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Original Research Article

A Case- Control Study on Hematological Profile in Thyroid Dysfunction

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Abstract

Introduction: Thyroid hormones regulate hematopoiesis and as a result hematological abnormalitites can occur in thyroid dysfunctions. But these are rarely studied and we attempted to evaluate hematological profile in thyroid dysfunction.

Materials and Methods: A case- control, cross sectional study was performed on 30 normothyroid, hypothyroid and hyperthyroid patients. The thyroid profile values were compared with the hematological profile and analysed using SPSS software.

Results: Erythrocyte sedimentation rate (ESR) and hematocrit showed significant statistical difference ($p < 0.05$) between control and both hypothyroid and hyperthyroid groups. Hemoglobin showed significant decrease in hypothyroid group when compared with controls. There was a significant increase in red cell distribution width (RDW) in hypothyroid patients when compared with controls.

Conclusion: Hypothyroidism can result in increase in MCV and RDW. Hence, hypothyroid patients should be investigated for red cell indices and RDW. Contradictory to this, patients with unexplained refractory anaemia with increase in MCV and RDW should be investigated with thyroid profile to rule out thyroid dysfunction. This will help in early diagnosis, intervention and thus avoiding the complications.

Keywords: Hematological Profile; Thyroid Function Test; Thyroid Dysfunction; RDW.

Introduction

Thyroid hormones (THs) are vital for physiological function, metabolism, development and differentiation of most tissues in human body [1]. They regulate hematopoiesis taking place in bone marrow. As a result hematological abnormalities are evident in thyroid dysfunction [2]. Disorders of thyroid can alter hematological profile resulting in anaemia, erythrocytosis, leucopenia, thrombocytopenia and rarely pancytopenia [3]. But these are rarely studied and we have attempted to evaluate hematological profile in thyroid dysfunction.

Materials and Methods

A case – control, cross sectional study was performed on 30 patients with hypothyroidism, 30 with hyperthyroidism and 30 healthy individuals as control group. The patients' thyroid stimulating hormone (TSH) level was determined by fluorescence enzyme immunoassay using TOSOH AIA360 automated immunoassay analyser. According to TSH level (normal value 0.4 to 4.0mIU/L) the study group was divided into hypothyroidism (TSH > 4.0mIU/L) and hyperthyroidism (TSH <0.4 mIU/L) groups. Complete blood count was

measured by Sysmex XS-800i automated cell counter. The results were analysed using SPSS software.

Results

Table 1 shows comparison between hematological profile in normothyroid, hypothyroid and hyperthyroid individuals. In this study, we found that T4 and TSH had significant statistical difference ($p < 0.05$) between control and both hypothyroid and hyperthyroid groups, as well as between hypothyroid and hyperthyroid groups. Erythrocyte sedimentation rate (ESR) and hematocrit showed significant statistical difference ($p < 0.05$) between control and both hypothyroid and hyperthyroid groups. Hemoglobin showed significant decrease in hypothyroid group when compared with controls. There was a significant increase in red cell distribution width (RDW) in hypothyroid patients when compared with controls.

Table 2 shows correlation between TSH and hematological profile in hypo and hyperthyroid patients. All hematological parameters show positive correlation with TSH in hypothyroid patients but only ESR is statistically significant. ESR, RBC count, Hemoglobin level, hematocrit, mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) show negative correlation with TSH in hyperthyroid patients, whereas total leucocyte count, mean corpuscular volume (MCV), RDW and mean platelet volume (MPV) show positive correlation.

Table 1: Showing comparison between hematological profile in normothyroid, hypothyroid and hyperthyroid individuals

