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CLINICAL, BIOCHEMICAL, CYTOLOGICAL, AND ULTRASONOGRAPHIC SPECTRUM OF AUTOIMMUNE THYROIDITIS: EXPERIENCE FROM A TERTIARY CARE CENTRE

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ABSTRACT

Background: Autoimmune thyroiditis (AIT) is the most common organ-specific autoimmune disorder characterized by chronic immune-mediated destruction of thyroid follicles, resulting in progressive thyroid dysfunction. Hashimoto's thyroiditis represents the predominant form of AIT and is diagnosed through a combination of clinical manifestations, thyroid function tests, thyroid autoantibody estimation, fine needle aspiration cytology (FNAC), and ultrasonography.

Aim: To evaluate the clinical, biochemical, cytological, and ultrasonographic characteristics of patients diagnosed with autoimmune thyroiditis attending a tertiary care hospital.

Materials and Methods: A retrospective cross-sectional study was conducted among 420 patients with autoimmune thyroiditis in the Department of General Surgery, Shija Academy of Health Sciences, Manipur (India). Clinical records, thyroid function parameters, thyroid autoantibody profiles, FNAC findings, and ultrasonographic reports were reviewed. Descriptive and inferential statistical analyses were performed to assess the clinicopathological and radiological presentations of the disease.

Findings: The study demonstrated a marked female predominance among patients with autoimmune thyroiditis. Thyroid functional status ranged from euthyroidism to subclinical and overt hypothyroidism, with elevated thyroid-stimulating hormone (TSH) being the most frequent biochemical abnormality. Anti-thyroid peroxidase (Anti-TPO) antibodies were positive in a substantial proportion of patients, confirming autoimmune thyroid involvement. Cytological examination predominantly revealed diffuse lymphocytic infiltration with varying degrees of Hurthle cell metaplasia, while ultrasonography commonly demonstrated diffuse hypoechogenicity and heterogeneous thyroid echotexture, consistent with chronic autoimmune thyroiditis.

Conclusion: Autoimmune thyroiditis exhibits diverse clinical, biochemical, cytological, and ultrasonographic manifestations. The combined assessment of thyroid function tests, thyroid autoantibodies, FNAC, and ultrasonography offers a comprehensive and reliable diagnostic approach for the early detection and characterization of autoimmune thyroiditis, thereby facilitating timely clinical management and improved patient outcomes.

KEYWORDS: Autoimmune thyroiditis, Hashimoto's thyroiditis, Anti-thyroid peroxidase antibody, Fine needle aspiration cytology, Ultrasonography

INTRODUCTION

Autoimmune thyroid diseases (AITDs) are among the most common organ-specific autoimmune disorders, resulting from an abnormal immune response against thyroid tissue. The two principal clinical forms are Hashimoto's thyroiditis (HT) and Graves' disease (GD), which differ in their clinical manifestations but share a common autoimmune pathogenesis. Hashimoto's thyroiditis is characterized by progressive destruction of thyroid follicles through lymphocytic infiltration, leading primarily to hypothyroidism, whereas Graves' disease causes hyperthyroidism due to thyroid-stimulating autoantibodies. The presence of anti-thyroid peroxidase (Anti-TPO) and anti-thyroglobulin (Anti-Tg) antibodies serves as important immunological markers of thyroid autoimmunity. Since its first description by Hakaru Hashimoto in 1912, Hashimoto's thyroiditis has become the leading cause of hypothyroidism in iodine-sufficient populations and remains a significant contributor to the global burden of endocrine disorders. The occurrence of autoimmune thyroiditis is influenced by a complex interaction of genetic susceptibility, environmental factors, nutritional status, and iodine intake. Although iodine deficiency has historically been recognized as the primary cause of endemic goitre (Stanbury et al., 1954; Patel et al., 1973; Goslings et al., 1977), evidence accumulated over recent decades indicates that excessive iodine intake may also promote thyroid autoimmunity by increasing the antigenicity of thyroglobulin and enhancing lymphocytic infiltration of the thyroid gland (Stanbury et al., 1998; Pedersen et al., 2002; Kahaly et al., 1998). Experimental studies have further demonstrated that excess iodine modifies the molecular structure and immunogenicity of thyroglobulin, thereby triggering autoimmune responses in genetically susceptible individuals (Li and Boyages, 1994; Saboori et al., 1998). In addition to

iodine, micronutrients such as selenium have been identified as important modulators of thyroid immune function (Rayman, 2019).

