

Does assessment of haematological parameters using automated haematology analyser help in diagnosing non-neoplastic lesions of thyroid

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Abstract

Background: Thyroid hormones play an important role in maintenance of metabolism. They are required for differentiation and development of foetus. It has a crucial role in haemoglobin synthesis by regulating haematopoiesis in the bone marrow by increasing the erythropoietin production or by production of erythropoietic factors by non-erythroid cells. **Aim of the study:** To determine the association between thyroid function tests and haematological parameters using Automated Sysmex XN-1000 haematology analyser. **Methods and material:** The was retrospective study conducted in the department of Pathology in a tertiary care hospital. About 109 samples were included in the study and subjects were grouped into hypothyroidism and hyperthyroidism. Statistical analysis of data was done by SPSS 25.00 IBM: USA. **Results:** The study group consisted of 109 patients with mean age 44 years and standard deviation 13.93. There were 78.9% females and 21.1% males. Based on thyroid function status patients were divided into hypothyroidism and hyperthyroidism. The analysis showed a significant association in RBC and WBC parameters with hypothyroidism but there were no association seen between platelet parameters and thyroid hormone levels. **Conclusion:** The study concluded that females are more affected by thyroid disorders than males and the peak age is in the 5th decade of life. Thyroid dysfunction especially hypothyroidism affects all blood parameters except WBC and platelets. The follow up of patients with thyroid disorders should include the complete blood count and patients diagnosed with anaemia should be evaluated for thyroid function before iron therapy. Cases of anaemia that resist treatment should be investigated for the possibility of thyroid dysfunction.

Keywords: Haematological parameters, non neoplastic lesions, Thyroid function test.

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Introduction

The thyroid gland plays an important role in overall body metabolism, including hematopoiesis. Thyroid hormones bring about proliferation and metabolism of red blood cells and all other blood constituents; hence blood abnormalities are common in people with thyroid diseases[1,2].

Anemia is a widespread clinical disease. Its prevalence in the general population can reach up to 10% in various regions of the world. Females of childbearing age and the elderly are the most affected. Anemia is described as a decrease in the amount of red blood cells (RBC) or haemoglobin (Hb) in the blood, which reduces the blood's ability to transport oxygen to body tissues. Anaemia is diagnosed when the haemoglobin level is less than 12.0 g/dL for women and 13.0g/dL for males, according to WHO guidelines. [3,4,5].

A mean corpuscular volume (MCV) of 80 to 100 fL is considered normocytic red cell morphology, while MCV of less than 80 fL is considered microcytic anaemia, and MCV of more than 100 fL is considered macrocytic anaemia.

Thyroid hormones affect blood parameters directly by boosting erythrocyte precursors and indirectly by increasing erythropoietin synthesis[6]. Patients with thyroid abnormalities may have low iron levels, which affect haemoglobin levels, as well as low levels of both folate and B12, which have been detected in up to 25% of patients, affecting blood parameters such as haemoglobin and RBCs. Other causes of anemia include bone marrow suppression and other associated comorbid diseases[7]. Different kinds of anaemia can be detected in people with thyroid problems; iron deficiency anaemia is the most frequent, with macrocytic anemia occurring in a lesser extent[5]. Anemia in thyroid dysfunction patients is caused not only by a lack of nutrients, but also by a decrease in thyroid hormones, which results in a lack of stimulation of erythrocyte precursors in the bone marrow, a reduction in oxygen delivery to various tissues, and a decrease in erythropoietin levels[7,8].

Materials and methods

This was a descriptive retrospective study which was conducted in the department of pathology in a Tertiary care hospital in Dakshin kannada district of coastal Karnataka, India. The data were collected between January 2018 to December 2020 retrospectively. About 109 data were collected and subjects included in the current study were grouped into those having hypothyroidism and hyperthyroidism.

Procedure

Two ml of Ethylenediaminetetraacetic acid (EDTA) anticoagulated blood and three ml of whole blood were taken from these subjects under fully aseptic condition for complete blood count (CBC) and thyroid function tests respectively. EDTA blood samples were gently mixed for 5 min. CBC was performed by SYSMEX XN 1000 counter. The haematological parameters which were studied include the white blood cells (WBC), red blood cells (RBC), haematocrit (HCT), haemoglobin (Hb), mean corpuscular volume (MCV), mean

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corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), red cell distribution width (RDW), and Platelet counts. The other 3 ml of whole blood were put in gel tube, serum was prepared after centrifugation at 1000 gm and for 10 min, thyroid function tests including TSH, T3, T4 were performed based on electrochemiluminescence immunoassay (eCLIA). Only patients with thyroid dysfunction TSH > 5 iu/ml or TSH < 0.25 were included.

Aim of the study

1. To determine the thyroid hormone level and haematological indices in thyroid disorder patients attending a tertiary care hospital in coastal Karnataka.

2. To determine the association between thyroid function abnormalities and haematological parameters using Automated Sysmex XN-1000 haematology analyser.

Statistical analysis

The data analysis was done by SPSS 25:00 IBM: USA and descriptive statistics were displayed in terms of frequency, mean and standard deviations. The association between hypo and hyperthyroidism and haematological parameters were tested using chi square test. Level of significance is set at 5%.

