



## STUDY OF HAEMATOLOGICAL PARAMETERS IN HYPOTHYROID PATIENTS IN A TERTIARY CARE HOSPITAL

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### ABSTRACT

Hypothyroidism is the most common functional disorder of thyroid gland. Substantial increase in primary hypothyroidism has been reported in the past few years especially among women with Kolkata recording the highest prevalence of hypothyroidism (21.67%) among Indian cities. Hence the present study was undertaken in Kolkata to find out the association between hematological parameters and primary hypothyroidism. In our cross sectional observational hospital based study we found decreased levels of hematological parameters like Hb%, PCV, MCV, MCH, MCHC and RDW in thyroid dysfunction patients. This suggested that abnormal levels of thyroid hormones may predispose patient to anaemia, predominantly normocytic normochromic anemia. These abnormalities should be investigated early and corrected. People with thyroid disorders should have routine screening of haematological, biochemical and hormonal profile assay with simultaneous proper management of this metabolic disease with iodine-rich foods and supplements.

**KEYWORDS :** Hypothyroidism, anaemia, haematological parameters

### INTRODUCTION

Hypothyroidism is the most common functional disorder of thyroid gland.

Overt primary hypothyroidism refers to cases in which TSH concentration is elevated and serum T4 is below reference range, while subclinical hypothyroidism is defined as elevated TSH associated with serum T4 that is still within reference range. The prevalence of overt hypothyroidism has been reported to be approximately 1-2% in women and 0.1% in men in large population studies.<sup>[1, 2, 3]</sup> The prevalence of subclinical hypothyroidism is higher and reported to be about 4-10% in multiple populations and as high as 18% in elderly.<sup>[4, 5, 6]</sup>

Anaemia is a reduction in number of red blood cells or less than normal quantity of haemoglobin in blood. The prevalence of anaemia in patients with hypothyroidism has been shown to be 20-60%.<sup>[7]</sup> Thyroid hormone is involved in haemoglobin synthesis in adults and maturation of haemoglobin in fetus.<sup>[8, 9]</sup> By affecting haematopoietic process, hypothyroidism results in anaemia through slowing oxygen metabolism.<sup>[10]</sup> Various forms of anaemias normocytic normochromic, microcytic hypochromic or macrocytic can be caused by reduced oxygen metabolism due to hypothyroidism. In patients with hypothyroidism anaemia may be undetected by routine tests like haemoglobin estimation because there is decreased erythrocyte mass as well as reduction in plasma volume.<sup>[11, 12]</sup> Alteration in haematological parameters such as Hb%, PCV, MCV, MCH, MCHC, RDW associated with thyroid dysfunction are observed as well<sup>[13]</sup> but all changes return to normal if an euthyroid state is obtained. Thus thyroid disorders can induce different effects on various blood cell lineages<sup>[10, 12, 13, 14]</sup>

Substantial increase in primary hypothyroidism has been reported in the past few years especially among women. Kolkata recorded the highest prevalence of hypothyroidism (21.67%) among Indian cities.<sup>[15]</sup>

Hence the present study was undertaken in Kolkata to find out the association between hematological parameters and primary hypothyroidism and to create awareness among people.

### AIMS & OBJECTIVES

To assess prevalence of haematological manifestations associated with hypothyroidism

### MATERIALS AND METHODS

**Place of study:** Departments of Pathology and Biochemistry, Calcutta National Medical College, Kolkata

**Study population:** Patients from OPD and wards referred to department of Biochemistry for thyroid profile assay.

**Sample size:** 130

#### Inclusion Criteria:

1. Patient age between 05-70yrs
2. Low level of serum T3, T4
3. Elevated or normal serum TSH
4. Not taking any drug affecting hematopoiesis

#### Exclusion Criteria:

1. Patients unwilling to participate in study
2. Cigarette smoking or use of any drug

#### Parameters to be studied:

1. Serum T3, T4, TSH
2. Hematological parameters- Haemoglobin concentration (Hb), Packed cell volume (PCV), Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC), Red cell distribution width (RDW)

#### Study Technique:

Serums T3, T4 and TSH were estimated by ELISA method using Erba Lisa scan in samples of patients sent from wards and OPDs for thyroid profile study.

Those patients detected as overt hypothyroidism/subclinical hypothyroidism were selected according to inclusion and exclusion criteria after proper consent and their bloods were sent for further hematological investigations.

The recorded data were analyzed using standard statistical methods.

