Selenium Status and Echocardiographic Parameters in Iraqi Patients with Idiopathic Dilated Cardiomyopathy

Basil O.M. Saleh.* Lewai S. Abdulaziz ** Thair I. Al-Bajjar **

ABSTRACT:

BACKGROUND:

It has been speculated that trace elements may play a role in the pathogenesis of dilated cardiomyopathy (DCM) .In the present study, we aimed to assess serum concentrations of selenium (Se) in Iraqi patients with idiopathic dilated cardiomyopathy (IDC) and to evaluate the correlation between serum Se concentrations and echocardiographic parameters.

METHODS:

This study included 28 patients with IDC and 22 healthy controls .Serum level of selenium was measured by atomic absorption spectrophotometry method .Echocardiographic parameters including left ventricular end diastolic diameter (LVEDD), LV end- systolic diameter (LVESD) ,and LV ejection fraction (LVEF) were measured in all patients with IDC in order to evaluate its correlation with serum Se concentrations.

RESULTS:

Serum concentration of Se in IDC patients was significantly lower than in healthy controls ($p<0.001$).Relationships of the serum Se levels with echocardiographic and clinical parameters were not statistically significant.

CONCLUSION:

The present study confirmed that IDC is associated with decreased serum Se concentrations. This change in Se may play an important role in the pathogenesis of myocardial damage in IDC.

KEY WORDS: Selenium, echocardiographic parameter, idiopathic dilated cardiomyopathy.

INTRODUCTION:

Idiopathic dilated cardiomyopthy (IDC) is a disease of unknown cause that results in an enlarged heart that does not pump properly .It is the most cause for people to get heart transplantation [1]. Cardiac chambers may be dilated and hypertrophied .Dilatation is more pronounced than hypertrophy, and the left ventricle (LV) is affected more often than the right ventricle (RV) [2]. Selenium (Se), a trace element is an essential micronutrient for organisms ranging from bacteria to humans. Most of the Se in tissues is present in two forms, selenocysteine and selenomethionine [3]. The principal dietary forms of Se are selenoaminoacids. Selenomethionine is derived from plants and selenocysteine from animal sources. the major function of Se in human body is as antioxidant at the cellular level ,providing protection against the reactive oxygen species (ROS)damage and oxidant stress[ROS include; superoxide anion(O2) hydrogen peroxide(H2O2),and hydroxyl radical (OH)] [4] . One of the best characterized roles of Se in mammalian systems is its incorporation into the Active site of the enzyme glutathione peroxidase (GSHPX) in the cytosol and mitochondria, which protects biomembranes against destruction [5] .Erythrocyte GSHPX contains four Se atoms in the from of selenocysteine that are essential for its biological activity. GSHPX catalyze the breakdown of H2O2, phospholipid hydroperoxides and other free hydroperoxides. In long term Se deficiency all body tissues show decreased GSHPX activity [6]. Therefore trace elements like Se,Zn and Cu have an antioxidant function in many essential enzyme system [7]. In the lack of these enzymes, such as GSHPX, O2, react with (H2O2) to from OH- and cause lipid peroxides and destruction of cell membrane [8] . Increased ROS production can result in myocyte hypertrophy, apoptosis and interstitial fibrosis which may contribute to the development of depressed cardiac function and progression to heart failure [9]. GSHPX (Selenium-containing protein) not only functions by removing H2O2 formed after the superoxide dismutase (SOD) catalyzed dismutation reaction but also detoxifies the lipid hydroperoxides [10].

Therefore, Se deficiency has been implicated as a contributory factor in some cases of congestive cadiomyopathies and increased cardiovascular complications [11]. In China, such deficiency has been involved in the pathogenesis of keshan disease, a well-described cadiomyopathies [12]. Iatrogenic causes of Se deficiency include parenteral and enteral nutrition. Low plasma Se is

* Physiological Chemistry Department, College of Medicine, University of Baghdad.

** Biochemistry Department , Al-Kindy College of Medicine, University of Baghdad.

also found in malabsorption, cystic fibrosis, and other varied clinical disorder [13]. The Se content of foods varies widely and is directly related to food protein content and the soil Se content in the area where the food was produced. The recommended daily intake of Se for men and women is 70 and 55 µg/day, respectively [6]. The aim of this study is to evaluate the status of Se in Iraqi patients with IDC and to investigate potential relation between serum Se conencentrations and the echocardiographic parameters.

SUBJECTS AND METHODS:

We studied 28 patients with idiopathic dilated cardiomyopathy (IDC)(21 males,7 females, mean age 48.64 +13,36 years) who were admitted to Teaching Medical Hospital and Ibn-Albitar Hospital in Baghdad .The control subjects in this study included 22 healthy volunteers(14 males,8 females ,mean age 41.91+10.07 years).

The diagnosis of IDC was based on the WHO/ISFC criteria (14). It was made when the echocardiogram showed a LV ejection fraction (less than 50%) in the absence of angiographic coronary artery disease. Patients were excluded from the study if they had a history of primary valvular disease, severe hypertension, heavy alcohol abuse or other known causes of dilated cardiomyopathy (DCM).

All patients were being treated with diuretics; most were receiving digoxin and an angiotensin converting enzyme inhibitor. There was no clinical history suggestive of cancer, underlying infection, and inflammatory disease.

METHOD:

Five milliliters of a blood sample was aspirated from peripheral vein of each patient and control subject and was transferred to plain test tube, left to clot and then centrifuged for 10 minutes at 3000 r.p.m. . The clear serum was stored at -20 ºC until used for measurement of the concentration of selenium (Se). Analyses of serum samples were carried out by using furnace atomic absorption spectrophotometry (AA 670). Serum samples were diluted (1:4) with deionized water and measurement directly at 196 nm.A standard curve was made from dilution of 1mg/m1.

