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Original Research Article

Anaemia profile in hypothyroid patients

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ABSTRACT

Introduction: Thyroid disease is associated with anaemia is a frequent haemoglobin disorder. Hypothyroidism is a clinical syndrome that results from deficiency of the thyroid hormones, thyroxine (T_4) and triiodothyronine (T_3).The prevalence of subclinical hypothyroidism is higher, ranging from 4% to 10% of adults, with possibly a higher frequency in older women. Anaemia is a different types e.g. Iron deficiency anaemia, B12 deficiency anaemia, Sickle cell anaemia, Aplastic anaemia, haemolytic anaemias.Thyroid gland has a very important role in hemopoiesis. In thyroid patients blood disorder are frequently seen as it has role in metabolism of RBC and other blood components. Anaemia can occur when there is not enough oxygen to carry by RBC.

Materials and Methods: This is a case control study which will be conducted in Rama medical college, hospital and department of Biochemistry in Hapur city (U.P). About 100 subjects will be enrolled in the current study including 50 patients with hypothyroidism and 50 with Healthy individual (controls) blood counts as control group. 2ml of EDTA anti coagulated blood and 3ml of whole blood will be taken from these subjects under fully aseptic condition (for CBC,TFT) respectively. EDTA Will be put on mixer instrument for mixing for 5min. CBC will be performed by coulter counter. The haematological parameters which will be studied include Hb, RBC, MCV, PCV. Iron profile (Iron, TIBC, Ferritin) level will be done by EM-200. The other 3ml of whole blood will be put in gel tube, serum will be prepared after centrifugation for 10 min, Thyroid function test including (T3, T4,TSH) based on ELISA.

Results: In this study, we found that T4 and TSH had significant statistical difference (<0.05) between control and both hypothyroid and hyperthyroid groups as well as between hypothyroid and hyperthyroid groups. Erythrocyte sedimentation rate (ESR) and haematocrit showed significant statistical difference ($p<0.05$) between control and both hypothyroid and hyperthyroid groups. Haemoglobin showed significant decrease in hypothyroid group when compared with controls.

Conclusion: In both people with hypothyroid and participants with hyperthyroid function, we found greater risks of anemia. Additionally, a decreased thyroid function at baseline indicated a tendency toward an elevated risk of anemia throughout follow-up. A randomized controlled research will be necessary to determine whether treating (subclinical) hypothyroidism reduces anemia.

1. Introduction

Thyroid disease is associated with anaemia is a frequent haemoglobin disorder. Thyroxine (T4) and triiodothyronine (T3) insufficiency leads to the clinical state known as hypothyroidism.[1] Between 4% and 10% of persons have subclinical hypothyroidism, which is more common overall and may be more common in older women.[2]

Anaemia is a different types e.g. Iron deficiency anaemia, B12 deficiency anaemia, Sickle cell anaemia, Aplastic anaemia, haemolytic anaemias.[3]

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Thyroid gland has a very important role in hemopoiesis. In thyroid patients blood disorder are frequently seen as it has role in metabolism of RBC and other blood components.[4] Anaemia can occur when there is not enough oxygen to carry by RBC.

Anaemia is a common clinical conditions which effect child bearing females and elderly population According to WHO anaemia is a condition when haemoglobin is less than 12 gm/dl for females and less than 13gm /dl for males. In normocytic anaemia both MCV and PCV will be less. Thyroid hormones (T3, T4, and TSH) stimulate the formation of erythropoietin and the precursors of RBC, which has a direct impact on blood parameters.[5]

Patients with thyroid disease have low iron haemoglobin levels also they have low B12 and folate level. And this effect the blood parameters.[6]

The purpose of this study is to assess the impact of various types of abnormal thyroid function on various blood parameters and compare them to a group of individuals who appear to be in good health to assess any potential correlation between the levels of various blood parameters and various types of thyroid function.

2. Objectives

1. To determine the haemoglobin level in hypothyroid patients.
2. To RBC, MCV, PCV, Hb in hypothyroidism.
3. To determine Iron profile in hypothyroidism.

3. Materials and Methods

This is a case control study which will be conducted in Rama medical college, hospital and department of Biochemistry in Hapur city (U.P).

