

Study of Liver Function Tests in Patients of Hypothyroidism

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ABSTRACT

Introduction:

The liver is fundamental in metabolizing thyroid hormones, and hepatocytes are often affected in thyroid disease. Thyroid disorders often accompany abnormal serum enzyme levels and disturbances in liver functions. These thyroid-liver associations may cause diagnostic confusions. Neglect of these facts may result in over or under diagnosis of associated liver or thyroid diseases and thereby cause errors in patient care. Aim of the present study was to determine the biochemical markers of liver function test Aspartate transaminase (AST), Alanine transaminase (ALT) and Alkaline phosphatase (ALP) in patients with hypothyroidism and to find their possible correlation with thyroid profile.

Material and Methods: The study included 50 patients with subclinical hypothyroidism (TSH 6.0-9.9miu/l), 50 patients with overt hypothyroidism (TSH \geq 10.0 miu/l) and 50 age matched normal euthyroid controls. In all study groups FT3, FT4, TSH, AST ALT and ALP were estimated. Thyroid profile and LFT were estimated using fully autoanalyser. p value $<$ 0.05 considered as significant.

Results: Subjects with both subclinical hypothyroidism and overt hypothyroidism had significantly raised serum AST, ALT and ALP ($p <$ 0.0001) compared to controls. Further, TSH showed significant positive correlation with AST, ALT and ALP ($P <$ 0.001) in both subclinical and overt hypothyroidism,

Conclusion: Hypothyroid patients should be regularly checked for biochemical parameters of LFT. As early detection and treatment can prevent the further complications related to the disorder and will be helpful during the management of hypothyroid patients.

Keywords: Liver Function Test, Hypothyroidism, FT3, FT4, TSH, AST, ALT and ALP

INTRODUCTION

The thyroid is an endocrine gland which secretes thyroid hormones. The main hormones released by the thyroid are L-thyroxine (T4) and 3, 5,3' L-tri-iodothyronine (T3). Thyroid hormones are crucial for growth and for the regulation of protein, carbohydrate and fat metabolism.¹ Thyroid disorders are commonly divided into two major categories, hyperthyroidism and hypothyroidism, depending on whether serum thyroid hormone levels (T4 and T3) are increased or decreased respectively.² The symptoms of hyperthyroidism are weight loss, rapid or irregular heartbeat, anxiety, irritability, trouble sleeping, trembling in the hands and fingers, increased sweating, increased sensitivity to heat, muscle weakness, etc. The symptoms of hypothyroidism are weight gain, increased sensitivity to cold, muscle weakness, joint or muscle pain, depression, fatigue, pale dry skin, a

puffy face, a hoarse voice, etc. Thyroid diseases are among the commonest endocrine disorders worldwide, it has been estimated that about 42 million people in India suffer from thyroid diseases. Hypothyroidism is the common thyroid disorder with the prevalence of 3.9% in India; subclinical hypothyroidism is more common than overt hypothyroidism with the prevalence of 9.4%. Euthyroidism refers to the state of normal functioning of thyroid gland. Thyroid hormones are essential for normal organ growth and development. Thyroid hormones regulate the basal metabolic rate of all cells, so alteration in their level can affect the entire metabolism.¹ Thyroid hormones regulate calorogenesis in tissues, including hepatocytes and thereby modulate hepatic function. The liver in turn metabolizes the thyroid hormones and regulates their systemic endocrine effect. Thyroid dysfunction may perturb liver function.³ Knowledge of the association between hypothyroidism and deranged biochemical markers of liver function is important for the clinician, to consider an evaluation of thyroid function in the work up of the patient with altered liver function tests. This may emphasize the need for monitoring liver function in hypothyroid patients and vice versa. The present study was undertaken to study the influence of thyroid hormones on liver function (transaminases) in hypothyroidism.

Present study was done to evaluate the biochemical parameters of thyroid function test (FT3, FT4, TSH) and liver function test (AST, ALT and ALP) among known hypothyroid patient and healthy control as well as to find any possible correlation among the measured parameters under study.

