Original Research Article

Study of liver enzymes and creatine phosphokinase in hyperthyroidism at tertiary care centre

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Abstract

Background: Thyroid dysfunction is one of the most common endocrinological disorders. Consequently, abnormalities of these hormones frequently involve many organ systems producing diverse clinical signs and symptoms.**Aim and objectives:** This study was conducted to evaluate the effects of thyroid hormones on the Alanine transaminase (ALT), Aspartate transaminase (AST), Alkaline Phosphatase (ALK) and Creatine Phosphokinase (CPK) levels. **Material and Methods:** The study was conducted in the Department of Biochemistry laboratory of SRG Hospital, Jhalawar Medical College, Jhalawar (Rajasthan) from May to November 2020. The present study comprised of 50 cases of hyperthyroidism and 50 were euthyroid subjects. The statistical analysis was performed by using SPSS version 17.0 and Microsoft excels 2007. **Results:** There were significantly increased liver enzymes in hyperthyroidism patients when compared with healthy controls (p value <0.05). The mean serum ALT level were 152.6 ± 61.63 IU/L in cases and 26.078 ± 9.04 IU/L in controls, AST level were 184.658± 83.95 IU/L in cases and 26.39 ± 10.25 IU/L in controls and ALK levels were 305.004 ± 121.35IU/L in cases and 72.87 ± 22.46 IU/L in controls. However serum levels of CPK were significantly (p value <0.05) decreased in cases as compared with controls. The mean serum levels of CPK in cases were 17.624 ± 7.03IU/L and 24.448 ± 8.25IU/L in controls. **Conclusion:** This study shows the increased serum levels of ALT, AST, and ALK and decreased serum levels of CPK in hyperthyroidism patients, whereas decreased serum levels of ALT, AST, ALK and increased serum levels of CPK in euthyroid subjects.

Keywords: ALT, AST, ALK, CPK, Hyperthyroidism.

Introduction

Thyroid diseases are common worldwide. In India too, there is a significant burden of thyroid diseases. It has been estimated that about 42 million people in India suffer from thyroid diseases [1]. Thyroid disorder is a silent disease where the symptoms are subtle and may be often overlooked during diagnosis, so it's essential to critical monitoring during such type of diagnosis [2].

The thyroid is a small, butterfly-shaped gland located near throat, synthesizes and secretes mainly two hormones i.e., T4 (Thyroxine) and T3 (Triiodothyronine) [3]. Thyroid hormones control the metabolism—the process by which oxygen and calories are converted to energy for use by the cells and organs. As thyroid hormones are essential for normal organ growth, development, function and regulate the basal metabolic rate of all cells, its alteration can affects the entire metabolism [4,5].

Hyperthyroidism is a relatively common disease in which tissues are stimulated by an increased secretion of thyroid hormones tiroiodothyronin (T3) and/or thyroxin (T4) [6].

The liver has an important role in thyroid hormone metabolism because its manufacture of protein that bind thyroid hormone such as thyroxin binding globulin (TBG), pre-albumin and albumin, it's also the major site of thyroid hormone peripheral metabolism and is involved in its conjugated biliary excretion ,oxidation, deamination and extra thyroidal deiodination of thyroxin (T4) to triiodothyronine (T3) and reverse T3 [7,8].

In most cases of hyperthyroidism and liver dysfunction without heart failure, liver histology demonstrates some degree of fatty infiltration, cytoplasmic vacuolization, nuclear irregularity, and hyperchromatism in hepatocytes [9].

Although the pattern of biochemical hepatic abnormalities and hepatic injury in the setting of hyperthyroidism is variable in character and severity, it appears to be predominantly hepatitis with a few case reports demonstrating a cholestatic pattern [10, 11].

Musculoskeletal symptoms and signs are common in patients with thyroid dysfunctions because the skeletal muscle is a major target of thyroid hormone. In addition to well-known observation that musculoskeletal disorders are common in patients with hypothyroidism, they are also observed in thyrotoxicosis and level of CPK is altered in both these conditions. The association of myopathy with both myxedema and thyrotoxicosis is well known [12].

The serum CPK level in healthy individuals depends on age, race, and lean body mass and physical activity. Serum CPK was first used as a diagnostic aid in progressive muscular dystrophy. It has since then become important clinical marker for muscle damage [13].

