

To evaluate prevalence of anemia in hypothyroid patients

Sai Akhila Peraka¹, Saritha Karre^{2*}, Swarupa Ravuri³, Chandra Kumar Shanmugam⁴

¹IIIrd Year Student, ^{2,4}Associate Professor, ³Assistant Professor, ¹⁻⁴Dept. of Pathology, ¹⁻³ESIC Medical College, Sanathnagar, Hyderabad, Telangan, ⁴RVM Institute Of Medical Sciences And Research Center, Siddipet, Telangana, India

***Corresponding Author: Saritha Karre**

Email: dr_saritha14@yahoo.co.in

Abstract

Aims and objectives: The main objective of the current study is to delineate prevalence, type of anemia in patients enduring with hypothyroidism and to correlate its severity with deficient levels in thyroid profile.

Material and Methods: The prospective study spanning for a year (December 2017 to November 2018) consisting of 1500 patients was done in collaboration with Department of Biochemistry at tertiary care Centre. A detailed history was taken and investigations were done in all patients conferred with Anemia and hypothyroidism. Peripheral smear examination, RBC indices, Complete Blood Count were the essential investigations for anemia.

Results: The prevalence of anemia was found to be 41.8%. In anemic patients, the predominance of normocytic normochromic anemia was 98.56% (most common), microcytic hypochromic anemia was 0.95% and macrocytic anemia was 0.49%. 59.34% had mild anemia, 39.71% had moderate anemia and 0.95% had severe anemia.

Conclusion: The study showed the association of anemia and hypothyroidism and it further highlighted the relation between the two with respect to severity. Normocytic normochromic anemia and mild anemia were observed to be the most widely recognized types of anemia in hypothyroid patients. This will help in implementing appropriate therapeutic decisions for both the conditions and contribute to the wellbeing of the patients.

Keywords: Anemia, Hypothyroidism.

Introduction

The thyroid hormones play an important role in the regulation of red blood cell production, that is, erythropoiesis. Therefore, in hypothyroidism, a condition in which the production of thyroid hormones is reduced, a disturbance might be observed in the hematological parameters, despite the fact that, the accurate component of the impact of thyroid hormones on erythropoiesis has not yet been uncovered.¹ According to a study, pervasiveness of anemia in subclinical and overt hypothyroid groups was 26.6% and 73.2% individually. Thus, the recurrence of anemia in subclinical hypothyroidism is higher than in general population.² In this way, hypothyroidism could be a hazard factor for anemia. Normocytic and normochromic type of anemia in hypothyroidism is due to reduced stimulation for erythropoiesis. Iron deficiency anemia could be due to menorrhagia in women or due to malabsorption caused by the deficiency of the hormone.³ Vitamin B12 deficiency can cause megaloblastic anemia.^{4,5} In some cases, even Iron deficiency anemia could be one of the reasons for hypothyroidism because iron is required to catalyze the initial two steps involving the thyroid peroxidase and deiodinase, though the mechanisms are not clearly known.^{6,7} So, it is essential to pay attention to the relationship between anemia and hypothyroidism in diagnosis for choosing the course of the treatment as one might be the basic cause for the other.^{8,9} Therefore, this study aims at concentrating on the prevalence of anemia in hypothyroidism and the kinds of anemia in hypothyroid patients.

Material and Methods

The present study was conducted at tertiary care centre for a period of one year from December 2017 to November 2018

on 1500 patients in the age >18yrs in collaboration with Department of Biochemistry. Laboratory confirmation of overt hypothyroid patients was based on low T3, T4 and high TSH values and subclinical hypothyroid patients was based on normal T3, T4 and High TSH values. Patients with Secondary hypothyroidism, on thyroid medications (carbimazole, amiodarone, radio-iodine, propylthiouracil and others), other comorbidities (connective tissue disorders, haemoglobinopathies) causing anemia were avoided in the examination by obtaining the history. A definite history was taken and examinations were accomplished for assessment of anemia. The essential examinations for anemia were Complete Blood Count (CBC), RBC Indices, peripheral smear examination. Based on the RBC morphology they were partitioned into the following groups and specific investigations were done to decide the type of anemia. Normocytic normochromic anemia; Microcytic hypochromic anemia; Macrocytic anemia; Anemia was classified based on hemoglobin levels as Mild - Hb 10 to 12 gm%; Moderate - Hb 8 to 10 gm%; Severe - Hb < 8 gm%.

Estimation of the thyroid function (T3, T4, and TSH) test was carried out.

Overt Hypothyroid – Low T3, T4 and High TSH;
Subclinical Hypothyroid – Normal T3, T4 and High TSH.