Echocardiographic Evaluation:

Echocardiographic parameters including; left ventricular end diastolic diameter (LVEDD) ,LV end-systolic diameter (LVESD) and (LV ejection fraction (LVEF) were measured in all IDC patients by consultant cardiologist of echocardiographic unit by M-mode echocardiography.

Statistical analysis:

SPSS version 6 for window was used for all statistical analysis. Statistical significance was assessed by ANOVA, and student t-tests .

The linear regression test was applied for the correlation between different parameters and the significance of the r-values were checked using t-test. P-values of less than (0.05) was considered significant.

RESULTS:

Table 1: summarizes the mean (±SD) on serum levels of Se element in the IDC patients and in the controls. The mean (±SD) serum Se level in the healthy controls of present study was 97.68±2.15 ng/m1. Patients with IDC had lower serum Se concentrations than the controls (p< 0.001).

Table 1: Clinical Data and Serum Selenium (Se) Concentration in Patients with IDC and in Healthy Controls.

Parameters	IDC patients n=28	Controls n=22	P-value
Sex(M/F)	21/7	14/8	
Age (years)·	48.64.±13.3 6	41.91±10.07	<0.05
Weight (kilograms)·	79.11±10.0	74.59±6.20	<0.05
Duration(months)·	28.95±26.52		
Serum Se (ng/ml)·	59.93±7.92	97.68±2.15	<O.OO1
Values are means ± SD			

Table 2 revealed the mean (±SD) value of the measured echocardiographic parameters including LVEF (%), LVEDD and LVESD in patients with IDC. Correlation analysis, showed that serum Se concentration did not related to the echocardiographic parameters (for all, p >0.05, Table 3).

Table 2: Echocardiographical data of patients with IDC

Parameters	IDC patients (n=28)
LVEF (%)	33.43±8.74
LVEDD(mm)	69.05±9.43
LVESD(mm)	56.49±10.12

Values are means ±SD

LVEF- left ventricular ejection fraction, LVEDD - left ventricular end-diastolic diameter, LVESD - left ventricular end-systolic diameter.

Table 3: Correlation of serum Se concentration and echocardiographicparameters in IDC patients

Variables	Selenium(se)	
	r	P-value
LVEF	-0.16	NS
LVEDD	0.17	NS
LVESD	0.06	NS

NS- not significant.

The percentage of cases with serum Se levels below the normal reference range (<50 ng/m1) is 11% (3 of 28 patients).

DISCUSSION:

The mean Se serum level in Iraqi healthy controls of present study (97.68±2.15 ng/ml) was higher than that reported by Abbas, 2007 [15] who recorded mean serum Se level in northern Baghdad subjects around 87.0±3.0 ng/ml (mean ±SD). This difference may be interpreted depending on the region from where the control samples are collected. The Se supply found in the population depends on it's presence in the soil and in the food chain. Its nutritional status in human populations is related to geography [16]. In the present study we showed that patients with IDC had lower serum Se concentration compared to healthy subjects. This finding is similar to that of the previous studies [8, 17, and 18]. Nutritional factors such as inadequate intake and malabsorption of vitamins and trace elements, may contribute to the development of various heart diseases. Moreover, these diseases can be prevented by adding the adequate nutritive supply [8]. The keshan disease, a cardiomyopathy in China is characterized by the presence of multifocal necrosis and fibrous replacement of the myocardial tissue [8].The Keshan disease is due to Se deficiency in the diet and has been controlled with oral replacement of sodium selenit [19]. Additionally, many recent studies have been proposed that there is an association between serum Se status and various heart diseases such as cardiomyopathy and heart failure [8, 17, 18].

Trace elements are known to have a key role in myocardial metabolism. Trace elements such as Se may be protective against heart diseases [8, 20].

On the other hand the Se deficiency causes cardiomyopathy. As a result of the depletion of essential enzymes such as GSHPX ,which protect cell membranes from damage by ROS .Therefore ,one of the important biological function of the Se is antioxidant ,GSHPX, selenoenzyme ,reduces the production H2O2 and O2 ,therefore diminishing the propagation of free radicals and ROS [8]. It has been reported that GSHPX reduced chamber dilatation and dysfunction as well as myocyte hypertrophy, apoptosis and interstitial fibrosis of myocardium [10]. Hypothetically, such enzyme may reduce myocardial damage by inhibiting the reactive and injurious H2O2 and superoxide anion [8, 21]. In addition, the role of the trace elements such as Se, Cu and Zn in the syntesis of proteins and collagen and maintaining collagen integrity is well established and deficiencies of such elements have been shown to lead to myocardial friability and necrosis [8]. Of the results of the present study is no correlation between serum Se levels and echocardiographic parameters including LVESD, LVEDD, and LVEF .The results are similar to that

reported by previous studies [8, 22]. However, three patients with IDC (11 %) of the present study had serum Se levels (< 50 ng/ml), which we consider significant, because such levels have already been reported as sufficient to induce myocardial dysfunction [21, 23].

This finding raises the question of the possible benefit of Se replacement in patient with LDC refractory to conventional therapeutic schemes.

CONCLUSION:

This study confirmed that Iraqi patient with IDC have had decreased serum Se concentrations .This change in Se serum concentration may play an important role in the pathogenesis of myocardial damage in IDC. Further studies are required to evaluate the effect of an appropriate dose of an oral Se supplement in such patients, in particular, those of an early diagnosis.

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