International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-06-96*

Cytomorphological Spectrum of Thyroid Lesions on Fine Needle Aspiration Cytology and Cyto-Histological Correlation in Surgically Resected Cases: A Two-Year Study from Tertiary Care Centres in Andhra Pradesh and Telangana.

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Received: 07-05-2026
Revised: 21-05-2026
Accepted: 02-06-2026
Published: 16-06-2026

Abstract

Background: Thyroid swellings are among the most frequent endocrine complaints encountered in clinical practice, particularly in semi-urban and rural populations of South India where iodine deficiency and goitrogenic dietary factors persist. Fine needle aspiration cytology (FNAC) is the established first-line diagnostic tool for thyroid nodule evaluation, offering rapid, cost-effective, and minimally invasive assessment. This study aimed to characterise the cytomorphological spectrum of thyroid lesions using The Bethesda System for Reporting Thyroid Cytopathology (BSRTC), determine the risk of malignancy (ROM) in each category, and establish the diagnostic accuracy of FNAC through cyto-histological correlation in surgically resected cases. ***Methods:*** A two-year combined retrospective and prospective study was conducted from January 2022 to December 2023 at the Departments of Pathology, Santhiram Medical College and General Hospital, Nandyala, Andhra Pradesh, and Prathima Institute of Medical Sciences, Karimnagar, Telangana, India. All thyroid FNAC specimens received over the study period were included and classified using the six-category BSRTC (2017). For all cases that subsequently underwent surgical resection, cyto-histological correlation was performed against histopathological examination (HPE) as the gold standard. Histological diagnoses were rendered per the WHO Classification of Tumours of Endocrine Organs (4th Edition, 2017). Diagnostic accuracy parameters — sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy — were calculated. ***Results:*** A total of 280 thyroid FNAC specimens were analysed. The overall female-to-male ratio was 5.5:1 and mean age was 39.8 ± 13.2 years. Distribution by BSRTC category: Category I (7.9%, n=22), Category II (60.0%, n=168), Category III (8.6%, n=24), Category IV (10.0%, n=28), Category V (6.4%, n=18), Category VI (7.1%, n=20). Nodular/colloid goitre (48.8%) was the most common benign cytological diagnosis. Among 96 surgically resected cases, histopathology revealed benign lesions in 57 (59.4%) and malignant lesions in 39 (40.6%). Papillary thyroid carcinoma (PTC, all variants) was the most frequent malignancy (71.8% of malignant cases). ROM in the present study was: Category I 37.5%, Category II 6.3%, Category III 42.9%, Category IV 40.0%, Category V 83.3%, Category VI 100%. FNAC yielded a sensitivity of 80.0%, specificity of 94.6%, PPV 90.9%, NPV 87.5%, and overall accuracy of 88.7%. ***Conclusions:*** Benign thyroid lesions, particularly nodular goitre, predominate in this South Indian semi-urban demographic. FNAC, systematically reported using the BSRTC, demonstrates high specificity and satisfactory sensitivity for malignancy detection. The ROM in Category III (AUS/FLUS) exceeded BSRTC reference ranges, suggesting a need for closer clinical and radiological follow-up in this population. PTC remains the most common thyroid malignancy. Cyto-histological correlation is essential for quality assurance and continual improvement of institutional FNAC diagnostic accuracy.

Keywords: Thyroid FNAC; Bethesda System; Cytomorphology; Cyto-histological correlation; Papillary thyroid carcinoma; Nodular goitre; Risk of malignancy; Follicular neoplasm.

INTRODUCTION

Thyroid nodules represent one of the most common clinical presentations encountered in endocrinology, surgery, and general medicine, with a prevalence of approximately 19–68% depending on the detection modality — from 4–7% on clinical palpation to over 67% on high-resolution ultrasonography in autopsy series. [5,15] While the overwhelming

majority of thyroid nodules are benign, approximately 4–15% harbour clinically significant malignancy, most commonly papillary thyroid carcinoma (PTC). [3,7] The exponential increase in the incidence of thyroid cancer globally — attributed in part to improved detection of subclinical microcarcinomas — underscores the urgency of a reliable, reproducible, and cost-effective diagnostic paradigm. [7]

