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Original Article

Thyroid hormones and some hematological parameter change in Thyroid Disorder

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Abstract

Background: Thyroid hormones play an important role in human metabolism. Erythrocytes abnormalities are frequently associated with thyroid disorder. Disorders of these hormones cause an effect on hematological indices levels. AIM- evaluate the effect of thyroid disorders on different hematological indices levels. **Materials and Methods :** This study was conducted Blood sample from 70 thyroid disorders patients (40 hypothyroid and 30 hyperthyroid) and 80 control subjects were evaluated. Haematological parameters like Hemoglobin, MCV (mean corpuscular volume), MCHC (mean corpuscular hemoglobin concentration) WBC and platelet parameter were evaluated and other routine haemogram were studied. Biochemical parameter like T3, T4 and TSH were measured. A comparison was done on different parameters **Results :** A statistical difference was observed for MCV and MCH but other parameters did not show any statistically significant difference. **Conclusion :** All the patients with thyroid disorders should be periodically evaluated for hematological changes.

Key words: Thyroid hormones, hypothyroid, hyperthyroid.

Introduction

The thyroid gland is the largest endocrine gland of human body. It synthesizes and secretes two major hormones-3, 5, 3 triiodo thyronine (T3) and thyroxin (T4). These hormones are necessary for metabolic activity of the body. These also have important role in early brain development, somatic growth, bone maturation, protein synthesis and production of red blood cells. These hormones are under the control of TSH (thyroid stimulating hormone) secreted by anterior pituitary which itself is mediated by TRH (thyrotropin-releasing hormone) secreted by hypothalamus. Thyroid hormones also play an important role in hemoglobin production in adult and maturation of Hb in fetus.¹⁻³ Thyroid hormones has effect on erythropoiesis. They cause hyper proliferation of immature erythroid progenitors and induce erythropoietin gene expression thus increasing secretion of erythropoietin leading to increased erythropoiesis. Thyroid disorders are accompanied by red blood cell abnormalities. Thyroid disorders can induce different effects on various blood cell lineages. Hypothyroidism can cause various forms of anemia

(normocytic-normochromic, microcytic, hypochromic or macrocytic). Patients with hypothyroidism have a decreased erythrocyte mass due to reduction of plasma volume whereas increased erythrocyte mass is observed in most hyperthyroid patients. Alteration in other hematological parameters such as hemoglobin (Hb), hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), white blood cells (WBC) count and platelet count is associated with thyroid dysfunction.⁴⁻⁷ In the present study, we attempted to evaluate the effect of thyroid dysfunction on various hematological parameters.

Materials and Methods

A cross sectional study was conducted from March 2016 to April 2017. A total of 150 subjects from 10 years to 70 years of age were included in this study. Blood samples were collected by venipuncture in EDTA anticoagulant tube. All haematological parameters were carried out by automated method. Adequate quality control measures were taken on each test procedure to ensure the reliability of results.

Serum samples were collected in vacutainer after collection of whole blood, allow the blood by leaving it at room temperature. This usually takes 15-30 minutes. The clot was removed by centrifuging. All biochemical examinations (Serum T3, T4, & TSH) was done by automated Immunology analyzer. Haematological investigation Complete blood count (CBC) was analyzed by 5 parts fully automated haematology analyzer. The cell counting components counts the number and types of different cells within

blood such as hemoglobin, HCT, MCV, MCH, MCHC, WBC & Platelet count. The results is printed out and/or sent to a computer for review.

Results

In this study about 70 patients age between 10 years to 70 years and 80 control were enrolled. Out of 70 patients, 40 were hypothyroid and 30 hyperthyroid.

Table-I: Age range of the patient (n=70) and control (n=80)

Age (years)	Frequency (control)	Percentage (%)	Frequency (patient)	Percentage (%)
> 20	7	8.75	8	11.43
20-40	38	47.5	32	45.71
40-60	29	36.25	24	34.28
<60	6	7.5	6	8.58
Grand Total	80	100%	70	100%

Table - II: Biochemical parameters of thyroid diseases and control

Biochemical parameters	Control	Hypothyroidism	Hyperthyroidism
T3 (ng/mL)	0.90±.12	1.19±.29	1.97±.13
T4 (µg/mL)	7.20±1.5	1.53±2.3	13.52±1.20
TSH (µIu/mL)	2.80±2.3	7.34±1.2	0.20±.15