Parameters	Controls (n=30) Mean& Std. deviation	Hypothyroid patients (n= 30) Mean& Std.deviation	Hyperthyroid patients (n=30) Mean& std.deviation
TT3	1.23±0.21	1.33±0.7	1.68±0.63 [a*]
TT4	15.6±4.0	7.2±1.8 [a*]	12.3±2.9 [a*, b*]
TSH	5.0±0.8	10.7±2.3 [a*]	1.6±0.8 [a*, b*]
ESR	37.8±17.4	46.1±13.5 [a*]	52.0±28 [a*]
TC	8513.8±1574.1	8250.2±1822.7	9430±1927.1 [b*]
RBC	4.6±0.5	4.3±0.8	4.7±0.2
Hb	12.2±1.7	11.3±2.6 [a*]	12.6±1.0
HCT	36.8±4.2	34.2±6.1 [a*]	38.24±2.1 [b*]
MCV	79.6±8.4	79.9±15.2	80.5±5.7
MCH	26.6±3.7	26.5±7.3	26.6±2.4
MCHC	33.3±1.5	32.7±3.3	32.9±1.2
PLT	308.2±80	335.2±73.9	357.2±92.6 [a*]
RDW (CV)	14.1±2.2	15.1±2.9 [a*]	13.8±1.4
MPV	9.2±1.4	9.2±0.9	9.1±08

Data expressed as mean and std. deviation, p value ≤ 0.05 considered as significant.
a= Control Vs* Hypothyroid and Hyperthyroid
b*= Hypothyroid Vs Hyperthyroid

Table 2: Correlation between TSH and measured parameters in hypothyroidism and hyperthyroidism patients

Parameters	Hypothyroidism patients Correlation Coefficient(r)	Hyperthyroidism patients Correlation Coefficient(r)
TT3	0.119	-0.116
TT4	0.189	-0.521**
ESR	0.392*	-0.467**
TC	0.243	0.070
RBC	0.146	-0.156
Hb	0.128	-0.130
HCT	0.212	-0.061
MCV	0.024	0.068
MCH	0.213	-0.019
MCHC	0.105	-0.178
PLT	0.008	-0.074
RDW	0.089	0.324
MPV	0.043	0.070

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).*

Discussion

Thyroid gland is the largest endocrine gland and thyroid hormones play a significant role in proliferation and metabolism of blood cells (4). Thyroid hormones have a fundamental effect on erythropoiesis by inducing erythropoietin synthesis and proliferation of erythroid progenitors (5). Thyroid dysfunction is well known to be associated with alterations in hematological profile but not studied frequently. We have made a sincere effort to analyse the hematological alterations in hypo and hyperthyroid patients.

In our study, we found that RDW was significantly increased in hypothyroid patients (15.1±2.9 as CV) compared to euthyroid group. This was similar to study done by Geetha J P et. al (6). Contradictory to their study we did not find increase in RDW in hyperthyroid patients in our study. Hypothyroid group of patients showed a statistically significant decrease in hemoglobin and hematocrit values compared to control group. But other parameters like mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) did not show any variation in our study unlike many other studies (3, 1).

In hyperthyroid patients, total leucocyte count and ESR were increased. But there was no significant changes in red cell indices and RDW observed in our study unlike other studies (6). Hence we found that RDW determination is important in hypothyroid patients compared to hyperthyroid patients.

Thyroid dysfunctions are on rise in today's modern era and TSH measurement is a sensitive diagnostic test for early detection of hypo and hyperthyroidism (7). Abnormalities of erythrocyte are most often associated with thyroid dysfunction, which are investigated rarely (8). The anaemia of hypothyroidism will lead to physiological compensation for decreased need of tissues for oxygen. This is attributed to low plasma erythropoietin levels. Hence, hypothyroidism is to be considered as a cause for unexplained anaemia (9). The increase in MCV is associated with hypothyroidism and falls progressively with replacement therapy with thyroxine (10). The possible cause for increase in MCV is due to alteration in the amount or distribution of lipids in red cell membrane resulting in changes in red cell volume (11). This change in size of RBCs leads to increase in RDW which is seen in our study in hypothyroid patients.

Conclusion

Thyroid dysfunctions are on a rise and is the cause for unexplained anaemia. Hypothyroidism can result in increase in MCV and RDW. Hence, hypothyroid patients should be investigated for red cell indices and RDW. This will help in early intervention and timely treatment, thus reducing the complications. Contradictory to this, patients with unexplained refractory anaemia with increase in MCV and RDW should be investigated with thyroid profile to rule out thyroid dysfunction. This will help in early diagnosis, intervention and thus avoiding the complications.

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