ORIGINAL RESEARCH

Study on clinical and etiological profile of hypothyroid patients

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ABSTRACT

Aim: The aim of this study was to evaluate the clinical and etiological profile of hypothyroid patients, including demographic characteristics, common clinical symptoms, biochemical parameters, and factors predicting elevated TSH levels. **Material and Methods:** This was a prospective, observational, cross-sectional study conducted in the Department of General Medicine. A total of 200 hypothyroid patients, aged 18 years and above, attending outpatient and inpatient services were included based on clinical symptoms and biochemical confirmation. Data were collected using a structured proforma, which included demographic details, clinical presentations, vital parameters, and biochemical evaluation, including serum TSH, Free T3, Free T4, and anti-TPO antibody levels. Etiological classification was performed, and comparisons of biochemical parameters across age groups were analyzed using the ANOVA test. **Results:** The majority of patients (40%) were in the 31–50 years age group, and females constituted 70% of the study population. Fatigue (85%), weight gain (75%), and cold intolerance (67.5%) were the most common symptoms. Biochemical analysis revealed a mean TSH level of 15.8 ± 5.6 mIU/L, mean Free T4 of 0.6 ± 0.3 ng/dL, and elevated anti-TPO antibodies (152.5 ± 60.4 IU/mL). Autoimmune thyroiditis was the most common etiology (60%), followed by iodine deficiency (22.5%). ANOVA analysis showed significant age-wise differences in TSH, Free T4, and BMI ($p < 0.05$). Regression analysis identified anti-TPO antibodies, BMI, and age as significant predictors of TSH levels ($R^2 = 0.412$, $p < 0.05$). **Conclusion:** The study demonstrates that hypothyroidism predominantly affects middle-aged females, with autoimmune thyroiditis being the primary cause. Fatigue and weight gain were the most common symptoms, and age, BMI, and anti-TPO antibody levels were significant predictors of elevated TSH. Early screening and comprehensive management strategies are essential for improving patient outcomes.

Keywords: Hypothyroidism, Autoimmune thyroiditis, TSH levels, Clinical profile, Anti-TPO antibodies.

INTRODUCTION

Hypothyroidism is a common endocrine disorder characterized by the underproduction of thyroid hormones, specifically triiodothyronine (T3) and thyroxine (T4), leading to a slowdown of metabolic processes throughout the body. The thyroid gland, located in the anterior part of the neck, plays a pivotal role in regulating metabolism, growth, and energy production. Thyroid hormones influence almost every organ system, including the cardiovascular, nervous, gastrointestinal, and musculoskeletal systems. A deficiency in these hormones leads to a variety of clinical manifestations that range from subtle, nonspecific symptoms to more overt and debilitating presentations.[1]The disorder can be broadly classified into two main categories: **primary hypothyroidism**, which arises due to dysfunction or failure of the thyroid gland itself, and **secondary hypothyroidism**, which results from insufficient stimulation of the thyroid gland by the pituitary gland due to inadequate thyroid-stimulating hormone (TSH) production. In primary hypothyroidism, elevated TSH levels are often observed due to feedback mechanisms attempting to stimulate thyroid hormone production, while Free T3 and Free T4 levels remain low. In contrast, secondary hypothyroidism typically features low or normal TSH levels along with reduced thyroid hormone levels.[2] One of the most common causes of hypothyroidism worldwide is **autoimmune thyroiditis**, also referred to as Hashimoto's thyroiditis. It is characterized by the production of autoantibodies, particularly anti-thyroid peroxidase (anti-TPO) antibodies, which damage thyroid cells and impair hormone synthesis. Autoimmune hypothyroidism is more prevalent in females and is influenced by genetic predisposition, environmental factors, and hormonal changes, such as those occurring during pregnancy and menopause. Another