Results

Table 1: General characteristics of the patients enrolled in the study

Main category(n=109)	Sub category	frequency	%
Age (range 16-76)		Mean=44	SD=13.93
GENDER	Female	86	78.9
	Male	23	21.1
WBC	Low	9	8.3
	Normal	77	70.6
	high	23	21.1
RBC	Low	17	15.6
	Normal	87	79.8
	High	5	4.6
HB	Low	39	35.8
	Normal	70	64.2
HCT	Low	32	29.4
	Normal	71	65.1
	High	6	5.5
MCV	Low	17	15.6
	Normal	68	62.4
	High	24	22.0
MCH	Low	5	4.6
	Normal	96	88.1
	High	8	7.3
MCHC	Low	54	49.5
	Normal	55	50.5
PLATELETS	Low	23	21.1
	Normal	81	74.3
	High	5	4.6
RDW-SD	Low	3	2.8
	Normal	89	81.7
	High	17	15.6

The mean age of patients who were involved in this study is 44 years with a majority of female patients constituting 78.9% of cases. Thus, from this study it was noted that most patients who presented with thyroid symptoms were female patients in their early forties. RBC count was low in 15.6% of patients. MCV, MCH, MCHC showed low value in 15.6%, 4.6%, 49.5% of patients respectively. Haematocrit levels were low in 9.4% patients. Red cell distribution width was low in 8% thyroid patients.

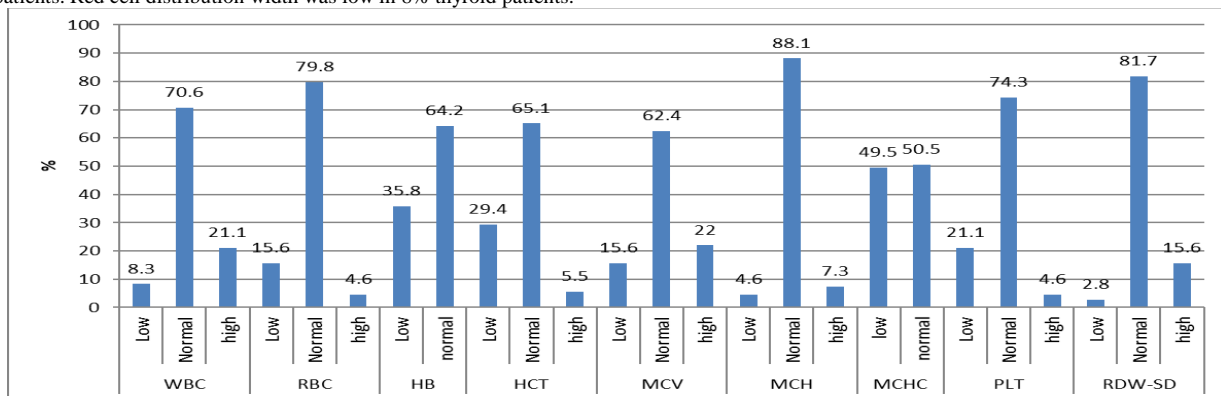


Fig 1: Graph showing percentage based on general characteristics of patients

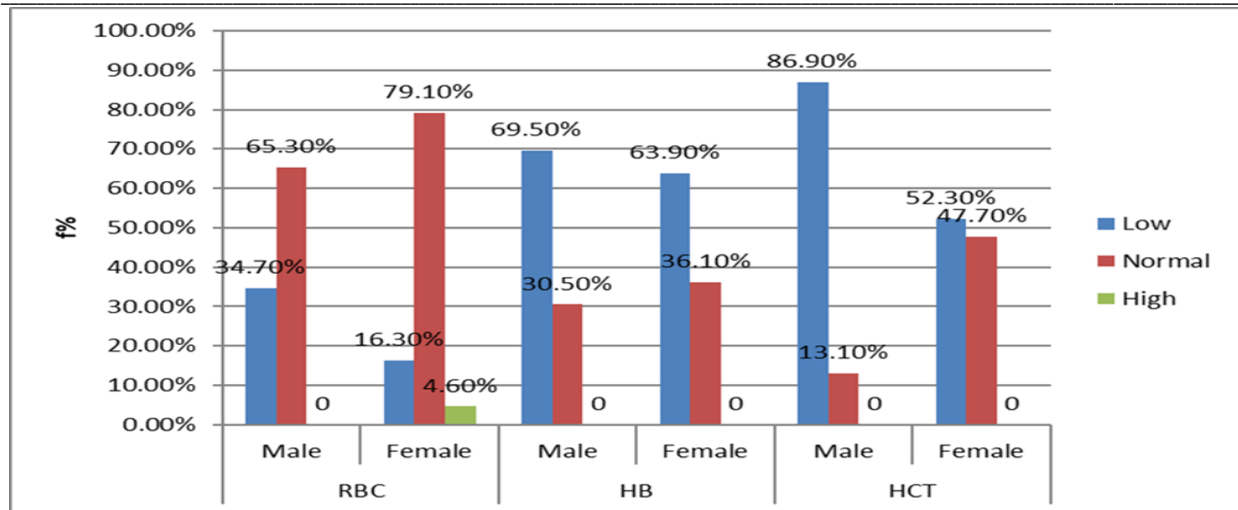


Fig 2: Graph showing comparison of RBC, Haemoglobin, haematocrit among male and female patients with thyroid disorders