About 100 subjects will be enrolled in the current study including 50 patients with hypothyroidism and 50 with Healthy individual (controls) blood counts as control group.

2ml of EDTA anti coagulated blood and 3ml of whole blood will be taken from these subjects under fully aseptic condition (for CBC,TFT) respectively.

EDTA will be added to the mixer and mixed for 5 minutes. Coulter counter will carry out CBC. The haematological parameters which will be studied include Hb, RBC, MCV, PCV.

Iron profile (Iron, TIBC, Ferritin) level will be done by EM-200.

The remaining 3 ml of whole blood will be placed in an ELISA-based gel tube, where serum will be produced after 10 minutes of centrifugation.

3.1. Inclusion criteria

This research included all persons with thyroid-stimulating hormone (TSH) levels >5.5 ulU/ml with anemia symptoms.

3.2. Exclusion criteria

Patients having a history of chronic kidney, liver, or heart illness, chronic infections, hemolytic anemia, peptic ulcers, hemorrhoids, bone marrow suppression, or recent blood transfusions.

Only patients with TSH levels above 5 IU/ML will be considered cases, while individuals with normal thyroid function will serve as the control group.

Exclusion criteria included individuals older than 12 years old, pregnant women, patients with known intrinsic red cell abnormalities (inherited or acquired), patients undergoing medication for thyroid disorders or anemia, patients with chronic conditions, and patients who were unwilling to participate in the trial. Patients with other conditions that could alter blood parameters and those who had signs of dietary deficits were also eliminated. Before patients got any sort of intervention or treatment, data were gathered.

4. Results

In this study, we found that T4 and TSH had significant statistical difference (<0.05) between control and both hypothyroid and hyperthyroid groups as well as between hypothyroid and hyperthyroid groups. Erythrocyte sedimentation rate (ESR) and haematocrit showed significant statistical difference ($p<0.05$) between control and both hypothyroid and hyperthyroid groups. Haemoglobin showed significant decrease in hypothyroid group when compared with controls in Table 1.

5. Discussion

The results of the present individual participant data meta-analysis add to those of past research that found a connection between thyroid dysfunction and aberrant red blood cell indices.[7] This study found an association between thyroid malfunction and somewhat lower hemoglobin levels, regardless of whether it was overt or caused by subclinical hypothyroidism or hypothyroidism. The impact of thyroid dysfunction on low hemoglobin levels or anemia may be minimal given the limited variation in hemoglobin levels among thyroid function groups.

To determine if the results are deemed clinically meaningful and whether they should affect practice and regulations, it must first be determined in a randomized controlled research whether treating (subclinical) hypothyroidism is successful in lowering anemia. Erythropoietin levels rose following thyroxin therapy in individuals with subclinical hypothyroidism, according to Christ-Crain et al.[8] Additionally, several studies have demonstrated a positive impact of thyroid hormone therapy on erythropoietin levels in individuals with hypothyroidism.[9]

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

Parameters	Control (n=50) Mean& Std. deviation	Hypothyroid patients (n= 50) Mean& Std. deviation	Hyperthyroid patients (n=50) Mean& std. deviation
TT3	2.28±0.25	2.37±0.9	2.72±0.8
TT4	17.68±6.0	9.4±2.9	14.5+4.9
TSH	7.0+0.9	12.9+4.9	3.8+1.9
ESR	39.9±20.6	48.3±15.7	54.0±32
TC	8520.9-±1594.2	8265.4±1900.9	9442±1927.3
RBC	6.8±0.7	6.5±1.9	6.9±1.4
H b	14.4±L1.9	13.8±4.9	14.9±2.0
H CT	38.9±4.4	36.7±8.5	40.30±25
MCV	81.8±10.6	81.9±7.4	82.8±7.9
M C H	28.9±5.9	28.55±9.5	28.8±4.6
MC HC	35.37±2.7	34.9±5.3	35.9±2.4
PLT	315.8±85	341.5±78.8	368.2±98
RDW (CV)	16.15±4.4	17.3±4.9	15.9±2.8
MPV	8.5±2.8	8.4±0.9	8.4±08

Data expressed as mean and std. deviation, p value 0.05 considered as significant.