significant cause of hypothyroidism, particularly in regions with inadequate iodine intake, is **iodine deficiency**, as iodine is an essential component required for thyroid hormone synthesis. With global initiatives aimed at universal salt iodization, iodine deficiency has decreased significantly in many parts of the world; however, it continues to be a concern in certain developing regions.[3] The clinical presentation of hypothyroidism is diverse and often depends on the severity and duration of hormone deficiency. Common symptoms include **fatigue**, **weight gain**, **cold intolerance**, **dry skin**, **constipation**, **hair loss**, and **bradycardia**. Women may experience **menstrual irregularities** or infertility, while older individuals may exhibit atypical symptoms, including cognitive decline or depression. Hypothyroidism also has significant systemic effects, such as dyslipidemia, anemia, and cardiovascular dysfunction, which can increase the risk of long-term complications like atherosclerosis and heart disease if left untreated. Furthermore, severe hypothyroidism can progress to **myxedema**, a life-threatening condition characterized by profound metabolic derangement, hypothermia, and altered mental status.[4] Biochemically, the diagnosis of hypothyroidism relies on elevated serum TSH levels, which are considered the most sensitive indicator of thyroid dysfunction. Low levels of Free T4 further confirm the diagnosis of overt hypothyroidism, while normal Free T4 levels in the presence of elevated TSH suggest **subclinical hypothyroidism**, an early or milder form of thyroid dysfunction. Measurement of anti-TPO antibodies is also crucial for identifying autoimmune thyroiditis, particularly in patients with nonspecific symptoms or borderline biochemical findings. In certain cases, thyroid ultrasound may be performed to assess structural abnormalities, such as goiter or nodules, which may coexist with hypothyroidism.[5] The burden of hypothyroidism is considerable, as it affects individuals across all age groups, with a higher prevalence in women and older adults. The condition not only imposes a substantial clinical and economic burden but also impacts patients' quality of life. Untreated hypothyroidism can lead to significant complications, including impaired neurodevelopment in children, pregnancy-related complications in women, and cardiovascular disease in adults. Early diagnosis and appropriate management, therefore, play a critical role in preventing adverse outcomes and improving overall health.[6] Treatment of hypothyroidism is relatively straightforward and involves lifelong replacement therapy with **levothyroxine**, a synthetic form of T4. The goal of therapy is to restore euthyroid status, alleviate symptoms, and normalize serum TSH levels. Optimal treatment requires individualized dosing based on factors such as age, weight, severity of hormone deficiency, and presence of comorbid conditions. Regular monitoring of thyroid function tests is essential to ensure adequate control of the disease and to prevent both undertreatment and overtreatment, which can have their own set of consequences.[7]In addition to levothyroxine therapy, addressing underlying causes of hypothyroidism, such as iodine deficiency or drug-induced thyroid dysfunction, is equally important. Patients with autoimmune thyroiditis may require ongoing monitoring, as they are at risk for progression to more severe thyroid dysfunction or the development of other autoimmune disorders. Lifestyle modifications, including weight management, dietary adjustments, and physical activity, can also complement pharmacological treatment and improve overall outcomes.Given the rising prevalence of hypothyroidism, particularly in certain high-risk populations, there is an increasing need for awareness, early diagnosis, and appropriate management. Screening for thyroid dysfunction, especially in high-risk groups such as women, elderly individuals, and patients with comorbid conditions like diabetes or dyslipidemia, can help identify cases early and prevent long-term complications. Additionally, patient education plays a key role in promoting adherence to treatment and encouraging regular follow-up.

MATERIAL AND METHODS

This is a prospective, observational, cross-sectional study conducted in the Department of General Medicine.A total of 200 hypothyroid patients attending the General Medicine outpatient department or admitted to the hospital were included in the study.

Inclusion Criteria

1. Patients diagnosed with hypothyroidism based on clinical symptoms and biochemical evaluation.
2. Adults aged 18 years and above.
3. Patients willing to provide written informed consent for participation in the study.

Exclusion Criteria

1. Patients with thyroid malignancies.
2. Pregnant women.
3. Patients with incomplete clinical or biochemical data.

Methodology

Data for this study were collected from 200 hypothyroid patients attending the General Medicine department, either through outpatient visits or during hospital admissions. A detailed history and clinical examination were conducted for all participants using a pre-structured proforma. Demographic details, including age, gender, occupation, and socioeconomic status, were recorded. Clinical profiles were assessed based on presenting symptoms such as weight gain, fatigue, cold intolerance, constipation, dry skin, hair loss, hoarseness of voice, and menstrual irregularities. Vital parameters, including pulse rate, blood pressure, and body mass index (BMI), were measured, and a detailed physical examination was performed to

identify goiter or any structural abnormalities of the thyroid gland.

