RESEARCH PAPER

CYTOMORPHOLOGICAL SPECTRUM OF THYROIDITIS AND ITS CLINICOBIOCHEMICAL CORRELATION: A CROSS-SECTIONAL STUDY FROM A TERTIARY CARE CENTRE

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ABSTRACT

Introduction

Thyroiditis comprises a heterogeneous group of inflammatory thyroid disorders with varied clinical presentation, cytomorphological features, and biochemical profiles. Fine-needle aspiration cytology (FNAC) plays an important role in the diagnosis and classification of thyroiditis and helps differentiate inflammatory lesions from neoplastic thyroid disorders.

Aim

To evaluate the cytomorphological spectrum of thyroiditis and correlate the findings with clinical presentation, biochemical parameters, ultrasonographic features, and histopathological findings.

Materials and Methods

This prospective observational cross-sectional study was conducted in the Department of Pathology at Saraswathi Institute of Medical Sciences from March 2024 to February 2026 after approval from the Institutional Ethics Committee. Fifty patients clinically suspected of thyroiditis were included in the study. FNAC was performed using standard techniques, and smears were stained with May-Grünwald-Giemsa, Papanicolaou, and Hematoxylin and Eosin stains. Cytological evaluation was carried out according to the Bethesda System for Reporting Thyroid Cytopathology. Thyroid hormone profile, anti-thyroid peroxidase antibody status, ultrasonographic findings, and available histopathological findings were correlated with cytomorphological diagnosis. Statistical analysis was performed using IBM SPSS Statistics version 29.0, with $p < 0.05$ considered statistically significant.

Results

The majority of patients belonged to the 31–40 years age group (78%) with marked female predominance (92%). Diffuse thyroid swelling was the most common clinical presentation. Hashimoto thyroiditis was the predominant cytomorphological subtype (72%), followed by subacute (De Quervain) thyroiditis (22%) and acute thyroiditis (6%). Significant association was observed between cytomorphological subtype and age group ($p < 0.001$), gender ($p = 0.049$), ultrasonographic findings ($p < 0.001$), and thyroid hormone profile ($p < 0.001$). Hashimoto thyroiditis showed elevated serum TSH and reduced T3/T4 levels, whereas subacute (De Quervain) thyroiditis demonstrated a hyperthyroid biochemical pattern. Anti-TPO positivity was observed in 52.17% of tested cases. Histopathological correlation available in selected cases showed complete concordance with cytological diagnosis.

Conclusion

FNAC is a reliable, minimally invasive, and cost-effective diagnostic modality for evaluating thyroiditis and differentiating different inflammatory thyroid lesions. Correlation with clinical, biochemical, ultrasonographic, and histopathological findings enhances diagnostic accuracy and facilitates appropriate patient management.

Keywords

Thyroiditis; Fine-needle aspiration cytology; Hashimoto thyroiditis; Cytomorphology; Thyroid function tests; Anti-TPO

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INTRODUCTION

Thyroiditis comprises a heterogeneous group of inflammatory disorders of the thyroid gland with diverse

etiologies, clinical manifestations, and histomorphological features. It includes autoimmune, granulomatous, subacute, acute, and chronic inflammatory conditions, among which Hashimoto's thyroiditis (HT) and subacute (De Quervain) thyroiditis are most frequently encountered in routine clinical practice [1,2]. Accurate differentiation among these entities is essential because their clinical course, management, and prognosis vary considerably.

FNAC remains the primary diagnostic modality for evaluation of thyroid lesions owing to its minimally invasive nature, rapid turnaround time, cost-effectiveness, and high diagnostic accuracy [3]. Distinct cytomorphological patterns observed on FNAC often permit reliable categorization of different types of thyroiditis. HT characteristically demonstrates a polymorphous lymphoid infiltrate, Hurthle cell metaplasia, and reduced colloid, whereas subacute (De Quervain) thyroiditis typically shows granulomatous inflammation with multinucleated giant cells and disrupted follicular architecture [4].
Despite characteristic cytological findings, considerable overlap may exist among different inflammatory and neoplastic thyroid lesions, posing diagnostic challenges. Furthermore, thyroiditis demonstrates variable biochemical and clinical profiles depending on the stage and severity of disease. Correlation of cytomorphological findings with thyroid function tests, including thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), free thyroxine (FT4), and thyroid autoantibodies such as anti-thyroid peroxidase (anti-TPO) and anti-thyroglobulin antibodies (TgAb), may improve diagnostic precision and facilitate early therapeutic intervention [5].

Although several studies have evaluated individual cytological features of thyroiditis, comprehensive analysis correlating cytomorphological patterns with clinical presentation and biochemical parameters remain limited, particularly in the Indian population. The present study was undertaken to evaluate the cytomorphological spectrum of various types of thyroiditis and correlate these findings with clinical and biochemical parameters in patients attending a tertiary care hospital.

