Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

Research Paper

Assessment of serum liver enzymes levels in hypothyroid and hyperthyroid subjects in indian population

Biochemistry

KEYWORDS : Hypothyroid, hyperthyroid, liver enzymes

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ABSTRACT

The thyroid gland is essential for metabolism and normal function of body cells including the liver cells. It helps in the development and maturation of the hepatocytes and other body cells and tissues. This study enrolled a total of 100 patients with thyroid gland diseases hyperthyroid and hypothyroid diseases. The activities of the enzyme GGT, ALP, AST and ALT were evaluated in these diseases state and were compared with normal healthy thyroid gland. There was highly significant increase and decrease in the activity of GGT, ALP, AST and ALT in hyperthyroid and hypothyroid patients (P < 0.001) respectively when compared with third group normal. The emerging evidence suggests that abnormal LFTs may be a marker for diagnosis of thyroid dysfunction.

INTRODUCTION

The thyroid gland is one of the largest endocrine glands in the body. In healthy people it produces thyroid hormones which are important at a cellular level, affecting the growth development and rate of function of many other systems in the body.[1] It has functions as a stimulus to metabolism and is critical to normal function of the cell.

These hormones also have direct effect on most organs including heart, beats faster and harder under influences of thyroid hormone. The thyroid hormone control how quickly the body burns energy, makes proteins, and how sensitive the body should be to other hormones. As well many functions of the liver, this is the primary organ responsible for the maintenance of the metabolic process. [2]

According to the World Health Organization, iodine deficiency is the world's most prevalent yet easily preventable cause of brain damage. It affects more than 740 million people worldwide – 13% of the world's population.[3] As many as an additional 30% of the population worldwide is at risk of iodine deficiency-related problems. Besides iodine deficiency, there are number of risk factors for thyroid disease. These include genetics and heredity, personal or family, history of endocrine or autoimmune disease, infection, and exposure to goitrogenic foods, cigarette smoking, pregnancy, certain drugs, particular chemical exposures, radiation exposure, and many other factors. It is estimated that more than 200 million people at minimum worldwide have thyroid disease.

Alkaline phosphatase, ALP [EC 3.1.3.1] is found in all tissue of the body, serum, cell membrane, liver, bile duct, placenta, chromosome and intestinal epithelium.[4]

Gamma glutamyltransferase ,GGT [EC 2.3.2.3], is the enzyme responsible for extracellular catabolism of glutathione (GSH-Gamma Glutamyl-Cysteinyl- Glycine), the main thiol intracellular antioxidant agent [5] and the larger function of enzyme is located in the cell membrane and may act to transport amino acid and peptide into the cell across the cell membrane in the form of gamma glutamyl peptidase. The enzyme is present on the surface of most cells, in serum and also in various body compartment of human body tissue.

Triiodothyronine (T3) and thyroxine (T4) are the only iodine-containing amine hormones in the vertebrate and are necessary for optimal growth, development, and function of tissues. They have vital influence on oxygen consumption and metabolic rate of all cells including hepatocytes, thus alter hepatic function. The liver in turn metabolizes thyroid hormones through conjugation, excretion, peripheral deiodination, and in the synthesis of thyroid-binding globulin, and thus controls their endocrine effects.

Studies have reported conflicting results on the effect of hepatic dysfunction seen in liver diseases on thyroid function and documented that chronic liver disease is associated with low circulating T4 and its conversion to T3. [6] however reported hyperthyroidism in intrahepatic cholestatic patients.

Although few studies have documented the pathophysiological effect of hypothyroidism, including its effect on liver function, none has reported the changes in liver enzymes in thyroid dysfunction (hypothyroid and hyperthyroid). However, the data on the changes in liver enzymes in relation to hypothyroidism and hyperthyroidism are scarce.

Therefore, the present study is designed to investigate the activity of serum amylase, alkaline phosphatase and gamma glutamyltransferase in patients with thyroid diseases, hyperthyroidism and hypothyroidism. Further an attempt will be made to know the association of serum transaminases (GOT and GPT) activities in aforesaid subjects.

MATERIAL AND METHODS

The present study was conducted on 100 hypothyroid and hyperthyroid patients attending Medical OPD and Radioimmunoassay (RIA) Laboratory of Biochemistry Department of J.L.N. Medical College and Hospital, Ajmer. The results of the patients were compared with 50 healthy subjects of either sex of similar age group.

INCLUSION CRITERIA:

The individual within 20–60 age groups and without any chronic condition other than thyroid are included in this study.

