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Original Research Article

A Cross-Sectional Descriptive Study to Evaluate the Hematological Changes in Hypothyroidism and Hyperthyroidism Patients Attending Medicine OPD in Darbhanga Medical College, Laheriasarai

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Abstract

Aim: To study the pattern of hematological changes in thyroid dysfunction and to correlate thyroid function tests with complete blood count & red cell indices findings.

Material & Method: This was a cross-sectional descriptive study conducted in Department of pathology, DMCH, Darbhanga, Bihar, over a period of one year to evaluate the correlation between thyroid disease and hematological changes. For study 100 patients of hypothyroidism, 50 patients of hyperthyroidism and 50 euthyroid patients attending Medicine OPD at tertiary care center were selected.

Results: Hypothyroid group showed statistically significant reduction in Mean RBC count, hemoglobin, hematocrit, MCV and MCH and increased RDW whereas hyperthyroid group showed reduction in Mean RBC count, hemoglobin, and hematocrit and increased RDW when compared with control group. There was no statistically significant difference in total leukocyte count and platelets count among hypothyroid and control as well as hyperthyroid and control group.

Conclusion: Thyroid function test should be done in cases of unexplained anemia. So, periodic evaluation for probable hematological changes should be done in all the patients with hypothyroidism and hyperthyroidism.

Keywords: Hematological changes, hypothyroidism, hyperthyroidism

Introduction

The thyroid gland has a very important role in the body metabolism in general including the hematopoiesis. Blood disorders are frequently seen in patients with thyroid disorders because thyroid hormones have a very crucial role in the proliferation and the metabolism of red blood cells and all other blood elements [1,2].

Thyroid hormones often have important effect on erythropoiesis. They enhance erythropoiesis through hyper proliferation of immature erythroid progenitors and increase secretion of erythropoietin (EPO) by inducing erythropoietin gene expression. Thyroid hormones also augment repletion of hypoxia inducible factor1 (HIF-1) and then motivate growth of erythroid colonies (BFU-E, CFU-E). These hormones also intensify erythrocyte 2, 3 DPG compactness, which enhances the delivery of oxygen to tissues. Hyperthyroidism causes mild decreases in total white blood cell count, neutropenia, thrombocytopenia and increased, normal or mild decreases in total white blood cell count. Generally, it seems that hypothyroidism causes hypoplasia in all myeloid cell lineages and hyperthyroidism result in hyperplasia. With regard to lymphocytes, T3 is as a precursor substance for normal B cell formation in bone marrow through its mediation of pro-B cell proliferation. Therefore, thyroid disorders can induce different effects on various blood cell lineages [3-6].

Hypothyroidism can cause certain forms of anemia. [7] One of the studies suggested that there is an essential relationship between the hypothyroid state and low levels of iron, vitamin B12, and folic acid in the human body. [8-9] In contrast, hyperthyroid patients do not show anemia frequently, whereas erythrocytosis is fairly common.[10]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. [11]

With reference to lymphocytes, triidothyronine (T3) has been demonstrated to regulate pro-B-cell proliferation and thus a prerequisite for normal B-cell production in the bone marrow. These observations confirmed the association between thyroid gland dysfunction and Hematopoiesis. [12-14]

Material & Method:

This was a cross-sectional descriptive study conducted in Department of pathology, DMCH, Darbhanga, Bihar over a period of one year to evaluate the correlation between thyroid disease and hematological changes.

Inclusion criteria:

The present study included cases of thyroid dysfunction attending the medicine OPD above the age of 14 years irrespective of sex.

Exclusion criteria:

Cases of thyroid dysfunction attending the medicine OPD having infectious diseases, history of recurrent infections, asthma, allergy or using any drugs and age below 14 years were excluded from the study.

Methodology

For study 100 patients of hypothyroidism, 50 patients of hyperthyroidism and 50 euthyroid patients attending medicine OPD at tertiary care center were selected.