In India, thyroid disorders are particularly prevalent in the inland and riverine regions of Andhra Pradesh and Telangana, including Kurnool district (of which Nandyala is a district headquarters) and North Telangana (including Karimnagar), where iodine deficiency has historically been documented, goitrous enlargement is commonplace, and access to tertiary endocrinological care remains limited. The ICMR Population-Based Cancer Registry data indicate that thyroid cancer constitutes approximately 0.5–1.5% of all cancers in these regions, with a rising incidence trend, particularly among women in the 30–50 year age group. [12]

Fine needle aspiration cytology (FNAC) of the thyroid — introduced as a routine diagnostic procedure by Soderstrom (1952) and refined by the Swedish school — has evolved into the cornerstone of the triple assessment approach for thyroid nodule evaluation. [13] Its advantages — minimal invasiveness, rapid turnaround, absence of general anaesthesia, and cost-effectiveness — make it particularly suited to resource-limited settings in India. [16] Standardisation of cytological reporting terminology, however, remained inconsistent across institutions until 2009, when the National Cancer Institute (NCI) and the Bethesda System for Reporting Thyroid Cytopathology (BSRTC) established a six-tier classification framework — subsequently revised in 2017 — that systematically categorises thyroid FNAC aspirates and correlates each category with an estimated risk of malignancy (ROM) and recommended clinical management. [1,2,9]

Despite the broad acceptance of the BSRTC, its ROM estimates were derived predominantly from Western institutional data, and their applicability to South Asian populations — where the morphological spectrum of thyroid lesions, iodine status, and genetic risk factor profiles differ substantially — remains a subject of ongoing investigation. [4,11] Institutional cyto-histological correlation studies from tertiary care centres in Andhra Pradesh and Telangana are sparse but critically needed to validate BSRTC ROM estimates against local histopathological outcomes, identify diagnostic pitfalls specific to this geographic region, and establish quality benchmarks for cytopathology practice.

This study was undertaken at two tertiary care institutions — Santhiram Medical College and General Hospital, Nandyala (Kurnool district, Andhra Pradesh) and Prathima Institute of Medical Sciences (PIMS), Karimnagar (Telangana) — to: (i) document the BSRTC category-wise distribution of thyroid FNAC aspirates over a two-year period; (ii) describe the cytomorphological features of thyroid lesions across the diagnostic spectrum; (iii) determine the histopathological profile of surgically resected thyroid lesions; (iv) establish ROM per BSRTC category and compare with published reference ranges; and (v) compute the diagnostic accuracy of FNAC against histopathological examination as the gold standard.

MATERIALS AND METHODS

Study Design, Duration, and Setting

A combined retrospective and prospective observational descriptive study was conducted over a two-year period from January 2022 to December 2023 at the Departments of Pathology, Santhiram Medical College and General Hospital, Nandyala, Andhra Pradesh (a 750-bed government-aided teaching hospital serving Nandyala and Kurnool districts), and Prathima Institute of Medical Sciences, Karimnagar, Telangana (a 750-bed private tertiary care hospital serving North Telangana). Institutional Ethics Committee clearance was obtained from both institutions. All data were anonymised and patient confidentiality was maintained.

Specimen Collection and FNAC Technique

FNAC of thyroid nodules was performed by experienced pathologists using a 23-gauge needle attached to a 10 mL syringe under strict aseptic conditions, with or without ultrasound guidance depending on lesion palpability and clinical indication. Multiple passes were made from different areas of the nodule. Aspirated material was smeared on glass slides; wet-fixed smears were stained with Papanicolaou (PAP) stain and air-dried smears with May-Grünwald-Giemsa (MGG) stain. Special stains (Congo red for amyloid in suspected MTC, PAS for colloid characterisation) were applied as indicated. All cytological aspirates were classified per the BSRTC 2017 six-category nomenclature: Category I (Non-Diagnostic/Unsatisfactory), Category II (Benign), Category III (Atypia of Undetermined Significance / Follicular Lesion of Undetermined Significance — AUS/FLUS), Category IV (Follicular Neoplasm / Suspicious for Follicular Neoplasm — FN/SFN), Category V (Suspicious for Malignancy — SFM), and Category VI (Malignant). [1,2]

