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Original Research Article

Assessment of Liver Enzymes, Creatine Phosphokinase and Electrolytes in Patients with Hyperthyroidism Visiting Tertiary Center

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ABSTRACT

Background: Thyroid hormones regulate the metabolisms of all cells. Hyperthyroidism is one of the most common endocrine disorders characterized by increased secretion of thyroid hormones T3 and/or T4. Since majority of metabolic activities occur in liver; kidney and muscle in body, so biochemical markers reflecting function of these organs are altered in hyperthyroid state. The present study is designed to compare the level of enzymes like Serum Glutamate Pyruvate Transferase (SGPT), Serum Glutamate Oxaloacetate Transferase (SGOT), Alkaline Phosphatase (ALP) and Creatine Phosphokinase (CPK) along with electrolytes (Sodium, Potassium) in clinically hyperthyroid patients with age and sex matched control subjects.
Materials and Methods: The Study was conducted in patients visiting to Endocrinology OPD in the Institute of Medicine, Nepal during the interval of 3rd February 2017 to 3rd May 2017. Total of fifty-one patients diagnosed as hyperthyroidism in age group 20-70 were included in the study. Patients with TSH values less than0.01 mIU/L were taken as cases. Total fifty-two individuals were taken as control in whom age and sex was matched.
Results: In hyperthyroid cases, the mean fT3 and fT4 values were 18.24 ± 9.33 pmol/L and 52.95 ± 20.81 pmol/L which were higher than that of controls. Similarly, mean TSH level in hyperthyroid patients was 0.03 ± 0.05 mIU/ml which was lower than that of control. The mean values of SGPT, SGOT, sodium and potassium in hyperthyroid cases were high compared to the mean values obtained from control. The mean value of ALP was significantly increased in cases whereas CPK was decreased compared to control.
Conclusion: It can be concluded from this study that increased value of SGPT, SGOT, ALP, sodium and potassium are seen in association with hyperthyroidism and conversely lower values of CPK are seen in association with hyperthyroidism. These altered parameters are seen in absence of underlying disease in individuals and are to be expected when analyzing serum sample of patients with hyperthyroidism.

Keywords: Hyperthyroidism; Alkaline Phosphatase (ALP); Creatine Phosphokinase (CPK); Serum Glutamate Oxaloacetate Transferase (SGOT); Serum Glutamate Pyruvate Transferase (SGPT)

INTRODUCTION

The levels of thyroid hormone in blood are tightly regulated by feedback mechanism involving hypothalamo-pituitary-thyroid axis. Serum free triiodothyronine (fT3), which is active form binds to the thyroid hormone receptor virtually present in each tissue. So, normal thyroid functioning is required to keep the metabolic activity normal in entire body.

Highly specific chemiluminescent immunoassays are used to measure serum free thyroxine (fT4), fT3 and serum thyroid stimulating hormone (TSH) level. Serum TSH level is used as the initial laboratory test for diagnosing thyroid disorders. Hyperthyroidism is diagnosed when serum TSH level is decreased while fT3 and fT4 are increased. Various biochemical alterations in hyperthyroidism have already been established. Since liver, heart, muscle and kidney is metabolic organ; any disturbance in thyroid physiology will alter the level of enzymes reflecting these organs like alkaline phosphatase (ALP), Serum Glutamate Oxaloacetate Transferase (SGOT), Alkaline Phosphatase (ALP) and Creatine Phosphokinase (CPK). Present study was done to evaluate the thyroid function test and liver function test along with serum CPK level and electrolytes level among known hyperthyroid patient and healthy control as well as to find any possible correlation.

MATERIALS AND METHODS

The Study was conducted in patients visiting to Endocrinology OPD in Institute of Medicine, Nepal. Total of fifty-one patients diagnosed as hyperthyroidism in age group 20-70 were included in the study. Total fifty-two individuals were taken as control in whom age and sex was matched. Patients with history of diabetes mellitus, renal disease, active infection, liver disease, bone and muscle disease, cardiac disease, pancreatic disease, hypertension, malignancy, taking oral contraceptive pills, pregnancy, alcoholics, and drug abusers were excluded from the study. The level of thyroid hormone was assayed by Enhanced Chemiluminescent Immunoassay. Hyperthyroid patients were selected from medical outpatient department who were diagnosed based on thyroid function test reporting. Level of SGPT, SGOT, ALP and CPK was determined by UV Kinetic method and level of electrolytes was obtained by direct ion selective electrode method. Statistical analysis was done by SPSS version 20.0. Data were expressed as mean ± SD. Correlations were observed by using Pearson's correlation coefficient and probability (p value) < 0.05 was considered significant.

RESULTS

Out of 103 subjects, 51 were hyperthyroidism and 52 were healthy controls. The mean age of subjects with hyperthyroidism and healthy controls were 35.45 ± 12.225 and 38.75 ± 13.48 respectively. Table 1 shows the distribution of subjects according to gender.