Clinically, autoimmune thyroiditis exhibits a broad spectrum ranging from asymptomatic disease to overt hypothyroidism, presenting with painless goitre, fatigue, weight gain, constipation, cold intolerance, hair loss, menstrual disturbances, and cardiovascular complications. Accurate diagnosis relies on an integrated evaluation of thyroid function tests, thyroid autoantibodies, fine needle aspiration cytology (FNAC), and ultrasonography. Previous studies have shown that elevated serum TSH and positive thyroid autoantibodies are strong predictors of progression to overt hypothyroidism, while ultrasonographic abnormalities improve diagnostic accuracy and disease monitoring (Huber et al., 2002; Diez and Iglesias, 2004; Rosario et al., 2009). In India, autoimmune thyroid disorders have gained increasing importance following universal salt iodization, and studies from Manipur suggest that autoimmune thyroiditis occurs even in iodine-sufficient populations. However, comprehensive clinicopathological data from Northeast India remain limited. Therefore, the present study was undertaken to evaluate the demographic, biochemical, immunological, cytological, and ultrasonographic profile of patients with autoimmune thyroiditis attending a tertiary care hospital in Imphal, thereby contributing to improved diagnosis and clinical management of the disease.

LITERATURE REVIEW

Extensive research over the past several decades has established autoimmune thyroid diseases as multifactorial disorders resulting from complex interactions among genetic susceptibility, immune dysregulation, nutritional factors and environmental influences. Early investigations into thyroid disorders primarily focused on iodine deficiency and endemic goitre. Stanbury et al. (1954) demonstrated that inadequate iodine intake was the principal cause of endemic goitre, while Patel et al. (1973), Goslings et al. (1977), and Zhu documented altered thyroid hormone profiles among populations living in iodine-deficient regions. Subsequent epidemiological studies by Laurberg et al. (1998) and Pedersen et al. (2002) revealed that even relatively small differences in iodine intake substantially influence the pattern of thyroid diseases, including hypothyroidism and hyperthyroidism. Reports from Zimbabwe (Todd et al., 1995), Zaire (Bourdoux et al., 1996), and the comprehensive review by Stanbury et al. (1998) further highlighted the occurrence of iodine-induced hyperthyroidism following iodine supplementation, indicating that both iodine deficiency and iodine excess have important implications for thyroid health. Several investigators have specifically examined the relationship between iodine and thyroid autoimmunity. Sundick et al. (1992) reviewed experimental evidence demonstrating that excess iodine enhances autoimmune responses against thyroid tissue. Li and Boyages (1994) showed that iodide directly damages thyroid follicular cells and induces lymphocytic thyroiditis in experimental animals. Similarly, Dunn et al. (1983) and Saboori et al. (1998) reported that iodination modifies thyroglobulin structure, thereby increasing its immunogenicity and promoting autoimmune reactions. Clinical investigations by Kahaly et al. (1998), Pedersen et al. (2011), and Lombardi et al. (2013) observed increased prevalence of thyroid autoantibodies following iodine prophylaxis programmes, suggesting that iodine supplementation in previously deficient populations may trigger autoimmune thyroiditis among genetically susceptible individuals. Rayman (2019) further emphasized that thyroid autoimmunity is influenced not only by iodine but also by several nutritional factors, including selenium and other micronutrients essential for thyroid function and immune regulation.

Considerable attention has also been directed towards the diagnosis, natural history and clinical progression of autoimmune thyroid disorders. Hollowell et al. (2002), through the NHANES III survey, documented the distribution of serum TSH, thyroid hormones and thyroid antibodies in the general population, establishing important reference data for thyroid disease epidemiology. Canaris et al. (2000) similarly reported a high prevalence of previously undiagnosed thyroid dysfunction in community populations. Longitudinal studies by Huber et al. (2002) and Diez and Iglesias (2004) demonstrated that elevated serum TSH, positive thyroid antibodies and reduced thyroid reserve significantly increase the likelihood of progression from subclinical to overt hypothyroidism. Rosario et al. (2009) additionally found that ultrasonographic abnormalities provide valuable prognostic information in patients with subclinical hypothyroidism. Clinical guidelines developed by Khandelwal and Tandon (2012), Cojic and Cvejanovic-Kezunovic (2017), and Biondi et al. (2015) emphasize the importance of integrating biochemical markers, autoantibody status, imaging findings and clinical presentation for appropriate diagnosis and therapeutic decision-making. Despite substantial global evidence, region-specific studies from Northeast India remain limited, particularly regarding the combined evaluation of clinical manifestations, biochemical parameters, cytological findings and ultrasonographic characteristics among patients with autoimmune thyroiditis. This gap underscores the need for comprehensive hospital-based investigations to improve early diagnosis, risk stratification and effective management of autoimmune thyroid diseases in the region.

