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Serum Creatine Kinase Activity in Thyroid Disorders.

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ABSTRACT

There are studies recognising a pattern of alterations of the serum enzymes in thyroid disorder. One such enzyme is creatine kinase the concentration of which is often increased in primary hypothyroidism. Hence, This study is taken up to identify the same in south Chennai population attending Sree Balaji Medical College & Hospital. To study the concentration of serum creatine kinase (CK) in thyroid disorders and to analyze their association in comparison with control. A total of 50 subjects including 30 patients, with thyroid disorders (20 hypothyroid and 10 hyperthyroid) attending the O.P.D. of Sree Balaji Medical College & Hospital and 20 healthy age and sex matched controls were studied. The Serum T3, T4 and TSH were measured to identify the thyroid disorders. Serum creatine kinase activity was measured to correlate the association with the thyroid function. Data collected was analysed using SPSS package. In hypothyroid patients with decrease in serum T3, there was a significant elevation in CK and findings were reversed in hyperthyroid patients. Serum creatine kinase activity demonstrates an inverse relationship with thyroid activity. All the hypothyroid patients show a significant elevation of creatine kinase activity over the upper limit of the reference interval. By contrast in hyperthyroidism, the serum CK activity tends to be at the lower end of the reference interval. This may be attributed to the effect of thyroid hormone on muscular contraction requiring energy released by creatine kinase. T3 being low, the muscle becomes weaker and strenuous effort leads to damage of muscle cells resulting in leakage of creatine kinase into circulation. There is an inverse relation in the serum levels of T3 and CK in thyroid disorders, especially in hypothyroid conditions. Hence the estimation of serum CK levels will be useful in screening for hypothyroid patients.

Keywords: Hyperthyroidism, hypothyroidism, serum creatine kinase

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INTRODUCTION

Creatine kinase being an important enzyme of muscles for energy release, the serum creatine kinase (CK) activity in healthy individuals is dependent on many factors like age, race, lean body mass and physical activity. It is also an important clinical marker for muscle damage. Musculoskeletal disorders often accompany thyroid dysfunction. The association of myopathy with both myxedema and thyrotoxicosis is well known [1]. Concentrations of CK in serum are often increased in patients with primary hypothyroidism [2,3], but evidence for any change in thyrotoxicosis is conflicting. Some authors [4] reported normal and others subnormal [5] CK activity in patients with thyroid dysfunction.

In recent years studies have been conducted to establish a relationship of CK activity in thyroid diseases [6]. However, no correlation has been consistently described so far between CK activity and circulating concentrations of either T_3 , T_4 , or TSH [7-9]. This study is an attempt to correlate and substantiate their association.

Aim and Objectives

- To estimate the concentration of serum creatine kinase (CK), T_3 , T_4 , and TSH in healthy subjects and in thyroid disorders.
- To analyze the association between the activities of CK, T_3 , T_4 , and TSH in comparison with controls.

MATERIALS AND METHODS

The present study was conducted on 50 subjects including 30 patients, out of which 20 were hypothyroid and 10 were hyperthyroid attending the O.P.D. of Sree Balaji Medical college and Hospital & 20 healthy age & sex matched control. After obtaining the informed consent from the subjects, the fasting venous blood samples were collected by standard aseptic techniques. Serum was separated for the various assays. Serum T_3 , T_4 and TSH were measured by chemiluminescence Immuno sorbent assay (CLIA) using Siemes kit. Serum creatine kinase activity was measured by kinetic method using Mindray kit in autoanalyzer. Data collected were analysed using SPSS package.

Inclusion Criteria: Age group- 20-60 yrs of age

Exclusion Criteria: Patients with muscular disorders, cardiovascular manifestations, those on drugs that could alter the CK enzyme.