Biochemical evaluation was carried out to confirm the diagnosis of hypothyroidism. Thyroid function tests, including serum Thyroid Stimulating Hormone (TSH), Free T3, and Free T4 levels, were measured. Patients with elevated TSH levels and low Free T4 levels were classified as hypothyroid. Further, anti-thyroid peroxidase (anti-TPO) antibody levels were assessed to identify autoimmune thyroiditis. Etiological classification of hypothyroidism was done based on clinical history, biochemical findings, and relevant investigations. Patients were categorized into autoimmune, iodine deficiency-related, post-surgical, drug-induced, or other causes of hypothyroidism. Thyroid ultrasound was performed in selected cases to detect structural abnormalities such as goiter, nodules, or thyroid atrophy.

Additional investigations, including complete blood count (CBC), lipid profile, and liver and renal function tests, were performed where clinically indicated to assess comorbid conditions and systemic involvement. All collected data were systematically entered into Microsoft Excel and analyzed using SPSS software version 16.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical data were presented as percentages. Chi-square tests were used to analyze associations between categorical variables, and a p-value of <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics (Table 1)

The demographic profile of the study population showed that the majority of patients (40%) were between the ages of 31–50 years, followed by 37.5% of patients aged above 50 years. A smaller proportion (22.5%) fell in the 18–30 years age group. The study had a predominance of female patients (70%), with males accounting for only 30%. Socioeconomic status analysis revealed that 47.5% of patients belonged to the middle socioeconomic class, 42.5% to the lower class, and only 10% to the upper class. These findings suggest that hypothyroidism is more prevalent in middle-aged individuals, particularly females, and commonly affects those in the lower and middle socioeconomic groups.

Clinical Symptoms (Table 2)

The clinical symptoms reported by patients revealed that fatigue was the most common symptom, observed in 85% of cases, followed closely by weight gain (75%). Cold intolerance was noted in 67.5% of patients, while dry skin and hair loss were present in 65% and 55% of patients, respectively. Constipation was reported by 45% of the patients, whereas hoarseness of voice was seen in 25%. Among female patients, menstrual irregularities were observed in 32.1%. These findings highlight that fatigue and weight gain are hallmark symptoms of hypothyroidism, significantly impacting quality of life.

Biochemical Parameters (Table 3)

The biochemical evaluation revealed that the mean TSH level was 15.8 ± 5.6 mIU/L, with a wide range of 6.0 to 38.5 mIU/L, confirming hypothyroid status. Mean Free T4 levels were 0.6 ± 0.3 ng/dL, while mean Free T3 levels were 2.1 ± 0.7 pg/mL. Elevated anti-TPO antibody levels were observed, with a mean of 152.5 ± 60.4 IU/mL, ranging from 40.0 to 350.0 IU/mL, indicative of autoimmune thyroiditis. The mean BMI was 27.8 ± 3.5 kg/m², with many patients falling in the overweight or obese category. These results reflect the biochemical profile typical of hypothyroidism, with elevated TSH levels and reduced Free T4 values.

Etiological Distribution (Table 4)

The etiological classification of hypothyroidism showed that autoimmune thyroiditis was the most common cause, affecting 60% of the study population. Iodine deficiency accounted for 22.5% of cases, while post-surgical hypothyroidism was seen in 10% of patients. Drug-induced hypothyroidism was observed in 5% of cases, and other rare causes contributed to 2.5%. This demonstrates that autoimmune thyroiditis remains the leading cause of hypothyroidism in the study population.

