Original Research Article

Assessment of Iron, Ferritin, TIBC and LDH Levels: A Cross Sectional Study in Hypothyroid Patients at a Tertiary Care Centre

Santosh Kumar[1], Sudha Kumari[2], Sude Kumar Singh[3]

[1]Assistant Professor, Department of Biochemistry, Darbhanga Medical College, Darbhanga, Bihar, India

[2]Assistant Professor, Department of Biochemistry, Darbhanga Medical College, Darbhanga, Bihar, India

[3]Professor & Head, Department of Biochemistry, Darbhanga Medical College, Darbhanga, Bihar, India

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Abstract

Aim: Is to study the changes of serum ferritin, Iron, TIBC and LDH levels which may affect the thyroid functions in hypothyroid patients.**Materials and Methods:** Serum Thyroid profile, Ferritin levels were estimated in 100 age and sex matched controls and patients of hypothyroidism, using CLIA in Mindray. Serum Iron, TIBC and LDH levels were estimated in ERBA chem7 and the results were correlated statistically.**Results:** Serum ferritin levels were found to be significantly decreased in patients with hypothyroidism compared to normal subjects ($p < 0.001$) and TIBC levels were significantly increased.**Conclusion:** Hypothyroidism is associated with low serum ferritin levels. The estimation of serum ferritin may help in understanding the etiopathogenesis, diagnosis, and monitoring of hypothyroid patients.

Keywords: Iron, Ferritin, Hypothyroidism, TIBC, LDH.

Introduction

Thyroid gland is an endocrine gland which is in butterfly shape located lower part of the neck. They contain follicular cells which is responsible for synthesis of thyroid hormones T3 and T4 besides the follicular cells they also contain parafollicular cells which synthesizes calcitonin.[1] It mainly plays a role in controlling basal metabolic rate, cell differentiation and development and also plays a role in maintaining calcium levels.Ferritin is a protein which plays an important role that it indicates the storage levels of iron and had positive correlation between ferritin and iron stores[1-3]Iron acts as a co factor for enzymes like TPO.It acts by oxidation of iodine which later binds to tyrosyl of thyroglobulin.When there is a decrease in iron status it leads to derailment of this enzyme causes effect on thyroid hormone synthesis[4-6].Some of the studies showed there will be a decrease in iron storage level status in hypothyroidism.[4] Hypothyroidism is an endocrine disorder which ranges from an overt state of myxedema, end-organ effects and multisystem failure to an asymptomatic or sub clinical condition state[7-10]. The prevalence of hypothyroidism in the developed world is about 4-5%[11,12] The prevalence of sub clinical hypothyroidism in the developed world is about 4-15%[13]It is a most common disorder of thyroid gland which effects irrespective of age, sex and socioeconomic status. Overt hypothyroidism presents with low levels of serum thyroid hormone levels and TSH levels are elevated.Subclinical hypothyroidism presents with normal serum thyroid hormone levels are within normal levels and there is a elevation of TSH levels[14]To diagnose subclinical hypothyroidism it is solely based on biochemical diagnosis.Studies in animals and humans have shown that iron deficiency anemia (IDA) impairs thyroid metabolism. IDA decreases plasma total thyroxine (T_4) and triiodothyronine (T_3) concentrations, reduces peripheral conversion of T_4 to T_3 and may increase circulating thyrotropin (TSH). In regions of endemic goiter, the thyroid response to iodized oil is impaired in children with IDA compared with Fe-sufficient children. In addition, Fe supplementation of goitrous children with IDA improves the efficacy of iodized oil and iodized salt.IDA could impair thyroid metabolism through anemia and lowered oxygen transport. IDA may also alter central nervous system control of thyroid metabolism and nuclear T_3 binding. Another potential mechanism is impairment of thyroid peroxidase (TPO) activity. TPO is a 103-kDa Fe-dependent enzyme located at the apical membrane of the thyrocyte. TPO catalyzes the first two steps of thyroid hormone synthesis, iodination of thyroglobulin and coupling of the iodotyrosine residues.The aim of this study is to assessment of iron, ferritin, TIBC and LDH levels a cross sectional study in hypothyroid patients.

Materials and Methods

It is a cross-sectional study in which those patients included who are attending medical OPD and study is carried in the Department of Biochemistry, Darbhanga Medical College, Darbhanga, Bihar, India. There are hundred (100) samples of age and sex matched were collected for estimating Thyroid Profile, Iron, TIBC, LDH and Ferritin levels and divided into two groups- control and the hypothyroid patients. We collected 3ml of venous blood for estimating these parameters. Thyroid profile and Ferritin were estimated in chemiluminesence Mindray hormonal auto analyzer and LDH is measured in ERBA chem semi auto analyzer. The study is approved by our ethical committee. Written consent is taken for this work and they are also given free option to withdraw anytime from this study.