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	0.123	-0.121
TT4	0.194	-0.52
ESR	0.398*	-0.472
TC	0.249	0.075
RBC	0.152	-0.161
Hb	0.134	-0.139
H CT	0.218	-0.068
MCV	0.031	0.075
M C H	0.219	-0.025
M C H C	0.111	-0.184
PLT	0.009	-0.080
RDW	0.094	0.331
MPV	0.049	0.078

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

According to whether the anemia is largely brought on by blood loss, shortages in the generation of healthy erythrocytes, or by decreased erythrocyte survival, there are many different forms of anemia that may be characterized. Exactly how thyroid function and erythropoiesis are pathophysiologically connected as well as how both extremes of the thyroid illness continuum could result in an anemic state are currently unknown. However, a number of mechanisms have been suggested for overt and subclinical hyperthyroidism. Reduced erythrocyte survival as a result of altered iron metabolism and use, increased oxidative stress, and increased hemolysis may be linked to hyperthyroidism and anemia. The increased need for oxygen transport to tissues as a result of thyroid hormone stimulation speeds up damaging processes. [10]

Although the underlying mechanisms by which thyroid hormones and TSH may cause anemia are not fully understood, there is mounting evidence that low thyroid function may be causally related to anemia via deficits in the production of healthy erythrocytes in cases of subclinical and overt hypothyroidism. T3, T4, and TSH could have an immediate impact on erythropoiesis. [11,12] For instance, through affecting the proliferative ability of erythroid precursors, both T3 and T4 are implicated in the control of hematopoiesis. [13]

Additionally, it has been demonstrated that T4 directly stimulates red cell precursors through the 2-adrenergic receptor. T4 has also been shown to promote red blood cell production and the in vitro beginning and completion of hemoglobin protein chains. [14] It has also been demonstrated that thyroid hormones stimulate erythropoiesis via boosting the kidneys' synthesis of erythropoietin. There is evidence that thyroid hormones influence the transport and absorption of iron. Erythrocytes and several extrathyroidal tissues

include functional TSH receptors, which TSH may bind to and influence hematopoiesis.[15]

Another explanation for the association between anemia and poor thyroid function is that anemia and aberrant thyroid status have similar origins. Reduced thyroid function may be a result of chronic (inflammatory) illnesses, starvation, and malabsorption as an adaptive reaction to energy deficiencies. Additionally, micronutrient shortages such as those in iron, vitamin B12, folate, and other essential nutrients for erythropoiesis, as well as iodine deficit, which is essential for healthy thyroid function, may result from malnutrition and malabsorption. It is interesting to note that thyroid peroxidase, an iron-containing enzyme involved in the manufacture of thyroid hormones, was shown to have lower activity when iron shortage, the most prevalent cause of anemia, was present.[16]

The inclusion of individual participant data from significant cohort studies conducted globally is a strength of the present individual participant data meta-analysis. We were able to choose clinically applicable subcategories of thyroid function and anemia, standardize these definitions, and carry out many standardized subgroup analyses thanks to the availability of individual participant data.

Many of these factors are taken into account in our study. Despite the fact that the individual research cohorts and subgroups may have been small, the larger aggregate sample size allowed us to explore the relationships in our pooled analysis. We could examine consistency in the outcomes of the various cohorts because several studies were included (for example, effect estimates all going in the same direction); the lack of significant heterogeneity also makes it easier to infer a causal relationship.[17]

We were also able to construct identical subgroups for each trial in a biological gradient, ranging from overt hypothyroidism to overt hyperthyroidism, thanks to the availability of the individual participant data. In 14 trials, baseline measurements of the determinant (thyroid function) and (baseline and) follow-up measures of the outcome of interest (hemoglobin) were available. This is in accordance with the fourth factor of temporality. Our combined analysis of observational research thus meets a number of Hill's criteria. The effectiveness of medication in lowering anemia must yet be determined in a carefully planned, randomized controlled research with a sizable number of individuals who have (subclinical) hypothyroidism.[18]

6. Conclusion

In both people with hypothyroid and participants with hyperthyroid function, we found greater risks of anemia. Additionally, a decreased thyroid function at baseline indicated a tendency toward an elevated risk of anemia throughout follow-up. A randomized controlled research will be necessary to determine whether treating (subclinical) hypothyroidism reduces anemia.

7. Source of Funding

None.

8. Conflict of Interest

None.

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