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Original Article

Assessment of Serum Zinc among Sudanese Patients with Acute Myocardial Infarction

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ABSTRACT:

Background: AMI is one of the leading causes of morbidity and mortality across the world. Zinc is important trace element and has important role as antioxidant element and cell membrane stability and there is paucity of information in the literature in this regard ;so this study was done to assess serum level of zinc in cases of AMI in Khartoum state. **Objective:** The aim of this study is to assess the level of serum zinc in patients with acute myocardial infarction an its correlation with cardiac markers. **Materials and Methods:** this study was performed at Sudan Center for Heart disease in Khartoum state , Sudan, during the period from February to October 2017.50 sample were collected from admitted patients with acute myocardial infarction as test group, in addition to other 50 sample from healthy volunteer sex and age matched as control group . the levels of serum zinc element were determined in both group by atomic absorption spectroscopy. **Results:** serum zinc levels were significantly lower in patients with acute myocardial infarction when compared with control group (0.351±0.08 versus 0.531±0.09, p = 0.000) in table 1.According to age groups of the test group there is insignificant difference in serum zinc and troponin T levels (P > 0.05) .Whereas across duration of infarction serum zinc level is significantly decreased in day 1(0.35 ± 0.08 versus 0.53 ±0.09, p = 0.000), day 2 (0.31± 0.05 versus 0.53 ±0.09, p = 0.000), and started to increase in day 3(0.39 ± 0.09 versus 0.53 ±0.09, p = 0.01), and serum zinc fluctuated to normal level in day 10 (0.50 ± 0.06 versus 0.53 ±0.09, p = 0.91) . The study observed insignificantly inversely correlated between serum zinc level with AST and LDH (P > 0.05).But significant inversely correlation with with serum CKMB and troponin T(r= - 0.28. p= 0.03and -r = 0.34,p = 0.001respectively). **Conclusion:** The study revealed reduced serum zinc level in patients with acute myocardial infarction, and significantly inversely correlated with cardiac markers CKMB and troponin T.

Key words: Acute myocardial infarction; AST, LDH CKMB, Cardiac Troponin T, Serum Zinc.

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INTRODUCTION:

Myocardial infarction is one of the dangerous manifestations of coronary artery disease and is one of the most common causes of mortality.[1] It has now become an important health problem despite advancement in diagnosis and management over the last few decades. The World Health organization estimated in 2004, that 12.2% of worldwide deaths were from ischemic heart disease.[1] Myocardial infarction (MI) occurs due to accumulation of lipids and fibrous elements in arteries.[2] The development of atherosclerosis depends on the balance between pro-inflammatory stimuli, anti-inflammatory, and antioxidant defense mechanisms.[3] Acute myocardial infarction should be diagnosed by two of three; ECG, patient history and the elevation in biochemical markers such as serum Troponin and CK-MB.[4] Cardiac Troponin I or Cardiac Troponin T are preferred biomarkers for diagnosis of myocardial injury.[5,6]

Zinc (Zn) is the second most common trace mineral in the body after iron and is present in every living cell .Zinc is found in nearly 100 different enzymes and as such is an essential building block for all life.[7] Trace elements are being increasingly recognized as essential mediators of the development and progression of MI.[8,9] Although there is no necessarily a direct cause–effect relationship between the development of MI and trace elements status, it is generally believed that the disturbances of the trace elements such as

zinc (Zn) and copper (Cu), are risk factors for MI.[10,11] The cell protective mechanisms including antioxidants prevent the cell from free radical in normal conditions thus preventing microscopic injuries in the inner lining of the arteries. As the trace element zinc play important role in the activation of superoxide dismutase (SOD) which has been linked to atherosclerosis.[12] Because the AMI is dangerous disease and considering the importance and the role of serum zinc level it worthful to investigate the relationship between serum zinc level with acute myocardial infarction and its markers.

MATERIALS AND METHODS:

Study population:

A case- control hospital base study was conducted at Sudan Center for Heart Diseases in Khartoum state, during the period from May to October 2017. Patients whom attended to the emergency unit with an acute myocardial infarction were included in this study.50 cases (males and females) aged from 50 to 70 years were included in this group. The control group (n=50), ages and sex matched healthy individuals (age range 50-70 years), none of them had a history of AMI.

Inclusion criteria:

Patients diagnosed with AMI (with high troponin I level over 0.04 ng/mL) were included in the study.