Objectives

The present study was undertaken to comprehensively evaluate the clinicopathological profile of patients diagnosed with autoimmune thyroiditis attending a tertiary care hospital. Specifically, the study aimed to determine the demographic characteristics of the affected patients; assess thyroid biochemical parameters, including triiodothyronine (T3), free thyroxine (Free T4), and thyroid-stimulating hormone (TSH); evaluate the prevalence of thyroid autoantibodies, namely anti-thyroid peroxidase (Anti-TPO) and anti-thyroglobulin (Anti-Tg); examine the cytomorphological features of autoimmune thyroiditis using fine needle aspiration cytology (FNAC); analyse the ultrasonographic characteristics of the thyroid gland; and investigate the association between biochemical abnormalities, thyroid autoantibody status, cytological findings, and ultrasonographic features to facilitate a comprehensive understanding of the disease and improve its diagnostic evaluation.

MATERIALS AND METHODS

A retrospective cross-sectional observational study was conducted in the Department of General Surgery, Shija Academy of Health Sciences, Manipur, India, over a three-year period from February 2023 to February 2026. The study included 420 patients diagnosed with autoimmune thyroiditis based on clinical presentation supported by biochemical, cytological, and/or ultrasonographic findings. Patients with confirmed autoimmune thyroiditis and complete thyroid function test reports, along with available thyroid autoantibody profiles, fine needle aspiration cytology (FNAC), and ultrasonography (USG) records, were included in the study. Patients with thyroid malignancy, a history of previous thyroid surgery, or incomplete clinical records were excluded from the analysis. Relevant data were extracted retrospectively from hospital medical records using a structured data collection format. Demographic variables included age and sex. Biochemical parameters comprised serum total triiodothyronine (T3), free thyroxine (Free T4), thyroid-stimulating hormone (TSH), anti-thyroid peroxidase (Anti-TPO) antibody, and anti-thyroglobulin (Anti-Tg) antibody levels. Cytological findings obtained through FNAC were reviewed to assess lymphocytic infiltration, Hurthle cell changes, and other characteristic features of autoimmune thyroiditis. Ultrasonographic reports were evaluated for thyroid size, echogenicity, echotexture, vascularity, and the presence of nodules or other associated abnormalities. The collected data were entered into a computerized database and analysed using appropriate descriptive and inferential statistical methods. Continuous variables were summarized as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Associations between biochemical parameters, thyroid autoantibody status, cytological findings, and ultrasonographic characteristics were assessed using suitable statistical tests, and a p-value of <0.05 was considered statistically significant.

ANALYSIS AND RESULTS

Table 1 summarizes the demographic characteristics and thyroid biochemical profile of the 420 patients diagnosed with autoimmune thyroiditis. The study population showed a marked female predominance, with females comprising 379 (90.2%) patients compared with 41 (9.8%) males, indicating that autoimmune thyroiditis predominantly affects women. The mean age of the patients was 40.2 ± 14.0 years, with a median age of 39 years, suggesting that the disease is most common among middle-aged adults. The mean serum concentrations of Total T3, Free T4, and TSH were 2.54 ± 6.93 nmol/L, 18.14 ± 12.46 pmol/L, and 8.23 ± 15.43 µIU/mL, respectively. The wide variation in these biochemical parameters reflects the heterogeneous thyroid functional status of patients, ranging from euthyroidism to overt thyroid dysfunction. Elevated TSH was the predominant biochemical abnormality, consistent with the hypothyroid nature of autoimmune thyroiditis. Analysis of TSH categories revealed that 186 (44.8%) patients had normal TSH levels, while 137 (33.0%) had elevated TSH and 92 (22.2%) had suppressed TSH levels, indicating that a substantial proportion of patients had evidence of thyroid dysfunction at the time of diagnosis.

