Levels of Zinc & Copper in Acute Pancreatitis Patients

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ABSTRACT:

BACKGROUND:

Acute pancreatitis has traditionally been defined as an acute inflammatory process of the pancreas that (1) is associated with abdominal pain and elevations in serum levels of pancreatic enzymes and, (2) disrupts normal pancreatic architecture and function.

AIM OF THE STUDY:

To assess the serum level of zinc and copper in patients with acute pancreatitis.

METHOD:

A study conducted in Gastrointestinal Teaching Hospital in Baghdad, from first May 2005 to first March 2006, twelve patients were eligible in this study, and they were 4 females & 8 males. Zinc & Copper were measured for every patient by Perkin-Elmer (USA) atomic absorption spectrophotometer model 305B fitted with nitrous oxide acetylene burner head.

RESULTS:

Zinc & Copper concentrations were significantly decreased ($p < 0.001$ and $p < 0.0001$ respectively) in the serum of acute pancreatitc patients.

CONCLUSION:

These findings of Zinc & Copper levels suggest that altered minerals metabolism in serum may have contributed to the pathophysiology of acute pancreaitits.

KEYWORDS:Acute pancreatitis, Zinc, Copper, Serum level .

INTRODUCTION:

Acute pancreatitis has traditionally been defined as an acute inflammatory process of the pancreas that is associated with abdominal pain and elevations in serum levels of pancreatic enzymes [(1)]. The prevalence of acute pancreatitis varies from population to population, depending on the relative prevalence of alcohol abuse and gallstone disease.Estimates of the incidence of acute pancreatitis range from about 5 to 25 cases per 100,000 populations [(2, 3)]. The reason for the increased incidence of acute pancreatitis is unclear, but the increase may be related to the increased incidence of gallstones in association with the epidemic of obesity [(4)]. Many factors have been implicated as causes of acute pancreatitis Together, gallstone disease and alcohol abuse account for 70% to 80% of all cases of acute pancreatitis.[1] The pathophysiology of acute pancreatitis, irrespective of cause, remains poorly understood. All etiologies appear to converge on a final common pathway that allows the premature activation of digestive enzymes within the pancreas [(5, 6)]. The conversion of the inactive proenzyme trypsinogen to its active form trypsin appears to be a critical early step because trypsin can then activate most of the other digestive proenzymes.

The release of activated digestive enzymes into the pancreas and surrounding tissues can produce tissue damage and necrosis of the pancreas, its surrounding fat, and adjacent structures [(7)]. This chemical "burn" of the retroperitoneum leads to substantial fluid loss into this area—so-called third-space fluid losses. The release of activated digestive enzymes into the systemic circulation can overwhelm normal protective mechanisms (e.g., antiproteases) and cause direct damage to distant organs and other systemic enzyme systems (e.g., complement and kinin systems) [(7,8)]. Finally, a number of inflammatory mediators and cytokines can be released from inflammatory cells to produce a systemic immune response syndrome (SIRS) or sepsis like syndrome [(7,8)] The diagnosis of acute pancreatitis is usually suspected on the basis of compatible signs and symptoms and confirmed by laboratory tests and radiographic imaging. Pain is the most common symptom of acute pancreatitis, occurring in up to 95% of patients.

The serum amylase level has long been the most widely used confirmatory laboratory measurement for acute pancreatitis. At least 75% of patients with acute pancreatitis will have increased levels of serum amylase at the time of initial evaluation [(9)]. Levels greater than three times the upper limit of

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normal are highly suggestive of acute pancreatitis. During first 24 hours, normal levels of serum amylase, however, do not rule out the presence of pancreatitis. Serum amylase levels may be normal in some patients with acute alcoholic pancreatitis and in patients with hyperlipidemic pancreatitis (2), (marked elevations in triglyceride levels can interfere with the laboratory assay for amylase)

PATIENTS & METHOD:

Nineteen patients complained from acute pancreatitis symptoms attended to GIT Hospital in Baghdad from 1st of May 2005 to 1st of March 2006, only twelve (4 females & 8 males) are enrolled in our study, after clinical evaluation, acute penceratitis diagnosis is confirmed with a combination of laboratory tests and imaging studies (ultrasonogragphy and computed tomography). For all cases included in this study, serum Zinc and Copper levels (during first 48hr. of onset of symptoms) were measured by Perkin-Elmer (USA) atomic absorption spectrophotometer model 305B fitted with nitrous oxide acetylene burner head. Hallow cathode lamps were used as radiation emission source and the absorption was measured in fuel rich flame in order to obtained maximum sensitivity.

