SELENIUM LEVEL IN PATIENTS WITH DILATED CARDIOMYOPATHY
A POSSIBLE ETIOLOGICAL FACTOR
قياس مستوى السلينيوم في مرضى اعتلال عضلة القلب التوسعي
واحتمال كونه عامل مسبب

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Summary:

Selenium is essential micronutrients for development and growth as well as being necessary for the immune system and as an antioxidant defense.
The best-known biochemical role of selenium is through it's selenocysteine residue, which is an essential element of an enzyme glutathione peroxidase, involved in the removal of hydrogen peroxide molecules, produced during the lipid oxidation process in the cell, thereby protecting proteins and unsaturated phospholipids from the deleterious effects of free radicals.
The aim of this study was to determine the level of selenium in patients with dilated cardiomyopathy.
Estimation of serum selenium was done for Sixteen patients (eight males, eight females) who had dilated cardiomyopathy and in 16 age and sex matched healthy control group. Hydride generation atomic absorption spectrophotometric method was used.
Their ages range from 35 to 68 years with an average of 50±11 years).
The serum selenium level was markedly lower in pts group (40±10.4mcg\l) Vs (87±11mcg\l) in control group. This was statistically highly significant (P value less than 0.0001).
Serum selenium was lower in pt groups than in controlled group in both sexes.
In conclusion: This study shows a significant reduction in serum concentration of selenium in pts with dilated cardiomyopathy.
We recommend to supply those pts with selenium, and to study its effect on cardiac function.

Key words: cardiomyopathy, selenium deficiency

الخلاصة:

السلينيوم عنصر غذائي أساسيُ للتَّطوّر والنّمو وأيضا يَكُون ضرورة للنّظامِ المنيع وكمدافع ضد التأكسد.
إنّ الدّورَ الكيماوي الحيوي المَعْرُوفَ الأفضل للسلينيوم كسلينيوسيستين ، أنْ يَكُونَ جزءَ الموقع النّشيطِ للإنزيم ,كلوتاثيون بروكسيديز الذي تَضمّنَ في إزالةِ جزيئاتِ بيرو كسيد الهيدروجين الناتج خلال عملية أكسدةِ الشحوم في الخليةِ لذا تَحْمي بروتين والشحوم المفسفرة غير المشبّعة من التّأثيراتِ الضارة للجذور الحرّة للأوكسجين .
هدف هذه الدّراسةِ كَان قياس مستوى السلينيوم في المرضى المصابون بالاعتلال عضلة القلب التوسعي .
تم قياس مستوى السلينيوم في مصل المرضى المصابون بالاعتلال القلبي التوسعي في 16 مريض (ثمانية منهم إناثَ) وفي 16 شخص متناظرين بالعُمر ،والجنس كمجموعةِ سيطرةِ صحّيةِ.تم استخدام طريقة الامتصاص الذري اللهيبي لتحرير الهيدريد .
كانت أعُمارهم تتراوح من 35 إلى 68 سنةِ (أي بمعدلِ 50 ±11 سنةِ انحراف معياري).
أظهرت هذه الدراسة أنحفاض هام في مستوى السلينيوم في مجموعة المرضى منه في مجموعة السيطرة حيث كان((40±10.4mcg\l) في مجموعة المرضى و (87±11mcg\l) في مجموعة السيطرة. وكان هذا الانخفاض ذو دلالة معيارية هامة.لذا نقترح تزويدهم بالسلينيوم ودراسة تأثير ذلك على وظيفة قلبهم .

INTRODUCTION:

Selenium is essential micronutrient for development and growth as well as being necessary for the immune system and as an antioxidant defense. [1,2] Biologically active selenium is usually incorporated into protein as selenocysteine. [3] The best-known biochemical role of selenium is through it's selenocysteine residue, which is an essential element of an enzyme glutathione peroxidase, involved in the removal of hydrogen peroxide molecules, produced during the lipid oxidation

process in the cell thereby protecting proteins and unsaturated phospholipids from the deleterious effects of free radicals [4]

The oxidative stress, which alters the balance between the higher activity of oxygen and the enzymatic or nonenzymatic protection systems, may be one of the causes that starts and aggravates a disease because the free radicals may damage the cell membrane or macromolecules such as DNA. [5]

Dilated cardiomyopathy is a disease of unknown etiology, characterized by impaired systolic function of the heart ,and increase in the volume of one or both ventricles.[6]

Selenium deficiency has been implicated in the etiology of non-cardiac [7,8], as well as cardiac diseases, [9-13]. Dietary selenium deficiency represents an etiological factor in "Keshan disease", a distinct form of an endemic cardiomyopathy in china.[10] Numbers of cases also reported in western countries mainly in pts receiving parenteral nutrition[8] or cases with multiple trauma. [14] It also reported in women with peripartum dilated cardiomyopathy in Africa. [15]

