Original Research Paper

Volume - 11 | Issue - 06 | June - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Medicine

TO STUDY HAEMATOLOGICAL CHANGES IN PATIENTS WITH PRIMARY HYPOTHYROIDISM AND HYPERTHYROIDISM

Dr Amit Singh Bisht	PG student department of medicine HIMS, jolly grant, Dehradun, Uttarakhand.
Dr S.K. Verma*	Professor, department of medicine HIMS, jolly grant, Dehradun, Uttarakhand. *Corresponding Author
Dr Sagar Modi	Associate Professor, department of Medicine HIMS, jolly grant, Dehradun, Uttarakhand.

ABSTRACT **Background:** Thyroid disorder have been associated with abnormalities in haematological parameters mainly RBC indices.

Objective: To compare haematological parameter between patients with primary hypothyroidism and those with hyperthyroidism.

Materials & Methods: Study was carried out in the dept. of General Medicine at the Himalayan Institute of Medical Sciences, Swami Ram Nagar, Dehradun. Patients with primary hypothyroidism and hyperthyroidism(50 each) attending the Medicine OPD and 50 age and gender matched controls where enrolled for duration of study was 12 months based on inclusion and exclusion criteria. The diagnosis of hypo and hyperthyroidism was based on clinical features and predefined lab values as per our lab. Healthy controls had normal FT4 and TSH.

Results: Patients with hypothyroidism had significantly higher BMI compared to the hyperthyroid subjects. (P<0.002).Significantly higher RBC and PCV values in hyperthyroid group compared to hypothyroid group, (p <0.001 and <0.023 respectively).when comparing PCV, MCV & RDW between the hypothyroid and hyperthyroid groups, PCV values were significantly higher in hyperthyroid patients and MCV and RDW values were significantly lower in hyperthyroid patients.

Conclusion: Extensive workup can be avoided for deranged haematological indices when cause(thyroid dysfunction) is established, correcting thyroid dysfunction may correct haematological indices.

KEYWORDS : Primary hypothyroidism, hyperthyroidism, Anemia, RBC, indices, Haemoglobin, RBC count, Hematocrit/PCV, MCH, MCHC, MCV, PCV, RDW, TLC, DLC, Platelet count.

I. INTRODUCTION

Thyroid disorders among most common endocrine diseases have important role to play in homeostasis via adaptation of various physiological processes (1). Both hypo- and hyperthyroidism have been associated with abnormalities in haematological parameters. In vitro studies have shown direct stimulatory effect of thyroid hormones on the proliferative capacity of erythroid precursors (2) but mechanisms underlying these haematological anomalies observed among patients with thyroid disorders are not fully clear. Thyroid hormones can also exert indirect influence on erythropoiesis by increased production of erythropoietin (3). At cellular level, actions of thyroid hormones are mediated through nuclear thyroid receptors (TR) alpha and beta. TR alpha and TR beta genes are expressed in bone marrow CD 34(+), peripheral blood and human cord blood cells (4). These observations might have relevance to the development of haematological abnormalities in patients with thyroid disorders (5).

The data obtained from previous studies highlight the influence of thyroid hormones on the process of haematopoiesis. However, the effects observed have not been consistent (6-10).

Considering the significant burden of thyroid disorders in India (15), assessment of haematological problems in these patients has clinical relevance. There is limited published experience from India on this matter (13). In our present study we aim to assess the abnormalities in haematological parameters among patients with primary hypothyroidism and hyperthyroidism.

II. MATERIALS & METHODS:

This cross-sectional observational study was carried out at a tertiary referral centre of Uttarakhand over a period of one year. After obtaining institutional ethical clearance. 50 patients with primary hypothyroidism, 50 patients with hyperthyroidism and 50 age and gender matched controls.

INCLUSION CRITERIA:

Age >18 years, Patients with primary hypothyroidism, (FT4 – normal or decreased; TSH>4.25 µU /ml) and Patients with hyperthyroidism, (FT4 – normal or elevated; TSH < 0.3 µU/ml).

