Original Research Paper

Pathology

COMPARATIVE STUDY OF FNAC AND HISTOPATHOLOGY OF THYROID SWELLING

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ABSTRACT

Background: Thyroid swellings are frequently encountered endocrine disorders in clinical practice. Fine needle aspiration cytology (FNAC) has emerged as a reliable, minimally invasive diagnostic tool for evaluating thyroid lesions. However, the ultimate diagnosis rests in histopathological examination of the excised thyroid tissue. This study was carried out with the objective of comparing the findings of FNAC and histopathological examination (HPE) and evaluating the diagnostic accuracy of FNAC in preoperative assessment. **Methods:** This retrospective study was conducted over a period of 24 months from January 2024 to December 2025 on 240 patients with thyroid lesions. Fine needle aspiration cytology was performed using non-aspiration technique, and smears were classified according to the Bethesda System for Reporting Thyroid Cytopathology. The preoperative FNAC and postoperative histopathology reports were correlated in 97 cases, and statistical analysis was performed to determine sensitivity, specificity, and diagnostic accuracy. **Results:** Out of 240 aspirations, 238 (99.16%) were satisfactory for evaluation. The majority of cases were females (90.41%) with a female to male ratio of 9.43:1. The age ranged from 6 to 80 years with a mean age of 39.30 years. Based on Bethesda classification, 226 (94.16%) cases were benign (Category II), 9 (3.75%) were suspicious for follicular neoplasm (Category IV), 4 (1.70%) were malignant (Category VI), and 1(0.41%) were non-diagnostic (Category I). Colloid goiter was the most common benign lesion (56.19%), and papillary carcinoma was the most common malignancy. Cytohistopathological correlation showed sensitivity of 85.71%, specificity of 100%, positive predictive value of 100%, negative predictive value of 98.76%, and diagnostic accuracy of 88.65%. **Conclusions:** FNAC is a simple, safe, cost-effective, and highly accurate modality in the preoperative evaluation of thyroid swellings. It helps in distinguishing benign from malignant lesions, thereby guiding appropriate surgical management and avoiding unnecessary surgeries in benign conditions.

KEYWORDS : FNAC, Bethesda Classification, Diagnostic Accuracy

INTRODUCTION

The thyroid gland is the largest endocrine gland in the body and is frequently affected by various pathological conditions [1]. Thyroid swellings are common endocrine disorders encountered in clinical practice, with the majority being benign conditions such as goiter, while approximately 5 to 30% are malignant and require surgical intervention. The prevalence of goiter exceeds 40 million in India alone [2].

Fine needle aspiration cytology (FNAC) has emerged as a valuable diagnostic tool in the evaluation of thyroid swellings. It is a simple, cost-effective, minimally invasive procedure with high sensitivity and specificity that can be readily performed in the outpatient department with excellent patient compliance [3,4]. The technique was first evolved by Martin and Ellis in 1934, and subsequently refined by Franzen et al. in 1968 [5]. FNAC is now established as the gold standard for preoperative evaluation of thyroid lesions, helping to determine the mode of therapy and extent of surgery.

Despite its advantages, FNAC has certain limitations related to specimen adequacy, sampling techniques, operator skill, cytopathologist experience, and overlapping cytological features between benign and malignant follicular neoplasms [6]. In such cases, histopathological examination remains the final diagnostic test.

This study aims to correlate cytological diagnoses with histopathological findings to evaluate the diagnostic accuracy, sensitivity, specificity, and predictive values of FNAC in thyroid swellings.

MATERIALS AND METHODS
Study Design and Setting

This retrospective study was conducted in the Department of Pathology, Government Medical College and Associated Group of Hospitals, Kota, Rajasthan, over a period of 24 months from January 2024 to December 2025. The study included patients suffering from various thyroid swellings including goiter, thyroiditis, adenoma, and carcinomas who were admitted to various surgical wards or attending the outpatient department.

Sample Collection and Processing

Fine needle aspiration cytology was performed using the non-aspiration technique (FNC/FNCB) described by Franzen (1968)[7]. Smears prepared were air-dried immediately and fixed in methanol for five minutes, then stained with May-Grünwald-Giemsa (MGG) stain.The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was followed.

Histopathological Examination

Thyroidectomy specimens were preserved in 10% formalin and sent for histopathology examination to the pathology department. Standard processing and sectioning were performed, and sections were stained with H&E stain for microscopic examination.

RESULTS AND DISCUSSION

During the study period from January 2024 to December 2025, a total of 240 fine needle aspirations were performed. The age of the patients ranged from 6 years to 80 years with a mean age of 39.30 years and median age of 39 years, which is comparable to studies by Handa et al. (mean age 37.69 years) [8] and Rangaswamy et al. (mean age 40.57 years) [9].

The thyroid lesions were significantly more common in females than males. Among 240 cases, 217 (90.41%) were females and 23 (9.58%) were males, with a female to male ratio of 9.43:1, consistent with other studies. Handa et al. reported a ratio of 6.35:1 [9] and Mandal et al. reported 5:1 [10].

The most common clinical presentation was midline swelling in the neck, which was the principal indication for thyroid FNAC in all patients. The maximum number of patients (38.30%) presented with symptoms lasting 1-6 months. Clinically, the size of thyroid swellings ranged from 0.8 cm to 6.5 cm in the largest dimension, with the maximum number of cases (41.36%) having swelling size between 1-2 cm in diameter.