Table-III: Comparison between blood cell count, RBC and Platelet indices in patients with Hypothyroidism & Hyperthyroidism

Index		No. of Patient	Mean±SD
MCV (fl)	Hypothyroidism	40	86.0±11.97
	Control	80	84.1±7.67
	Hyperthyroidism	30	77.1±8.10
MCH (pg)	Hypothyroidism	40	27.3±4.92
	Control	80	27.6±3.15
	Hyperthyroidism	30	24.2±2.76
MCHC (g/dL)	Hypothyroidism	40	30.9±1.64
	Control	80	31.2±1.54
	Hyperthyroidism	30	32.5±2.81
Hb (g/dL)	Hypothyroidism	40	10.5±2.24
	Control	80	11.4±2.07
	Hyperthyroidism	30	11.1±1.15

Index		No. of Patient	Mean±SD
RBC (M/ μ L)	Hypothyroidism	40	4.16±1.10
	Control	80	4.07±0.78
	Hyperthyroidism	30	4.16±0.54
HCT(%)	Hypothyroidism	40	34.4±6.17
	Control	80	35.6±5.18
	Hyperthyroidism	30	34.6±3.48
RDW(%)	Hypothyroidism	40	15.16±2.44
	Control	80	13.85±1.69
	Hyperthyroidism	30	14.41±2.23
Platelet (K/ μ L)	Hypothyroidism	40	204.08±50.86
	Control	80	257.11±40.85
	Hyperthyroidism	30	245.13±30.56
PDW 10(GSD)	Hypothyroidism	40	15.18±9.06
	Control	80	13.19±8.06
	Hyperthyroidism	30	14.23±5.06
PCT (%)	Hypothyroidism	40	0.79 ±0.54
	Control	80	0.52 ±0.39
	Hyperthyroidism	30	0.51± 0.29

Comparison of different parameters revealed that red cell indices including MCV and MCH have significant statistical difference (P value <0.05) but no difference was observed for Hb, RBC, Hct, RDW, PC, PDW, Pct, and MCHC. Comparison between control group and two study groups revealed statistically significant difference in MCV, MCH but no significant difference was observed for Hb, RBC, Hct, RDW, PC, PDW & MCHC.

Discussion

Thyroid hormones play an important physiological role in metabolic activity of human body. They also have role in erythropoiesis by induction of erythropoietin secretion and proliferation of erythroid progenitors.^{6,8} Thyroid dysfunctions including hypothyroidism and hyperthyroidism affect blood cells and cause anemia. They may also cause pancytopenia. Other blood cell indices including MCV, MCH, and MCHC also could change during thyroid dysfunction.⁴ According to our study, MCV, MCH and Pct show significant difference between two groups of patients but no statistically significant

difference was found in Hb, MCHC, RDW, Pct, Hct and RBC. Comparison of two groups with control group revealed statistically significant difference in MCV, MCH, but no difference was observed for Hb, MCHC, RDW, platelet count, Hct, RBC, PDW and Pct. Dorgalallh et al. reported that red cell indices Including MCH, MCHC, RDW, Hb and Hct show significant difference was found in WBC, platelet count and RDW. Comparison of two groups with control group revealed statistically significant difference in Hb, Hct, MCV, MCH, MCHC and RDW but no difference about RBC, WBC and platelet count.⁹ Geetha and Srikrishna in their study found statistically significant difference in RDW and MCV in two groups of patients in comparison to euthyroid control group. Other parameters like Hb and Hct did not show any significant difference.¹⁰ Kawa et al reported that RBC, Hb and Hct in patients with hyperthyroidism were significantly higher than in control group while RBC and Hb were decreased in hypothyroidism and Hct was increased. They also showed that MCH and MCHC were lower in both groups in comparison with control group and MCV was increased in two study groups.⁴

Conclusion

The presence of anaemia in thyroid disease is associated with thyroid hormone. Therefore thyroid hormones have a significant influence on erythropoiesis. The finding suggests that the molecular mechanism by which thyroid hormone influence hematopoiesis may provide a basis for therapeutic intervention in thyroid diseases. All patients with hypothyroidism and hyperthyroidism should be periodically evaluated for probable hematological changes.

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