Table 1. Distribution of study subjects based on gender

Gender	Controls		Hyperthyroid Patients	
	Count	Percentage	Count	Percentage
Male	18	34.6	11	21.6
Female	34	65.4	40	78.4
Total	52	100	51	100

The comparison of mean values of thyroid profile (fT3, fT4, and TSH), serum liver enzymes (SGPT, SGOT, ALP) CPK and serum electrolytes (sodium and potassium) are shown in Table.2 for both controls and cases.

Table 2. Thyroid profile, liver enzymes, CPK and electrolytes of the hyperthyroidism and control

Study Group	Controls (n=52) Mean, SD	Hyperthyroid (n=51) Mean, SD	P value
fT3	5.32 ± 0.91	18.24 ± 9.33	<0.001
fT4	14.14 ± 3.65	52.95 ± 20.81	<0.001
TSH	3.64 ± 7.1	0.03 ± 0.05	<0.001
SGPT	25.73 ± 10.12	33.82 ± 19.02	0.008
SGOT	31.65 ± 8.53	37.92 ± 15.95	0.014
ALP	215.96 ± 53.23	340.04 ± 152.34	<0.001
CPK	104.77 ± 47.55	79.41 ± 68.45	0.031
Na	138.54 ± 4.41	139.29 ± 3.44	0.011
K	4.19 ± 0.37	4.44 ± 0.52	0.017

Pearson's correlation between TSH and other tested parameters are shown in Table 3.

Table 3. Correlation between TSH and other parameters

	r Value	P Value
TSH vs SGPT	-0.132	0.184
TSH vs SGOT	-0.009	0.927
TSH vs ALP	-0.176	0.075
TSH vs CPK	0.113	0.258
TSH vs Na	-0.220	0.126
TSH vs K	-0.108	0.278
*. Correlation is significant at the 0.05 level (2-tailed).		

DISCUSSION

Thyroid hormones T3 and T4 are essential for the growth, development and function of all organs of the body. They regulate basal metabolic rate of all cells of the body and thereby modulate all the organ function. The liver, muscle and kidney in turn metabolizes thyroid hormones and regulates their systemic endocrine effects. Therefore, thyroid dysfunction may disturb liver, muscle and kidney function and vice versa. This study shows that there is a significant increase in biochemical parameters of liver function test in hyperthyroid patients when compared to normal controls. Similarly, biochemical marker for muscle (CPK) is significantly decreased in hyperthyroid patients compared to normal controls. This clearly suggests that biochemical markers of liver and muscle may be affected by alteration in the thyroid hormone levels in the body. Serum level of SGOT, SGPT and ALP are significantly increased in hyperthyroid patients. This association may cause diagnostic dilemma and may result in over or under diagnosis of associated liver or thyroid diseases while evaluating thyroid or liver disease respectively. Therefore, it is suggested to measure free T4 and TSH level to rule out coexistent possibility of thyroid dysfunction in any patient with unexplained liver biochemical test abnormalities. [1] A study on clinical associations between thyroid and liver diseases revealed that liver has a key role in thyroid hormones metabolism. Normal level of thyroid hormone in serum is very important for normal hepatic function and bilirubin metabolism. [1] Finding of our study is consistent with the findings of previous studies. [2,3] The mechanism of this elevation appears to be relative hypoxia in periventricular regions of the liver. [4] Upadhyay *et al.* showed that elevated levels of fT3 induces apoptosis of hepatocytes and causes hepatic dysfunction through the activation of the mitochondrial dependent pathway. [5] Similarly, Biscoveanu *et al.* reported that out of 30 study patients, 11 (37%) had at least one abnormal result of a liver function test. [4] The increased osteoblastic activity is pointed out as a cause of elevated ALP in patients with hyperthyroidism. [6]

The result of our study shows that the activity of CPK is found to be lower in hyperthyroidism which is similar to the report presented by Shamali Jungare *et al*. [7] In hypermetabolic state, there is increase enzyme degradation which may have contributed to low CPK activity.[7]It has also been proposed that the muscle cell in hyperthyroid state is less permeable than normal cell to efflux CPK. [8]

The result shows mean serum sodium and potassium values in hyperthyroid cases minimally altered than that of control. There is not strong association of hyperthyroidism with alteration of sodium and potassium. However, occasional reports have been published regarding thyrotoxicosis periodic paralysis. This is due to hypokalemia of thyrotoxicosis which is the consequence of a rapid and massive shift of potassium from the extracellular into intracellular compartment due to overactivity of sodium/potassium adenosine triphosphate pump.

In summary, the findings of our study will be helpful to guide clinicians and laboratory staffs while dealing with hyperthyroidism patient or their serum sample.

CONCLUSION

It can be concluded from this study that increased value of SGPT, SGOT, ALP, sodium and potassium are seen in association with hyperthyroidism and conversely lower values of CPK are seen in association with hyperthyroidism. These altered parameters are seen in absence of underlying disease in individuals and are to be expected when analyzing serum sample of patients with hyperthyroidism.

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