



ORIGINAL RESEARCH PAPER

Endocrinology

PREVALENCE AND MORPHOLOGICAL SPECTRUM OF ANEMIA IN PRIMARY HYPOTHYROIDISM: A CROSS-SECTIONAL STUDY

KEY WORDS:

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ABSTRACT

Introduction: Hypothyroidism is a systemic metabolic disorder that leads to a slowdown of all physiological functions, including the hematopoietic system. Anemia is a common clinical manifestation of thyroid dysfunction, yet it remains under-investigated in many clinical settings. **Objectives:** This study aims to evaluate the prevalence, morphological types, and etiology of anemia in patients with primary hypothyroidism and to correlate anemia severity with thyroid function parameters. **Methodology:** A cross-sectional study was conducted among 170 newly diagnosed primary overt hypothyroid patients at SRG Hospital, Jhalawar. Participants underwent detailed clinical examinations and laboratory investigations, including thyroid profiles (T3, T4, TSH), complete blood counts, peripheral smear examinations, and anti-TPO antibody testing. **Results:** The mean age of the participants was 39.1 ± 13.6 years, with a female-to-male ratio of approximately 1.8:1. Anemia was prevalent in 61.2% (n=104) of cases. Microcytic hypochromic anemia was the most frequent morphological type (57.7% of anemic cases), followed by dimorphic anemia. A statistically significant correlation was found between hemoglobin levels and thyroid markers: Hb positively correlated with T3 ($r=0.328$) and T4 ($r=0.389$), while negatively correlating with TSH ($r=-0.331$). **Conclusion:** Anemia is a highly prevalent complication of primary hypothyroidism. Routine screening for hematological parameters is essential in hypothyroid patients to ensure early detection and comprehensive management.

INTRODUCTION

Thyroid hormones (T3 and T4) are critical regulators of human metabolism, influencing nearly every organ system. Hypothyroidism, characterized by insufficient thyroid hormone production, affects between 2% and 5% of the global population. In India, the burden of hypothyroidism is significant, particularly among women and the elderly.

One of the most profound effects of thyroid deficiency is on the hematopoietic system. Thyroid hormones directly and indirectly stimulate the growth of erythroid colonies in the bone marrow. Consequently, hypothyroidism leads to a decrease in red blood cell mass due to reduced oxygen demand and diminished erythropoietin production. Anemia in these patients is not merely a single entity but can manifest as normocytic, microcytic, or macrocytic depending on the underlying pathophysiology, such as bone marrow suppression, iron malabsorption, or autoimmune processes like pernicious anemia.

Despite its high frequency, the relationship between thyroid status and anemia is often overlooked in clinical practice, posing therapeutic challenges. This study provides critical data on this interrelationship within the population of Rajasthan, India.

MATERIALS AND METHODS

Study Design And Population

This cross-sectional study was conducted at the Department of General Medicine, Jhalawar Medical College. The sample size was calculated as 170 patients based on a 50% expected prevalence.

Inclusion And Exclusion Criteria

Inclusion:

Overt primary hypothyroid patients (TSH > 10 IU/ml), age > 18 years, providing written consent.

Exclusion:

Patients with known hemoglobinopathies, secondary hypothyroidism, those on hematinics or anti-thyroid drugs, post-thyroidectomy patients, and those with a BMI > 35.

Laboratory Investigations

Venous blood samples were collected for:

Thyroid Profile: T3, T4, and TSH levels.

Hematological Parameters: Complete Blood Count (CBC) and Peripheral Smear to classify anemia based on RBC morphology (Normocytic, Microcytic, Macrocytic).

Etiological Workup: Serum iron studies for microcytic cases and Vitamin B12 levels for macrocytic cases.

Autoimmunity: Serum anti-TPO antibody testing.

RESULTS

Demographic Characteristics

The study population of 170 individuals had a mean age of 39.1 years. Females (n=109, 64.1%) outnumbered males (n=61, 35.9%).