Histopathological Processing

All thyroid specimens submitted following surgical resection (hemithyroidectomy, total thyroidectomy, modified radical neck dissection) were fixed in 10% neutral buffered formalin, processed by routine paraffin embedding, sectioned at 4–5 µm, and stained with haematoxylin and eosin (H&E). Representative sections were taken from all nodules, surgical

margins, uninvolved thyroid parenchyma, and all lymph nodes. Additional immunohistochemical stains (thyroglobulin, calcitonin, HBME-1, CK19) were performed in selected cases requiring confirmation of diagnosis or lineage. Histological diagnoses were rendered per the WHO Classification of Tumours of Endocrine Organs (4th Edition, 2017). [6].

Cyto-Histological Correlation and Statistical Analysis

For all cases in which both FNAC and subsequent histopathological examination (HPE) were available within the study period, a formal cyto-histological correlation was performed. ROM was calculated per BSRTC category as the proportion of cases with malignant histology out of all operated cases within that category, and compared against the published BSRTC 2017 reference ROM ranges by chi-square test. Diagnostic accuracy of FNAC was calculated using a 2×2 contingency table considering BSRTC Categories V and VI as cytologically "positive" (suspicious/malignant) and Categories I and II as cytologically "negative" (indeterminate categories III and IV excluded from primary accuracy analysis, as per standard practice). Sensitivity, specificity, PPV, NPV, and overall accuracy were calculated by standard formulae. All statistical analyses were performed using IBM SPSS Statistics v25.0; $p < 0.05$ was considered statistically significant.

RESULTS

Volume and BSRTC Category Distribution

A total of 280 thyroid FNAC specimens were received and analysed over the two-year study period. The overall female-to-male ratio was 5.5:1 (237 females: 43 males), and the mean age was 39.8 ± 13.2 years (range: 14–78 years). The largest category was BSRTC Category II – Benign (60.0%, n=168), followed by Category IV – FN/SFN (10.0%, n=28), Category III – AUS/FLUS (8.6%, n=24), Category I – Non-Diagnostic (7.9%, n=22), Category VI – Malignant (7.1%, n=20), and Category V – Suspicious for Malignancy (6.4%, n=18). The distribution of BSRTC categories and demographic characteristics are presented in Table 1.

Table 1: Distribution of thyroid FNAC cases by The Bethesda System for Reporting Thyroid Cytopathology (BSRTC) category (n = 280)

BSRTC Category	n	%	F:M	Mean Age (years)
I — Non-Diagnostic / Unsatisfactory	22	7.9	18:4	40.6 ± 14.8
II — Benign	168	60.0	144:24	38.4 ± 13.6
III — AUS / FLUS	24	8.6	20:4	41.2 ± 12.4
IV — Follicular Neoplasm / SFN	28	10.0	22:6	43.6 ± 11.8
V — Suspicious for Malignancy	18	6.4	16:2	44.8 ± 12.2
VI — Malignant	20	7.1	17:3	48.4 ± 13.4
Total	**280**	**100.0**	**237:43**	**39.8 ± 13.2**

AUS: Atypia of Undetermined Significance; FLUS: Follicular Lesion of Undetermined Significance; SFN: Suspicious for Follicular Neoplasm; F: Female; M: Male.

Cytomorphological Spectrum of Benign (Category II) Lesions

Among the 168 Category II cases, nodular/colloid goitre was the most frequent diagnosis (48.8%, n=82), characterised by abundant watery colloid background, scattered follicular cells in flat sheets, and occasional macrophages on smears. Hashimoto's thyroiditis (22.6%, n=38) was the second most common benign diagnosis, identified by a polymorphous lymphoid infiltrate with germinal centre formation, Hürthle cell change (oncocytic transformation of follicular cells with abundant granular cytoplasm and large nuclei), and lymphoepithelial aggregates. Subacute granulomatous thyroiditis (De Quervain's, 4.8%, n=8) showed characteristic epithelioid cell granulomas, multinucleated giant cells phagocytosing colloid, and a mixed inflammatory background. Follicular adenoma cytological pattern (9.5%, n=16) was characterised by microfollicular clusters and Hürthle cells with scant colloid. The full cytomorphological spectrum is presented in Table 2.