Exclusion criteria:

Patients with a previous history of AMI, ischemic heart disease, Diabetes mellitus, non-Q wave infarct, ECG showing left ventricular hypertrophy, bundle branch block, hypertension, alcoholic liver disease, hepatitis, cerebro-vascular episode and patients on supplemental zinc were excluded from the study.

Sample collection:

Blood samples were collected in a plain metal free glass bottles from patients whom met the inclusion criteria for the measurement of serum zinc level. The blood samples were allowed to coagulate and then centrifuged at 5000 RPM for 10 min. Then the serum obtained was separated and preserved at 2– 8°C until analyzed.

Measurement of zinc:

Serum zinc estimation was performed by atomic absorption spectrometry (AAS) method with Zeeman background correction (Z-2000 instrument, Hitachi, Japan). Certified reference material of human serum (Seronorm Trace Elements, Serum Level 1, 0903106, Sero AS, Norway) was used to test the accuracy of methods, in the Laboratory of National Center for Research-Khartoum

Quality control:

Sample representing the normal and pathological level of serum zinc, was used for assessment of the quality control. Result ±2SD of the target values of the control sera were accepted.

Statistical analysis:

Data was analyzed by computer software, by using SPSS program manual master sheet. The mean and standard deviation of zinc level was obtained, and the T- test was used for the comparison of zinc levels between the test and control group, and the mean difference is significant at $p \leq 0.05$, Correlation(r) between zinc level with age, troponin I level is considered to be statistically significant at $P \leq 0.05$.

RESULTS:

Total of 100 samples were enrolled in this study, of this 50 patients with acute myocardial infarction , with age range from 50 - 69 years in table 1 as test group . In addition to 50 healthy subjects as control group sex and age matched shown in table 1, male comprise 85% of the test group and the female were 15% in figure 1.

The serum zinc levels were significantly lower in patients with acute myocardial infarction when compared with control group (0.351±0.08 versus 0.531±0.09, p = 0.000) in table 2.

According to age groups of the test group there is insignificant difference in serum zinc and troponin T levels (P > 0.05) illustrated in table 3. Whereas across duration of infarction serum zinc level is significantly decreased in day 1(0.35 ± 0.08 versus 0.53 ±0.09, p = 0.000), day 2 (0.31± 0.05 versus 0.53 ±0.09, p = 0.000), and started to increase in day 3(0.39 ± 0.09 versus 0.53 ±0.09, p = 0.01), and serum zinc fluctuated to normal level in day 10 (0.50 ± 0.06 versus 0.53 ±0.09, p = 0.91) as shown in table 4.

In the test group of acute myocardial infarction serum zinc level is insignificantly inversely correlated with AST and LDH (P > 0.05). But significantly inversely correlated with CKMB and cardial troponin T (r = -0.28, p= 0.03 and r = -0.34,p = 0.001 respectively) as shown in table 5.

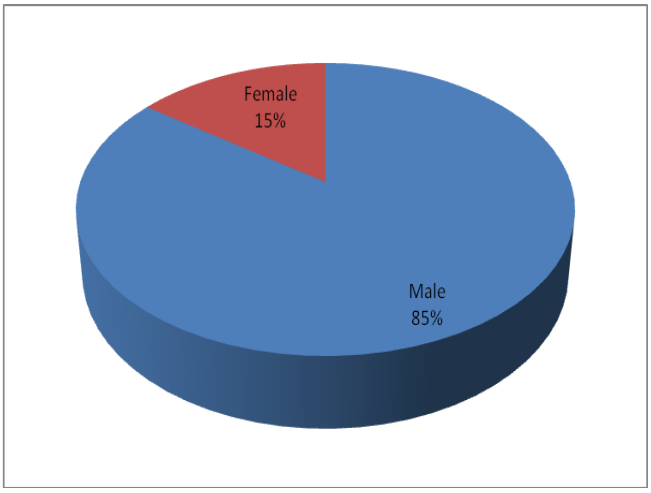

Figure 1: Percentage of patients according to gender in the test group

Table 1: show the minimum , maximum and mean of troponin and age of the case and control

Variables	Minimum	Maximum	Mean±SD
Age (years)	50.00	69.00	58.86±5.90
Troponin T	0.13	50.00	10.39±14.63

Table 2: Comparison of mean serum zinc (mg/dl) level in case with their control.