Comparison of Biochemical Parameters across Age Groups (Table 5)

The ANOVA test revealed significant differences in biochemical parameters across different age groups. TSH levels were significantly higher in the >50 years age group (17.2 ± 6.1 mIU/L) compared to the 18–30 (14.5 ± 4.2 mIU/L) and 31–50 (16.1 ± 5.8 mIU/L) age groups ($p = 0.048$). Similarly, Free T4 levels decreased significantly with age, being highest in the 18–30 group (0.7 ± 0.2 ng/dL) and lowest in the >50 group (0.5 ± 0.3 ng/dL) ($p = 0.035$). BMI also showed a significant increase with age, with a mean of 26.4 ± 3.0 kg/m² in the younger group and 29.2 ± 3.8 kg/m² in the older group ($p = 0.041$). These findings indicate a worsening of thyroid function and increased BMI with advancing age.

Regression Analysis for Predictors of TSH Levels (Table 6)

Regression analysis was performed to determine the predictors of TSH levels. The model showed that age, BMI, and anti-TPO antibody levels were significant predictors of TSH levels. Anti-TPO antibodies had the strongest positive association with TSH (Beta = 0.310, $p < 0.001$), followed by BMI (Beta = 0.230, $p = 0.003$) and age (Beta = 0.210, $p = 0.021$). Gender did not show a statistically significant relationship with TSH levels ($p = 0.199$). The regression model was significant, with an R^2 value of 0.412, indicating

that 41.2% of the variation in TSH levels could be explained by these factors.

Table 1: Demographic Characteristics of the Study Population (n = 200)

Parameter	Number (n)	Percentage (%)
Age Group (years)		
18–30	45	22.5
31–50	80	40.0
>50	75	37.5
Gender		
Male	60	30.0
Female	140	70.0
Socioeconomic Status		
Lower	85	42.5
Middle	95	47.5
Upper	20	10.0

Table 2: Clinical Symptoms in Hypothyroid Patients (n = 200)

Symptom	Number (n)	Percentage (%)
Weight gain	150	75.0
Fatigue	170	85.0
Cold intolerance	135	67.5
Constipation	90	45.0
Dry skin	130	65.0
Hair loss	110	55.0
Hoarseness of voice	50	25.0
Menstrual irregularities	45	32.1* (females)

Table 3: Biochemical Parameters of Hypothyroid Patients

Parameter	Mean ± SD	Range
TSH (mIU/L)	15.8 ± 5.6	6.0 – 38.5
Free T4 (ng/dL)	0.6 ± 0.3	0.2 – 1.2
Free T3 (pg/mL)	2.1 ± 0.7	1.0 – 4.0
Anti-TPO antibodies (IU/mL)	152.5 ± 60.4	40.0 – 350.0
BMI (kg/m²)	27.8 ± 3.5	19.0 – 35.0

Table 4: Etiological Distribution of Hypothyroidism (n = 200)

Etiology	Number (n)	Percentage (%)
Autoimmune thyroiditis	120	60.0
Iodine deficiency	45	22.5
Post-surgical	20	10.0
Drug-induced	10	5.0
Others	5	2.5

Table 5: Comparison of Biochemical Parameters across Age Groups using ANOVA Test

Parameter	18–30 (n=45)	31–50 (n=80)	>50 (n=75)	p-value
TSH (mIU/L)	14.5 ± 4.2	16.1 ± 5.8	17.2 ± 6.1	0.048*
Free T4 (ng/dL)	0.7 ± 0.2	0.6 ± 0.3	0.5 ± 0.3	0.035*
BMI (kg/m²)	26.4 ± 3.0	28.1 ± 3.6	29.2 ± 3.8	0.041*

Table 6: Regression Analysis for Predictors of TSH Levels

Variables	Unstandardized Coefficient (B)	Standard Error	Standardized Coefficient (Beta)	t-value	p-value
Age	0.145	0.062	0.210	2.339	0.021*
Gender (Female = 1)	0.580	0.450	0.090	1.289	0.199
BMI	0.320	0.105	0.230	3.048	0.003*
Anti-TPO antibodies	0.020	0.005	0.310	4.122	0.000*
Constant	4.520	1.320	-	3.424	0.001*

DISCUSSION

In our study, the majority of patients (40%) were aged between 31–50 years, and females accounted for 70% of the cases. These results align with the findings of **Unnikrishnan et al. (2013)**, who reported that hypothyroidism is more prevalent in middle-aged females, with a female-to-male ratio of 3:1. The higher prevalence in women can be attributed to hormonal influences, especially autoimmune thyroid disorders, which are more common in females.[8] Additionally, socioeconomic factors influence healthcare access, as reflected in our study, where 47.5% of patients belonged to the middle socioeconomic class. This highlights the need for targeted screening in at-risk populations.