Table 1: Demographic characteristics and thyroid biochemical profile of patients with autoimmune thyroiditis

Variable	Value
Study population (n)	420
Sex, n (%)	
Female	379 (90.2)
Male	41 (9.8)
Mean age ± SD (years)	40.2 ± 14.0
Median age (years)	39
Thyroid biochemical parameters (Mean ± SD)	
Total T3 (nmol/L)	2.54 ± 6.93
Free T4 (pmol/L)	18.14 ± 12.46
TSH (µIU/mL)	8.23 ± 15.43
Predominant biochemical abnormality	Elevated TSH
TSH distribution, n (%)	
Low (<0.40 µIU/mL)	92 (22.2)
Normal (0.40–6.40 µIU/mL)	186 (44.8)
High (>6.40 µIU/mL)	137 (33.0)

Figures in parentheses in Column 2 indicate percentages

The association between gender and thyroid-stimulating hormone (TSH) categories is presented in Table 2. Among female patients, 21.4% had low TSH, 47.1% had normal TSH, and 31.5% had elevated TSH levels. In comparison, male patients demonstrated a relatively higher proportion of abnormal thyroid function, with 29.3% having low TSH, 24.4% normal TSH, and 46.3% elevated TSH levels. The association between gender and TSH category was assessed using the Chi-square test, which demonstrated a statistically significant relationship ($\chi^2 = 7.72$, df = 2, $p = 0.021$). Since the p-value was less than 0.05, the null hypothesis was rejected, indicating that thyroid functional status differed significantly between male and female patients. Although females represented the majority of autoimmune thyroiditis cases, males exhibited a relatively greater proportion of elevated TSH levels, suggesting possible gender-related differences in disease expression. The thyroid autoantibody profile of patients is presented in Table 3. Among the 142 patients tested for anti-thyroid peroxidase (Anti-TPO) antibodies, 114 (80.3%) were positive, whereas only 28 (19.7%) were negative. Similarly, among 82 patients evaluated for anti-thyroglobulin (Anti-Tg) antibodies, 70 (85.4%) tested positive and 12 (14.6%) tested

negative. The mean Anti-TPO concentration was 449.7 ± 419.6 IU/mL, while the mean Anti-Tg concentration was 359.1 ± 340.9 IU/mL. The relatively high mean antibody levels together with their wide standard deviations indicate considerable variation in autoimmune activity among patients. Nevertheless, the high prevalence of antibody positivity confirms the autoimmune origin of the disease and demonstrates the usefulness of Anti-TPO and Anti-Tg antibodies as important serological markers for the diagnosis and assessment of autoimmune thyroiditis.

Table 2. Association between gender and thyroid-stimulating hormone (TSH) category

Gender	Low TSH	Normal TSH	High TSH	Total
Female	80 (21.4)	176 (47.1)	118 (31.5)	374 (100.0)
Male	12 (29.3)	10 (24.4)	19 (46.3)	41 (100.0)
Total	92 (22.2)	186 (44.8)	137 (33.0)	415 (100.0)

Figures in parentheses indicate percentages; Chi-square test: $\chi^2 = 7.72$; df = 2; p = 0.021

Table 4 presents the cytological and ultrasonographic characteristics of autoimmune thyroiditis. Fine needle aspiration cytology (FNAC), performed in 68 patients, revealed Hashimoto's or lymphocytic thyroiditis in 51 (75.0%) cases, whereas 17 (25.0%) patients were diagnosed with other benign thyroid lesions. Ultrasonographic evaluation of 110 patients showed thyroid enlargement in 65 (59.1%) cases and normal thyroid volume in 45 (40.9%) cases. Heterogeneous echotexture was observed in 80 (72.7%) patients, while hypoechogenicity was present in 89 (80.9%), both representing characteristic sonographic features of autoimmune thyroiditis. Normal vascularity was observed in 76 (69.1%) patients, whereas increased vascularity was detected in 34 (30.9%) patients, indicating varying degrees of inflammatory activity. Overall, the biochemical, immunological, cytological, and ultrasonographic findings consistently demonstrate the diverse clinical presentation of autoimmune thyroiditis and highlight the value of integrating thyroid function tests, autoantibody estimation, FNAC, and ultrasonography for accurate diagnosis, disease characterization, and effective clinical management.

Table 3: Thyroid Autoantibody Profile of Patients with Autoimmune Thyroiditis

Parameter	Frequency/Value
Anti-TPO antibody (n = 142)	
Positive (>8 IU/mL)	114 (80.3)
Negative	28 (19.7)
Mean Anti-TPO level (IU/mL), Mean ± SD	449.7 ± 419.6
Anti-TG antibody (n = 82)	
Positive (>18 IU/mL)	70 (85.4)
Negative	12 (14.6)
Mean Anti-TG level (IU/mL), Mean ± SD	359.1 ± 340.9

Figures in parentheses in Column 2 indicate percentages

Table 4: Cytological and ultrasonographic characteristics of patients with autoimmune thyroiditis