MATERIALS AND METHODS

This prospective observational cross-sectional study was conducted in the Department of Pathology at Saraswathi Institute of Medical Sciences from March 2024 to February 2026 after obtaining approval from the Institutional Ethics Committee (IEC No. SIMS/FMT/ETHI/32/2024 dated 07/02/2024). A total of 50 patients clinically and radiologically suspected of having thyroiditis were enrolled after obtaining written informed consent.

Patients presenting with diffuse or nodular thyroid swelling associated with clinical or biochemical suspicion of inflammatory thyroid disease were included in the study. Patients diagnosed with non-inflammatory thyroid lesions, benign thyroid neoplasms, or malignant thyroid tumors were excluded.

The sample size was calculated using the prevalence formula based on the reported prevalence of Hashimoto thyroiditis (2.5%) in a previous study conducted by Das P. et al. [6].

Detailed clinical history and physical examination findings were recorded for all patients. Fine-needle aspiration cytology (FNAC) was performed under aseptic precautions using a 23–25 gauge needle attached to a 10 mL disposable syringe. Both aspiration and non-aspiration techniques were employed wherever appropriate. Multiple smears were prepared and stained with May-Grünwald-Giemsa (MGG), Papanicolaou (PAP), and Hematoxylin and Eosin (H&E) stains.

Cytological evaluation and categorization were performed according to The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) [7]. Hashimoto thyroiditis was diagnosed in the presence of dense lymphocytic infiltrate, Hurthle cell change, follicular epithelial destruction, and scant colloid. Subacute (De Quervain) thyroiditis was diagnosed by the presence of granulomatous inflammation, multinucleated giant cells, epithelioid histiocytes, and inflammatory background.

Histopathological correlation was performed wherever thyroidectomy or biopsy specimens were available. Tissue sections were processed routinely and stained with Hematoxylin and Eosin stain.

Biochemical investigations including serum triiodothyronine (T3), thyroxine (T4), thyroid-stimulating hormone (TSH), and anti-thyroid peroxidase (anti-TPO) antibody levels were performed using automated immunoassay analyzers and correlated with cytomorphological findings.

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 29.0. Quantitative variables were expressed as mean ± standard deviation (SD), while qualitative variables were expressed as frequency and percentage. Association between categorical variables was assessed using the Chi-square test or Fisher's exact test, wherever applicable. Comparison of continuous variables between groups was performed using one-way ANOVA. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 50 patients diagnosed with thyroiditis were included in the study. The majority of patients belonged to the 31–40 years age group (78%), followed by 21–30 years (12%) and 41–50 years (10%). Females constituted

92% of the study population, with a female-to-male ratio of 11.5:1 (Table 1).

Table 1: Age and Gender Distribution of Patients with Thyroiditis (n = 50)

Variable	Category	n (%)
Age group (years)	21–30	6 (12%)
	31–40	39 (78%)
	41–50	5 (10%)
Gender	Female	46 (92%)
	Male	4 (8%)

The most common clinical presentation was diffuse thyroid swelling, observed in 94% of patients, predominantly diffuse and firm in consistency. Bilateral thyroid lobe involvement was seen in 64% of cases. Pain and fever were present in 22% of patients each, while fatigue was reported in all cases. Most patients had symptom duration exceeding 6 months. Hashimoto thyroiditis was the predominant cytomorphological subtype, accounting for 72% of cases, followed by subacute (De Quervain) thyroiditis (22%) and acute thyroiditis (6%) (Table 2).

Table 2: Cytomorphological Spectrum of Thyroiditis (n = 50)

Thyroiditis Type	n (%)
Acute thyroiditis	3 (6%)
Subacute (De Quervain) thyroiditis	11 (22%)
Hashimoto thyroiditis	36 (72%)
Total	**50 (100%)**

Representative cytomorphological features observed on FNAC smears are shown in Figure 1.