EXCLUSION CRITERIA:

Individuals with an active infection or a recent infection including liver disease, bone and muscle disease, pancreatic, hepatobillary, malignancy, oral contraceptive pills (OCP), pregnancy, alcoholics, and drug abusers were excluded.

Informed consent was secured from all subjects for participating in the study.

Blood samples were collected by venipuncture by aseptic technique and samples with signs of hemolysis were discarded. The serums separated from the samples were analyzed for following

Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

biochemical parameters:

Serum were subjected for estimations including thyroid function tests – T3, T4 and TSH by Radioimmunoassay (RIA) method, serum AST, ALT, ALP, GGT by using commercially available kits and methods on fully auto analyser.

RESULT AND DISSCUTION

The present study was conducted to compare liver function tests in hypothyroid and hyperthyroid patients. Grouping of subjects were as follows:

Group I : Healthy control subjects (n= 50)
Group II : Hypothyroid subjects (n=50)
Group III : Hyperthyroid subjects (n=50)

The mean±SD value of GGT in healthy control subjects was 23.18±3.31 U/L, in hypothyroid subjects (Group II) it was 20.0±4.20 U/L (Table1), and in hyperthyroid subjects (Group III) was 122.56±5.7 U/L (Table 2) (Fig.1).

The decrease in GGT level was observed statistically highly significant ($P < 0.001$) in hypothyroid subjects (Group II) when compared with healthy control subjects (Table1) (Fig.1). On comparing hyperthyroid subjects (Group III) with healthy control subjects, the GGT values of hyperthyroid subjects was increased significantly ($P < 0.001$) (Table 2) (Fig.1).

The possible explanation could be that goiterous tissue produce high enzymatic activity than in healthy individuals and that may be released in blood stream and cause rising of enzymes activities in serum during presence of goiter and damage of thyroid gland tissue.

The mean±SD value of ALP in healthy control subjects was 39.02±4.8 U/L, in hypothyroid subjects (Group II) it was 25.6±3.54 U/L, and in hyperthyroid subjects (Group III) was 158.94±6.26 U/L. ALP level showed highly significant decrease ($P < 0.001$) in hypothyroid subjects (Group II) (Table 1) (Fig1) and increase in hyperthyroid subjects (Group III) (Table 2) (Fig 1) when compared to healthy controls.

The mean±SD value of SGOT level in healthy control subjects was 26.52±4.49 U/L, in hypothyroid subjects (Group II) it was 22.5±3.95 U/L, and in hyperthyroid subjects (Group III) was 39.76±5.0 U/L. SGOT level showed highly significant decrease ($P < 0.001$) in hypothyroid subjects (Group II) (Table 1) (Fig1) and increase in hyperthyroid subjects (Group III) (Table 2) (Fig 1) when compared to healthy control subjects.

The mean±SD value of SGPT in healthy control subjects was 23.98±5.27 U/L, in hypothyroid subjects (Group II) it was 19.4±4.4 U/L, and in hyperthyroid subjects (Group III) was 38.78±4.96 U/L. SGPT level showed highly significant decrease ($P < 0.001$) in hypothyroid subjects (Group II) (Table 1) (Fig1) and increase in hyperthyroid subjects (Group III) (Table 2) (Fig 1) when compared to healthy controls.

It is explained that in excess of thyroid hormone, it over stimulate metabolism and exacerbates the effect of the sympathetic nervous system causing speeding up of various body system and symptoms and increase the enzyme activities and releasing into blood stream in patients.

Raju Pandey *et.al* (2013)(7) reported similar findings in which they showed that thyroid hormones have significant effect on various organ systems of the body. During thyroid alteration, serum enzymes levels were also fluctuated. There was a positive association between increased serum AST, ALT, GGT, CPK, ALP, and LDH in hyperthyroidism and hypothyroidism.

Malik R *et.al* (2002)(8) reviewing the relationship between thyroid gland and liver in hyperthyroidism 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.

Our findings are in agreement with Biscoveanu M *et.al* (2000)[9] who analyzed clinical records of 30 cases of Grave's disease to identify the spectrum of abnormal results of liver function tests.

Tariq Mehmood Khan *et.al* (2010)[10] reported that more the plasma thyroid hormones level is elevated the higher is plasma liver enzyme level. Thus showing a positive relationship between T3, T4 and ALT, AST ALK levels, that is in accordance with the values reported in our study.

Our study also correlates with the Ayodeji F. *et.al* (2012)[11] who studied the effect of altered thyroid state on liver function and showed that thyroid dysfunction led to lysis of the hepatocytes.

Hypothyroidism and hyperthyroidism were associated with significant ($p<0.05$) increase in liver weight and diameter which reveals that although hyperthyroid state is not associated with alterd liver function hypothyroidism caused hepatic dysfunction.

