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Original Research Article

Clinico-Pathological Evaluation and Surgical Management of Thyroid Swellings: A Prospective Study

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Abstract:

Background: Thyroid swellings, often referred to as goitres, can occur by multiple aetiologies - benign nodular hyperplasia or malignancy. Accurate clinico-pathological evaluation is critical in the management and diagnosis of surgery.

Aim: To prospectively evaluate the clinico-pathological characteristics of thyroid swellings and evaluate surgical management outcomes.

Methodology: This prospective observational study included seventy patients, aged ≥ 18 years, individuals with thyroid swellings at Department of General Surgery, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, India. Clinical assessment; thyroid function tests; ultrasonography, FNAC, and selective advanced imaging of the neck were conducted. Surgical treatment was offered in the form of hemithyroidectomy or total thyroidectomy based upon clinical and cytological evaluation. Histopathological evaluation of excised specimens was conducted. Data were analysed descriptively, and FNAC evaluation was correlated with histopathology.

Results: FNAC classified 61.43% colloid goiters, 28.57% nodular goiters, 7.14% follicular neoplasms and 2.86% papillary carcinomas. FNAC had good specificity, 2 true positives, 65 true negatives, 0 false positive and 3 false negatives. Hemithyroidectomy was the most common surgical intervention in this study (64.29%) followed by Thyrodidectomy (32.86%). Most histopathological evaluations correlated with FNAC evaluation, some lesions were classified as neoplastic lesions.

Conclusion: FNAC has proven to be a dependable preoperative diagnostic method to evaluate thyroid swellings, especially for benign lesions. The gold standard remains the histopathology examination. Surgical management should be guided by the histological type of the lesion, with an emphasis on conservative surgical management in benign lesions and more extensive surgery for thyroid malignancies.

Keywords: Thyroid swelling, FNAC, Histopathology, Hemithyroidectomy, Thyroid carcinoma, Goiter.

Introduction

The thyroid gland, although small, serves as a crucial endocrine organ and is generally not palpable in normal physiological conditions. Anatomically, it is located at the anterior and lateral regions of the lower neck, positioned over the trachea and extending from the fifth cervical vertebra to the first thoracic vertebra. Despite its relatively small dimensions, the thyroid gland is instrumental in regulating basal metabolic rate, thermogenesis, and calcium homeostasis, primarily via the secretion of thyroid hormones (thyroxine, T4; triiodothyronine, T3) and calcitonin. The proper functioning of this gland is vital for normal growth, development, and metabolic balance, and any structural or functional abnormalities can markedly impact overall health.

A generalized or localized enlargement of the thyroid gland is also known as a goitre. On clinical grounds, goitres are categorized as toxic or nontoxic, based on the functional state of the gland. Toxic goitres are related to hyperthyroidism, whereas nontoxic goitres are not associated with over excess of thyroid hormone. Nontoxic goitres are also divided into endemic and sporadic types, based on their occurrence among communities. Endemic goitre is described as thyroid enlargement affecting more than 10% of patients living in a given geographical region, which frequently occurs due to iodine deficiency, presently a major public health issue, affecting many developing countries. Sporadic goitres, on the other hand, are seen among communities not experiencing iodine deficiency and characteristically occur due to genetic predisposition, local factors of an environmental nature, or by autoimmunity. Of nontoxic thyroid enlargements, by far, multinodular goitre (MNG) is the most frequent presentation. MNG is almost entirely due to chronic iodine deficiency and is one

of the most common endocrine diseases globally, affecting between 500 and 600 million individuals of different populations [1].

The etiopathology of thyroid enlargement is ultimately multifactorial. Indeed, goitres may occur as a result of autoimmune conditions such as Hashimoto's thyroiditis and Graves' disease, which result in immune-mediated injury to the architecture and function of the gland. Other causes of thyroid enlargement include nodular hyperplasia, biosynthetic disorders of thyroid hormone synthesis, and neoplastic changes. Often, palpable thyroid nodules are the first clinical clue; however, benign and malignant conditions behave rather differently in terms of biological properties. Palpation may be a useful primary clinical investigation, but further evaluation is often warranted to classify the nature of the expanded thyroid. Fine-needle aspiration cytology (FNAC) is now a critical companion to the workup of thyroid nodules; it is highly sensitive and specific and is particularly useful for characterizing papillary thyroid carcinoma (PTC), the most common form of thyroid malignancy. FNAC does, however, have some disadvantages inherent in its use: it cannot reliably distinguish between follicular adenoma versus follicular carcinoma, nor is it accurate for cystic lesions or toxic nodular pathology [2].