Parameter	Level	Frequency (in %)
Fine needle aspiration cytology (FNAC) findings, (n = 68)	Hashimoto's/Lymphocytic thyroiditis	51 (75.0)
	Other benign thyroid lesions	17 (25.0)
Ultrasonographic findings, (n = 110)	Enlarged thyroid	65 (59.1)
	Normal thyroid volume	45 (40.9)
	Heterogeneous echotexture	80 (72.7)
	Homogeneous echotexture	30 (27.3)
	Hypoechogenicity	89 (80.9)
	Normal echogenicity	21 (19.1)
	Normal vascularity	76 (69.1)
	Increased vascularity	34 (30.9)

DISCUSSION

The present study provides a comprehensive evaluation of the demographic, biochemical, immunological, cytological, and ultrasonographic characteristics of patients with autoimmune thyroiditis attending a tertiary care centre in Northeast India. The marked female predominance (90.2%) observed in the study is consistent with the established epidemiology of autoimmune thyroid diseases, reflecting the greater susceptibility of women to autoimmune disorders due to genetic, hormonal, and immunological factors. The mean age of 40.2 years indicates that autoimmune thyroiditis predominantly affects middle-aged adults, corroborating previous population-based observations by Canaris et al. (2000) and Hollowell et al. (2002), who reported a high prevalence of thyroid dysfunction among adults. The predominance of elevated serum TSH levels further confirms that hypothyroidism is the principal biochemical manifestation of Hashimoto's thyroiditis. Similar findings were reported by Huber et al. (2002) and Diez and Iglesias (2004), who demonstrated that elevated TSH, together with thyroid autoantibody positivity, predicts progression from subclinical to overt hypothyroidism. The statistically significant association between gender and TSH categories (p = 0.021) suggests that thyroid functional abnormalities may vary according to sex, although the relatively small number of male patients warrants cautious

interpretation. Overall, these findings reinforce the importance of routine biochemical screening for early detection and monitoring of thyroid dysfunction among individuals at risk of autoimmune thyroid disease.

The high prevalence of Anti-TPO (80.3%) and Anti-Tg (85.4%) antibody positivity observed in the present study confirms the autoimmune basis of thyroid destruction and supports the diagnostic value of thyroid autoantibodies. These observations are in agreement with the reports of Pedersen et al. (2011), Kahaly et al. (1998), and Lombardi et al. (2013), who demonstrated increased thyroid autoantibody prevalence following iodine supplementation, particularly among genetically susceptible populations. Experimental evidence provided by Sundick et al. (1992), Li and Boyages (1994), and Saboori et al. (1998) further established that excess iodine enhances thyroid antigenicity and promotes autoimmune responses through structural modification of thyroglobulin. Cytological examination in the present study predominantly demonstrated lymphocytic thyroiditis, while ultrasonography frequently revealed heterogeneous echotexture, hypoechogenicity, and thyroid enlargement, findings that are characteristic of chronic autoimmune thyroiditis. These results are consistent with the observations of Rosario et al. (2009), who reported that ultrasonographic abnormalities are valuable predictors of disease progression, and with the recommendations of Khandelwal and Tandon (2012), Cojic and Cvejanovic-Kezunovic (2017), and Biondi et al. (2015), emphasizing the integration of thyroid function tests, autoantibody estimation, FNAC, and ultrasonography for accurate diagnosis and clinical management. Thus, the present study highlights the complementary role of biochemical, immunological, cytological, and imaging investigations in improving the diagnosis, characterization, and long-term management of autoimmune thyroiditis.

CONCLUSION

The present study demonstrates that autoimmune thyroiditis is a predominantly female disorder affecting mainly middle-aged adults and is characterized by diverse biochemical, immunological, cytological, and ultrasonographic manifestations. Elevated thyroid-stimulating hormone (TSH) and a high prevalence of Anti-TPO and Anti-Tg antibody positivity confirmed the autoimmune nature of the disease, while fine needle aspiration cytology and ultrasonography revealed characteristic features of chronic lymphocytic thyroiditis. A statistically significant association between gender and TSH status further suggests possible variations in thyroid dysfunction according to sex. The findings highlight that no single investigation is sufficient for accurate diagnosis; rather, the combined assessment of thyroid function tests, thyroid autoantibodies, FNAC, and ultrasonography provides a comprehensive and reliable diagnostic approach. Early identification and integrated evaluation of autoimmune thyroiditis are essential for timely therapeutic intervention, appropriate disease monitoring, and prevention of progression to overt hypothyroidism, thereby improving long-term patient outcomes and quality of life.

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