Original Article

Thyroid Hormones and Hematological Indices Levels in Thyroid Disorder

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Abstract

Background: Thyroid hormones play an important role in hematopoiesis. Disorders of these hormones cause an effect on hematological indices levels. Present study is designed to evaluate the effect of thyroid disorders on different hematological indices levels.

Material and Method: A total of 166 including 54 hypothyroid, 30 hyperthyroid and 82 control subjects were evaluated. A comparison was done on different parameters.

Result: 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.

Keywords: 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 triiodothyronine (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 have 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

The procedures followed were in accordance with the ethical standards of

institutional experimentation. This was a prospective study comprising of a total of 166. Based on TSH value (normal range 0.3500–4.9400 IU/mL), the study group was divided into three subgroups: Hypothyroid (TSH>4.94I U/dL) = 54

Hyperthyroid (TSH<0.35I U/dL) = 30

Euthyroid or control group (normal TSH value and without any thyroid and hematological disorder) = 82

Initially, two separate blood samples were taken from each patient, 2 mL of uncoagulated sample from each patient for thyroid hormone assay and EDTA whole blood sample for whole blood count. Serum samples were used to determine level of T3, T4 and TSH (ARTECTi-1000, Abott). Complete blood cell count was measured with EDTA anticoagulated sample by NIHON KOHDEN 5 part differential cell counter.

Statistical Analysis

Results were reported as mean SD for variables. ANOVA and POST HOC test were used to calculate the significance of difference between two groups. P value <0.05 was considered as a significant change.

Results

Table 1.Descriptive Analysis of Patients with Hypothyroidism and Hyperthyroidism

	Number	Age (mean)	Max. (years)	Min. (years)	Male (%)	Female (%)	TSH (miu/mL)	T3 (mg/mL)	T4 (mg/dL)
Hypothyroidism	54	29.61	53	05	3	51	5.34	1.19	1.53
Hyperthyroidism	30	32.4	50	20	9	21	0.20	1.57	1.52
Control	82	11.59	60	05	12	70	2.8	0.9	7.2

Table 2.Comparison between Blood Cell Count, RBC and Platelet Indices in Patients with Hypothyroidism and Hyperthyroidism

Index		No. of patients	Mean	Std. deviation	P-value
MCV (fl)	Hypothyroidism	54	87.0	10.97	0.22
	Control	82	84.1	8.67	
	Hyperthyroidism	30	78.1	7.10	0.047
MCH (pg)	Hypothyroidism	54	27.8	3.92	0.42
	Control	82	27.2	2.95	
	Hyperthyroidism	30	24.7	2.46	0.02
MCHC (g/dL)	Hypothyroidism	54	31.9	1.44	0.58
	Control	82	32.2	1.44	
	Hyperthyroidism	30	32.5	2.87	0.56
Hb (g/dL)	Hypothyroidism	54	11.2	2.24	0.63
	Control	82	11.0	2.07	
	Hyperthyroidism	30	11.1	1.15	0.90
RBC (million/mm^3)	Hypothyroidism	54	4.13	1.0	0.77
	Control	82	4.08	0.68	
	Hyperthyroidism	30	4.46	0.44	0.12
Hct (%)	Hypothyroidism	54	35.4	7.17	0.60
	Control	82	34.6	5.48	
	Hyperthyroidism	30	34.6	2.48	0.99
RDW (%)	Hypothyroidism	54	15.86	2.44	0.98
	Control	82	15.85	1.69	
	Hyperthyroidism	30	15.41	2.23	0.48
Platelet count (lacs/dL)	Hypothyroidism	54	2.08	0.86	0.88
	Control	82	2.11	0.85	
	Hyperthyroidism	30	2.13	0.56	0.94
PDW (%)	Hypothyroidism	54	0.18	0.06	0.60
	Control	82	0.19	0.06	
	Hyperthyroidism	30	0.23	0.06	0.80
Pct (%)	Hypothyroidism	54	14.79	2.54	0.045
	Control	82	16.12	2.59	
	Hyperthyroidism	30	15.51	2.29	0.46

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In 54 patients with hypothyroidism, mean age was 29.61+11.95 years (min. 5, max. 53) and in 30 patients with hyperthyroidism, mean age was 32.4+10.1 years (min. 20, max. 50) and in control group, the mean age was 32.71+11.59 years (min. 5, max 60) (Table 1).

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 and Pct but no significant difference was observed for Hb, RBC, Hct, RDW, PC, PDW, and MCHC (Table 2).

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

According to obtained data, we suggested that all patients with hypothyroidism and hyperthyroidism should be periodically evaluated for probable hematological changes.

Conflict of Interest: None

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