MATERIAL AND METHODS

An analytical cross-sectional study was conducted in the Department of Biochemistry, JJMMC Davangere. Institutional ethical clearance obtained for the study. Total no of 50 patients with diagnosed subclinical hypothyroidism and 50 patients with diagnosed overt hypothyroidism each, coming for thyroid function test were enrolled in the study

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How to cite this article: Sudha Ambiger, Shrikanth P Chincholikar. Study of liver function tests in patients of hypothyroidism. International Journal of Contemporary Medical Research 2019;6(8):H1-H4.

DOI: <http://dx.doi.org/10.21276/ijcmr.2019.6.8.36>

and compared with 50 age matched normal euthyroid controls. Informed consent duly signed by each of the participants was taken.

Inclusion criteria

Study conducted on hypothyroid cases irrespective of duration of disease and treatment in the age group of 20-50 years. Healthy adults in the age group of 20-50 years are considered as control.

Exclusion criteria

History of liver diseases, chronic alcoholism, individuals with an active infection or a recent infection including liver disease, bone and muscle disease, cardiac disease, pancreatic disease, Hepatobiliary disease, diabetes, hypertension, malignancy, oral contraceptive pills (OCP), pregnancy, and drug abusers were excluded.

Sample collection

5 ml of venous blood was collected from the selected patients in a plain test tube. Blood collected in plain tube was allowed to clot at room temperature and then centrifuged at 1,500 rpm for 5 min. Serum so obtained was used to determine the thyroid hormones (TSH, FT3, FT4) and serum enzymes (ALT, AST, and ALP). If parameters not estimated early, serum stored at deep freezer at a temperature of -4°C . T3, T4 and TSH were determined by ELISA method. Serum AST, ALT and ALP were estimated by kinetic spectrophotometric method using fully automated Erba EM360 autoanalyzer. Thyroid profile tests (FT3, FT4 and TSH) were estimated to categorize subclinical hypothyroidism and overt hypothyroidism. Subjects were divided into two groups, test

group1 and test group 2.

- 1) Test group 1- consists of 50 patients with subclinical hypothyroidism (TSH 6.0-9.9 mIU/L)
- 2) Test group 2- consists of 50 patients with overt hypothyroidism (TSH ≥ 10.0 mIU/L)

STATISTICAL ANALYSIS

All the statistical analysis were performed using SPSS version 17.0 and Microsoft excel 2007. Data were expressed as mean \pm SD. ANOVA tests were used to analyze differences in biochemical parameters between the control and the test groups. Correlations were observed by using Pearson's correlation coefficient and probability (p value) < 0.05 was considered significant.

RESULTS

In our study we did not find any significant difference in mean level of age ($p=0.726$) and sex ratio ($p=0.648$) between control group and the test groups (Table 1). Mean of FT3 AND FT4 levels decreased in both test group1 and test group2 when compared with controls with p value found to be extremely significantly ($p<0.0001$) (Table 1, Fig 1). Mean of TSH level increased in both test group1 and test group2 when compared with controls with p value found to be extremely significantly ($p<0.0001$) (Table 1, Fig 1). We also found that the mean of AST, ALT and ALP levels increased in both test group1 and test group 2 when compared with healthy controls with p value

	Control Mean \pm S.D	Test group 1 Mean \pm S.D	Test group 2 Mean \pm S.D	P value
Age (yrs)	32 \pm 4.92	33.98 \pm 4.06	35 \pm 5.37	0.007
Sex(M/F)	32/18	24/26	28/22	0.865
FT3(4.26-8.10pmol/L)	5.46 \pm 0.97	3.80 \pm 0.44	3.55 \pm 0.36	<0.0001**
FT4 (10-28.2pmol/L)	15.29 \pm 2.75	10.13 \pm 1.05	8.74 \pm 0.33	<0.0001**
TSH (0.465- 4.68mIU/L)	2.87 \pm 0.73	8.36 \pm 0.78	20.06 \pm 3.16	<0.0001**
AST (17-59U/L)	42.38 \pm 5.45	72.33 \pm 6.04	94.76 \pm 4.18	<0.0001**
ALT (21-72U/L)	43.43 \pm 6.08	78.38 \pm 4.80	95.55 \pm 5.18	<0.0001**
ALP (38-126U/L)	99.35 \pm 12.44	154.35 \pm 8.32	180.91 \pm 5.29	<0.0001**

Table-1: Shows comparison between the baseline and biochemical characteristics of the studied groups.