Table 2: Cytomorphological spectrum of BSRTC Category II (Benign) thyroid lesions (n = 168)

Cytological Diagnosis	No. of Cases (n)	Percentage (%)	F:M
Nodular/Colloid Goitre	82	48.8	70:12
Hashimoto's Thyroiditis (Lymphocytic)	38	22.6	36:2
Hyperplastic / Colloid Nodule	18	10.7	16:2
Benign Follicular Adenoma Pattern	16	9.5	14:2
Subacute Granulomatous Thyroiditis (De Quervain's)	8	4.8	6:2
Acute Suppurative Thyroiditis	3	1.8	2:1
Thyroid Cyst	3	1.8	3:0
Total	**168**	**100.0**	**147:21**

Histopathological Spectrum in Surgical Cases

Of the 280 FNAC cases, 96 patients (34.3%) underwent surgical resection — hemithyroidectomy (n=54), total thyroidectomy (n=34), or modified radical neck dissection (n=8) — within the study period. Histopathological examination revealed benign lesions in 57 (59.4%) and malignant lesions in 39 (40.6%) of these cases. Among benign surgical lesions, nodular/colloid goitre (22.9%, n=22) and follicular adenoma (18.8%, n=18) were predominant. Among malignant lesions, papillary thyroid carcinoma (PTC) across all variants was the most common histological type (71.8% of malignant cases; n=28), followed by follicular thyroid carcinoma (FTC, 15.4%; n=6) and medullary thyroid carcinoma (MTC, 7.7%; n=3). The full histopathological spectrum is presented in Table 3.

Table 3: Histopathological spectrum of surgically resected thyroid lesions (n = 96)

Histopathological Diagnosis	No. of Cases (n)	Percentage (%)	Mean Age (years)
BENIGN LESIONS (Total)	**57**	**59.4**	**37.4 ± 12.6**
Nodular / Colloid Goitre	22	22.9	36.8 ± 12.2
Follicular Adenoma	18	18.8	38.6 ± 11.4
Hashimoto's Thyroiditis	10	10.4	34.2 ± 10.8
Hyperplastic/Adenomatous Nodule	4	4.2	40.4 ± 13.6
Subacute (De Quervain's) Thyroiditis	2	2.1	32.6 ± 9.4
Thyroid Cyst	1	1.0	44.0
MALIGNANT LESIONS (Total)	**39**	**40.6**	**46.8 ± 12.4**
Papillary Thyroid Carcinoma (PTC) — all variants	28	29.2	44.6 ± 11.8
— Classical PTC	20	20.8	43.4 ± 11.2
— Follicular Variant PTC	6	6.3	46.8 ± 12.6
— Tall Cell Variant PTC	2	2.1	52.4 ± 10.2
Follicular Thyroid Carcinoma (FTC)	6	6.3	51.2 ± 13.6
Medullary Thyroid Carcinoma (MTC)	3	3.1	48.6 ± 12.4
Poorly Differentiated Thyroid Carcinoma	1	1.0	58.0
Anaplastic Thyroid Carcinoma	1	1.0	64.0
GRAND TOTAL	**96**	**100.0**	**41.2 ± 12.8**

PTC: Papillary thyroid carcinoma; FTC: Follicular thyroid carcinoma; MTC: Medullary thyroid carcinoma.

Cyto-Histological Correlation and Risk of Malignancy

The ROM per BSRTC category in operated cases, compared against published 2017 BSRTC reference ranges, is presented in Table 4. Category II (Benign) demonstrated a ROM of 6.3% (2/32), marginally higher than the BSRTC reference of 0–3%, attributable to two cases of follicular variant PTC that were falsely categorised as Category II due to absent classical nuclear features on cytological smears. Category III (AUS/FLUS) showed an elevated ROM of 42.9% (6/14), significantly exceeding the BSRTC reference range of 10–30% ($p = 0.024$), suggesting that AUS/FLUS in this South Indian cohort carries a higher malignant risk than Western reference data predict — a finding of direct clinical management significance. Category IV (FN/SFN) ROM was 40.0% (8/20), within BSRTC reference range. Category V (SFM) and Category VI (Malignant) demonstrated ROM of 83.3% and 100% respectively, consistent with BSRTC predictions.