Biostatistical analysis using Student's t-test with p-value ≤ 0.05 was considered as significance.

RESULTS:

Twelve acute pancreatitis patients were submitted to this study (serum Zn level were 0.75± 0.14 & serum Cu level were 0.82 ± 0.09), compared with twenty control subjects (serum Zn level were 1.02 ± 0.02 & serum Cu level were 1.47± 0.31). This study shows significant decreases in the levels of zinc & copper ($p<0.001$ & $p<0.0001$ respectively) when compared with control subjects (table below & fig. 1).

Table (1): **Levels of serum Zn and serum Cu compared with control subjects.**

	No.	Zn (mean ±SD)	Cu (mean ±SD)
Patients	12	0.75± 0.14	0.82 ± 0.09
Control subjects	20	1.02 ± 0.02	1.47± 0.31
p<value		<0.001	<0.0001

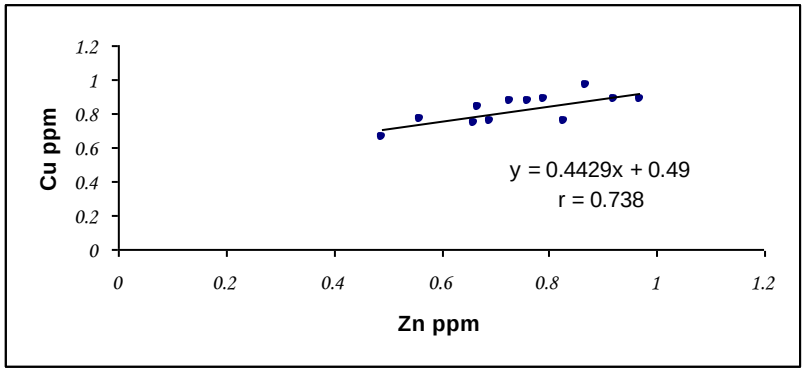

Figure (1): Levels of serum Zn and serum Cu compared with control subjects.

In other hand, direct strong correlation between Zn & Cu concentrations revealed in this study (r = 0.738) which is clearly shows in fig (2).

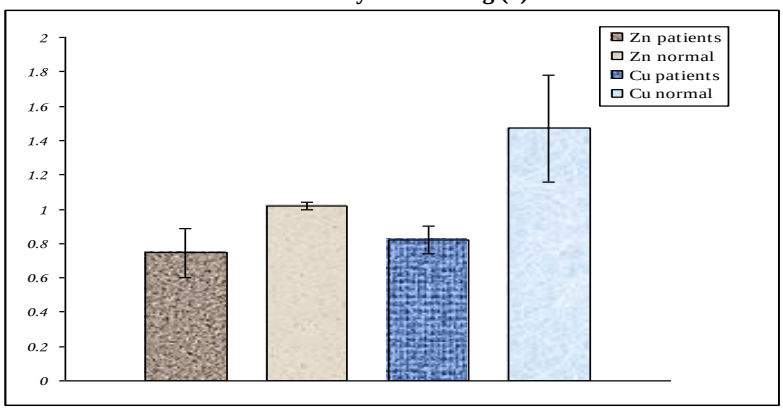

Figure (2): Correlation between Zn & Cu concentrations.

