant correlation.

In this study, we observed that of 21 patients who had mild pancreatitis 5 patients had calcium <8.5 mg/dl, 15 patients had normal calcium between 8.5-10.5 mg/dl and 1 patient had calcium >10.5 mg/dl. In moderate pancreatitis, 45 patients had calcium <8.5 mg/dl, 19 between 8.5-10.5 mg/dl and no patients >10.5 mg/dl. In severe pancreatitis, 14 patients had calcium <8.5 mg/dl, 1 between 8.5-10.5 mg/dl and none >10.5 mg/dl.

In the present study, on comparing the serum calcium level of all the patients with the CT severity index we observed that there was decrease in the value of serum calcium of patients who had higher CT Severity Index. A statistically significant inverse co-relation (p=0.0001) was observed between the CT Severity Index and serum calcium levels by Spearman's rank correlation method indicating that hypocalcemia was associated with poor prognosis of Acute Pancreatitis

On comparison of CT abdomen findings with respect to serum calcium level it was observed that more hypocalcemia was observed with more severe CT abdomen appearance of pancreatitis and necrosis.

"A study done by A.A. Gutiérrez-Jiménez *et al* to study Serum Calcium and Albumin Corrected Calcium obtained within the first 24 h of hospital admission concluded that they are useful predictors of severity in Acute Pancreatitis and have S_n, S_p, and predictive values that are comparable with those of the traditional prognostic scales. With an adequate interpretation of their cut-off points, they are valuable for identifying the patients that require intensive care support, even in primary and secondary care centers."

Conclusion:

Based on the findings of this study it may be concluded that, Serum calcium level can be used as a simple marker to assess the severity and prognosis of Acute Pancreatitis which helps to determine need for intensive care management as it is easily available in primary and secondary care centers but further large-scale studies are needed.

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