In this study we have investigate the patterns of liver biochemical abnormalities and CPK level in patients at our institution in patients with hyperthyroidism.

There is limited understanding regarding the patterns of biochemical liver abnormality and CPK level that occur in hyperthyroidism. Hence this study is undertaken with the hope that this can provide us with hidden clues which may be revealed only very late otherwise. The objective of this study was to determine the relationship between

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serum level of liver enzymes and thyroid hormones among the apparently healthy and hyperthyroidism patients.

Materials and Methods

The study was conducted in the Department of Biochemistry laboratory of SRG Hospital, Jhalawar Medical College, Jhalawar (Rajasthan) from May to November 2020. The present study was conducted on 50 patients of hyperthyroidism attending the OPD of Medicine department, SRG Hospital, Jhalawar Medical College, Jhalawar. Fifty healthy age and sex matched subjects were recruited from local population of Jhalawar as control.

Careful history has been taken and clinical examination done as per Proforma. Around 5ml of venous blood samples will be drawn under aseptic precautions in sterile tubes.

Samples will be allowed to clot and centrifuged at 3000 rpm for 10 min and serum separated. Serum will be analyzed for T3, T4 & TSH on Chemiluminiscence immunoassay technique by Maglumi auto analyser. SGOT, SGPT, and serum CPK will be estimated by Beckman coulter auto analyser using UV kinetic method.

After selection of the participants and signing of the consent form, they were interviewed by the principal investigators by asking the questions included in the questionnaire. Ethical permission has been obtained from institutional ethical committee Jhalawar Medical College, Jhalawar

Inclusion criteria for this study

- Diagnosed cases of hyperthyroidism those does not taking any drugs.

Exclusion criteria

- Individuals with an active infection or a recent infection including liver disease, bone and muscle disease, cardiac disorders.
- Pancreatic insufficiency, hepatobillary infectios, diabetes, hypertension, malignancy.
- Oral contraceptive pills (OCP), pregnancy, alcoholics, and drug abuser.

Table: 1 Reference range of various parameters[14]

Parameters (Unit)	T3 (ng/ml)	T4 (ng/ml)	TSH (µ IU/ml)	ALT (IU/L)	AST (IU/L)	ALK (IU/L)	CPK (IU/L)
Normal Range	0.4 to 2.2	52 to 127	0.3 to 4.5	0-40	0- 40	30-120	0- 40

Statistical analyses were carried out using SPSS version 17.0 and Microsoft excels 2007. Student's *t*-test was used to analyse differences between normally distributed data. A p value <0.05 was considered as statistically significant.

Results

Three variables T3, T4 and TSH were measured for rule out hyperthyroidism in healthy controls and four variables of liver enzymes e.g. ALT, AST, CPK, and ALK were measured to know about the status of liver functions. Thyroid profile T3, T4 and TSH were measured to diagnose the hyperthyroidism cases. The data were analyzed to compare the mean values between hyperthyroidism and healthy controls and to find out correlation between thyroid profile and serum enzymes in the hyperthyroidism and controls. In this study we have recruited age and sex matched subject in both the group of study. Sex distribution was ten male and forty female patients of hypothyroidism and same in control group. The average age of study subject was 28.38 ± 6.52 years (Table2).

Table-2: Showing age and sex-wise distribution of controls and cases.

Variables	Age in years (Mean ± SD	SEX	T Value	p value
Cases	28.38 ± 6.52121	10 Male 40 Female	0	1
Controls	28.38 ± 6.52121	10 Male 40 Female	0	1

p value < 0.05 highly significant, > 0.05 not significant

The mean serum level of T3 was 3.53± 1.02 ng/ml, T4 level 153.41 ± 16.90 ng/ml and TSH 0.1048±0.084 (µIU/ml) in cases and T3 was 1.45± 0.60 ng/ml, T4 levels 89.67 ± 25.25 ng/ml and TSH 02.29 ±0.96 (µIU/ml) in controls Table(3).

Table-3: Mean value and standard deviation of serum T3, T4, TSH levels in Hyperthyroidism patients and in controls.