		AST	ALT	ALP
Subclinical hypothyroidism.	FT3	r = 0.103 p = 0.475	r = 0.257 p = 0.07	r = 0.294 p = 0.03
	FT4	r = 0.091 p = 0.528	r = 0.105 P = 0.466	r = 0.195 p = 0.173
	TSH	r = 0.438 p < 0.001**	r = 0.415 p < 0.05*	r = 0.863 p < 0.001**
Overt hypothyroidism.	FT3	r = 0.02 p = 0.877	r = 0.112 p = 0.436	r = 0.008 p = 0.951
	FT4	r = 0.02 p = 0.888	r = 0.08 P = 0.542	r = 0.041 p = 0.775
	TSH	r = 0.733 p < 0.001**	r = 0.415 p < 0.05*	r = 0.863 p < 0.001**

*denotes significant and ** denotes highly significant p values.

Table-2: Showing correlations between thyroid profile and LFT in subclinical and overt hypothyroidism.

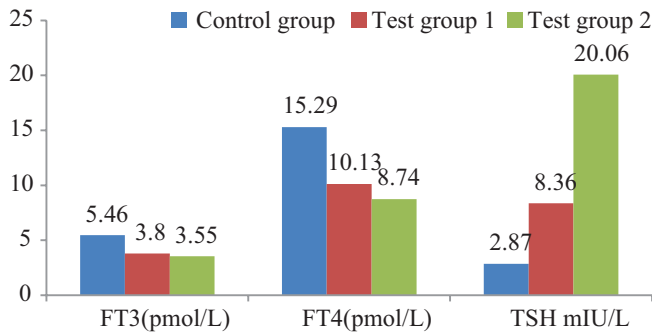


Figure-1: Showing means of FT3, FT4 and TSH in the studied groups

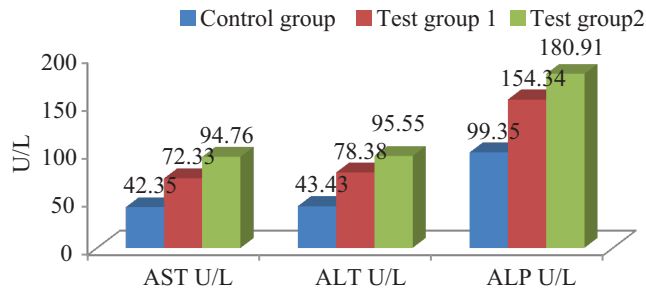


Figure-2: Showing means of AST, ALT and ALP in the studied groups

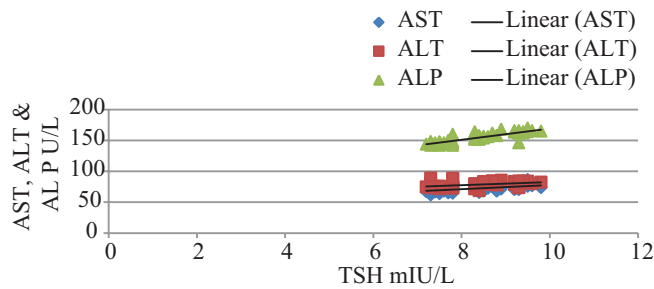


Figure-3: Showing Pearson's correlation between TSH and AST, ALT and ALP in test group 1

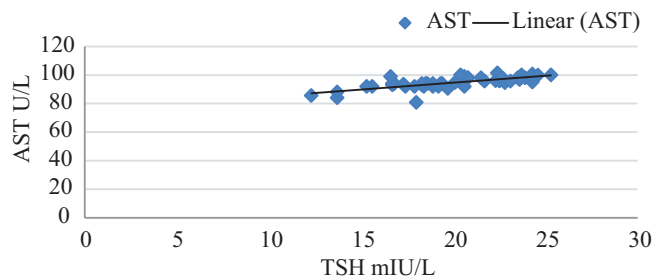


Figure-4: Showing Pearson's correlation between TSH and AST in test group 2

again found to be extremely significantly ($p < 0.0001$) (Table 1, Fig 2).