Table 4: Cyto-histological correlation and risk of malignancy (ROM) by BSRTC category in surgically resected cases (n = 96)

BSRTC Category	Operated (n)	Benign on HPE	Malignant on HPE	ROM — Present Study (%)	ROM — BSRTC 2017 (%)	p-value
I — Non-Diagnostic	8	5	3	37.5	5–10	0.032
II — Benign	32	30	2	6.3	0–3	0.08
III — AUS / FLUS	14	8	6	42.9	10–30	0.024
IV — FN / SFN	20	12	8	40.0	25–40	0.74
V — Suspicious for Malignancy	12	2	10	83.3	50–75	0.18
VI — Malignant	10	0	10	100.0	97–99	>0.99
Total	**96**	**57**	**39**	**40.6**	—	

ROM: Risk of Malignancy; HPE: Histopathological examination; BSRTC 2017: Reference ROM ranges from Cibas & Ali (2017); p-values for ROM deviation from BSRTC reference ranges by chi-square test.

Cytological Features of Papillary Thyroid Carcinoma

The key cytomorphological features identified in confirmed PTC cases (n=28) are presented in Table 6. Nuclear grooves (92.9%) and intranuclear pseudoinclusions (85.7%) were the most diagnostically specific features. Pale "ground-glass" (Orphan Annie) chromatin was identified in 78.6% of cases. Psammoma bodies, though highly specific for PTC, were present in only 35.7% of cases — emphasising that their absence does not preclude diagnosis. In the 6 follicular variant PTC cases, classical nuclear features were variably expressed, contributing to the false-negative FNAC results in 2 cases initially classified as Category II.

Table 6: Characteristic cytomorphological features of papillary thyroid carcinoma (PTC) on FNAC in confirmed cases (n = 28)

Cytological Feature	Frequency in Confirmed PTC Cases n (%)
Nuclear enlargement and crowding	28 (100.0)
Intranuclear pseudoinclusions	24 (85.7)
Nuclear grooves (coffee-bean nuclei)	26 (92.9)
Pale / ground-glass (Orphan Annie) chromatin	22 (78.6)
Papillary tissue fragments	20 (71.4)
Psammoma bodies	10 (35.7)
Scant / absent colloid background	18 (64.3)
Multinucleated giant cells	8 (28.6)

Diagnostic Accuracy of FNAC

Using histopathological examination as the gold standard and considering BSRTC Categories V+VI as cytologically positive and Categories I+II as negative (n=62; Categories III and IV excluded as indeterminate), the diagnostic accuracy parameters were: Sensitivity 80.0% (20/25), Specificity 94.6% (35/37), PPV 90.9% (20/22), NPV 87.5% (35/40), and Overall Accuracy 88.7% (55/62). The 2×2 contingency table is presented in Table 5. Five false-negative cases included 2 lobular-pattern follicular carcinomas, 2 low-grade papillary microcarcinomas with scant cellularity yielding a Category I result, and 1 follicular variant PTC classified as Category II. The 2 false-positive cases were Hashimoto's thyroiditis with Hürthle cell change and reactive nuclear atypia simulating the nuclear features of PTC.

Table 5: Diagnostic accuracy of FNAC cytology for detection of thyroid malignancy in operated cases (n = 62; categories I, II, V, VI included; III and IV excluded as indeterminate)

FNAC Result	HPE: Benign (n)	HPE: Malignant (n)	Total
Positive — Category V or VI (Suspicious/Malignant)	2 (FP)	20 (TP)	22
Negative — Category I or II (Non-diagnostic/Benign)	35 (TN)	5 (FN)	40
Total	**37**	**25**	**62**

TP: True Positive; FP: False Positive; TN: True Negative; FN: False Negative. Sensitivity: 80.0% | Specificity: 94.6% | PPV: 90.9% | NPV: 87.5% | Overall Accuracy: 88.7%. False-negative cases (n=5): 2 lobular-pattern follicular carcinomas (mistaken for adenomatous nodule), 2 low-grade papillary microcarcinomas (scant cellularity on Cat I smears), 1 follicular variant PTC (Cat II due to absent nuclear features on smear). False-positive cases (n=2): Hashimoto's thyroiditis with Hürthle cell change and nuclear atypia simulating papillary carcinoma on cytology.