Parameters		Mean	Std. Deviation	T value	P value
TSH(µIU/ml)	Case	0.1048	0.08476		
	Control	2.292	0.96507	15.964	<0.0001*
T3 (ng/ml)	Case	3.53	1.02703		
	Control	1.45	0.6092	12.317	<0.0001*
T4 (ng/ml)	Case	153.418	16.90964		
	Control	89.676	25.25059	14.834	<0.0001*

P value < 0.05 highly significant, > 0.05 not significant

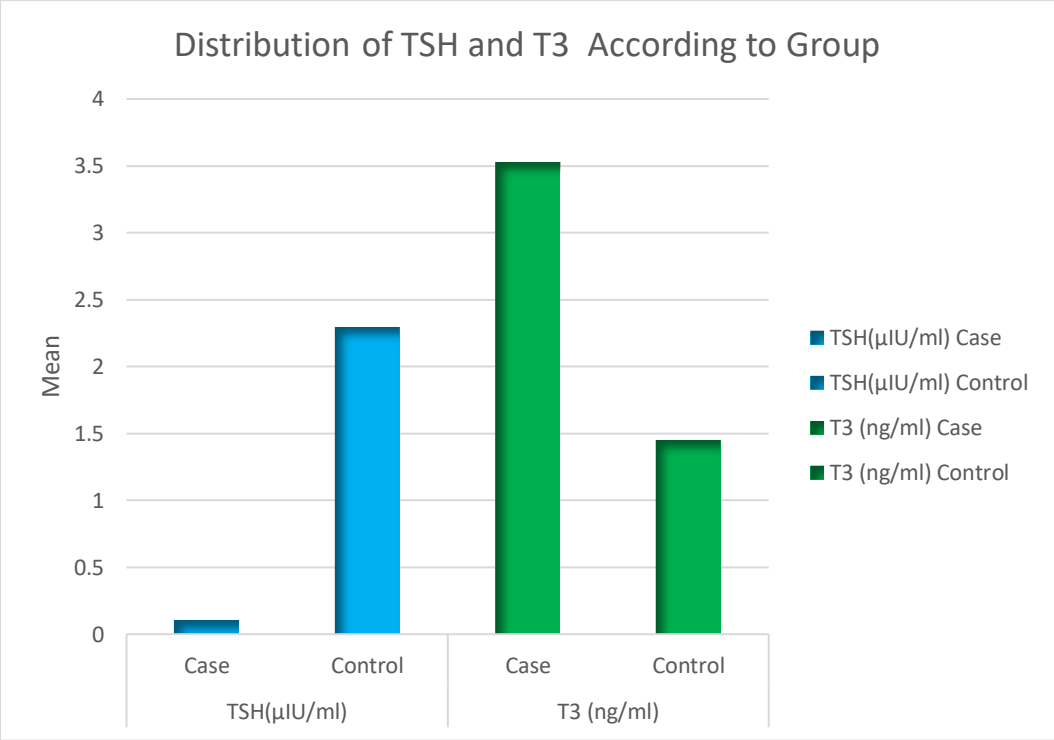

Fig 1: Serum T3 and TSH levels in hyperthyroidism and healthy controls

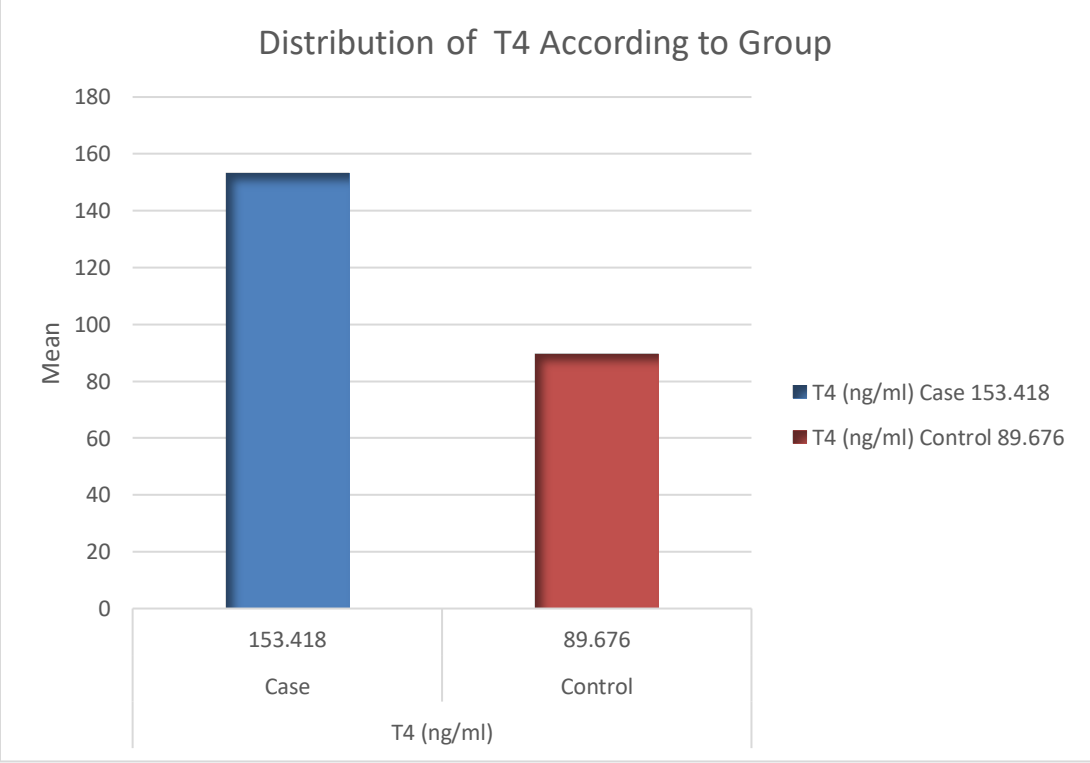

Fig 2: Serum T4 levels in hyperthyroidism and healthy controls

There are significantly increased liver enzymes in hyperthyroidism patients as compare to healthy controls. The mean serum ALT level were 152.6 ± 61.63 IU/L in cases and 26.078 ± 9.04 IU/L in controls, AST level were 184.658± 83.95 IU/L in cases and 26.39 ± 10.25 IU/L in controls and ALK levels were 305.004 ± 121.35IU/L in cases and 72.87 ± 22.46 IU/L in controls. Whereas serum levels of CPK were significantly decreased in cases as compare to controls. The mean serum levels of CPK in cases were 17.624 ± 7.03IU/L and 24.448 ± 8.25IU/L in controls (Table 4).

Table-4: Mean value and standard deviation of Liver enzymes (ALT, AST, ALK and CPK) levels in Hyperthyroidism patients and in controls.

Parameters	Group	Mean	Std. Deviation	T value	P value
ALT (IU/ml)	Case	152.63	61.63		
	Control	26.078	9.04	14.36	<0.0001*
AST (IU/ml)	Case	184.658	83.95		
	Control	26.392	10.25	13.23	<0.0001*
ALK (IU/ml)	Case	305.004	121.35		
	Control	72.87	22.46	13.30	<0.0001*
CPK (IU/ml)	Case	17.624	7.03		
	Control	24.448	8.24	4.45	<0.0001*