Table 1: Prevalence Of Anemia In The Study Group

Anemia Status	Frequency (n)	Percentage (%)
Anemic	104	61.2%
Non-Anemic	66	38.8%
Total	170	100.0%

Age And Gender Association

Anemia prevalence significantly increased with age ($p=0.0001$). While hypothyroidism was more common in females, the development of anemia was found in 74% of female participants compared to 26% of males ($p=0.001$).

Morphological Spectrum Of Anemia

Among the 104 anemic patients, Microcytic Hypochromic anemia was the most prevalent type.

Type of Anemia	Number of Cases	Percentage (%)
Microcytic Hypochromic	60	57.7%
Dimorphic	32	30.8%
Normocytic Normochromic	10	9.6%
Macrocytic	2	1.9%
Total	104	100.0%

Correlation With Thyroid Function

There was a highly significant statistical difference in thyroid profiles between anemic and non-anemic groups.

Table 3: Association Of Anemia With Thyroid Profile

Parameter	Anemic (Mean ± SD)	Non-Anemic (Mean ± SD)	p-value
T3 (ng/ml)	1.03 ± 0.50	1.59 ± 0.62	< 0.001*
T4 (µg/dl)	0.63 ± 0.40	1.24 ± 0.63	< 0.001*
TSH (µIU/ml)	37.68 ± 17.84	23.18 ± 9.48	< 0.001*

*Statistically significant ($p < 0.05$)

Hemoglobin levels showed a strong negative correlation with TSH ($r = -0.331$), indicating that as the severity of hypothyroidism increases (higher TSH), the severity of anemia also increases.

Correlation Of Hemoglobin (Hb) With Thyroid Parameters

Variable Pair	Correlation Coefficient (r)	p-value	Interpretation
Hb vs TSH	-0.331	0.0001	Significant Negative Correlation
Hb vs T3	+0.328	0.0001	Significant Positive Correlation
Hb vs T4	+0.389	0.0001	Significant Positive Correlation

Table 5: Distribution Of Anemia Severity By Gender

Gender	Mild (n)	Moderate (n)	Severe (n)	Total Anemic
Female	36	32	9	77
Male	12	12	3	27
Total	48	44	12	104

DISCUSSION
 The findings of this study confirm that anemia is a major comorbidity in primary hypothyroidism, with a prevalence of 61.2%. This is consistent with existing literature where anemia rates range from 20% to 60% in hypothyroid cohorts.

The female predominance in our study (64.1%) reflects the global trend of thyroid disorders being more prevalent in women. Our data showed that anemia was significantly more common in older age groups, likely due to the cumulative effect of chronic thyroid hormone deficiency on the bone marrow.

The predominance of microcytic hypochromic anemia (57.7% of anemic cases) in this study suggests a strong link to iron deficiency. In hypothyroid patients, iron deficiency often arises from malabsorption due to achlorhydria or, in women, increased blood loss through menorrhagia caused by hormonal imbalances. Interestingly, while some literature suggests normocytic anemia is the most common type due to metabolic slowdown, our clinical findings in Rajasthan highlight a higher burden of nutritional-related microcytic and dimorphic anemia.

The strong correlation between Hb and thyroid markers (T3, T4, TSH) underscores the physiological role of thyroid hormones in erythropoiesis. Low T3 and T4 levels directly impair the formation of erythroid colonies, while high TSH serves as a marker for the severity of this metabolic deficit. Furthermore, 94% (160/170) of our participants were anti-TPO positive, suggesting that autoimmune thyroiditis is a primary driver of these conditions in our population.

CONCLUSION
 Anemia is an exceedingly common finding in newly diagnosed primary hypothyroidism. The severity of thyroid dysfunction directly impacts hemoglobin levels, with microcytic and dimorphic anemia being the most frequent morphological types in this study population.

Clinicians should adopt a high index of suspicion for thyroid dysfunction in patients presenting with unexplained anemia. Routine screening for thyroid function in anemic patients and vice versa is recommended to ensure early management and improve the quality of life for patients.

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