The recent advancements in diagnostic imaging have greatly improved the assessment of thyroid enlargement. Ultrasonography (USG), often with Doppler assessment, assists with precise characterization of nodule size, nature, echogenicity, vascularity and the presence of microcalcifications, which may signal malignant features. Computed tomography (CT) and magnetic resonance imaging (MRI) are rarely needed but assist in assessing larger or retrosternal goitres and the relation of the goitre to surrounding structures. In the face of these technical advancements, thorough clinical examination remains a requisite component of primary assessment, through which suspicion of suspicious nodules is determined early and informs further diagnostic strategies [3].

Surgery also remains fundamental in the management of thyroid enlargement, especially in the presence of compressive symptoms, suspicion of malignancy, or significant functional disabilities. The confirmation of a diagnosis of thyroid lesions also requires histopathologic assessment of resected tissue, which many individuals consider to be the gold standard, in the case of non-diagnostic cytology. The precise identification of thyroid swellings not only assists with the development of an appropriate management plan but also provides clinicians with prognostic information and long-term management plan [4].

Due to multiple etiopathies, different clinical presentations, and possible malignancies, a methodical clinico-pathologic evaluation of thyroid swellings is imperative. This paper aims to provide a comprehensive prospective evaluation of thyroid swellings, correlating clinical presentations, FNAC, ultrasound patterns, and histopathologic results. Additionally, it aims to assess surgical management, the indications for surgery, and the post-operative outcomes. By systematic appraisal, it aims with both facets of this study to increase diagnostic accuracy, provide better tailored management for patients, and achieve a clearer understanding of thyroid pathology at a clinical level.

Materials And Methods

Study Design: This was a prospective, observational, descriptive study conducted to evaluate the clinico-pathological features and surgical management of patients presenting with thyroid swellings.

Study Area: The study was conducted in the Department of Surgery, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India from November 2021 to October 2022

Study Population: The study population included all patients presenting with thyroid swellings to the Surgery outpatient and inpatient departments of the institution who met the inclusion criteria.

Sample Size: A total of 70 patients were enrolled in the study.

Inclusion Criteria

- Patients aged 18 years and above present with thyroid swellings.

Exclusion Criteria

- Patients below 18 years of age.
- Patients with recurrent thyroid swellings.
- Patients with a history of prior thyroid surgery.

Data Collection: Participants in the study underwent thorough medical history-taking and clinical examinations to quantify the size, location, consistency and associated symptoms of the thyroid swellings. All participants had relevant laboratory investigations undertaken, which included hemoglobin, CBE, bleeding time, clotting time, ESR, random blood glucose, blood urea, serum creatinine, HIV, HBsAg, urine analysis, ECG and chest X-ray. Other specific investigations, based on clinical evaluation, including thyroid function tests (T3, T4, TSH), fine needle aspiration cytology (FNAC), ultrasonography of the thyroid, neck X-rays (AP and lateral views) and indirect laryngoscopy were performed. Some patients also underwent CT scan of the neck and thorax and thyroid isotope scanning to assess for thyroid disease or to aid in further diagnosis. Patients that

were determined to require surgical management underwent appropriate surgery in the form of thyroidectomy, with excised specimens sent for histopathological examination to definitively confirm the diagnosis.

Procedure: All patients with thyroid swellings were screened according to the defined inclusion and exclusion criteria. Patients were first evaluated by history and clinical examination, and then they underwent the necessary laboratory and radiological investigations. FNAC was performed in all cases for determination of the cytological nature of the swelling. Surgical procedures including hemithyroidectomy or total thyroidectomy were performed when the size, clinical suspicion of malignancy, and FNAC results dictated surgical intervention. The excised specimens underwent histopathological examination for confirmation of diagnosis. Postoperatively, patients were followed for recovery, complications, and outcomes.

Statistical Analysis: The gathered data was recorded in Microsoft Excel and analyzed using descriptive statistical methods. Continuous variables were expressed using means and standard deviations, and categorical variables were summarized using frequencies and percentages. The Chi-square test and other applicable statistical tests identified associations between variables with a statistically significant threshold of $p < 0.05$."

Result

Table 1 presents the distribution of 70 cases based on FNAC diagnosis. Colloid goiter was the most common finding with 43 cases (61.43%), followed by nodular goiter in 20 cases (28.57%). Follicular neoplasm accounted for 5 cases (7.14%), and papillary carcinoma was diagnosed in 2 cases (2.86%). This distribution highlights that benign thyroid conditions predominated, while malignant lesions were relatively rare.