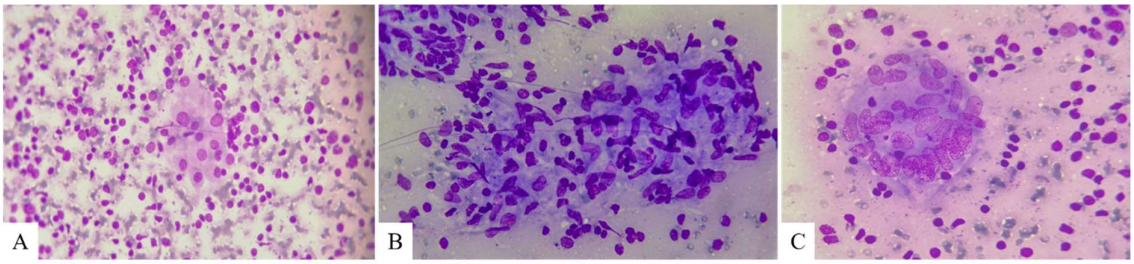

Figure 1: Representative cytomorphological features of thyroiditis on FNAC smears. (A) Hashimoto thyroiditis showing dense lymphocytic infiltrate with Hurthle cell change and follicular epithelial destruction (MGG stain, ×400). (B, C) Subacute (De Quervain) thyroiditis showing granulomatous inflammation with multinucleated giant cells and epithelioid histiocytes (MGG stain, ×400).

A statistically significant association was observed between age group and cytomorphological subtype of thyroiditis ($p < 0.001$). Hashimoto thyroiditis was most frequently encountered in patients aged 31–40 years, whereas acute and subacute (De Quervain) thyroiditis were more common in older patients. Gender distribution also showed significant association with the cytomorphological spectrum of thyroiditis ($p = 0.049$), with marked female predominance observed in Hashimoto thyroiditis (Table 3).

Table 3: Association of Cytomorphological Types of Thyroiditis with Age Group and Gender (n = 50)

Variable	Acute	Subacute (De Quervain)	Hashimoto	p-value
Age group (years)				<0.001
21–30	0	3	3	
31–40	0	6	33	
41–50	3	2	0	

Variable	Acute	Subacute (De Quervain)	Hashimoto	p-value
Gender				
Female	3	8	35	0.049
Male	0	3	1	

Ultrasonographic findings showed significant correlation with cytomorphological diagnosis ($p < 0.001$). Heterogeneous echotexture was consistently associated with Hashimoto thyroiditis, whereas decreased vascularity and enlarged hypoechoic areas were associated with subacute (De Quervain) thyroiditis (Table 4).

Table 4: Correlation of Ultrasonographic Findings with Cytomorphological Types of Thyroiditis (n = 50)

USG Finding	Acute	Subacute (De Quervain)	Hashimoto	Total
Decreased vascularity	0	5	0	5
Enlarged hypoechoic areas	0	6	0	6
Heterogeneous echotexture	0	0	36	36
Normal	3	0	0	3
p-value: <0.001				

Anti-thyroid peroxidase (anti-TPO) antibody testing was performed in 23 patients, among whom 52.17% showed antibody positivity.

Table 5: Comparison of Thyroid Function Parameters among Different Cytomorphological Types of Thyroiditis

Thyroiditis Type	T3 (Mean ± SD)	T4 (Mean ± SD)	TSH (Mean ± SD)
Acute	1.1 ± 0.1	8.1 ± 0.1	4.3 ± 0.1
Subacute (De Quervain)	2.3 ± 0.8	11.2 ± 1.5	1.5 ± 1.4
Hashimoto	1.0 ± 0.1	5.5 ± 0.3	8.9 ± 0.6
ANOVA p-value: <0.001			

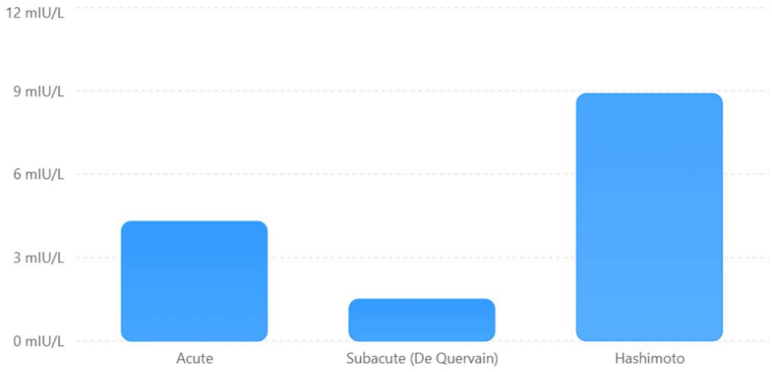

Figure 2: Comparison of mean serum TSH levels among different cytomorphological types of thyroiditis. Elevated TSH levels were observed in Hashimoto thyroiditis, whereas suppressed TSH levels were noted in subacute (De Quervain) thyroiditis.

Histopathological correlation was available in 4 cases, all of which were confirmed as Hashimoto thyroiditis, showing complete concordance with the cytological diagnosis. Germinal center formation was observed in all cases, while atrophic follicles and fibrosis were identified in 75% and 50% of cases, respectively. Granulomatous inflammation and multinucleated giant cells were absent in all histologically examined cases (Table 6).