Table 2: Association between the levels of different blood parameters and hyper and hypothyroidism

Main category	Sub category	Hyperthyroidism	Hypothyroidism	Significance
WBC	LOW	0	9	.036
		0.0%	9.7%	
	NORMAL	9	68	
		56.3%	73.1%	
	HIGH	7	16	
		43.8%	17.2%	
RBC	LOW	2	15	.014
		12.5%	16.1%	
	NORMAL	11	76	
		68.8%	81.7%	
	HIGH	3	2	
		18.8%	2.2%	
HB	LOW	2	37	.029
		12.5%	39.8%	
	NORMAL	14	56	
		87.5%	60.2%	
HCT	LOW	9	23	.033
		56.3%	24.7%	
	NORMAL	6	65	
		37.5%	69.9%	
	HIGH	1	5	
		6.3%	5.4%	
MCV	LOW	5	12	.027
		31.3%	12.9%	
	NORMAL	11	57	
		68.8%	61.3%	
	HIGH	0	24	
		0.0%	25.8%	
MCH	LOW	2	3	.035
		12.5%	3.2%	
	NORMAL	11	85	
		68.8%	91.4%	
	HIGH	3	5	
		18.8%	5.4%	
MCHC	LOW	4	50	.030
		25.0%	53.8%	
	NORMAL	12	43	
		75.0%	46.2%	
PLATELETS	LOW	3	20	.597
		18.8%	21.5%	
	NORMAL	13	68	
		81.3%	73.1%	

RDW-SD	HIGH	0	5	.701
		0.0%	5.4%	
	LOW	0	3	
		0.0%	3.2%	
	NORMAL	14	75	
		87.5%	80.6%	
	HIGH	2	15	
		12.5%	16.1%	

There is significant association between level of WBC, RBC, Haemoglobin, Haematocrit, mean corpuscular volume, mean corpuscular haemoglobin, Mean corpuscular haemoglobin concentration and thyroid parameters ($p < 0.05$). (Table.2). This shows that thyroid hormone is very essential component in haematopoiesis. This study showed that level of RBC is significantly associated (0.014) with thyroid function status. Table showed RBC count is significantly lower in hypothyroid patients (16.1%) as compared to hyperthyroid patients (12.5%). Low level of Haemoglobin is significantly associated with hypothyroidism (39.8%) as compared with hyperthyroidism (12.5%). According to our study mean corpuscular volume is significantly associated (0.27) with hypothyroidism, that is 25.8%. Hypothyroid patients showed high mean corpuscular volume level compared to hyperthyroidism (0%) and it clearly states that macrocytic anemia is the most common type of anaemia seen in hypothyroid patients which is similar to the study conducted by Szczepanek-Parulska et al. [5] This study also showed there is no significant association between platelet count, red cell distribution width with hyper and hypothyroidism ($p > 0.05$) (fig 2). This is similar to the study conducted by. Cinemre, et al., Fatima, P et al

Discussion

Anemia is common in thyroid function abnormalities mainly hypothyroidism, and most patients improve after thyroid hormone replacement and normalization of the thyroid function[9,10]. Thyroid abnormalities are common in the population being more common in females. In our study there was female predominance (78.9%) similar to most studies such as the studies done by Preethi S. et al. and M. A. Iddah et al. who showed the male to female ratio was around 1:3.8 Many studies concluded that low hemoglobin levels are seen in patients with thyroid function derangement particularly hypothyroidism. Our study showed similar results and the level of hemoglobin was significantly associated with thyroid dysfunction (P value 0.029). Most authors recommend treatment with iron supplementation in those patients, and patients who were treated with iron supplement alone without treatment with thyroxin showed lower response rates than combination therapy. Some population-based studies confirmed that there is no significant association between anemia and thyroid dysfunction, this suggest that the results showed variation and this association is not constant[11,12,13,14]. A univariate analysis was done and showed that the most affected blood parameters by thyroid dysfunction were the RBC, the Hb, and the WBC respectively. This may indicate that these parameters may be affected initially before the development of derangement of other parameters. Many studies showed that platelets are also affected by thyroid dysfunction, but in this study, we found that platelets were the only parameters which showed no significant correlation with thyroid dysfunction (P value 0.597)[15]. Platelets are less affected by thyroid function status; this finding has been found in many other studies and this may be due to the fact that platelets are non-nucleated and have short life span with continuous rapid turnover[16].

Conclusion

Thyroid disorders mostly affect females and the peak age is at the forties. Thyroid dysfunction affects all blood parameters indicating

that thyroid hormones are very important for blood formation. Patients diagnosed with anaemia should be evaluated for thyroid disorders before iron therapy. Cases of anaemia that resist treatment should be investigated for thyroid dysfunction.

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