

Assessment of Liver Enzymes, Creatine Phosphokinase and Electrolytes in Hypothyroid Patients Visiting Tertiary Centre

Suman Baral¹, MD; Binod Aryal², MSc; Vivek Pant², MD; Vijay K Sharma², MD

¹Department of Medicine, Institute of medicine, Kathmandu, Nepal

²Department of Biochemistry, Institute of medicine, Kathmandu, Nepal

Address for Correspondence:

Suman Baral, MD

Department of Medicine, Institute of medicine, Kathmandu, Nepal

Email: drsumaniom@gmail.com

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Various biochemical alteration in hypothyroidism has already been established. Since majority of metabolic activities occur in liver; kidney and muscle in body, so biochemical markers reflecting function of these organs are altered in hypothyroid 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 hypothyroid patients with age and sex matched control subjects.

The Study was conducted in patients visiting to Endocrinology OPD in Institute of Medicine, Nepal. Total of 49 patients diagnosed as hypothyroidism in age group 20-70 were included in the study. Patients with TSH values above 10 mIU/L were taken as cases. Total 49 individuals were taken as control in whom age and sex was matched.

The mean SGOT, ALP and CPK in Hypothyroid patients was 31.65 ± 8.53 IU/L, 215.96 ± 53.23 IU/L and 104.77 ± 47.55 IU/L respectively which were significantly increased in comparison with mean value from control subjects. The mean value of SPGT was 25.73 ± 10.12 IU/L which was statistically not significant as compared to normal. Likewise, the mean value of Sodium and Potassium was 138.54 ± 4.41 and 4.19 ± 0.37 which was within the normal range and statistically not significant with the control.

Enzymes like SGOT, ALP & CPK level are significantly increased in hypothyroid patient and this increase is more likely due to muscle involvement in hypothyroidism.

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

The level 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. Hypothyroidism is diagnosed when serum TSH level is increased while fT₃ and fT₄ are decreased. Various

biochemical alteration in hypothyroidism has already been established. Since liver, heart, muscle and kidney are metabolic organ; any disturbance in thyroid physiology will alter the level of enzymes reflecting these organs like ALP, SGOT, SGPT and 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 hypothyroid patient and healthy control as well as to find any possible correlation.

| Gender | Controls | | Hypothyroid Patients | |
|---------------|----------|------------|----------------------|------------|
| | Count | Percentage | Count | Percentage |
| Male | 17 | 34.6 | 10 | 20.4 |
| Female | 32 | 65.4 | 39 | 79.6 |
| Total | 49 | 100 | 49 | 100 |

Table 1: Distribution of study subjects based on gender

| Lab Variables | Hypothyroid Patients | Controls | P Value |
|---------------|----------------------|----------------|---------|
| T3 | 2.55 ± 1.15 | 5.32 ± 0.91 | 0.000 |
| T4 | 4.27 ± 3.08 | 14.14 ± 3.65 | 0.000 |
| TSH | 77.8 ± 32.13 | 3.64 ± 7.1 | 0.000 |
| SGPT | 40.1 ± 57.97 | 25.73 ± 10.12 | 0.082 |
| SGOT | 59.88 ± 93.51 | 31.65 ± 8.53 | |
| ALP | 301.24 ± 290.25 | 215.96 ± 53.23 | 0.040 |
| CPK | 416.53 ± 626.07 | 104.77 ± 47.55 | 0.001 |
| Na | 139.31 ± 4.13 | 138.54 ± 4.41 | 0.370 |
| K | 4.29 ± 0.58 | 4.19 ± 0.37 | 0.279 |

Table 2: Comparison of cases and control

| | r Value | P Value |
|--------------------|---------|---------|
| TSH vs SGPT | 0.192 | 0.05 |
| TSH vs SGOT | 0.221* | 0.02 |
| TSH vs ALP | 0.228* | 0.02 |
| TSH vs CPK | 0.454** | 0.00 |
| TSH vs Na | 0.051 | 0.61 |
| TSH vs K | 0.13 | 0.19 |

Table 3: Correlation of TSH with other lab parameters. * Correlation is significant at the 0.05 level (2-tailed).

Materials and Methods

The Study was conducted in patients visiting to Endocrinology OPD in Institute of Medicine, Nepal. Total of 49 patients diagnosed as overt hypothyroidism in age group 20-70 were included in the study. Total 49 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. 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 \pm SD. Correlations were observed by using Pearson's correlation coefficient and probability (p value) < 0.05 was considered significant.

Results

Majority of the patients (79.6%) were females and 20.4% of the patients were

male (**Table 1**).

When the cases and controls were compared, there was a significant variation in the values between the two groups. SGPT, SGOT, ALP and CPK were found to be significantly elevated in hypothyroid patients compared to the controls. Electrolytes level was not significant when compared to controls (**Table 2**)

The serum TSH values of patients were studied in relation to the values of serum liver enzymes, sodium, potassium and Creatine Phosphokinase. On analyzing the values, a statistically significant positive correlation between serum TSH and SGOT, ALP and CPK levels was noticed ($p < 0.026$, 0.022 and 0.000 respectively). At the same, a statistically not significant positive correlation between serum TSH and SGPT, Sodium and Potassium levels was observed (**Table 3**).

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 hypothyroid patients when 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, ALP and CPK are significantly increased in hypothyroid patients. This association may cause diagnostic dilemma and may result in over or under diagnosis of associated liver or thyroid diseases. 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 In hypothyroidism there is an increase in membrane cholesterol phospholipid ratio and diminished membrane fluidity, which affect many canalicular membrane transporters and enzymes, including the NaK-ATPase resulting in the change of ALP enzymes.² The findings of our study is consistent with the findings in previous studies.^{3,4,5} As SGOT is also distributed in skeletal muscles, it is more likely that the elevated SGOT level in serum of hypothyroid patients could be due to release of SGOT from the skeletal muscles. So, there is significant increase in SGOT in our study but SGPT is not significantly increased. Changes in ALP

are not due to abnormality in liver only. It is more likely due to altered bone metabolism. It is known that musculoskeletal disorders are common in thyroid diseases.⁶ Hypothyroidism reduces the ability of skeletal muscles to maintain adequate energy via several mechanisms. This may lead to injury that allows CPK to leak out of cells and cause its elevation.⁷ Increased CPK level in hypothyroidism has been reported in various studies.^{5,8,9} The implication of this finding is that determination of serum CPK with thyroid profile may increase the diagnostic sensitivity especially in subclinical hypothyroidism.⁷ The findings of our study will be helpful to guide clinician and a laboratory staff while dealing with hypothyroidism patient or their serum sample.

Conclusion

Enzymes like SGOT, ALP & CPK level are significantly increased in hypothyroid patient and this increase is more likely due to muscle involvement in hypothyroidism.

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