Statistical analysis:

Data was entered into Microsoft Excel and analyzed using SPSS (Statistical Package for Social Sciences) Software 20. Categorical variables were expressed in terms of frequency and percentage and continuous were expressed in terms of mean and SD. ANOVA test was applied to see any significant difference in continuous variables (RBC, WBC, TFT variables and platelet) among study groups (Hypothyroid, hyperthyroid and control group) Bonferroni post hoc correction was applied to see any difference between hypothyroid and control as well as hyperthyroid and control group with $p<0.05$ as statistically significant value.

Results:

Hypothyroidism was more common among younger, and hyperthyroidism was common in elderly population with overall female predominance (Table 1) and

hypothyroid group showed raised TSH with depressed T3 and T4 levels and hyperthyroid group showed depressed TSH with raised T3 and T4 levels (Table 2).

Hypothyroid group showed statistically significant reduction in Mean RBC count, hemoglobin, hematocrit, MCV and MCH and increased RDW whereas hyperthyroid group showed increase in Mean RBC count, hemoglobin, hematocrit and RDW when compared with control group. There was no statistically significant difference in MCV and MCH in hyperthyroid group. MCHC results were statistically insignificant in both hypothyroid and hyperthyroid group as compared with control group (Table 3).

There was no statistically significant difference in total leukocyte count and platelets count among hypothyroid and control as well as hyperthyroid and control group. In differential leukocyte count both hypothyroid and hyperthyroid group showed statistically significant difference in neutrophil, lymphocyte and monocyte count. In addition, hyperthyroid group also had significant difference in eosinophil count (Tables 4 and 5).

Peripheral Blood Smears (PBS) showed anemia in 92% of hypothyroid and 55% of hyperthyroid subjects. The most common type of anemia noted was Normocytic Normochromic followed by Microcytic Hypochromic anemia (Table 6).

Table 1: Age-wise distribution and Male: Female ratio among study groups (n=200)

Age group	Hypothyroid (n=100)	%	Hyperthyroid (n=50)	%	Control (n=50)	%	Total (n=200)	%
14-20yrs	3	3	0	0	3	6	6	3.0
21-30yrs	16	16	8	16	2	4	26	13.0
31-40yrs	39	39	12	24	20	40	71	35.5
41-50yrs	23	23	9	18	10	20	42	21
51-60yrs	5	5	8	16	1	2	14	7
61-70yrs	12	12	7	14	9	18	28	14
71-80yrs	2	2	6	12	5	10	13	6.5
Total	100	100	50	100	50	100	200	100

Table 2: Comparison of TFT variables among study groups

Variables	Hypothyroid	Hyperthyroid	Control	P value
	(n=100)	(n=50)	(n=50)	p1= p value of hypothyroid
	Mean±Std Deviation	Mean±Std Deviation	Mean±Std Deviation	p2= p value of hyperthyroid
TSH (µIU/ml)	25.6±3.32	0.17±0.088	2.52±1.20	p1=0.0001 p2=0.0001
T3 (ng/dl)	0.47±0.07	4.8±0.7	1.61±0.62	p1=0.0001 p2=0.0001
T4 (µg/dL)	4.8±0.84	19.6±0.57	10.6±3.7	p1=0.0001 p2=0.0001

Table 3: Comparison of RBC indices among study groups

RBC Indices	Hypothyroid	Hyperthyroid	Control	P value
	Mean±Std Deviation	Mean±Std Deviation	Mean±Std Deviation	p1= p value of hypothyroid p2= p value of

				hyperthyroid
RBC(N x 106/µl)	4.4±0.85	5.81±0.63	4.82±0.71	p1=0.0001 p2=0.0001
Haemoglobin (gm %)	11.3±3.72	15.61±4.82	14.7±2.85	p1=0.0001 p2=0.0001
Haematocrit (%)	30.2±7.4	38.63±8.51	46.62±7.64	p1=0.0001 p2=0.0001
MCV (fl)	86.4±6.7	83.71±6.61	88.61±8.99	p1=0.061 p2=0.291
MCH (pg)	25.2±4.75	26.5±2.30	24.82±2.30	p1=0.002 p2=0.724
MCHC (g/dl)	27.5±3.63	28.5±4.8	30.90±1.00	p1=0.432 p2=0.232
RDW (%)	15.62±0.6	11.6±0.70	12.81±0.80	p1=0.001 p2=0.0001