Selenium deficiency occurs in many regions of the world [3], study from Saudi Arabia shows selenium soil samples was low, and in some farms, the selenium content of alfalfa approached that in the low-selenium zone in China. This may be reflected in the dietary se-intake level of the Saudi population with an increased risk for developing selenium deficiency-associated diseases. [4]

The highest value of selenium enzyme glutathione perioxidase have been found in protein foods (meat and Fish) and to less extent in vegetable.[2]

The aim of this study was to determine whether selenium deficiency would be observed in patients with dilated cardiomyopathy, and to discuss it's possible role in the etiology of the disease.

Patients and methods:

Sixteen patients (pts) who had dilated cardiomyopathy were included in this study, eight were females. Their ages range from 35 to 68 years with an average of 50±11 years. The study was conducted in Basrah general and Sadam teaching hospital in Basrah governate.

Complete history and full physical exam were performed. Investigations requested included chest X-ray, electrocardiography, and echocardiography. Both M Mode and 2-D echocardiography with 2-4 MHZ sector probe was done with patient in supine and lateral decubitus position. Apical 4 chamber, long axis and short axis views were studied. The following parameters were measured :left atrium dimension (LAD), aortic root dimension (AOD), left ventricular end diastole dimension (LVEDD), left ventricular end systole dimension (LVESD), right ventricular dimension (RV) , Ejection fraction (EF), and stroke volume (SV). **.** All measurements were made according to the recommendations of the American Society of Echocardiography [16]

Diagnostic criteria for dilated cardiomyopathy was taken as left ventricular dilatation, global hypokinesia of LV with impaired systolic function (ejection fraction less than 40%) in the absence of valvular, congenital, hypertensive, or ischemic heart disease.[17]

Estimation of serum selenium was done for all patients and for the matched age and sex controlled healthy group, by using a hydride generation atomic absorption spectrophotometric method. The instrument conditions had been optimize such as using reducing agent 15 NaBH4, flow rate of N2 2L\min, sample volume 1ml,lamp current 10mA,slit b and with 9.5 A, Shimadzu AAS mode 637. All analysis were performed at least four runs, extreme caution was exercised to ensure no contamination. Previous analysis of quality controlled selenium sampled according to described procedure in the laboratory of college of science was confirmed high reliability of this assay.

Chi-square test was used for statistical analysis. Differences were considered statistically significant if the P value was less than 0.05.

RESULTS:

Sixteen patients who had dilated cardiomyopathy, and 16 age and sex matched controls were studied for the period from Jan 2001 to Jan 2002. Their ages range from 18 to 62 years with an average of 49.9±9.9 years. The majority of patients presented in advanced stages of heart failure (New York Heart Association class III eight (50%) patients, and class IV 4(25%) patients)

Their average LVDD was 62.64±8.36mm, LVSD 53.64 ± 9mm and an ejection fraction of 0.28±0.07 (See table I)

The ECG changes were abnormal in 8 (50%) patients, atrial fibrillation were seen in 5 (31.25%) patients, ventricular ectopics in 2(12.5%) patients and left bundle branch block in 1(6.25%) patient.

The serum selenium level was markedly lower in pts group (40±10.4 mcg\l) Vs (87±11mcg\l) in controlled group. This was statistically highly significant (P value less than0.0001). Serum selenium was lower in pts group than in control group in both sexes. It was 39±1o.6 in-patients Vs 95±14 mcg\l in control group in males, and 43±10.2 mcg\l in pt group Vs 79±8.3 mcg\l in control group in females. These differences were statistically highly significant. (P value less than 0.0001). (See table II)

There was no significant difference among sexes in pt groups (39±10.6 in males Vs 43 ± 10.2 mcg \l in females) (p value was >0.005).

The serum selenium concetration distributions in most pts were at the levele of 31 to 50 mcg\l and in both sexes.(See figure II& III)

DISCUSSION:

This study has shown that serum selenium level was markedly lower in pts with dilated cardiomyopathy group (40±10.4 mcg\l) than in control group (87±11mcg\l). This was statistically highly significant (P value less than0.0001).
This was in consistence with other studies [18-19], but in contrast with Fawzy ME et al of Saudi Arabia who showed no significant difference [19], although Alsaleh AI et al has shown that the soil selenium level in Saudi Arabia was very low approaching to that low level of selenium zone in china [4].