### RESULTS AND ANALYSIS

Table 1

#### DISTRIBUTION OF HYPOTHYROIDISM IN MALE

	TSH	T4, T3	%
Overt	> 5Mu/l	Low	7%
Subclinical	> 5Mu/l	normal	11%

**Table 2**  
**DISTRIBUTION OF HYPOTHYROIDISM IN FEMALE**

	TSH	T3/T4	%
Overt	>5mU/l	low	24%
Subclinical	>5mU/l	normal	46%

**Table 3**  
**DISTRIBUTION OF ANAEMIA IN MALE (Hb %)**

Hb%	No of patient	%
>13gm	20	55.56
<13gm	16	44.44
TOTAL	36	100

Out of 36 male hypothyroid patients, 20[55.56%] patient had hemoglobin more than 13gm% and 16[44.44%] patient had hemoglobin less than 13gm%.

**Table 4**  
**DISTRIBUTION OF ANAEMIA IN FEMALE (Hb %)**

Hb%	No of patient	%
>12gm	15	15.96
<12gm	79	84.04
TOTAL	94	100

Out of 94 female hypothyroid patients, 15[15.96%] patient had hemoglobin more than 12gm% and 79[84.04%] patient had hemoglobin less than 12gm%.

**Table 5**  
**DISTRIBUTION OF TYPE OF ANAEMIA IN STUDY POPULATION**

Type of anaemia	Number of patients	%
Microcytic Hypochromic anaemia	34	35.78%
Normocytic Normochromic anaemia	58	61.05%
Macrocytic anemia	3	3.15%
Total	95	100

**Table 6**  
**DISTRIBUTION OF PACKED CELL VOLUME (PCV)**

PCV	No of patient	%
<40	102	78.46
40-50	24	18.46
>50	4	3.07
Total	130	100

Among 130 patients, the study showed 102(78.46%) patients had PCV less than 40, 24 (18.46%) patient had PCV between 40 to 50 and 4(3.07%) patient had PCV more than 50.

**Table 7**  
**DISTRIBUTION OF MEAN CORPUSCULAR VOLUME (MCV)**

MCV	No of patient	%
<80	29	22.30
80-100	98	75.38
>100	3	2.30
Total	130	100

Among 130 study population, 98(75.38%) patients showed MCV between 80 to 100, 29% (22.30%) patient showed MCV less than 80 and rest 3(2.3%) showed MCV more than 100.

**Table 8**  
**DISTRIBUTION OF MEAN CORPUSCULAR HAEMOGLOBIN (MCH)**

MCH	No of patient	%
<27	37	28.46
27-32	83	63.84
>32	10	7.69
Total	130	100

Among 130 study population, 83 (63.84%) patient had MCH

between 27 to 32, 37(28.46%) patient had MCH less than 27 and rest 10(7.69%) had MCH more than 32.

**Table 9**  
**DISTRIBUTION OF MEAN CORPUSCULAR HAEMOGLOBIN CONCENTRATION (MCHC)**

MCH	No of patient	%
<27	37	28.46
27-32	83	63.84
>32	10	7.69
Total	130	100

Among 130 study population, 94(72.30%) patient had MCHC between 32 to 35, 31(23.84%) had MCHC less than 32 and rest 5(3.84%) had MCHC more than 35.

**Table 10**  
**DISTRIBUTION OF RED CELL DISTRIBUTION WIDTH (RDW)**

RDW	No of patients	%
<14	42	32.30
>14	88	67.69
Total	130	100

Among 130 study population, 88(67.69%) patients had Red cell distribution (RDW) more than 14 and 42 (32.30%) patients had RDW less than 14.

## DISCUSSION

The present study is a retrospective cross sectional observational hospital based study.

In this study population thyroid dysfunction was observed in both male and females and all patients of hypothyroid irrespective of etiology, aged 5 to 70 undergone hematological tests including Hb%, PCV, MCV, MCH, MCHC and RDW.