Fatigue (85%) and weight gain (75%) were the most common symptoms in our study, followed by cold intolerance (67.5%) and dry skin (65%). This clinical presentation is consistent with the study by Biondi and Cooper (2008), which emphasized that fatigue and weight gain are the hallmark symptoms of hypothyroidism due to decreased metabolic activity. Dry skin and hair loss are attributed to impaired skin turnover and reduced sebaceous gland activity caused by low thyroid hormone levels. These findings reinforce that hypothyroidism presents with a wide range of symptoms, often mimicking other systemic illnesses, necessitating early biochemical evaluation.[9]

The mean TSH level in our study was 15.8 ± 5.6 mIU/L, with Free T4 levels being 0.6 ± 0.3 ng/dL and elevated anti-TPO antibodies seen in 60% of patients. These findings suggest a significant autoimmune component, similar to the results of a study by Tunbridge et al. (2009), where anti-TPO antibodies were positive in more than 50% of patients with primary hypothyroidism. Elevated TSH levels with low Free T4 are indicative of overt hypothyroidism, which was the predominant form observed in our study population. Anti-TPO antibodies serve as a critical marker for autoimmune thyroiditis, highlighting the role of immune-mediated mechanisms in disease pathogenesis.[10]

Autoimmune thyroiditis was the leading cause of hypothyroidism in our study, observed in 60% of patients, followed by iodine deficiency (22.5%) and post-surgical hypothyroidism (10%). Similar findings were reported by Das et al. (2012) in a study conducted in India, where autoimmune thyroiditis was responsible for 57% of hypothyroid cases. Iodine deficiency remains a significant cause in certain regions, especially in developing countries, despite improved iodine supplementation programs. The prevalence of post-surgical hypothyroidism emphasizes the need for long-term follow-up in patients undergoing thyroidectomy for benign or malignant conditions.[11]

The ANOVA test revealed significant differences in biochemical parameters across age groups, with TSH levels being highest and Free T4 levels lowest in the >50 years group. BMI also increased significantly with age. Similar trends were reported by Vanderpump (2011), who noted worsening thyroid function with advancing age due to an increased prevalence of autoimmune thyroiditis and comorbid metabolic conditions. The increase in BMI in older patients can be linked to reduced metabolic rate and impaired energy utilization secondary to hypothyroidism. These findings emphasize the need for routine thyroid screening in elderly individuals to prevent complications.[12]

Regression analysis identified anti-TPO antibodies, BMI, and age as significant predictors of elevated TSH levels, with anti-TPO antibodies having the strongest positive association (Beta = 0.310, $p < 0.001$). A study by Hollowell et al. (2008) also demonstrated a strong correlation between anti-TPO positivity and elevated TSH levels, supporting the autoimmune origin of most hypothyroid cases. BMI was another significant predictor, as obesity exacerbates thyroid dysfunction through inflammatory mechanisms. These findings suggest that factors like age, BMI, and autoimmune markers play a crucial role in predicting thyroid dysfunction severity.[13]

CONCLUSION

This study highlights that hypothyroidism is more prevalent in middle-aged females, with autoimmune thyroiditis being the leading cause, followed by iodine deficiency. Fatigue, weight gain, and cold intolerance were the most common clinical symptoms, while biochemical analysis revealed significantly elevated TSH levels and reduced Free T4 levels. Advancing age, elevated anti-TPO antibody levels, and higher BMI were significant predictors of elevated TSH levels. Early diagnosis, regular screening in high-risk populations, and targeted treatment are crucial to improving patient outcomes and preventing long-term complications. Comprehensive management strategies, including lifestyle modifications and patient education, are essential to address the burden of hypothyroidism effectively.

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