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ORIGINAL RESEARCH

Anemia in the Context of Primary Hypothyroidism: A Study of Prevalence and Characteristics

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ABSTRACT

Background: Primary hypothyroidism, a prevalent endocrine disorder, is characterized by insufficient synthesis of thyroid hormones. Anemia frequently coexists with hypothyroidism, often arising from deficiencies in nutrients such as iron or vitamin B12 or as a consequence of chronic disease. Consequently, identifying the underlying cause of anemia in individuals with hypothyroidism is essential. This study aimed to assess the prevalence of anemia and its various subtypes in patients diagnosed with primary hypothyroidism. **Materials and Methods:** A prospective cross-sectional observational study recruited 198 adult participants aged 18–65 years, irrespective of gender. These participants were either newly diagnosed with primary hypothyroidism or presented with its symptoms. Patients on anti-thyroid medications or with hypothyroidism due to post-thyroidectomy were excluded. Demographic details and results from complete blood count parameters, including hemoglobin (Hb) and mean corpuscular volume (MCV), were documented on a structured proforma to determine the presence and type of anemia. Statistical analysis was performed using the chi-square test, with significance set at $p < 0.05$. **Results:** The study population had a mean age of 43.21 ± 8.54 years, comprising 59.09% (n = 117) females and 40.91% (n = 81) males. Anemia was identified in 67.68% (n = 134) of participants, with 38.38% (n = 76) exhibiting normocytic anemia, 19.70% (n = 39) presenting with microcytic anemia, and 9.60% (n = 19) displaying macrocytic anemia. Anemia prevalence was significantly higher in females (88.78%, n = 87) compared to males (46.94%, n = 46) ($p < 0.01$). **Conclusion:** The study revealed a high prevalence of anemia among patients with primary hypothyroidism, with normocytic anemia being the most frequently observed subtype. Identifying and addressing the root cause of anemia in hypothyroid patients is crucial for optimal management.

Key Words: Anemia, Hypothyroidism, Normocytic, Microcytic, Macrocytic

INTRODUCTION

Anemia continues to be a significant global health concern, affecting people across a wide range of age groups and backgrounds. Among the many factors that contribute to anemia, primary hypothyroidism—a common endocrine disorder caused by an insufficient production of thyroid hormones—has emerged as an important one. Understanding the prevalence and types of anemia in individuals with primary hypothyroidism is essential for improving clinical care and patient outcomes [1,2].

Primary hypothyroidism can arise from various causes, such as autoimmune thyroiditis (commonly known as Hashimoto's thyroiditis), iodine deficiency, thyroid surgery, certain medications, and exposure to radiation therapy. It presents with a variety of symptoms, including fatigue, sensitivity to cold, weight gain, and problems affecting the cardiovascular, neurological, and hematological systems. Hematological issues, especially anemia, are of particular concern because of their significant impact on patient well-being and quality of life [3,4].

Research shows that the prevalence of anemia in primary hypothyroidism varies based on factors like patient characteristics, the severity of the disease, and other underlying conditions. Studies suggest that anemia is often present in people with primary hypothyroidism, with prevalence estimates ranging

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from 30% to 60%, highlighting the importance of recognizing and addressing this as a potential complication of thyroid hormone deficiency [5,6].

Several types of anemia are found in individuals with primary hypothyroidism, each stemming from different physiological causes. One common type is normocytic normochromic anemia, where red blood cells are of normal size and hemoglobin concentration, but the body's ability to produce enough red blood cells is compromised due to low thyroid hormone levels. Despite adequate iron stores and erythropoietin, this form of anemia results from impaired erythropoiesis. Another type is macrocytic anemia, where red blood cells are larger than normal due to disruptions in DNA synthesis and cell maturation caused by thyroid hormone deficiency, leading to ineffective erythropoiesis [7,8].

Iron deficiency anemia (IDA) may also coexist with primary hypothyroidism due to altered iron metabolism. Thyroid hormones are critical for iron absorption, transport, and utilization, and their deficiency can impair these processes, reducing the availability of iron for red blood cell production. Megaloblastic anemia, characterized by larger erythrocytes and hyper-segmented neutrophils, can occur in patients with concurrent vitamin B12 deficiency or pernicious anemia. Insufficient thyroid hormone may further hinder vitamin B12 absorption, exacerbating the issue of ineffective erythropoiesis. Additionally, autoimmune hemolytic anemia (AIHA), which involves the destruction of red blood cells by autoantibodies, is linked to autoimmune thyroid conditions, including primary hypothyroidism. While the exact mechanisms connecting AIHA to hypothyroidism remain unclear, this association reflects the complex role of autoimmune factors in these patients [9,10].