The collected data was analyzed by applying appropriate statistical tests.

Results

The aim of this study is to depict the predominance, type of anemia in patients with hypothyroidism and correspond its seriousness with inadequate dimensions in thyroid profile. 1500 hypothyroid patients were considered. The

prevalence of anemia was observed to be 41.8% (Table 1). In the anemic patients, the predominance of normocytic normochromic anemia was 98.56% (most common), microcytic hypochromic anemia was 0.95% and macrocytic anemia was 0.49% (Table 2). 59.34% had mild anemia, 39.71% had moderate anemia and 0.95% had severe anemia (Table: 3). In mild anemia patients, 9.67% had overt hypothyroidism and 90.33% had subclinical hypothyroidism (Table 4). In moderate anemia patients, 9.63% had overt hypothyroidism and 90.37% had subclinical hypothyroidism. In severe anemia patients, 100% had subclinical hypothyroidism.

Discussion

Anemia could be a frequent, though typically neglected, clinical condition incidental to thyroid diseases. Although it is an indisputable fact that anemia and thyroid pathology often occur at the same time, the relationship between the two disorders remains uncertain. Thyroid hormones activate the proliferation of erythrocyte precursors both directly and through increase in erythropoietin production, whereas iron-deficiency anemia negatively influences the activity of thyroid gland. So, different sorts of anemia would develop in the course of thyroid pathology. The danger of anemia in autoimmune thyroid disease (AITD) may be associated with pernicious anemia and atrophic gastritis, celiac disease, autoimmune hemolytic syndrome, or rheumatic disorders. Anemia is seen in 20 to 60% of the patients with hypothyroidism.^{10,11} Normocytic anemia is the most common, whereas macrocytic or microcytic anemia occurs less frequently. Anemia in hypothyroidism would probably be due to bone marrow depression, reduced erythropoietin production, any comorbid diseases, or associated iron, vitamin B12, or folate deficiency. Normocytic normochromic anemia may be due to depression of bone marrow, thyroid gland underactivity or due to less erythropoietin production because of feedback inhibition as a result of decreased need of oxygen (as metabolism is reduced in hypothyroidism). Hypoproliferative erythropoiesis is seen in hypothyroidism (erythrocyte life cycle is normal). Thyroid hormone increases the production of 2,3-diphosphoglycerate which increases the transfer of oxygen into cells, this function is also impaired in hypothyroidism.^{9,11,12} Microcytic hypochromic anemia occurs due to increased loss of blood because of menorrhagia in women and malabsorption seen in hypothyroidism. Macrocytic anemia is seen in because of autoimmune origin (causing vitamin B12) or due to malabsorption of folic acid.¹³ The occurrence of anemia and thyroid pathology together is an important clinical problem. Thyroid gland abnormality and AITD need to be considered as potential causes, especially in cases of treatment-resistant or refractory anemia, as well as in the case of increased red blood cell distribution width. In patients with increased RDW, but with normal iron levels, thyroid function should be checked with vitamin B12 and folic acid levels. Moreover, hematological parameters of patients with thyroid dysfunction should also be checked.

As per the information of WHO, the pervasiveness of anemia is 24.8% all through the world and it is seen more often in underdeveloped countries. In our investigation, the prevalence of anemia in hypothyroid patients was observed to be 41.8%. Hence, recurrence of anemia in hypothyroidism is more noteworthy than general population. This demonstrates hypothyroidism is a hazard factor for anemia.

As per the investigation by Das et al, among hypothyroid patients with anemia in Eastern India, the most widely recognized type of anemia seen was normocytic normochromic anemia with a percentage of 51.6%, microcytic hypochromic anemia (46.6%) and macrocytic anemia (10.8%) were also seen.⁸ In another study by Kulkarni VK et al,⁵ the most common type of anemia observed was normocytic normochromic anemia (65.9%), microcytic hypochromic (22.72%) and macrocytic anemia (11.36%) were also seen in it. In correlation with these studies, in our investigation also, we saw that the most well-known type of anemia in hypothyroid patients was normocytic normochromic anemia (98.56%) (Fig. 1A), while microcytic hypochromic (0.95%) (Fig. 1B) and macrocytic (0.49%) (Fig. 2A & 2B) were also seen.