On observing correlation using Pearson's correlation coefficient, we found that TSH levels

Showed highly significant positive correlation with AST ($p < 0.0001$), ALP ($p < 0.0001$) and significant positive correlation with ALT levels ($P < 0.05$) in subjects with subclinical hypothyroidism (Table 2, Fig 3). TSH levels also showed highly significant positive correlation with AST, ALP ($p < 0.0001$) and ALT levels ($P < 0.005$) in subjects with

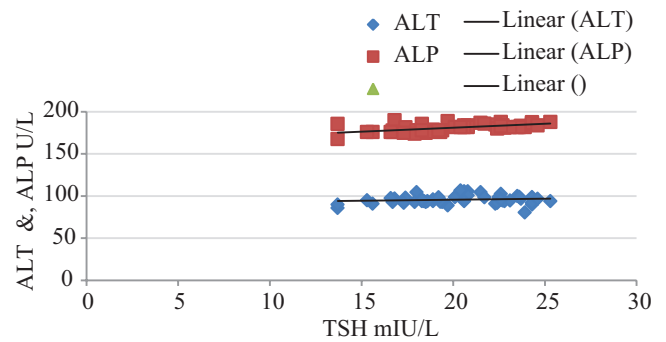


Figure-5: Showing Pearson's correlation between TSH and ALT and ALP in test group 2

overt hypothyroidism (Table 2, Fig 4 and 5).

DISCUSSION

Thyroid dysfunction is found to be common across all age groups. Previous studies have shown that females are more hypothyroidism than male,^{2,3} but in our study we did not find that relation. The terminology subclinical hypothyroidism is gaining importance, based on evidence that potentially important tissue abnormalities can occur during progressive thyroid failure before the serum T4 concentration becomes clearly subnormal. The major concern with subclinical hypothyroidism has been risk of progression to overt hypothyroidism.⁴ Liver abnormalities in thyroid diseases or thyroid abnormalities in liver diseases were known in the Past. However, the cause and effect relationship between the two is now becoming clear.⁵ In the present study an attempt is made to assess liver functions (AST, ALT and ALP) in patients with subclinical and overt hypothyroidism and compare with healthy euthyroid controls. Our data showed a significant increase in AST, ALT and ALP levels in hypothyroid patients when compared to healthy controls and this increase was also significant when overt hypothyroid patients were compared with subclinical hypothyroid patients (Table 1 AND FIGURE 2). The findings of our study is in corroboration with findings of the study by Kalita N et al⁶, Yadav A. et al.⁷, p.d Griffiths et al⁸ and Pandey R. et al.¹ Malik and Hodgson¹⁰ mentioned that thyroid hormones T3 and T4 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 hepatic function. The liver in turn metabolises thyroid hormones and regulates their systemic endocrine effects. Therefore thyroid dysfunction may disturb liver function and liver disease affects thyroid hormone metabolism and a variety of systemic diseases affect both organs. It highlights a close relationship between thyroid and liver in health and disease. In our study TSH level showed significant positive correlation with AST, ALT and ALP levels in subclinical and overt hypothyroidism. (Table 2, FIGURE 3-5).

The positive correlation of TSH levels with levels of ALT in both patients with subclinical hypothyroidism (test group 1) ($p < 0.005$) and over hypothyroidism (test group 2) ($p < 0.005$) in our study may be explained by the observations made by Targhar G. et al.¹¹, Khan T. et al.¹² and Prakash A. et al.¹³

that thyroid alteration effects the liver enzymes like ALP, AST and ALT. The significant positive correlation of TSH levels with AST and ALT levels in both subclinical and overt hypothyroid subjects ($p < 0.0001$ and $p < 0.05$) may be because of myopathy associated with hypothyroidism. The significant positive correlation of serum TSH levels with ALP in both subclinical and overt hypothyroidism ($p < 0.0001$) may be explained on the basis observations of Klion F et al.¹⁴ that in hypothyroidism there is an increase in membrane cholesterol phospholipid ratio and diminished membrane fluidity, which affect a number of canalicular membrane transporters and enzymes, including the Na⁺, K⁺-ATPase resulting in the change of ALP enzymes. Hypothyroidism may be associated with deteriorating liver function. The liver function should, therefore, be regularly monitored for evaluation of patients presenting with hypothyroidism and vice versa.