EXCLUSION CRITERIA:

Euthyroid patients with treatment, Pregnant women, known cases of haematological disorders, those who have received blood transfusion in last 3 months and patients with advanced chronic liver disease and chronic kidney disease.

The diagnosis of hypothyroidism was made on the basis of (i) symptoms and signs of hypothyroidism, (ii) low or normal levels of FT4, and (iii) elevated levels of TSH (1). Hyperthyroidism was diagnosed based on the presence of (i) symptoms and signs of thyrotoxicosis, (ii) normal or elevated levels of serum FT4, and (iii) decreased levels of serum TSH (1). Healthy controls had normal FT4 and TSH.

Reference ranges for FT4 and TSH as per assay used in our laboratory were : (A) FT4 = 0.6 - 1.7 ng/dl, (B) TSH = 0.3 – 4.25 µU/ml.

Data Management & Statistical Analysis:

Data entry was done using M.S. Excel and statistically analysed using Statistical package for social sciences (SPSS Version 16) for M.S Windows. Descriptive statistical analysis was carried out to explore the distribution of several categorical and quantitative variables. Quantitative variables were summarized by mean ± S.D while qualitative variables were summarized with n (%). Results are presented in tabular form.

INFERENTIAL STATISTICS:

Statistical Significance using was analysed by Parametric tests such as t-test and categorical variables tested by chi square test in between group. P-value < 0.05 was considered to be statistically significant.

III. RESULTS:

Controls, hypothyroid patients and hyperthyroid patients were equally distributed. Patients with hyperthyroidism had significantly lower age compared to the controls (P value = 0.031). Patients with hypothyroidism(26.05±5.54) had significantly higher BMI compared to the hyperthyroid subjects(23.09±4.02).

Mean Hb among controls, hypothyroid and hyperthyroid patients was 11.5 ±1.63(p=0.950), 11.4 ± 2.07(p=0.722), 11.9 ± 2.17(p=0.495) respectively. No statistically significant difference was found in Hb values, RBC values when three group were compared.

Subjects with hyperthyroidism had significantly higher PCV (p=0.023), lower MCV (p=0.002) and lower RDW (p=0.021) compared to hypothyroid group. (TABLE 1).

Table 1: PCV, MCH, MCHC, MCV, RDW in three study groups

Indices	Hypothyroid	Hyperthyroid	**p value
	Mean ± SD	Mean ± SD	
Haematocrit / PCV (%)	33.4 ± 8.15	37.31 ± 4.59	0.023
MCH (pg.)	28.51 ± 3.38	28.7 ± 12.54	0.999
MCHC (gm/dl)	32.97 ± 1.00	32.47 ± 1.23	0.107
MCV (fl)	86.54 ± 8.75	80.51 ± 7.56	0.002
RDW (%)	16.36 ± 2.3	15.08 ± 2.19	0.021

Subclinical hypothyroidism and overt hypothyroidism patients showed no significant difference in Mean HB (gm/dl), Mean RBC, Mean haematocrit/PCV(%), MCH (pg), MCHC(g/dl), MCV(fl), RDW(%), Platelet count($10^{3/}$cmm) and TLC($10^{3/}$cmm).(Table 2).

Table 2: Comparison between overt hypothyroidism and subclinical hypothyroidism.

Lab parameters	Subclinical hypothyroidism, TSH (mIU/ml) = <10	Overt hypothyroidism, (mIU/ml) = > 10	p value
	Mean ± SD	Mean ± SD	
HB (gm/dl)	11.65 ± 1.35	11.27 ± 2.25	0.716
RBC count (Million/cu mm)	4.21 ± 0.53	3.99 ± 0.85	0.390
haematocrit/PCV (%)	35.14 ± 3.45	32.84 ± 9.14	0.478
MCH (pg)	27.71 ± 3.84	28.76 ± 3.23	0.577
MCHC (gm/dl)	33.08 ± 0.92	32.93 ± 1.03	0.561
MCV (fl)	84.43 ± 9.93	87.24 ± 8.36	0.443
RDW (%)	15.92 ± 2.43	16.51 ± 2.27	0.377
Platelet count ($10^{3/}$cmm)	214.69 ± 103.24	190.15 ± 82.17	0.306
TLC ($10^{3/}$cmm)	8.51 ± 2.77	7.74 ± 2.78	0.348
Neutrophil (%)	69.56 ± 13.43	62.44 ± 15.83	0.125
Lymphocyte (%)	21.37 ± 12.14	25.26 ± 10.95	0.237
Eosinophil (%)	1.77 ± 1.76	2.62 ± 2.66	0.554
Monocyte (%)	6.99 ± 2.88	6.89 ± 3.04	0.982
Basophil (%)	0.31 ± 0.4	0.32 ± 0.55	0.766