DISCUSSION:

In diagnosis of acute pancreatitis of special importance is determination of the activity of transamidinase, phospholipase A, lipase, concentration of copper, calcium and triglycerides in blood serum as well as laparoscopy with biopsy and local thermometry of the pancreas [10]. Zinc deficiency and its malabsorption have been previously described in patients with alcoholic pancreatitis [11, 12]. Metal ions are required as active components of several proteins, including pancreatic enzymes, and they can play important roles in the etiopathogenesis of acute pancreatitis. In the present study, we measured the concentrations of zinc (Zn) and copper (Cu) in both serum as markers of trace element status in acute pancreatitis. Serum Zn and Cu levels were very significantly lower ($p<0.001$ and $p<0.0001$, respectively) these findings were very similar to those of Ferahman M *et al.* [13] ; and other studies which determined zinc concentration in combination with other trace elements [14],or with Serum free prostate-specific antigen [15]. In addition, we correlate between Zn & Cu concentrations in this study and find a very strong direct correlation ($r = 0.738$). Our current findings raise the significance, of future research, verified the prognostic value of these trace elements in patients with acute pancreatitis.

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CONCLUSION:

These findings of Zinc & Copper levels suggest that altered minerals metabolism in serum may have contributed to the pathophysiology of acute pancreaitits.

REFERENCES:

1. Bradley EL: A clinically based classification system for acute pancreatitis. Arch Surg 128:586, 1993.
2. DiMagno EP, Chari S: Acute pancreatitis. Sleisinger and Fordtran's Gastrointestinal and Liver Disease: Pathophysiology, Diagnosis, Management, 7th ed. Feldman M, Friedman LS, Sleisenger MH, Eds. WB Saunders Co, Philadelphia, 2002.
3. Go VLW, Everhart JE: Pancreatitis. Digestive Diseases in the United States: Epidemiology and Impact. Everhart JE, Ed. (NIH Publication No. 94-1447.) U.S. Dept of Health and Human Services, Public Health Service, National Institutes of Health, Washington, DC, 1994.
4. Overweight and Obesity: Obesity Trends: U.S. Obesity Trends 1985–2004 (Online): Centers for Disease Control and Prevention, Atlanta, 2005 http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/index.
5. Norman J: The role of cytokines in the pathogenesis of acute pancreatitis. Am J Surg 175:76, 1998 [PMID 9445247]
6. Raraty MG, Connor S, Criddle DN, et al: Acute pancreatitis and organ failure: pathophysiology, natural history, and management strategies. Curr Gastroenterol Rep 6:99, 2004 [PMID 15191686]
7. Al-Bahrani AZ, Ammori BJ: Clinical laboratory assessment of acute pancreatitis. Clin Chim Acta 362:26, 2005 [Epub July 18, 2005] [PMID 16024009]
8. Lankisch PG, Schirren CA, Kunze E: Undetected fatal pancreatitis. Why is the disease so frequently overlooked? Am J Gastroenterol 86:322, 1991 [PMID 1705388]
9. Baillargeon JD, Orav J, Ramagopal V, et al: Hemoconcentration as an early risk factor for necrotizing pancreatitis. Am J Gastroenterol 93:2130, 1998 [PMID 9820385]
10. Dalgat DM, Magomaev MSh, Medzhidov RT, Kurbanov KM. Diagnosis and treatment of acute pancreatitis. Vestn Khir Im II Grek 1986 ; 136,29-33. Russian
11. Sullivan JF, O'Grady J, Lankford HG: The zinc content of pancreatic secretion. Gastroenterology 48: 438–443, 1965.[Medline]
12. Williams RB, Russell RM, Dutta SK, Giovetti A: Alcoholic pancreatitis: patients at high risk of acute zinc deficiency. Am J Med 66: 889–893, 1979.[Medline]
13. Ferahman M, Unal E, Sakoglu N, Ersoy YE, As A, Ozdemir S. Zinc and copper status in acute pancreatitis: an experimental study. Biol Trace Elem Res. 2003 ; 91,89-94(6).
14. Kashiwagi M, Akimoto H, Goto J, Aoki T. Analysis of zinc and other elements in rat pancreas, with studies in acute pancreatitis. J Gastroenterol 1995; 30,84-9.
15. Yavuz N, Unal E, Dogan M, Kiziler AR, Aydemir B, Titiz I. Serum free prostate-specific antigen and zinc levels in experimental acute pancreatitis. Biol Trace Elem Res. 2005; 106,205-9.