DISCUSSION

This two-centre, two-year study from tertiary care institutions in Andhra Pradesh and Telangana provides a comprehensive analysis of the BSRTC category-wise cytomorphological spectrum and cyto-histological outcomes of thyroid FNAC in a South Indian semi-urban population. The predominance of females (F:M = 5.5:1) and the peak incidence in the 31–40 year age group are consistent with the well-established female preponderance of thyroid disorders, attributable to the oestrogen-mediated influence on thyroid follicular cell proliferation, iodine transport, and thyroglobulin synthesis, as well as the higher prevalence of autoimmune thyroiditis in women of reproductive age. [5,15,19]. Category II (Benign) was the largest BSRTC category (60.0%), consistent with most published Indian and global FNAC series, which report benign rates of 55–74%. [4,8,11] Within Category II, nodular/colloid goitre dominated (48.8%), consistent with the iodine-deficient and goitrogenic dietary background of inland Andhra Pradesh (including Kurnool and Nandyala districts) and North Telangana. Iodine deficiency causes persistent TSH stimulation, leading to follicular hypertrophy, colloid accumulation, and eventual multinodular goitre formation. Despite the introduction of universal salt iodisation in India, dietary habits and the consumption of traditionally goitrogenic vegetables (particularly cruciferous vegetables high in thiocyanate precursors) in rural AP and Telangana maintain a residual endemic goitre risk. [19]

Hashimoto's thyroiditis (lymphocytic thyroiditis) was the second most prevalent benign entity (22.6% of Category II cases), characterised by the diagnostic cytological triad of Hürthle cell change, a polymorphous lymphoid background, and lymphoepithelial aggregates. [9] Its high prevalence in this cohort — primarily in women aged 30–50 years — reflects the rising incidence of autoimmune thyroid disease across urban-transitioning South India. Hashimoto's thyroiditis poses a significant diagnostic challenge in FNAC, as Hürthle cell change may induce nuclear enlargement and nucleolar prominence that can be misinterpreted as features of PTC — a pitfall responsible for 2 false-positive results (elevated to Category V) in our series. Baloch et al. (2008) specifically highlighted this as a major source of false-positive FNAC diagnoses. [9]. The BSRTC Category III (AUS/FLUS) ROM in our study (42.9%) substantially exceeded the BSRTC 2017 reference range of 10–30% ($p = 0.024$). This observation aligns with emerging data from Asian centres. Arul and Masilamani (2015), in a South Indian study using the Bethesda System, similarly reported an elevated ROM in AUS/FLUS beyond BSRTC estimates. [11] The higher ROM in this category in our cohort may reflect: (a) follicular variant PTC cases with subtle nuclear features, (b) sampling from predominantly microfollicular areas of follicular adenomas with mild atypia, and (c) the stringent categorisation criteria applied where atypical cases were not reflexly upstaged to Category IV. These findings suggest that for Category III cases in this population, clinical management should trend towards repeat FNAC under ultrasound guidance within 3–6 months rather than watchful waiting, with a lower threshold for proceeding to core needle biopsy or diagnostic hemithyroidectomy.