Mean Neutrophil count(%), Lymphocyte count(%), Mean Eosinophil count(%), Mean Monocyte count(%) and Mean Basophil count(%) among subclinical hypothyroidism and overt hypothyroidism patients showed no statistically significant difference.

IV. DISCUSSION:

Study was conducted to know the haematological changes in patients with primary hypothyroidism and hyperthyroidism as it known from previous studies that thyroid dysfunction can cause changes in the blood cell indices (PCV, MCV, MCH , and MCHC) and rarely pancytopenia.

In our study, no statistically significant difference was found in haemoglobin values between the three groups. .Kawa MP et al., (5) and Geetha J et al., (13) found that there was statistically significant difference in HB values in two groups of patients when compared with euthyroid group.

Significant difference in RBC values when hypothyroid group was compared with hyperthyroid group (higher in hyperthyroid group) ($p<0.001$). In Kawa MP et al., (5) and Kamdar PK et., (12) showed similar result in their study.

No significant difference was found in mean platelet count($10^{3/}mm^3$) , when three groups were compared. Olt S et al., (8) and Kamdar PK et., (12) also showed no statistically significant association between platelet count and thyroid dysfunction. No significant difference in total leucocyte count($10^{3/}mm^3$) was found in our study when three groups were compared. In Kamdar PK et., (12)showed similar results.
In this study, mean haematocrit / PCV(%) was significantly higher in hyperthyroid group compared to hypothyroid group. Kamdar PK et., (12) also showed significant association of haematocrit with thyroid dysfunction.

In this study, Mean MCH and MCHC among hypothyroid and hyperthyroid patients was not statistically significant. In Kamdar PK et., (12) study Mean value for MCH was 40.92 and 27.36 in hypothyroidism and hyperthyroidism, respectively, greater number of patients(68) from hypothyroidism than hyperthyroidism. In Kawa MP et al., (5), Jafarzadeh A et al., (10) showed no statistically significant difference in MCHC values.

In this study, Mean MCV and RDW among hypothyroid and hyperthyroid patients was lower with hyperthyroidism. Similar result was shown by Kawa MP et al., (5)

In this study, when comparing PCV, MCV & RDW between the hypothyroid and hyperthyroid groups, PCV values were significantly higher in hyperthyroid patients and MCV and RDW values were significantly lower in hyperthyroid patients. In Jafarzadeh A et al., (10) When comparing PCV, MCH, MCHC & MCV between the controls and hypothyroid groups, Statistical significance was not found. Geetha J et al., (13) found that when two groups of patients were compared to control group, there was statistically significant difference in RDW and MCV. PCV did not show any significant difference.

When comparing eosinophil count, basophil count, neutrophil count, monocyte count & lymphocyte count between the hypothyroid & hyperthyroid groups, no significant differences were found. Similar results with Jafarzadeh A et al., (10).

In this study, Mean HB(gm/dl), mean RBC count mean haematocrit/ PCV(%), Mean MCH(Pg), Mean MCHC(gm/dl), Mean MCV(%) , RDW(%),Platelet count($10^{3/}$cmm) and TLC($10^{3/}$cmm) among subclinical hypothyroidism and overt hypothyroidism showed no significant difference. In Fatima Q et al., (14) these parameters showed no significant difference in subclinical hypothyroidism and overt hypothyroidism patients.(Table 3)

V. LIMITATIONS-

- Single blood sampling was done . Various causes of variation in haematological indices were not investigated though as far as possible were ruled on basis of history and general examination.
- Need large sample size to generalise this study.