In our study out of 36 male hypothyroid patients, 20 [55.56%] patient had hemoglobin more than 13gm% and 16[44.44%] patient had hemoglobin less than 13gm%. Out of 94 female hypothyroid patients, 15[15.96%] patient had hemoglobin more than 12gm% and 79[84.04%] patient had hemoglobin less than 12gm%. The mean Hb% is 9.9gm%. In a study by H.Bashir et al<sup>[16]</sup> mean Hb% was 10.73gm%. In a study conducted by Kawa MP et al<sup>[13]</sup> PCV and Hb% was significantly higher in hyperthyroidism and decreased in hypothyroidism. In another study by Mehmet E et al<sup>[17]</sup> it was found that Hb level in hypothyroid subjects and control groups were 11.9gm% and 12.8gm% respectively and it was lower in hypothyroid subjects. The mean Hb level of hypothyroid and control group was 12.2gm% and 13.6gm% in study by Dorgalaleh A et al (2013).<sup>[18]</sup>

In a study conducted by Bates 1993, Tunbridge et al<sup>[3]</sup> showed prevalence of hypothyroid approximately 2% in adult female and 0.2% in adult male and increasing to 15% by age 75. Our study showed similar prevalence with anaemia among males and females are found to be 16(44.44%) and 79(84.04%). The distribution found to be significant [ $\chi^2(2) = 18.782$  and p value is  $<0.0001$ ].

Thyroid hormone is involved in haemoglobin synthesis in adults and maturation of haemoglobin in fetus.<sup>[8,9]</sup> By affecting haematopoietic process, hypothyroidism results in anaemia through slowing oxygen process.<sup>[10]</sup> Thyroid hormones enhance erythropoiesis through hyperproliferation of immature erythroid progenitors and increase secretion of erythropoietin by inducing erythropoietin gene expression. Thyroid hormones also augment repletion of hypoxia inducible factor1 (HIF 1) and then motivate growth of erythroid colonies. These hormones also intensify erythrocyte 2,3diphosphoglycerate (2,3 DPG) compactness which enhances delivery of oxygen to tissues. Altered iron

metabolism and oxidative stress may contribute to anaemia. Lack of stimulation of erythroid colony, reduction in oxygen distribution to tissues and diminution of erythropoietin level in absence of thyroid hormones lead to normocytic anaemia which is most frequent type of anaemia in hypothyroid patients.<sup>[8, 9, 10]</sup> In our study too, the most common type of anaemia found was normocytic normochromic in 58 [61.05%] patients. This is similar to observations by Erdogan and colleagues.<sup>[19]</sup> 34 [35.78%] patients in the present study had microcytic hypochromic anaemia and remaining 3 [3.15%] had macrocytic anaemia. Studies by Geeta J and Srikrishnan in 2012 had similar observations with 30% microcytic hypochromic anaemia, 1% macrocytic anaemia and rest 69% normocytic normochromic anaemia.

PCV did not show any statistically difference with control population in study conducted by Geeta J and Srikrishna R. In another study by Kawa MP et al in 2010<sup>[12]</sup> PCV was mildly increased. In our study we found 78.46% patients had PCV less than 40%, 18.46% had normal PCV and 3.07% patient had PCV more than 50%.

MCV values were found statistically significant among patient with abnormal thyroid function test in a study by Hamid Basir et al in 2012<sup>[16]</sup>. MCV was significantly decreased in both subclinical and overt hypothyroidism. But in study by Geeta J and Srikrishna R 2010, MCV value did not show any statistical significance. The present study showed decreased or normal MCV values in untreated and treated primary hypothyroidism subjects.

MCH and MCHC values were both lower in comparison with control group in a study conducted by Kawa MP et al in 2010.<sup>[12]</sup> MCH in hypothyroid patients and control group in Dorgalaleh A et al (2013)<sup>[18]</sup> study were 27.4pg and 29.3pg respectively. But in our study we found 63.84% of patients had MCH in normal range (27 to 32 pg), 28.46% had less than 27pg and rest had MCH more than 32pg.

Study conducted by Hamid basir et al in 2012<sup>[16]</sup> showed that patient with high TSH value had significant RDW difference with control. In a study conducted by Geeta J and Srikrishna R in 2010, RDW did not show significant changes between hypothyroid patients and control. Although no definitive mechanisms can be suggested to explain larger prevalence of increased RDW in patients with thyroid dysfunction, results of this retrospective cross sectional analysis suggest that abnormal levels of thyroid hormones might substantially influence size variability of circulating RBCs.

## SUMMARY AND CONCLUSION

Thyroid hormones (T3 and T4) have a significant influence on erythropoiesis. In our cross sectional observational hospital based study we found decreased levels of hematological parameters like Hb%, PCV, MCV, MCH, MCHC and RDW in thyroid dysfunction patients. This suggested that abnormal levels of thyroid hormones may predispose patient to anaemia, predominantly normocytic normochromic anemia. These abnormalities should be investigated early and corrected. We suggest those people with thyroid disorders should have routine screening of haematological, biochemical and hormonal profile assay with simultaneous proper management of this metabolic disease with iodine-rich foods and supplements.

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