The severity of anemia was assessed on the basis of hemoglobin levels in the blood of the hypothyroid patients and categorized into mild, moderate and severe anemias. The deficient levels in thyroid profile was assessed on the basis of T3, T4 and TSH levels of the patients and was categorized into overt (low T3, T4 levels and high TSH levels) and subclinical (normal T3, T4 levels and high TSH levels) hypothyroidism. As per the investigation by Das et al, mild anemia (51.6%) was the most basic type of anemia depending on severity among the hypothyroid patients, while moderate (25%) and severe (20%) anemias were also seen. Even in our study the most common type depending on severity was found to be mild anemia (372 patients out of 627 patients with anemia – 59.34%), while moderate anemia (249 patients out of 627 patients – 39.71%) and severe anemia (6 patients out of 627 patients – 0.95%) were also seen. In contrast to the study by Das et al, we also tried to correlate the severity of anemia with deficient levels in thyroid profile in the hypothyroid patients. In our investigation we saw that, the predominance of mild anemia in overt hypothyroid patients was 20.33%, while in subclinical hypothyroid patients, it was 24.94%. The pervasiveness of moderate anemia was 13.55% and 16.7% in overt and subclinical hypothyroidism individually. Severe anemia was additionally observed in subclinical hypothyroid patients with a prevalence of 0.4%. On the whole it was observed that mild, moderate and severe anemias were more prevalent in subclinical hypothyroidism. According to a study by Mehmet E et al, which was done in turkey, the anemia recurrence in overt hypothyroidism was 43% while in subclinical hypothyroidism it was found to be 39%. In that review, it was presumed that the recurrence of anemia in subclinical hypothyroidism can be as high as that in overt hypothyroidism.¹⁴ The observation in our study

revealed higher prevalence of mild, moderate and severe anemias in subclinical hypothyroidism.

Conclusion

The present study identified the association of anemia and hypothyroidism and it further highlighted the correlation between the two with respect to severity. Normocytic normochromic anemia and mild anemia were observed to be the most widely recognized types of anemia in hypothyroid patients. This will help in implementing appropriate therapeutic decisions for both the conditions and contribute to the well-being of the patients.

Observations and Results

Prevalence of anemia in hypothyroid patients = Number of hypothyroid patients with anemia/ total number of hypothyroid patients=627/1500 = 41.8%.

Table 1: Percentage of male and female among the hypothyroid patients

Gender	Number	Percentage
Male	162	10.80%
Female	1338	89.20%
Total	1500	100%

Table 2: Prevalence of anemia in hypothyroid patients relying upon morphology

Morphology	Number of patients with the anemia	Prevalence of the anemia
Normocytic normochromic	618	98.56%
Microcytic hypochromic	6	0.95%
Macrocytic	3	0.49%
Total	627	100%

Table 3: Prevalence of anemia in hypothyroid patients depending on severity

	HB Levels (MG/DL)	Number of patients with anemia	Prevalence of the anemia
Mild	10 to 12	372	59.34%
Moderate	8 to 10	249	39.71%
Severe	Less than 8	6	0.95%
Total		627	100%

Table 4: Correlation of severity of anemia and hypothyroidism:

Total number of overt hypothyroid patients = 177

Total number of subclinical hypothyroid patients = 1347

Anemia	Total number of patients	Number of patients with overt hypothyroid	Number of subclinical hypothyroid patients
Mild	372	36(9.67%)	336(90.33%)
Moderate	249	24(9.63%)	225(90.37%)
Severe	6	0	6(100%)

Anemia	Total number of patients	Prevalence in overt hypothyroid patients	Prevalence in subclinical hypothyroid patients
Mild	372	20.33%	24.94%
Moderate	249	13.55%	16.7%
Severe	6	0%	0.4%
Total	627		

Fig. 1A: Photomicrograph of Normocytic normochromic; **1B:** Microcytic hypochromic Anemia