Category IV (FN/SFN) ROM of 40.0% in our study is consistent with the upper range of BSRTC 2017 estimates (25–40%) and with data from other Indian institutional series. [4,8] The distinction between follicular adenoma (FA) and follicular thyroid carcinoma (FTC) on FNAC is inherently impossible by cytological criteria alone, as capsular and vascular invasion — the defining histological features of FTC per WHO 2017 — cannot be evaluated on aspirated material. [6] This fundamental limitation mandates surgical resection for all Category IV cases, and molecular markers (BRAF V600E, RAS mutations, TERT promoter mutations) evaluated on liquid biopsy or on-slide molecular assays are increasingly being explored as adjuncts to resolve this diagnostic impasse. Papillary thyroid carcinoma was the most common malignancy (71.8% of malignant cases, n=28), dominated by the classical variant (71.4% of PTC), consistent with national and global epidemiological data. [7,14] The follicular variant PTC (21.4% of PTC cases, n=6) posed the greatest diagnostic challenge, contributing to 2 false-negative FNAC results (Category II), consistent with the well-documented difficulty in recognising follicular variant PTC cytologically due to the variable and often subtle expression of the pathognomonic nuclear features of PTC — intranuclear pseudoinclusions, grooves, and pale chromatin — in this variant. [10] Nikiforov et al. (2016) proposed the re-designation of non-invasive encapsulated follicular variant PTC as "Non-Invasive Follicular Thyroid Neoplasm with Papillary-Like Nuclear Features" (NIFTP) — a clinically indolent lesion that should not be categorised as carcinoma — further complicating cytological risk stratification for follicular-patterned lesions. [10]

Medullary thyroid carcinoma (MTC, n=3; 7.7% of malignancies) presented with characteristic plasmacytoid or spindle-cell morphology on smears, with amyloid deposits (confirmed by Congo red staining) in two cases. Calcitonin immunohistochemistry was employed for histopathological confirmation. All three MTC cases were correctly suspected on FNAC (Category V or VI), highlighting the importance of awareness of MTC's atypical cytological presentations in the differential of thyroid FNA in this age group (mean 48.6 years). [6]. The overall diagnostic accuracy of FNAC in our study (88.7%) is comparable to published institutional series, which report accuracy ranges of 83–96%. [16,17,18] Sensitivity (80.0%) is within the accepted range, limited primarily by the inherent cytological challenges of follicular variant PTC and Category I non-diagnostic smears from microcarcinomas. The high specificity (94.6%) reinforces FNAC's role as a gatekeeper against unnecessary thyroid surgery. The 2 false-positive cases — both Hashimoto's thyroiditis with Hürthle cell atypia — underscore the necessity of close clinico-radiological correlation before recommending surgical resection in Category V cases, particularly in patients with clinical, biochemical, or ultrasonographic features of autoimmune thyroiditis.

This study is limited by its retrospective component, institutional referral bias (not all FNAC-positive cases underwent surgery in both centres), and the absence of systematic ultrasound correlation with cytological findings. Molecular marker profiling (BRAF V600E, RAS mutation panel), which now significantly refines the management of indeterminate nodules (Categories III and IV), was not universally available and constitutes an important area for future research. Prospective multicentric studies across Andhra Pradesh and Telangana with unified BSRTC reporting, ultrasound correlation, and molecular profiling are recommended to generate population-specific ROM data that can inform region-specific thyroid nodule management guidelines.

CONCLUSION

This two-year, two-centre study of 280 thyroid FNAC aspirates from tertiary care hospitals in Andhra Pradesh and Telangana demonstrates that benign lesions — predominantly nodular goitre and Hashimoto's thyroiditis — constitute the majority of thyroid cytological diagnoses in this South Indian semi-urban demographic. Among 96 surgically resected cases, papillary thyroid carcinoma was the dominant malignancy. FNAC reported using the standardised BSRTC

terminology showed high specificity (94.6%) and satisfactory overall accuracy (88.7%) for malignancy detection. Critically, the ROM in Category III (AUS/FLUS) significantly exceeded BSRTC reference ranges, indicating that this category demands more aggressive clinical follow-up in this population than currently recommended by Western guidelines. Systematic cyto-histological correlation, as demonstrated in this study, is an indispensable quality assurance mechanism for pathology departments and should be performed routinely to identify institutional diagnostic pitfalls and refine cytological interpretation standards.

SOURCE OF FUNDING AND CONFLICT OF INTEREST

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sector. The authors declare no conflicts of interest.

ACKNOWLEDGEMENTS

The authors sincerely acknowledge the technical staff of the Departments of Pathology at Santhiram Medical College, Nandyala, and Prathima Institute of Medical Sciences, Karimnagar, for their invaluable assistance in specimen preparation, staining, and record retrieval. The authors thank the Departments of General Surgery and Endocrinology at both institutions for their cooperation in clinical data provision and specimen referral.

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