Table 4: Comparison of total WBC count and differential leucocyte count among study groups WBC Indices

WBC Indices	Hypothyroid Mean±Std.Deviation	Hyperthyroid Mean±Std. Deviation	Control Mean±Std. Deviation	P value p1= p value of hypothyroid p2= p value of hyperthyroid
TLC ($Nx10^3$/µl,)	9.82±3.8	7.55±2.02	7.42±2.08	p1=0.827 p2=1.000
Neutrophil %	65.7±5.2	62.6±4.64	60.62±3.75	p1=0.0001 p2=0.0001
Lymphocyte%	40.7±4.61	36.7±6.8	34.63±4.83	p1=0.0001 p2=0.0001
Monocyte%	3.6±2.53	2.79±1.62	1.40±0.60	p1=0.0001 p2=0.005
Eosinophil%	3.62±1.81	3.72±1.87	2.73±1.08	p1=0.281 p2=0.006
Basophil%	-	-	-	NA

Table 5: Comparison of Platelet findings among study groups

TFT Group	Mean platelet ($Nx10^3$/µl)	Std. Deviation ($Nx10^3$/µl)	P value p1= p value of hypothyroid p2= p value of hyperthyroid
Hypothyroid (n=100)	176.91	17.53	p1=0.077
Hyperthyroid (n=50)	269.02	30.67	p2=0.682
Control (n=50)	243.82	118.72	

Table 6: Comparison of Platelet findings among study groups

PBS	Hypothyroid (n=100)	%	Hyperthyroid (n=50)	%	Control (n=50)	%	Total (n=200)	%
MC HC anaemia	17	17	13	26	5	10	35	17.5

NC HC anaemia	6	6	0	0	0	0	6	3
NC anaemia	68	68	16	32	3	6	87	43.5
Within Normal Limit	9	9	21	42	42	84	72	36.0
Total	100	100	50	100	50	100	200	100

Discussion:

Thyroid gland as the largest and the most important endocrine gland of human body with the secretion of two hormones, T3 and T4, has a major role in metabolism of cells and organs. Thyroid gland also has a crucial effect on erythropoiesis by induction of erythropoietin secretion and also proliferation of erythroid progenitors [15].

The most common thyroid dysfunctions, hypothyroidism and hyperthyroidism affect blood cells and cause anemia with different severity. These thyroid disorders also cause thrombocytopenia, leukopenia and even in rare cases cause pancytopenia (in hypothyroidism). Other blood indices including MCV, MCH, MCHC, Hb also could change during thyroid dysfunction [16].

Thyroid hormones play a vital role in cell differentiation during development and maintain metabolic homeostasis in adults. Thyroid gland also has a significant effect on erythropoiesis. It induces erythropoietin secretion and proliferation of erythroid progenitors. [16].

In a study by Geetha J and Srikrishna R in 2012, red blood cell indices were compared in patients with hypothyroidism and hyperthyroidism and revealed that RDW and MCV in these two groups of patients in comparison to euthyroid individuals have statistically significant difference but other RBC parameters like HB and HCT did not show any significant difference in comparison with euthyroid status but in our study, these parameters were statistically different between patients with hypothyroidism and hyperthyroidism and control group except for MCV [17].

Kawa MP and et al in 2010 reported that RBC, HB and HCT in patients with hyperthyroidism were significantly higher than control groups while RBC and HB were decreased in hypothyroidism, while HCT was increased. [18] They also showed that MCH and MCHC were lower in both groups in comparison with control group and MCV was increased in two groups of hypothyroidism and hyperthyroidism [16].

Conclusion:

The present study stated that thyroid hormones estimation is essential in cases of unexplained anemia. So, periodic evaluation for probable hematological changes should be done in all the patients with hypothyroidism and hyperthyroidism.

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