In summary, anemia is a common complication in individuals with primary hypothyroidism, with normocytic normochromic and macrocytic anemia being particularly prevalent. These forms are indicative of disrupted erythropoiesis and abnormal red blood cell morphology due to thyroid hormone deficiency. Furthermore, iron deficiency anemia, megaloblastic anemia, and autoimmune hemolytic anemia contribute to the multifaceted nature of anemia in this context. Identifying the types and prevalence of anemia in primary hypothyroidism is crucial for accurate diagnosis and effective management to improve patient care outcomes [11,12]. This study aimed to evaluate the prevalence and types of anemia among patients diagnosed with primary hypothyroidism.

MATERIAL AND METHODS

This cross-sectional study enrolled patients aged 18 to 65 years, regardless of gender, who were newly diagnosed with primary hypothyroidism. Diagnosis was determined by elevated serum thyroid-stimulating hormone (TSH) levels accompanied by low levels of triiodothyronine (T3) and thyroxine (T4). Patients with TSH levels above 4.2 µIU/mL, reduced T3 and T4, and clinical signs of hypothyroidism were classified as having primary hypothyroidism. Exclusion criteria included those with secondary hypothyroidism, individuals undergoing antithyroid treatment, and patients with hypothyroidism due to thyroidectomy.

A total of 198 individuals meeting the criteria were included in the study after providing written informed consent. Key demographic and baseline details, such as age, gender, body mass index (BMI), and smoking history, were recorded. Venous blood samples (5 mL) were collected from all participants for complete blood count analysis, including mean corpuscular volume (MCV). Anemia was defined based on hemoglobin levels: less than 13.5 g/dL for males and less than 11.5 g/dL for females. Anemia types were categorized by MCV as microcytic (<76 fL), normocytic (76–96 fL), or macrocytic (>96 fL). All information was documented using a standardized data collection form.

Data entry and analysis were performed with IBM SPSS Statistics, Version 23. Continuous variables like age, BMI, and symptom duration were presented as means with standard deviations, while categorical variables such as gender, smoking history, anemia status, and anemia subtypes were expressed as frequencies and percentages. The study also stratified data based on variables like age, BMI, gender, and symptom duration to explore their relationship with anemia and its subtypes. Statistical significance was assessed using the chi-square test, with a p-value of less than 0.05 considered significant.

RESULTS

Table 1 summarizes the baseline demographic details of patients with primary hypothyroidism. A majority (55.05%) of the participants were below 40 years of age, while 44.95% were older than 40 years. The sample had a higher proportion of females (59.09%) compared to males (40.91%). Most participants had been diagnosed with hypothyroidism for less than 5 years (59.60%). The distribution of BMI was relatively even, with 51.52% having a BMI <27 kg/m² and 48.48% with BMI ≥27 kg/m².

Table 2 highlights the types of anemia observed among the participants. Normocytic anemia was the most common, affecting 38.38% of patients, followed by microcytic hypochromic anemia (19.70%) and macrocytic anemia (9.60%). Notably, 32.32% of patients did not exhibit any anemia.

Table 3 explores the relationship between anemia and various demographic parameters. While anemia was more prevalent among younger patients (<40 years: 71.43%) compared to older patients (>40 years: 64.29%), this difference was not statistically significant ($p = 0.32$). Similarly, no significant association was observed between anemia and BMI ($p = 0.17$) or duration of hypothyroidism ($p =$

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0.10).However, a significant association was identified between anemia and gender ($p < 0.01$), with a higher prevalence of anemia among females (88.78%) compared to males (46.94%). This indicates that female patients with hypothyroidism may have a greater predisposition to anemia than their male counterparts.