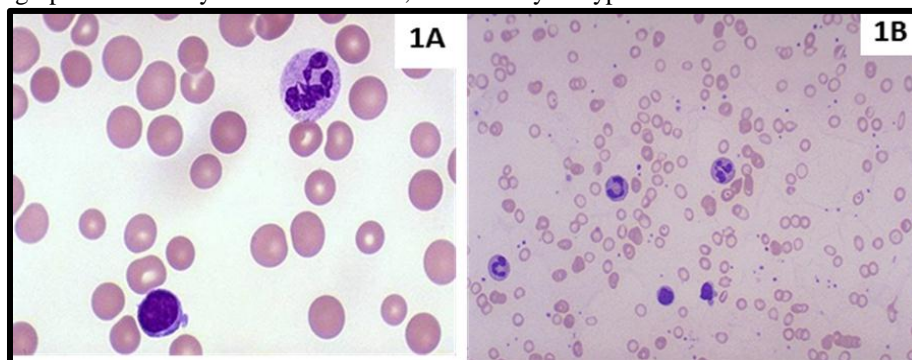
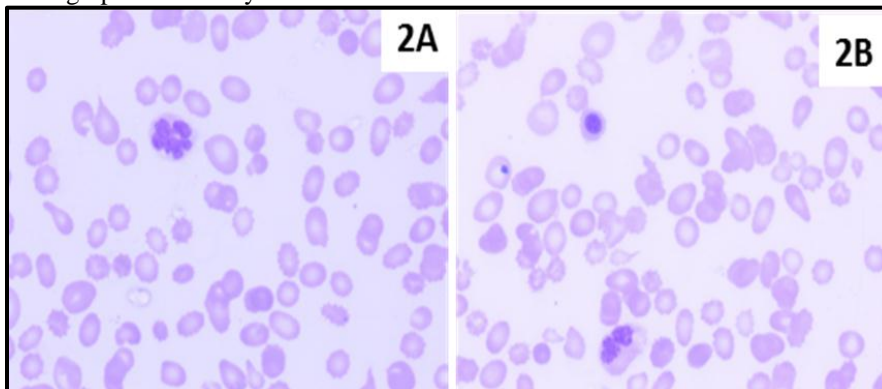


Fig. 2A & 2B: Photomicrograph of Macrocytic Normochromic Anemia.

Conflict of Interest: None.

References

1. Carmel R. Macrocytosis, mild anemia, and delay in the diagnosis of pernicious anemia. *Arch Intern Med* 1979;139(1):47-5.
2. Erdogan M, Kosenli A, Sencer G, Kulaksizoglu M. Characteristics of anemia in subclinical and overt hypothyroid patients. *Endocr J* 2012;59:213-20.
3. Larson SO. Anemia and iron metabolism in hypothyroidism. *Acta Med Scand* 1957;157:339-63.
4. Mclean E, Benoist B, Allen LH. Review of the magnitude of folate and vitamin B12 deficiencies worldwide. *Food Nutr Bull* 2008;29(2):38-51.
5. Kulkarni VK, Jadhav DU. A study of anemia in primary hypothyroidism. *Int J Adv Med* 2017;4:383-9.
6. Sonja YH, Michael BZ, Myrtha A, Wolfgang L, Richard FH. Iron deficiency anemia reduces thyroid peroxidase activity in rats. *J Nutr* 2002;132:1951-55.
7. Smith SM, Johnson PE, Lukaski HC. In vitro hepatic thyroid hormone deiodination in iron-deficient rats: effect of dietary fat. *Life Sci* 1993;53:603-09.
8. Das C, Sahana PK, Sengupta N, Giri D, Roy M, Mukhopadhyay P et al. Etiology of anemia in primary hypothyroid subjects in a tertiary care center in Eastern India. *Indian J Endocrinol Metab* 2012;16(2):S361-S363.
9. Antonijević N, Nesović M, Trbojević B, Milosević R. Anemia in hypothyroidism. *Med Pregl* 1999;52(3-5):136-40.
10. Christ-Crain M, Meier C, Huber P, Zulewski H, Staub JJ, Müller B et al. Effect of restoration of euthyroidism on peripheral blood cells and erythropoietin in women with subclinical hypothyroidism. *Hormones (Athens)* 2003;2:237-42.
11. Horton L, Coburn RJ, England JM, Himsworth RL. The hematology of hypothyroidism. *Q J Med* 1976;45(177): 101-23.
12. Fein HG, Rivlin RS. Anemia in thyroid diseases. *Med Clin North Am* 1975;59:1133-45
13. Sims EG. Hypothyroidism causing macrocytic anemia unresponsive to B12 and folate. *J Natl Med Assoc* 1983;75(4):429-31.
14. Mehmet E, Aybike K, Ganidagli S, Mustafa K. Characteristics of anemia in subclinical and overt hypothyroid patients. *Endocr J* 2012;59(3):213-20.
15. Lawrence E, Shapiro A, M. I. Surks. Hypothyroidism. Kenneth L. B, Principles and practice of endocrinology and metabolism. 3rd edition. Lippincott Williams & Wilkins, Philadelphia 2001:445-451.
16. Cinemre H, Bilir C, Gokosmanoglu F, Bahcebasi T. Hematologic effects of levothyroxine in iron-deficient subclinical hypothyroid patients: a randomized, double-blind, controlled study. *J Clin Endocrinol Metab* 2009;94(1):151-56.

How to cite this article: Peraka SA, Karre S, Ravuri S, Shanmugam CK, To evaluate prevalence of anemia in hypothyroid patients. *J Diagn Pathol Oncol* 2019;4(2):110-113.