Alkaline phosphatase which is mainly produced by osteoblasts of bone is elevated in goitre subjects when compared with the control. This elevation or increase in ALP may be linked to increase in binding protein, Thyroid Stimulating Hormone secretion tumors as well as receptor defect. This is in line with the work of Giannini *et al* (2005)[12] which is also consistent with our findings.

Nnodim John Kennedy *et.al* (2011)[13] revealed the role of serum hepatocellular enzymes in patients with Goitre. It was suggested that GGT and ALP are frequently increased in goiter. Hence, they are possibly thyroid dependent enzymes. This also correlates with our study.

Our study also correlates with the Sandeep Kharb *et.al* (2015)[14] who studied the effect of thyroid and gonadal functions in liver diseases.

In the study he revealed that thyroid dysfunction was present in 16% of patients with liver disease. In autoimmune hepatitis both Grave's disease (6%) and autoimmune hypothyroidism (12%) are common. He also concluded that thyroid dysfunction and hypogonadism forms an important part of the spectrum of acute and chronic liver disease and patients with liver transplant.

Ahmet Tarik Eminler (2014)[15] reported a study on thyroid disease and liver disease association. In patients with Graves' disease and subacute thyroiditis, elevation of liver enzymes and liver damage due to elevated thyroid hormones has been reported.

Liver disease associated with hyperthyroidism may range from mild liver enzyme elevations to serious hepatic ischemia. He also reported that cases showed an improvement in clinical and laboratory findings after antithyroid therapy and/or thyroidectomy and concluded that Graves' disease was considered as a cause of intrahepatic cholestasis after excluding other reasons by blood tests and imaging methods for the differential diagnosis of cholestasis.

The novelty of this study bridges the gap in the dearth of knowledge in the open literature on the effect of hypothyroidism and hyperthyroidism on liver function. The results from the study revealed that individuals with thyroid dysfunction have a high-

er incidence of LFT abnormalities than individuals who do not have thyroid disorders.

Because of high liver enzyme level in serum of patients with hypothyroidism and hyperthyroidism, it is thus recommended that liver function should be monitored in conditions associated with thyroid dysfunction to avoid hepatic complications of thyroid dysfunction.

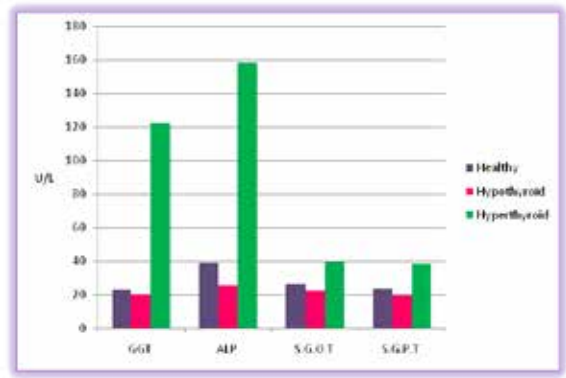
TABLE 1
BIOCHEMICAL PARAMETERS OF HEALTHY CONTROLS (GROUP-I), HYPOTHYROID SUBJECTS (GROUP-II) (n=50 each)

Parameters	Healthy control subjects Mean ± S.D	Hypothyroid subjects Mean ± S.D	P value
GGT (U/L)	23.18±3.3	20.0±4.20	P < 0.001
ALP (U/L)	39.02±4.8	25.6±3.54	P < 0.001
S.G.O.T. (U/L)	26.52±4.49	22.5±3.95	P < 0.001
S.G.P.T (U/L)	23.98±5.27	19.4±4.4	P < 0.001

TABLE 2
BIOCHEMICAL PARAMETERS OF HEALTHY CONTROLS (GROUP-I), HYPERTHYROID SUBJECTS (GROUP-III) (n=50 each)

Parameters	Healthy control subjects Mean ± S.D	Hyperthyroid subjects Mean ± S.D	P value
GGT (U/L)	23.18±3.3	122.56±5.7	P < 0.001
ALP (U/L)	39.02±4.8	158.94±6.26	P < 0.001
S.G.O.T. (U/L)	26.52±4.49	39.76±5.0	P < 0.001
S.G.P.T (U/L)	23.98±5.27	38.78±4.96	P < 0.001

BIOCHEMICAL PARAMETERS OF HEALTHY CONTROLS (GROUP-I), HYPOTHYROID SUBJECTS (GROUPII) AND HYPERTHYROID SUBJECTS (GROUP III) (n=50 each)
Fig.1



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