VI. CONCLUSION

After analysis and data obtained, we conclude that patients with alerted haematological indices should get thyroid function test done. Patients with thyroid dysfunction (hypothyroidism & hyperthyroidism) may be periodically evaluated for probably haematological changes. Sometimes, further investigations might be more useful to highlight the relationship between hypothyroidism and blood cell count and red cell indices and sometimes extensive workup can be avoided for deranged haematological indices when causes (thyroid dysfunction) is established, correcting thyroid dysfunction may correct haematological indices.

Thyroid dysfunctions influence the red blood cell indices and Hb as well. Investigating all the RBC indices in cases of thyroid disorders helps in the management of anaemia associated with thyroid disorders which are refractory to treatment with iron supplementation.

VII. RECOMMENDATIONS

We suggest avoiding extensive workup in resource poor countries for deranged haematological indices when causes (thyroid dysfunction) is established, correcting thyroid dysfunction may correct haematological indices.

We also suggest that patients with thyroid dysfunction should be periodically evaluated for probable haematological changes if correcting thyroid dysfunction doesn't correct RBC indices and on the other hand patients with alerted haematological indices may provide clue to underlying thyroid function and can be tested for thyroid dysfunction.

REFERENCES:

1. Jameson JL, Mandel SJ, Weetman AP. Disorders of the thyroid gland. In: Kasper DL, Fauci AS, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Harrison's Principles of Internal Medicine: 19th ed. New York: McGraw Hill Education: 2015. p. 2283.
2. Golde DW, Bersch N, Chopra IJ, Cline MJ. Thyroid hormones stimulate erythropoiesis in vitro. Br J Haematol. 1977;37(2):173-7.
3. Fandrey J, Pagel H, Frede S, Wolff M, Jelkmann W. Thyroid hormones enhance hypoxia-induced erythropoietin production in vitro. Exp Hematol. 1994;22(3):272-7.
4. Grymuła K, Paczkowska E, Dziedziejko V, Baskiewicz-Masiuk M, Kawa M, Baumert B, et al. The influence of 3,3',5-triiodo-L-thyronine on human haematopoiesis. Cell Prolif. 2007 ;40(3):302-15.
5. Kawa MP, Grymula K, Paczkowska E, Baskiewicz-Masiuk M, Dabkowska E, Koziolek M, et al. Clinical relevance of thyroid dysfunction in human haematopoiesis: biochemical and molecular studies. Eur J Endocrinol. 2010;162(2):295-305

6. Axelrod AR, Berman L. The Bone Marrow in Hyperthyroidism and Hypothyroidism. Blood. 1951;6:436-53.
7. Horton L, Coburn RJ, England JM, Himsworth RL. The Haematology of Hypothyroidism. QJM. 1976;45:101–23.
8. Olt S, Selcuk M, Tutak A, Akbas F, Oznas O. Investigation of the impact of hypothyroidism on haematological parameters. Mustafa KemelUniv Tip Derg 2016:7(25):23-27.
9. Bashir H, Bhat MH, Farooq R, Majid S, Shoib S, Hamid R, et al. Comparison of haematological parameters in untreated and treated subclinical hypothyroidism and primary hypothyroidism patients. Med J Islam Repub Iran. 2012;26(4):172-8.
10. Jafarzadeh A, Poorgholami M, Izadi N, Nemati M, Rezayati M. Immunological and haematological changes in patients with hyperthyroidism or hypothyroidism. Clin Invest Med. 2010;33(5): E271-9.
11. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. Indian Journal of Endocrinology and Metabolism. 2011;15(Suppl2):S78-S81.
12. Kamdar PK, Mendpara AV. To study haematological abnormalities in patients of thyroid dysfunction. IJSR. 2019;8(12): 33-37.
13. Geetha J, Srikrishna R. Role of red blood cell distribution width (RDW) in thyroid dysfunction. Int J Biol Med Res 2012; 3(2): 1476-78
14. Fatima Q, Dotasara P, Gauri LA. Hematological profile in primary hypothyroidism. IJMBS. 2020;4(1):156-160.