Table 1: Baseline demographic details of study patients

Variable	n	%
Age category		
<40 years	109	55.05
>40 years	89	44.95
Gender		
Male	81	40.91
Female	117	59.09
Duration of Hypothyroidism		
<5 years	118	59.60
>5 years	80	40.40
BMI category		
<27 kg/m²	102	51.52
>27 kg/m²	96	48.48

Table 2: Distribution of types of anemia in patients of primary hypothyroidism

Type of Anemia	n	%
Microcytic Hypochromic	39	19.70
Macrocytic	19	9.60
Normocytic	76	38.38
No Anemia	64	32.32
Total	198	100.00

Table 3: Association of anemia with demographics

Variable	Anaemia		P Value
	Yes	No	
Age category			
<40 years	70 (71.43)	39 (39.80)	0.32
>40 years	63 (64.29)	26 (26.53)	
Gender			
Male	46 (46.94)	35 (35.71)	<0.01
Female	87 (88.78)	30 (30.61)	
Duration of Hypothyroidism			
<5 years	84 (85.71)	34 (34.69)	0.10
>5 years	48 (48.98)	32 (32.65)	
BMI category			
<27 kg/m²	64 (65.31)	38 (38.78)	0.17
>27 kg/m²	69 (70.41)	27 (27.55)	

DISCUSSION

The most frequently observed type of anemia among hypothyroid patients in this study was normocytic normochromic anemia, followed by microcytic anemia. When anemia prevalence was analyzed based on demographic factors, a notable gender-related disparity was observed. Supporting these findings, Kulkarni et al. [13] reported anemia in 75% (n = 45) of hypothyroid patients, with 65% (n = 39) being normocytic, 23% (n = 14) microcytic, and 12% (n = 7) macrocytic. Another study similarly documented normocytic anemia in 46.27% (n = 902), microcytic anemia in 24.36% (n = 475), and macrocytic anemia in 16.36% (n = 319) of hypothyroid patients, with an overall anemia prevalence of 33.77% (n = 659) [14].

El-Masry et al. [15] also identified anemia in 65% (n = 39) of adolescent hypothyroid patients, a finding consistent with our study. Another investigation found anemia prevalence rates of 43% (n = 43) in patients with primary hypothyroidism ($p = 0.0003$) and 39% (n = 39) in those with subclinical hypothyroidism ($p = 0.02$), suggesting similar anemia rates in both overt and subclinical hypothyroidism [16]. In congenital hypothyroidism, anemia is also frequently seen, with its occurrence often linked to the severity of thyroid dysfunction [17].

A study of 60 hypothyroid patients noted microcytic anemia in 43.3% (n = 26) and found no significant differences in vitamin B12, folic acid, or iron levels. These findings emphasize the importance of

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evaluating anemia in hypothyroid patients regardless of their baseline nutritional status [18]. Hormonal disturbances such as menorrhagia may lead to microcytic anemia, while malabsorption of nutrients like vitamin B12 and folic acid can contribute to macrocytic anemia. Hypothyroid patients are reportedly up to 20 times more likely to develop pernicious anemia, with approximately 55% exhibiting macrocytosis even in the absence of nutritional deficiencies [19].

The prevalence of anemia in hypothyroidism has been reported to range from 32% to 67%, with meta-analyses of observational studies estimating an average prevalence of 43.2% (n = 48) [20]. Variations in prevalence are influenced by factors such as age, gender, disease severity, comorbidities, and geographic or ethnic differences [21]. This study also noted a significant gender disparity in anemia prevalence, although no associations were observed with age, BMI, or disease duration.

Normocytic anemia emerged as the most common subtype in this cohort. Microcytic anemia was often linked to chronic disease, while macrocytic anemia was primarily associated with vitamin B12 deficiency. These findings underscore the need to identify the specific causes of anemia in hypothyroid patients to ensure appropriate management [18,19].

However, this study has limitations. The single-center design and small sample size limit the generalizability of the findings. Additionally, long-term follow-up was not conducted to assess the response to iron supplementation in iron-deficiency anemia cases. Further, comprehensive investigations, such as iron studies, thalassemia screening, and vitamin B12 level measurements, were not performed to elucidate the underlying causes of anemia in hypothyroid patients.

CONCLUSION

A significant proportion of patients in our study cohort with hypothyroidism were found to have anemia, with normocytic anemia being the most prevalent subtype. Since untreated anemia can result in severe complications, such as arrhythmias and eventual heart failure, it is crucial to diagnose and manage anemia promptly, particularly in individuals with hypothyroidism, where symptoms may be exacerbated by coexisting anemia. We emphasize the importance of early evaluation for anemia in patients with hypothyroidism. Furthermore, given the diverse etiologies of anemia, it is essential to determine its underlying cause based on the specific type of anemia for effective management.

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