Groups	Mean±SD	P-value
Case	0.351±0.08	0.000
Control	0.531±0.09	

Table 3: Mean of serum zinc and troponin T across the age of the test group

Parameters	50-59 years (Mean±SD)	60-69 Years (Mean±SD)	P-value
Zinc (mg/dl)	0.36±0.09	0.34±0.08	0.624
Troponin	9.8±7.2	11.2±9.4	0.752

Table 4: Comparison of serum zinc level according to duration of infarction in the study group with their control group

Duration	Test group	Control group	p value
Day 1 (M±SD)	0.35± 0.08	0.531±0.09	0.000
Day 2 (M±SD)	0.31± 0.05	0.531±0.09	0.000
Day 3 (M±SD)	0.39 ± 0.09	0.531±0.09	0.01
Day 10 (M±SD)	0.50 ± 0.06	0.531±0.09	0.91

(M± SD) = mean plus standard deviation of serum zinc level

Table 5: Correlation of serum zinc level with AST, LDH,CKMB, and troponin T levels in the study group

Parameter	Statistic	AST	LDH	CKMB	Troponin T
Zinc (mg/dl)	Person correlation	-0.13	-0.9	-0.28	-0.34
	Significant (two tail)	0.6	0.11	0.03	0.001

Correlation is significant at $p \leq 0.05$
Correlation is significant at $p \leq 0.01$
Correlation is significant at $p \leq 0.001$

DISCUSSION:

Acute myocardial infarction (AMI) remains the most common cause of death world-wide. It results from myocardial cell death that occurs as consequence of the imbalance between the coronary blood supply and the requirements of the myocardial.[1,3] Many oxidative factors play a major role in the mechanism of AMI. Zinc is important antioxidant microelement in the body and zinc homeostasis plays essential role in maintaining cellular structure and function. Disturbance of Zinc level may contribute to many disorders, such as cardiovascular disease.[10- 12]

Numerous studies highlight the relationship between serum zinc level and prevalence of acute myocardial infarction The current study demonstrated significant reduction in serum zinc level in patients with acute myocardial infarction This finding is consistence with studies conducted by Lei Huang et al (2018).[13] and Wendy et al (1976)[14], whom deduced significant low serum zinc level in the patients with acute myocardial infarction. Shafqat et al (2013)[15], performed prospective case control study including ischemic subjects without myocardial infarction and ischemic subjects with infarction and illustrated that decreased serum zinc levels are associated with coronary artery disease especially the acute myocardial infarction. Sangyong et al (2018)[16], in review study concluded that zinc have antioxidant and anti-inflammatory effects.

In meta-analysis conducted by Liu et al (2015)[17], the authors illustrated that the patients with myocardial infarction had lower serum zinc level when compared with healthy control subjects. The concentration of zinc in extracellular and intracellular is correlated with the status of the cardiovascular.[18,19] However the exact mechanism that explain the relationship between zinc status and cardiovascular disorders is obscure. Furthermore zinc is antioxidant element and have anti-inflammatory effect, during AMI its up taken by the liver and other organs, the polymorph leucocyte endogenous mediator release humoral factor in response to tissue injury, which increase zinc consumption by the liver and decrease serum zinc level.[20]

In the present study according to age groups of the test group there is insignificant difference in serum zinc and troponin T levels ($P > 0.05$) in the study group when

compared to control group . Whereas across duration of infarction serum zinc level is significantly decreased in day 1, day 2 , and day 3,and fluctuated to normal level on day tenth. In accordance to Jain et al(91991)[21], whom observed decreased serum zinc level in the first to fourth day of the myocardial infarction and return to normal level by the fourteenth day. Foster et al (2011).[22] demonstrated that serum zinc level may alter over time with process associated with AMI.

Our study observed that serum zinc level is insignificantly inversely correlated with AST and LDH .But significantly inversely correlated with CKMB and cardial troponin T in patients with acute myocardial infarction. This agree with finding obtained by L.Huang et al (2018) [(23)] ,whom revealed a relationship between serum zinc level in that zinc levels were significantly inversely correlated with serum creatinine (kinase CK), CKMB, and cardiac troponin T, and the prevalence of acute myocardial infarction decreased with increasing serum zinc quartiles.

CONCLUSION: Serum zinc level is significantly lower in patients with acute myocardial infarction,and negatively correlated with cardiac markers**.**

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