



STUDY OF ALBUMIN, CALCIUM AND ALBUMIN CORRECTED CALCIUM WITH SEVERITY OF ACUTE PANCREATITIS

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ABSTRACT

Aim: The purpose of this study to evaluate the level of serum Albumin, Calcium and Albumin corrected calcium with severity of acute pancreatitis.

Material and methods: The study was conducted in Department of Biochemistry in association with Department of Gastroenterology, Mahatma Gandhi Medical College & Hospital. In present study out of 133 patients diagnosed for Acute Pancreatitis; total 115 patients (n=115) of either gender of 18 to 65 years age groups were enrolled for the study. Patients with history of any acute or chronic illness like: - Hyperparathyroidism, Diabetes Mellitus, Impaired renal function, Malnourished, Pregnant and lactating women and patients on calcium supplements were excluded.

Result: Mean level of calcium decreased with progression in disease severity ($p \leq 0.001$). The mean Albumin Corrected Calcium was also significantly lower in the patients presenting with severe and moderate acute pancreatitis compared with the mild acute pancreatitis patients ($p \leq 0.0001$).

Conclusion: The study recommends hypocalcaemia and hypoalbuminemia as independent risk factors of progression towards severe pancreatitis. Similarly, albumin corrected calcium is suggested as a reliable marker for severity of pancreatitis.

KEYWORDS : Albumin, Calcium, Albumin corrected Calcium, severity, Acute Pancreatitis.

INTRODUCTION

Acute pancreatitis (AP) is a disease characterized by acute inflammation of the pancreas and destruction of acinar cells. ^[1] It is a life threatening disease with hospital mortality rates of about 15% ^[2]. The general concord is that two of the following three characteristics are necessary for making AP diagnosis: intense epigastric pain, three times higher concentration of serum amylase and lipase, and CT scan ^[3].

According to revised Atlanta classification 2012, AP is classified into 3 states: mild, moderate, and severe based on the presence of organ failure or local complications ^[4]. Severity is grouped as mild, moderate, or severe by using "Ranson Score System".

In approximately one-third of the patients, acute severe pancreatitis may develop, producing progressive organ dysfunction, associated with prolonged hospital stay and significant morbidity and mortality ^[5].

Biochemical markers have also turned out to be helpful predictors. Total calcium and Albumin-corrected calcium is simplified marker that can be readily measured, calculated and interpreted by any healthy person. It has been evaluated as mortality prognostic aspect and has also been evaluated as a predictor of severe AP with infection ^[6].

Calcium plays a vital role in the pathogenesis of pancreatitis. Direct measurement of inorganic calcium (iCa) makes more sense, which is physiologically active. Calcium is essential for normal secretory function of the pancreatic acinar cells, but these signals are transitory and mainly confined to apical pole. ^[7] Calcium-mediated acinar cell injury suggests that hypocalcaemia of severe acute pancreatitis might play a protective role by depleting the acinar cells of extracellular supply of calcium ^[8].

Albumin is exclusively synthesized in the liver. The level of serum albumin is a good indicator of AP ^[9].

As calcium binds to albumin and only the unbound calcium is biologically active, the serum level needs to be adjusted for abnormal albumin levels. For every 1 g/dl drop in serum albumin below 4 g/dl, measured serum calcium decreases by 0.8 mg/dl.

The most common cause of low serum calcium in patients with this condition is low serum albumin. The occasional hypocalcaemia as shown by the 'corrected' serum calcium or by serum ionized calcium measurement is usually mild and transitory, indicating that the normal homeostatic mechanisms of the body can easily maintain the physiologically active fraction of the serum calcium within, or close to, the normal range ^[10].

Formula to calculate Albumin corrected Calcium ^[6] :-

$$\text{Albumin corrected calcium (mg/dl)} = \text{Total calcium (mg/dl)} + 0.8 \times [4 - \text{serum albumin (g/dl)}]$$

Serum calcium and albumin-corrected calcium (ACC) obtained within the first 24hrs of hospital admission are useful predictors of severity in AP and have sensitivity (S), specificity (Sp), and predictive values that are comparable with those of the traditional diagnostic scales. It is assessed as a prognostic factor for mortality and as a predictor of severe AP with infection. ACC has also been related with severity ^[8].

MATERIAL AND METHOD

The study was conducted in Department of Biochemistry in association with Department of Gastroenterology, Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan. Out of 133 patients diagnosed for Acute Pancreatitis; selected

115 patients (n=115), of either gender of 18 to 65 years age groups who fulfilling the inclusion criteria were enrolled for the study. Patients with history of any acute or chronic illness like: Diabetes Mellitus Impaired renal function, Hyperparathyroidism, Malnourished, Pregnant and lactating women and patients on calcium supplements were excluded. Blood samples were collected using the standard techniques and analyzed. According to revised Atlanta classification 2012 AP is classified into 3 states: mild, moderate, and severe. The results obtained were presented as mean ± SD. P value ≤ 0.05 was considered as statistically significant.