Table 6: Histopathological Findings in Cases with Available Tissue Correlation (n = 4)

Histopathological Feature	Present n (%)
Germinal center formation	4 (100%)
Atrophic follicles	3 (75%)
Disrupted follicles	1 (25%)
Fibrosis	2 (50%)
Preserved architecture	4 (100%)

DISCUSSION

Thyroiditis comprises a heterogeneous group of inflammatory thyroid disorders with variable clinical, cytomorphological, biochemical, and radiological manifestations. Fine-needle aspiration cytology (FNAC) plays a pivotal role in the evaluation of these lesions because of its simplicity, rapidity, cost-effectiveness, and high diagnostic accuracy. The present study evaluated the cytomorphological spectrum of thyroiditis and correlated the findings with clinical presentation, thyroid function parameters, ultrasonographic features, and histopathological findings.

The majority of patients in the present study belonged to the 31–40 years age group, with marked female predominance. These findings are comparable with studies conducted by Bhatia et al. [8], Sharma et al. [9], Khatib et al. [10], Singh et al. [1], and Das P. et al. [6], all of which reported higher prevalence of thyroiditis among females in the third and fourth decades of life. The observed female predominance may be attributed to the increased susceptibility of females to autoimmune thyroid disorders.

Diffuse thyroid swelling was the most common clinical presentation, with bilateral involvement observed in the majority of cases. Most patients presented with long-standing thyroid enlargement, reflecting the chronic and progressive nature of autoimmune thyroiditis. Pain and fever were infrequent overall and were mainly associated with subacute inflammatory thyroid lesions. Similar clinical findings have been reported by Thomas et al. [11], and Patel et al. [12].

Hashimoto thyroiditis was the predominant cytomorphological subtype in the present study. Similar observations have been reported in previous studies by Singh et al. [1], Shetty et al. [5], Bhatia et al. [8], and Sajjan et al. [13], confirming Hashimoto thyroiditis as the most common form of thyroiditis encountered in cytology practice. Characteristic cytological features observed included dense lymphocytic infiltrate, lymphocytic infiltration of follicular epithelial cells, Hurthle cell metaplasia, and scant colloid. In contrast, granulomatous inflammation with multinucleated giant cells and histiocytic aggregates was characteristic of De Quervain thyroiditis. These findings highlight the usefulness of FNAC in distinguishing autoimmune thyroiditis from granulomatous inflammatory lesions and other thyroid pathologies.

A significant correlation was observed between cytomorphological subtype and thyroid hormone profile. Hashimoto thyroiditis predominantly demonstrated a hypothyroid biochemical pattern characterized by elevated serum TSH and reduced T3/T4 levels, whereas subacute inflammatory thyroiditis showed a transient hyperthyroid profile with elevated T3/T4 and suppressed TSH levels. Similar biochemical correlations have been described by Patni et al. [14], Ashraf et al. [15], and Marachapu and Vij [16]. Anti-thyroid peroxidase (anti-TPO) antibody positivity observed in the present study further supported the autoimmune etiology of Hashimoto thyroiditis and was comparable to findings reported in previous studies [8,10,14].

Ultrasonographic findings showed significant association with cytomorphological diagnosis. Heterogeneous echotexture was the predominant ultrasonographic feature in Hashimoto thyroiditis, whereas decreased vascularity and hypoechoic areas were associated with inflammatory thyroid lesions. Similar observations have been reported by Patni et al. [14], Chandanwale et al. [6], Ashwin P. et al. [17], Takashashi et al. [18], and Park JE et al. [19]. Combined use of ultrasonography and FNAC improves diagnostic accuracy and facilitates early diagnosis while reducing unnecessary surgical intervention.

Histopathological correlation, available in a limited number of cases, demonstrated complete concordance with cytological diagnosis. Histopathological findings including germinal center formation, follicular atrophy, fibrosis, and lymphoid infiltration correlated well with the cytological features of chronic autoimmune thyroiditis. Similar cytohistological concordance has been reported by Gowardhan V. [20], and Handa et al. [21] supporting the reliability of FNAC in the diagnosis of thyroiditis.

The present study was limited by its single-center design, relatively small sample size, limited histopathological correlation, and convenient sampling technique, which may affect generalizability of the findings. Further multicentric studies with larger sample size and extensive histopathological evaluation are recommended to validate the observations.

CONCLUSION

FNAC is a reliable, minimally invasive, and cost-effective diagnostic modality for evaluating thyroiditis and differentiating its various cytomorphological subtypes. Correlation with clinical presentation, thyroid function tests, ultrasonography, and anti-TPO antibody status improves diagnostic accuracy and facilitates appropriate patient management. Hashimoto thyroiditis was the most common subtype observed in the present study and showed strong association with hypothyroid biochemical profile and characteristic cytomorphological features.

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