CONCLUSION

To conclude, the present study indicates that thyroid disorder might cause significant effect on metabolism of various cells including hepatocytes reflected by increase in biochemical parameters of liver function test AST ALT and ALP in both subclinical and overt hypothyroid subjects. This suggests that hypothyroid patients should be regularly checked for biochemical parameters of liver and kidney function tests. Early detection and treatment can prevent the further complications related to the disorder and will be helpful during the management of thyroid patients.

Limitations

Further studies are required to be carried out in large sample size to confirm our findings.

Future studies are also needed to evaluate the general population and to trace the subjects under risk for development of multi organ dysfunction due to thyroid alteration.

REFERANCES

1. Pandey R, Jaiswal S, Sah J, Bastola K, Dulal S. Assessment of Serum Enzymes Level in Patients with Thyroid Alteration Attending Manipal Teaching Hospital, Pokhara. *A Journal of Life Sciences* 2014;3: 2249-8656
2. Mittal A, Sathian B, Kumar A, Chandrasekharan N, Dwedi S. The Clinical Implications of Thyroid Hormones and its Association with Lipid Profile. *Nepal Journal of Epidemiology* 2010;1:11-16
3. Manjula K. S, Priyadarshini K. S, H. V. Shetty, Usha S.M.R, Reena. R. Study of serum transaminases in hypothyroidism. *Journal of Evolution of Medical and Dental Sciences* 2013;2:230-234
4. Hasan B, Ibrahim N. Estimation of thyroid hormones and liver enzymes levels in hypo and hyperthyroidism in iraqi women. *Int j pharm bio sci* 2016;7: 707 – 713
5. Mane A, Bhagwat V. Serum enzymes and liver function tests in thyroid disorders. *Biomedicine* 2011; 31: 517 – 522
6. Kalita N, Devi R, Ahmed S. Influence of hypothyroidism on biochemical markers of liver function test: a cross sectional study. *Indian Journal of Basic and Applied*

Medical Research 2016; 5:478-490

7. Yadav A., Arora S., Saini V., Arora MK., Singh R., Bhattacharjee J. Influence of thyroid hormones on biochemical parameters of liver function: a case-control study in North Indian population. *Internet Journal of Medical Update.* 2013;8: P.4-8
8. P. D. Griffiths. Serum enzymes in diseases of thyroid gland. *J Clini Path* 1965; 18:660.
9. Malik R, Hodgson H. The relationship between the thyroid gland and the liver. *Q J Med.* 2002;95:p.559-69.
10. Targher G., Montagnana M., Salvagno G. et al. Association between serum TSH, free T4 and serum liver enzyme activities in a large cohort of unselected outpatients. *Clin Endocrinol* 2008; 68: p.481–484.
11. Khan T.M., Malik S, Diyu I.U. Correlation between plasma thyroid hormones and liver enzymes level in thyrotoxic cases and controls in Hazara division. *J Ayub Med Coll Abbottabad.* 2010; 22: p.176–179
12. Prakash A., Lal A.K., Negi K.S. Serum Creatine Kinase activity in thyroid disorders. *J Med Edu Research.* 2007; 9: p.25–26.
13. Klion F.M., Segal R., Schaffner F. The effect of altered thyroid function on the ultrastructure of the human liver. 1971; 50: p.317-24.
14. Bandeduche S, Jagtap S. Study of liver and kidney function tests in patients of hypothyroidism. *International Journal of Biochemistry.* 2017;4:66-69

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 13-07-2019; **Accepted:** 31-07-2019; **Published:** 23-08-2019