Their was no significant different among sex in selenium level in pts group, this was consistent with other study [19]

The average serum selenium level in our control group was 87±11mcg\l, despite there was no previous study to determine the normal serum selenium in our country but this was consistent with an average level in different studies in other countries (The plasmatic values of Spanish people was 87 ± 14 mcg/l and the European average was 85 mcg/l). [2]Selenium deficiency had been implicated in the etiology of cardiac and non-cardiac diseases [9-13].

The biochemical effects of selenium depletion in the myocardium are, however, not yet known. Study on rats carried out in China, showed that mice fed diets composed of low selenium ingredients from a Keshan disease area suffered more extensive heart damage when infected with a coxsackie B4 virus than infected mice fed the same diet but supplemented with selenium by esophageal intubation [20]

Regitz-Zagrosek-V suggested that selenium deficiency affect myocardial energy metabolism and contractile proteins.[11]

Moriaki I et al speculated that the midmural fibrosis of left ventricle is characteristic change of cardiomyopathy related to selenium deficiency [17]. While Johnson et al described an "occidental" patient in whom Selenium deficiency was associated with dilated cardiomyopathy; autopsy showed subepicardial fibrosis [18]

The importance of identifying selenium deficiency as the underlying cause of dilated cardiomyopathy was reported in large prospective, placebo controlled study conducted in china.[21]

The daily requirements of elemental selenium remains controversial. Thus, although dietary selenium intake of 40 mcg\l is considered as adequate for prevention of Keshan disease, higher intake of 50-200mcg \day.[22] or even 400-600mcg\day have been recommended for treating active conditions.[23]

Conclusion:

The present study has shown a significant reduction in serum concentration of selenium in pts with dilated cardiomyopathy. Which probably indicates a role of selenium deficiency in the etiology of disease in our pts.

Further study is recommended to study the effect of selenium supplementation on cardiac function in pts with dilated cardiomyopathy and selenium deficiency.

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TABLE 1 AOD, LAD, RVD, LV size and function in the studied patients

AO	**27.85±5.11**	**EF**	**28.42±7.43**
La	**30.79±6.73**	**SF**	**14.36±4**
LVDD	**62.64±8.36**	**RV**	**36±3**
LVSD	**53.64 ±9**		

Table II Average serum selenium concentration in the different groups

Sex of pt	Average serum selenium conc. Pt group	Average serum selenium conc. Control group	**P Value**
Male	**39±10.6**	95±**14**	**<0.001**
Female	43±**10.2**	79 ± 8.3	**<0.001**
Both sex	41± **10.3**	87±**11**	**<0.001**

Figure 1Distributions of pts according to selenium concetration range

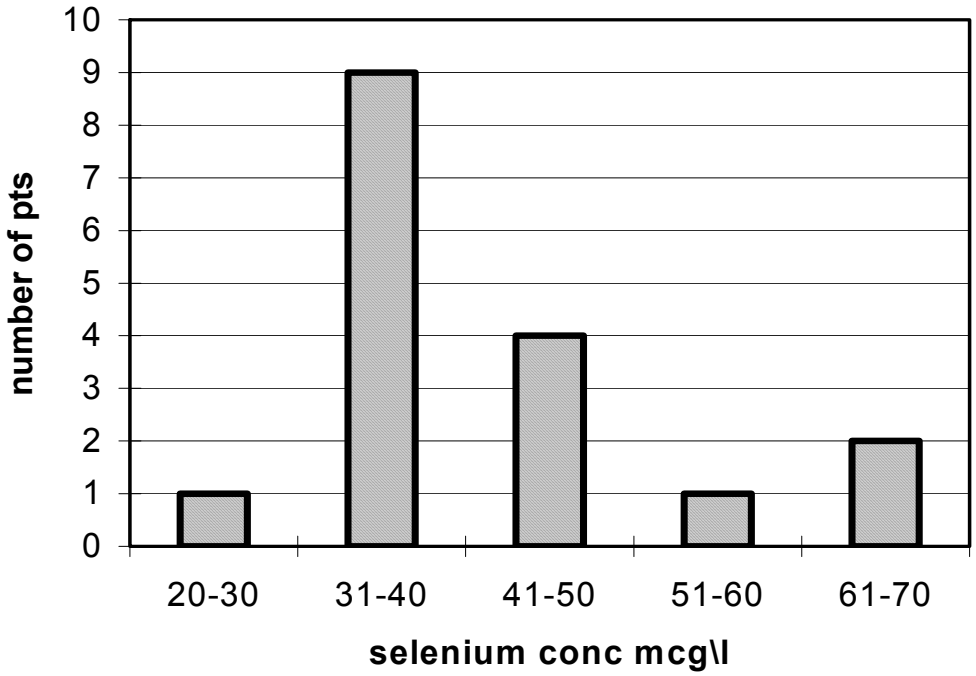

figure 2 The distribution of serum selenium concetration among sexes