RESULTS

The mean values of T_3 and T_4 in hypothyroid patients were 32.23 ± 7.13 ng/dl and 5.47 ± 0.74 mg/dl respectively. TSH levels were 20.11 ± 2.27 mIU/l. The mean values of T_3 and T_4 in hyperthyroid patients were 191.54 ± 8.64 ng/dl and 15.19 ± 1.32 mg/dl respectively. Their TSH level was 0.31 ± 0.13 mIU/l. The mean value of T_3 and T_4 in control patients was 60.46 ± 13.18 ng/dl and 7.43 ± 1.26 mg/dl, respectively. TSH level was 2.52 ± 0.84 mIU/l. The CK values in the three groups were 184.5 ± 41.02 , 59.9 ± 7.69 and 90.95 ± 10.87 IU/l in hypothyroid, hyperthyroid and normal individuals, respectively as shown in the table 1. On comparison with control group, the ck levels show significant elevations in hypothyroid patients, significant reduction in hyperthyroid patients with a positive correlation with TSH.

Table1: Thyroid function tests and serum ck levels in patients and controls

Parameter	Control N=20	Hypothyroid N=20	Hyperthyroid N=10
T_3 (ng/dl)	60.46 ± 13.18	32.23 ± 7.13	191.54 ± 8.64
T_4 (mg/dl)	7.43 ± 1.26	5.47 ± 0.74	15.19 ± 1.32
TSH(mIU/L)	2.52 ± 0.84	20.11 ± 2.27	0.31 ± 0.13
CK(IU/L)	90.95 ± 10.87	184.5 ± 41.02	59.9 ± 7.69

Table 2: CK in control, hypothyroid

CONTROL	HYPOTHYROID	P Value
90.95± 10.87	184.5 ± 41.02	<0.0001*

*Highly significant

Table 3: T4 and CK in control, hypothyroid, hyperthyroid

CONTROL	HYPERTHYROID	P Value
90.95± 10.87	59.9± 7.69	<0.0005*

*Highly significant

DISCUSSION

The findings of this study confirm that elevated serum CK activity is frequently increased in hypothyroidism and decreased in hyperthyroidism. This study also indicates that CK activity correlates with the degrees of hypothyroidism and hyperthyroidism, as evident by the magnitude of the TSH. Elevated serum CK activity was observed in hypothyroid patients, and was higher in patients with overt hypothyroidism, and less so in subclinical hypothyroid patients. These findings are in accordance with those of other studies, which report a 43% to 97% elevation of serum CK activity in hypothyroidism: Beyer *et al*, 43% [10] Giampietro *et al*, 90% [7] and Soufir *et al*, [11] 97%. This is in contrast to the findings of Hartl *et al*, who found an elevation of CK activity in only 2 of 69 patients (3%), one with overt and one with subclinical hypothyroidism [12]. The finding of decreased CK activity in patients with hyperthyroidism compared with controls is in accordance with other studies [4,13].

Various mechanisms have been proposed as causing elevated CK activity in hypothyroidism, hypothyroidism is associated with myopathy in many patients. The hypo-metabolic state of hypothyroidism can cause a reduction in glycolysis and oxidative phosphorylations and thus reducing adenosine triphosphate (ATP) concentrations beyond a critical limit. The alteration in sarcolemmal membranes can cause increased cell permeability and the leakage of CK from cells. There may be reduced turnover of CK because of hypothyroidism, allowing serum activities to rise generating a marked release of CK through the altered sarcolemmal membranes [14-16].

Our finding of lower CK activity in hyperthyroidism, is in accordance with other reports [4],[13] and suggests that in the hypermetabolic state there may be increased enzyme degradation which may have contributed to these low CK activity.

Limitations of the Study

Need to be done on a large scale to determine the effective usage as a diagnostic marker. Isoenzyme analysis may help in identifying the specific thyroid association ruling out the cardiac involvement.

CONCLUSION

The study found an inverse relation in the serum levels of T3 concentration and serum CK activity in thyroid diseases. In hypothyroid patients with decrease in serum T₃ concentration, there is a significant increase in CK activities. There is much reduction in CK level in hyperthyroid patients. Hence estimation of serum ck levels can be used for screening hypothyroid patients and to lesser extent in hyperthyroid patients. Thus the estimation of serum CK levels will be extremely valuable in screening for hypothyroid patients than hyperthyroid patients.

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