RESULT

Acute pancreatitis (AP) is an inflammatory condition of pancreas characterized by necrosis of acinar cells. In present study, the mean calcium levels for study population were below normal i.e. 7.88 ± 0.94 mg/dl. The mean calcium levels was found to be highly significant among three groups mild, moderate and severe AP. Mean level of calcium decreased with progression in disease severity ($p \leq 0.001$). A significant difference was observed in the mean calcium levels in mild AP (8.21 ± 0.68 mg/dL), moderate AP (7.11 ± 0.97 mg/dL), severe AP (6.84 ± 0.89 mg/dL) ($P \leq 0.0001$).

A significant decrease was found in serum albumin levels ($p \leq 0.0001$). The level of albumin decreases with increases in disease severity ($p \leq 0.0001$). This level was lower than the normal S albumin levels.

On applying one way ANOVA test significant differences in the serum albumin concentration of the patient in the 3 groups ($p \leq 0.0001$) i.e. mild AP (3.18 ± 0.70 g/dl), moderate AP (2.66 ± 0.76 g/dl) and severe AP (2.36 ± 0.84 g/dl).

The mean ACC was significantly lower in the patients presenting with severe and moderate AP compared with the mild AP patients ($p \leq 0.0001$).

Table 1: Distribution on the basis of Calcium Levels

Population Mean (n= 115)	Mild (n=83)	Moderate (n=20)	Severe (n=12)	P-Value
7.88 ± 0.94	8.21 ± 0.68	7.11 ± 0.97	6.84 ± 0.89	<0.0001

P-value as obtained on applying one way ANOVA



Figure 1: Distribution on the basis of Calcium Levels

Table 2: Distribution on the basis of Albumin Levels

Population Mean (n= 115)	Mild (n=83)	Moderate (n=20)	Severe (n=12)	P-Value
3.01 ± 0.78	3.18 ± 0.70	2.66 ± 0.76	2.36 ± 0.84	<0.0001

P-value as obtained on applying oneway ANOVA



Figure 2: Distribution on the basis of Albumin Levels

Table 3: Distribution on the basis of Albumin Corrected Calcium Levels

Population Mean (n= 115)	Mild (n=83)	Moderate (n=20)	Severe (n=12)	P-Value
8.67 ± 0.89	8.86 ± 0.70	8.18 ± 1.14	8.16 ± 1.11	<0.0001

P-value as obtained on applying oneway ANOVA

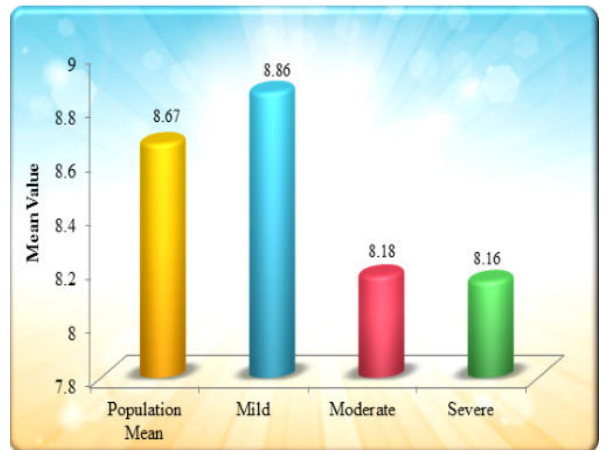


Figure 3: Distribution on the basis of Albumin Corrected Calcium Levels

DISCUSSION

To evaluate the prognosis of AP, therefore, there is need to identify independent markers which can predict severity of disease as well as help clinicians in planning early optimal management. The present study was planned to evaluate the association of serum Calcium and Albumin corrected calcium with severity of pancreatitis.

Mean calcium levels for study population was below normal i.e. 7.88 ± 0.94 mg/dl. And the mean value of serum albumin for cases were 3.01 ± 0.78 g/dL. Alike calcium, the level of albumin decreases with increases in disease severity ($p < 0.0001$). (As shown in Table no 1&2)

Calcium is essential for normal secretory function of the pancreatic acinar cells. During AP, hypocalcemia occurs which indirectly help in decreasing the extracellular supply of calcium. The low albumin levels are said to be decrease calcium levels in serum. Low Serum calcium levels are reported to be associated with low albumin concentration in pancreatitis patients:

In Similar findings,

- Kemparaj T et al^[12] 2018 reported the mean total calcium was 8.15mg/dL, 7.36 mg/dL, and 6.43 mg/dL for mild, moderate and SAP respectively. ($P < 0.05$)
- Pokharel A et al^[13] 2017 presented the significant mean total calcium for mild, moderate, and severe AP.
- Hong W et al^[14] 2017 observed that low serum albumin is associated with an increased risk of developing of persistent organ failure and death in AP.
- Gutierrez A. et al^[11] 2014, reported a significant difference in the total calcium concentration in all groups.
- The mean ACC was also significantly lower in the patients presenting with severe and moderate AP compared with the mild AP patients ($p \leq 0.001$).