P value < 0.05 highly significant, > 0.05 not significant

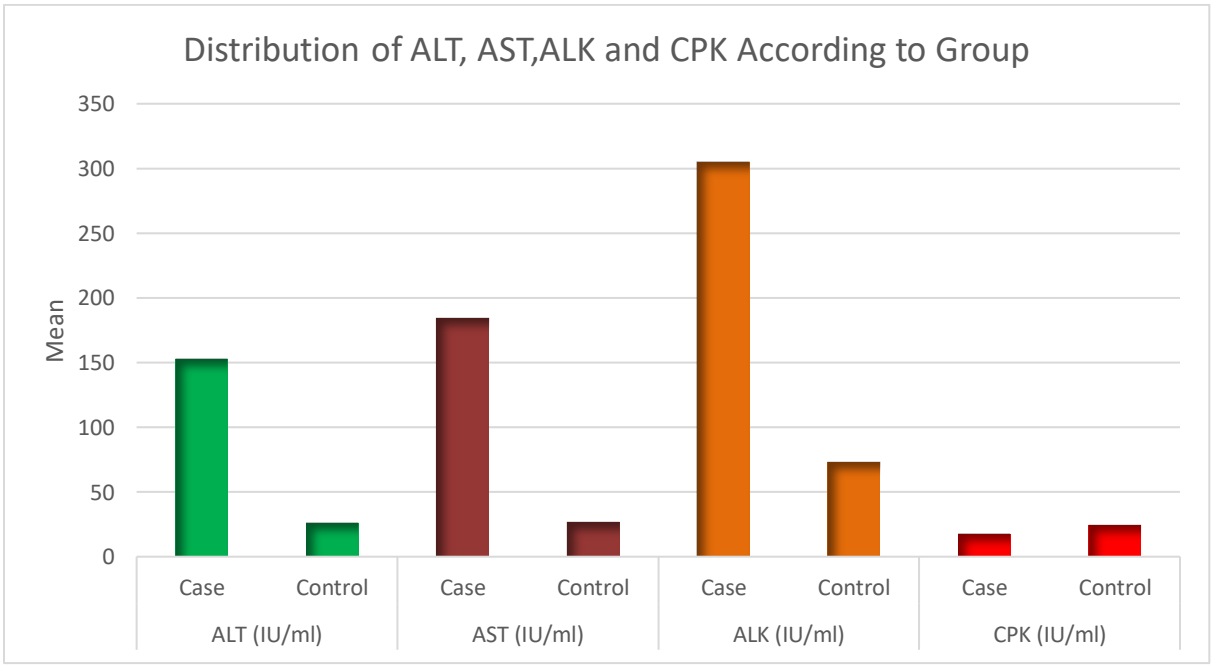

Fig 3: Serum Enzymes levels in hyperthyroidism and healthy controls

Discussion

Thyroid gland is major Metabolic-endocrine gland. It secretes thyroid hormones T3 and T4 those are essential for the growth, development and function of all organs of the body. They regulate BMR of all cells of the body including the hepatocytes and thereby modulate all the organ function. The liver, muscle and kidney in turn metabolize thyroid hormones and regulate their systemic endocrine effects. Sharma VK et al[15] observed that increased value of SGPT, SGOT, ALK and conversely lower value of CPK in association with hyperthyroidism.

Hepatic dysfunction is commonly observed in patients with thyroid disease. Thyroid hormones are glucuronidated and sulphated within the liver and subsequently excreted into bile, and also maintain the metabolism of bilirubin by regulating glucuronyl transferase and

ligandin, a hepatic transport protein. Derangements in LFTs are common even in patients with hyperthyroidism. *Elias RM, Dean DS, Barsness G* [16]demonstrate hepatic dysfunction is also attributed to the hypermetabolic state in thyrotoxicosis that increases hepatic oxygenconsumption without increasing hepatic blood flow, accentuating the low oxygen tension in the centrilobular zones, possibly leading to dysfunction in the centrilobular hepatocytes. *Huang MJ, Liaw YF* [17] revealed that hyperthyroidism is often associated with abnormal hepatocellular enzymes particularly ALT and ALP elevation and thus can be used as a diagnostic tool for predicting the presence of clinically significant hepatic changes in patients with hyperthyroidism.

The study of *Kanwar Gulab et al* [18] showed increases in serum ALT, AST and ALP levels in clinical hyperthyroidism patients. The results of our study reflects that as the serum levels of thyroid hormone increased the liver enzymes levels of ALT, AST, ALK also increased subsequently.Musculoskeletal disorders often accompany thyroid dysfunction. In addition to the well known observation that these disorders are common in patients with hypothyroidism, they are also observed in patients with thyrotoxicosis. *Ranka R and Mathur R*[19] demonstrated that activity of serum CPK was lower in hyperthyroidism.There is decreased serum activity of CPK in hypethyroidism patients as compare to normal healthy subject. The research of *Rupa G, Ashalatha G, Geetha N* [20] showed an early detection of thyroid dysfunction associated with myopathies. They showed lower levels of CPK in hyperthyroidism patients. The results of our study are in accordance with the above studies.

Conclusion

In conclusion, hyperthyroidism is major disorder that affects a vast majority of the body system. Liver injury and musculoskeletal disorders are relatively common findings in hyperthyroidism. Thyroid dysfunction has a definite role in myopathy. The mechanism for such association is still unclear and may be due to indirect and or direct pathways. Thus, further studies are needed for a better understanding of the etiopathogenesis and management of hepatic dysfunction in hyperthyroid patients.

Therefore, patients presenting unexplained hepatic abnormalities and altered serum CPK levels require close examination and an evaluation of the thyroid function should be sought. From this study it can be concluded that there is proportional relationship of thyroid hormone with liver enzymes and inverse with CPK levels in hyperthyroidism. Thus the estimation of liver enzymes and CPK levels will be extremely valuable in screening of hyperthyroidism patients.

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Conflict of Interest: Nil

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