Out of 240 aspirates, 238 (99.16%) were satisfactory for evaluation, and only 2 (0.83%) were unsatisfactory, giving a satisfactory to unsatisfactory ratio of 119:1, comparable to studies by Mangshetty et al. (99.1%) [11] and Komal Singh Likhar et al. (98.3%) [12].

Cytological Diagnosis

Based on the Bethesda System for Reporting Thyroid Cytopathology, the cytological diagnoses were as follows:

Table 1: Distribution of Cases According to Bethesda Classification

Bethesda Category	Number of Cases	Percentage
Category I: Non-diagnostic	1	0.41%
Category II: Benign	226	94.16%
Category III: AUS/FLUS	0	0.00%
Category IV: Follicular Neoplasm	9	3.75%
Category V: Suspicious for Malignancy	0	0.00%
Category VI: Malignant	4	1.70%
Total	240	100%

In the benign cytological category (Category II), out of 226 cases, the maximum number (127 cases, 56.19%) were diagnosed as colloid goiter, followed by nodular goiter (57 cases, 25.22%), thyroiditis (28 cases, 12.38%), and thyroglossal cyst (14 cases, 6.19%), which agrees with studies by Giri et al. (62.71%) [13] and Pandey et al. (67.94%)[14].

Among the 9 cases in the suspicious for follicular neoplasm category (Category IV), subsequent histopathological examination revealed: 4 cases as follicular adenoma, 1 case as Hürthle cell adenoma, 1 case as follicular carcinoma, 1 case as colloid goiter, 1 case as nodular goiter, and 1 case as hyperplastic goiter.

In the malignant category (Category VI), 2 out of 4 cases showed cytological diagnoses consistent with histopathological diagnosis of papillary carcinoma. Among the remaining cases, 1 was diagnosed as medullary carcinoma and 1 case as metastatic deposits of breast carcinoma.

Cytohistopathological Correlation

Histopathological examination was available in 97 cases for correlation with FNAC diagnosis. The distribution of histo-pathologically proven cases was as follows:

Table 2: Distribution of Histopathologically Proven Cases

Histopathological Diagnosis	Number of Cases	Percentage
Colloid/Nodular Goiter	72	74.22%
Follicular Adenoma	12	12.37%
Thyroiditis	5	5.15%
Papillary Carcinoma	3	3.09%
Follicular Carcinoma	3	3.09%
Hürthle Cell Adenoma	1	1.03%
Thyroglossal Cyst	1	1.03%
Total	97	100%

Out of 97 histopathologically proven cases, 85 cases (87.63%) showed concordance with FNAC diagnosis, while 12 cases (12.37%) showed discordance which is comparable to other studies showing concordance between 80% and 100% [15]. GG Swamy et al. reported accuracy of 96.6% [16], while Das et al. reported 80.43% [17].

The reasons for discordance may include sampling error, improper technique, and coexistence of two pathologies in one lesion.

Diagnostic Accuracy Parameters

Based on cytohistopathological correlation of 97 cases, the following diagnostic parameters were calculated:

Table 3: Diagnostic Accuracy Parameters of FNAC

Parameter	Value (%)
True Positive (TP)	6
True Negative (TN)	80
False Positive (FP)	0
False Negative (FN)	1
Sensitivity	85.71%
Specificity	100.00%
Positive Predictive Value (PPV)	100.00%
Negative Predictive Value (NPV)	98.76%
Diagnostic Accuracy	88.65%
False Positive Error Rate	0.00%
False Negative Error Rate	1.03%

The false negative error rate was 1.03% because one case of hyperplastic nodular goiter on FNAC turned out to be follicular carcinoma on histopathological examination. The false positive error rate was zero in this study.

The sensitivity of 85.71% was close to that reported by Sumit Giri et al. (87.50%) [13]. The specificity of 100% was excellent and comparable to studies by Bagga et al. [18], Koul et al. [19], and Kumar et al. [20]. High specificity indicates FNAC is highly reliable in correctly identifying benign lesions, thereby avoiding unnecessary surgeries. The diagnostic accuracy of 88.65% is within the acceptable range, as studies have shown accuracy rates ranging from 80.43% to 96.6% [16, 17].

The positive predictive value of 100% indicates all cases diagnosed as malignant on FNAC were confirmed on histopathology, with no false positive results. This is crucial for surgical planning. The negative predictive value of 98.76% indicates very high probability that a lesion is truly benign when FNAC reports it as benign. The false positive error rate was zero, and the false negative error rate of 1.03% was low and comparable to studies by Nirupama et al. (1.36%) [21].

The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was introduced in 2007 to standardize reporting and facilitate communication between cytopathologists and clinicians [22, 23]. The use of the Bethesda system allowed for standardized reporting in the present study.

CONCLUSION

Colloid goiter was the most common benign lesion, and papillary carcinoma was the most common malignancy. FNAC is a reliable first-line diagnostic tool for thyroid swellings that helps guide appropriate management. Final diagnosis and treatment decisions should be based on correlation of cytological findings with clinical presentation, laboratory investigations, imaging studies, and histopathological examination when available.

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