Similar findings were reported by Kemparaj T et al^[12] 2018 showed the significant mean value of ACC for mild, moderate and severe AP. Gutierrez A. et al^[11] 2014, reported the mean ACC was also significantly lower in the patients presenting with severe and moderately severe AP, compared with the mild AP patients.

CONCLUSION

Acute pancreatitis is a common disorder which resolves in most of the cases. However, in severe attacks, the mortality may be as high as 30-50%. To avert the risk of morbidity and mortality, grading of severity of disease is important. Therefore, markers which can help in early identification of severe pancreatitis need to be identified. The study recommends hypocalcaemia and hypoalbuminemia as independent risk factors of progression towards severe pancreatitis. Similarly, albumin corrected calcium is suggested as a reliable marker for severity of pancreatitis. The study recommends evaluation of these markers in the early hours of hospitalization for patients diagnosed with acute pancreatitis. Early identification of severe cases can be helpful in better patient management.

REFERENCES:

1. Garber A, Frakes C, Arora Z, Chahal P. Mechanisms and management of acute pancreatitis. *Gastroenterology Res Pract.*;2018;6218798.
2. van Santvoort HC, Bakker OJ, Bollen TL, Besselink MG, Ali UA, Am S, et al. A conservative and minimally invasive approach to necrotizing pancreatitis improves outcome. *Gastroenterology.* 2011;141:1254-63.
3. Banks PA, Freeman ML, The Practice Parameters Committee of the American College of Gastroenterology. Practice Guidelines in Acute Pancreatitis. *Am J Gastroenterol.* 2006;101:2379-400.6
4. Banks P.A., Bollen T.L., Dervenis C., Classification of acute pancreatitis-2012: revision of the Atlanta classification and definitions by international consensus. 2013;62(1):102-111.
5. Renner I. G., Savage W. T., Pantoja J. L., Renner V. J. Death due to acute pancreatitis. A retrospective analysis of 405 autopsy cases. *Digestive Diseases and Sciences.* 1985;30(10):1005-1018.
6. Gutierrez-Jimenez A. A., Castro-Jimenez E., Lagunes-Cordoba R. Total serum calcium and corrected calcium as severity predictors in acute pancreatitis. *Revista de Gastroenterologia de Mexico.* 2014;79(1):13-21.
7. Li J, Zhou R, Zhang J, Li ZF. Calcium signaling of pancreatic acinar cells in the pathogenesis of pancreatitis. *World J Gastroenterol.* 2014;20:16146-52.
8. Sava L, Pillai S, More U, Sontakke A. Serum calcium measurement total versus free (ionized) calcium Indian J Clin Biochem. 2005;20:(2): 158-61.
9. Zou C, Lu Z, Zhang Z, Zhao L, Tian L, Jiang K, Miao Y. Factors associated with pancreatic infection in patients with severe acute pancreatitis *Int J Clin Exp MED.* 2015;8(8):14100-4.
10. Allam BF, Imrie CW. Serum ionized calcium in acute pancreatitis. *British J Surg.* 1977;64(9):665-8.
11. Gutiérrez-Jiménez AA, Castro-Jiménez E, Lagunes-Córdoba R. Total serum calcium and corrected calcium as severity predictors in acute pancreatitis. *Revista de Gastroenterología de México.* 2014;79:13-21.
12. Kemparaj T, Narasimhamurthy KN, Muralidhar A. Total serum calcium and corrected calcium as a predictor of severity in acute pancreatitis. *Int Surg J* 2018;5:3558-3561.
13. Pokharel A, Raj Sigdel P, Phuyal S, Bir Singh Kansakar P, Vaidya P. Prediction of severity of acute pancreatitis using Total Serum Calcium and Albumin-Corrected Calcium : A Prospective Study in Tertiary Center Hospital in Nepal. *Hindawi surgery Research and Practice.* 2017;1-5.
14. Hong W, Lin S, Zippi M, Geng W, Stock S, Basharatz Z, Cheng B, Pan J, Zhou M. Serum Albumin is independently associated with persistent organ failure in Acute Pancreatitis. *Hindawi Canadian Journal of Gastroenterology and Hepatology.* 2017;1-10.