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Original Research Article

Hematological Indices in Thyroid Disorders

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Abstract

Context: Thyroid hormones are the important hormone helping in body metabolism. Every cell in the body depends on thyroid hormones for regulation of their metabolism. They are also known to play an important role in hematopoiesis. This study was done to know the impact of thyroid disorders like hypothyroidism and hyperthyroidism on various haematological indices which we see in routine complete blood count done using automated cell counter.

Aims: To study the effect of hypothyroidism and hyperthyroidism on various hematological indices

Settings and Design: Prospective study

Methods and Material: A total of 150 including 50 hypothyroid, 50 hyperthyroid and 50 control subjects were evaluated. A comparison was done on different parameters.

Statistical analysis used: 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: A statistical difference was observed for MCV and MCH but other parameters did not show any statistically significant difference.

Conclusions: All the patients with thyroid disorders should be periodically evaluated for hematological changes.

Keywords: Thyroid Hormones; Hypothyroid; Hyperthyroid.

Inroduction

The thyroid gland being the largest endocrine gland of human body is vital for body metabolism. It secretes hormones like triiodothyronine (T3) and thyroxine (T4) which primarily influence the metabolic rate and protein synthesis. Also play an important role in early brain development, somatic growth, bone maturation and production of red blood cells. Hormone output from the thyroid is regulated by Thyroid stimulating hormone (TSH) secreted from the anterior pituitary gland which is regulated by Thyrotropin releasing hormone (TRH) produced by hypothalamus [1-3]. The association of thyroid disorders and abnormalities in hematological parameters is well known. In 1979, Fein showed that Graves' disease is associated with anemia[4]. Horton observed a decreased number of red blood cells (RBCs) in the peripheral blood (PB) of patients after thyroidectomy [5]. Hypothyroidism can cause certain forms of anemia on the one hand or hyperproliferation of immature erythroid progenitors on the other hand. The anemia is usually macrocytic hypochromic anemia of moderate severity [5]. In contrast, anemia is not frequently observed in patients with hyperthyroidism, whereas erythrocytosis is

fairly common [4,6]. It has been found that all haematological parameters return to normal when a euthyroid state is achieved [7]. As far as white blood cells and thrombocytes are concerned, a slightly depressed total leucocyte count, neutropenia, and thrombocytopenia have been observed in hypothyroid patients [8]. Furthermore, elevated, normal, or slightly depressed total leucocyte counts have been found in hyperthyroid patients, with only a relative decrease in the number of neutrophils and a relative increase in the number of eosinophils and mononuclear cells (MNCs). Nevertheless, hyperplasia of all myeloid cell lines in hyperthyroidism and their hypoplasia in hypothyroidism were reported by Axelrod [9].

In the present study, we attempted to evaluate the effect of thyroid dysfunction on various hematological parameters.

Materials and Methods

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) = 50 Hyperthyroid (TSH<0.35I U/dL) = 50 Euthyroid or control group (normal TSH value and without any thyroid and hematological disorder) = 50 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. Complete blood cell count was measured with EDTA anticoagulated sample . The study was approved by the institutional ethics committee.

Results

In 50 patients with hypothyroidism, mean age 28 years and in 50 patients with hyperthyroidism, mean age was 30years and in control group, the mean age was 25years (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).

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/ml)
Hypothyroidism	50	28	55	12	5	45	5.34	1.19	1.53
Hyperthyroidism	50	30	52	15	10	40	0.20	1.57	1.52
Control	50	25	58	16	12	38	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	50	86.0	12.04	0.22
	Control	50	83.1	11.63	
	Hyperthyroidism	50	80.0	11.2	0.047
MCH (pg)	Hypothyroidism	50	27.4	3.84	0.42
	Control	50	28.0	3.92	
	Hyperthyroidism	50	25.0	3.16	0.02
MCHC (g/dL)	Hypothyroidism	50	31.0	4.34	0.58
	Control	50	31.2	4.37	
	Hyperthyroidism	50	31.5	4.41	0.56
Hb (g/dL)	Hypothyroidism	50	11.2	1.57	0.63
	Control	50	11.1	1.55	
	Hyperthyroidism	50	11.0	1.54	0.90
RBC (million/mm3)	Hypothyroidism	50	4.13	0.58	0.77
	Control	50	4.08	0.57	
	Hyperthyroidism	50	4.46	0.63	0.12
Hct (%)	Hypothyroidism	50	34.2	4.79	0.60
	Control	50	35.6	4.98	
	Hyperthyroidism	50	34.0	4.76	0.99

Index		No. of Patients	Mean	Std. Deviation	P-value
RDW (%)	Hypothyroidism	50	16.8	2.35	0.98
	Control	50	15.0	2.1	
	Hyperthyroidism	50	15.4	2.16	0.48
Platelet count (lacs/dL)	Hypothyroidism	50	2.00	0.28	0.88
	Control	50	2.50	0.35	
	Hyperthyroidism	50	2.20	0.31	0.94
PDW (%)	Hypothyroidism	50	0.18	0.031	0.60
	Control	50	0.19	0.031	
	Hyperthyroidism	50	0.23	0.031	0.80
Pct (%)	Hypothyroidism	50	15.00	2.1	0.045
	Control	50	16.00	2.24	
	Hyperthyroidism	50	15.50	2.17	0.46

Abbreviations:

MCV- Mean Corpuscular volume
MCH- Mean Corpuscular Hemoglobin
MCHC- Mean Corpuscular Hemoglobin concentration
Hb- Hemoglobin
Hct-Hematocrit
RDW-Red cell distribution width
PDW- Platelet distribution width
Pct- plateletcrit

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 [10,11].

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. 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.

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 [12].

Conclusion

According to obtained data, it is important to monitor the patients with hypothyroidism and hyperthyroidism for probable hematological changes.

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