Inclusion criteria: The patients with written consent for the project and diagnosed recently as hypothyroid patient within 1 year.

Exclusion criteria: The patients who were not willing to give consent for this project. The data analyzed statistically by graph pad version 6. The results will be explained in simple way i.e. mean ± standard deviation for quantitative variables, p value <0.05 considered as significant.

*Correspondence

Dr. Sudha Kumari

Assistant Professor, Department of Biochemistry, Darbhanga Medical College, Darbhanga, Bihar, India.

E-mail: drsudha222@gmail.com

Table 1: Present study results

Parameter SEM	Cases(Mean± SD)	SEM	Controls(Mean± SD)	SEM	p value
T3	1.10 ± 0.15	0.020	0.55 ± 0.14	0.028	< 0.001*
T4	8.30 ± 1.29	0.170	4.47 ± 0.58	0.090	< 0.001*
TSH	2.35 ± 0.90	0.111	25.45 ± 6.08	0.0860	< 0.001*
IRON	96.86 ± 28.46	9.46	50.12 ± 5.20	10.00	< 0.001*

FERRITIN	101.98 ± 41.82	5.74	23.15 ± 6.20	0.70	< 0.001*
TIBC	305.14 ± 30.09	8.40	471.42 ± 36.90	0.85	< 0.001*
LDH	299.80 ± 34.59	5.00	500.14 ± 75.41	4.51	< 0.001*

Result and Discussion

In our study we found that there is a significant low level of iron, ferritin and increased TIBC levels in our subjects with altered thyroid profile indicated by decreased in blood levels of T3 ($p<0.001$) and T4 ($p<0.001$). By this we can say there is positive correlation between iron deficiency and thyroid status. Our study is in accordance with other studies[15].Akhter S et al., reported that there is a significant alteration in thyroid hormone status in iron deficient people where it effects the enzyme TPO activity leading to the alteration in thyroid function[5].Another similar study which states that in iron deficiency anemia the TPO activity is decreased with decreased transportation of thyroid hormones into the cell which leads to development of hypothyroid condition.Eftekhari MS et al., showed that there is inverse relationship with plasma ferritin levels with thyroid hormones and iron status.Thyroid hormones play a role in regulation of gene expression for transferrin. The expression of gene for ferritin can be induced by T3 hormone[16,17]These hormones play a role in erythropoiesis and helps in erythroid colony development. Thus, hypothyroidism may lead to bone marrow repression and/or decrease in production of erythropoietin due to decreased oxygen requirement.[17]In our study we found that there is increase in serum LDH activity with hypothyroid patients. In primary hypothyroidism LDH activity reported as increased.[18,19]Thyroid dysfunction may alter the function of Liver, muscle and kidney function which plays a role in metabolizing thyroid hormones.[20] Elevation of LDH reflects increase or decrease clearance from the liver.[21] These changes may result from reduction in muscle mitochondrial oxidative capacity and b -adrenergic receptors, as well as the induction of an insulin resistant state.[22] In our study LDH activity is correlating with hypothyroidism.

Our study has tried to establish a relationship between total body iron status in patients of altered thyroid profile in hypothyroidism, which will help the medical professional to have an account of iron profile assessment in patients of thyroid disorders.The objective of the study by Hess SY et al was to investigate whether iron (Fe) deficiency lowers thyroid peroxidase (TPO) activity. TPO is a heme-containing enzyme catalyzing the two initial steps in thyroid hormone synthesis. Male weanling Sprague-Dawley rats (n = 84) were randomly assigned to seven groups. Three groups (ID-3, ID-7, ID-11) were fed an Fe-deficient diet containing 3, 7 and 11 μg Fe/g, respectively. Because IDA reduces food intake, three control groups were pair-fed Fe-sufficient diets (35 μg Fe/g) to each of the ID groups and one control group consumed food ad libitum. After 4 wk, hemoglobin, triiodothyronine (T3) and thyroxine (T4) were lower in the Fe-deficient groups than in the ad libitum control group ($P < 0.001$). By multiple regression, food restriction had a significant, independent effect on T4 ($P < 0.0001$), but not on T3. TPO activity (by both guaiacol and iodine assays) was markedly reduced by food restriction ($P < 0.05$). IDA also independently reduced TPO activity ($P < 0.05$). Compared with the ad libitum controls, TPO activity per thyroid determined by the guaiacol assay in the ID-3, ID-7 and ID-11 groups was decreased by 56, 45 and 33%, respectively ($P < 0.05$). These data indicated that Fe deficiency sharply reduces TPO activity and suggest that decreased TPO activity contributes to the adverse effects of IDA on thyroid metabolism[4].

Conclusion

In the conclusion we want to establish how the thyroid is affected with alteration in iron profile status along with LDH levels. By this study we can help the patients to get better treatment and make them more comfortable. Further studies are required by taking larger sample size for better establishing the relationship and eliminating the possible confounders.

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