Table 1: Distribution of cases on the basis of diagnosis through FNAC (N = 70)

FNAC	Colloid Goiter	Nodular Goitre	Follicular Neoplasm	Papillary CA	Total
No.	43	20	5	2	**70**
%age	61.43%	28.57%	7.14%	2.86%	**100.00%**

Table 2 shows the correlation between FNAC and histopathological diagnoses in 70 thyroid lesions. Among non-neoplastic lesions, 43 cases diagnosed as colloid goiter by FNAC corresponded to 31 true colloid goiters, 7 nodular goiters, and 5 thyroiditis on histopathology, all considered true negatives (TN). For nodular goiter FNAC diagnoses (n=20), 18 matched histopathology (TN), 1 was thyroiditis (false negative, FN), and 1 was follicular carcinoma. Among neoplastic lesions, 5 cases reported as follicular neoplasm on FNAC were confirmed as 2 follicular carcinomas, 1 follicular adenoma, and 2 nodular goiters on histopathology. Both cases reported as positive for malignant cells on FNAC were confirmed as papillary carcinoma (true positives, TP). This table highlights that FNAC has high specificity for malignant lesions but may have limitations in differentiating certain benign and follicular neoplasms.

Table 2: Cytodiagnosis and its correlation with histopathological diagnosis of various thyroid lesions (N = 70)

FNAC Diagnosis	No. of Cases	Histopathological Diagnosis	No. of Cases	Remarks
Non-neoplastic lesion				
Colloid Goitre	43	Colloid Goitre	31	TN
		Nodular Goitre	7	TN
		Thyroiditis	5	TN
		Follicular Carcinoma	0	
		Papillary Carcinoma	0	
Nodular Goitre	20	Nodular Goitre	18	TN
		Thyroiditis	1	FN
		Follicular Carcinoma	1	
		Papillary Carcinoma	0	
Neoplastic lesion				
Follicular Neoplasm	5	Follicular Carcinoma	2	
		Follicular Adenoma	1	
		Nodular Goitre	2	
Positive for Malignant Cells	2	Papillary Carcinoma	2	TP
		Medullary Carcinoma	0	

Table 3 presents the comparison of FNAC with histopathology in 70 thyroid cases using a confusion matrix. FNAC correctly identified 2 true positives (TP) and 65 true negatives (TN), with no false positives (FP = 0) but 3 false negatives (FN). This indicates that FNAC demonstrated high specificity and accuracy for ruling out malignancy, though a few malignant cases were missed, reflecting limited sensitivity in detecting certain lesions.

Table 3: Comparison of FNAC with Histopathology (confusion matrix and performance) (N = 70)				
Diagnosis	**True Positive (TP)**	**False Positive (FP)**	**False Negative (FN)**	**True Negative (TN)**
—	2	0	3	65

Table 4 shows the distribution of 70 thyroid cases based on the type of surgery performed. Hemithyroidectomy was the most common procedure, performed in 45 cases (64.29%), followed by total thyroidectomy in 23 cases (32.86%). More extensive surgeries, including total thyroidectomy with sternotomy and total thyroidectomy with neck dissection, were each performed in 1 case (1.43%). This indicates that the majority of patients underwent less extensive, thyroid-lobe–preserving surgery.

Table 4: Distribution of Cases Based on the Type of Surgeries Done (N = 70)		
Type of Surgery	**Cases**	**%age**
Hemithyroidectomy	45	64.29%
Total Thyroidectomy	23	32.86%
Total Thyroidectomy with Sternotomy	1	1.43%
Total Thyroidectomy with Neck Dissection	1	1.43%
Total	**70**	**100.00%**

Discussion

In our study, FNAC identified colloid goiter in 61.43%, nodular goiter in 28.57%, follicular neoplasm in 7.14%, and papillary carcinoma in 2.86% of cases. Results are largely conforming to studies prior, which have highlighted the prevalence of benign thyroid lesions. Gharib and Papini (2007) indicated colloid goiter to be a leading frequent thyroid pathology, similar to our cohort's prevalence of 61.43% [5]. Also, Baloch and LiVolsi (2008) identified a predominance of colloid goiter as a prevalent benign lesion, yet again corroborating our studies [6]. Our study percentage of nodular goiter (28.57%) also coincides with that of Gupta et al. (2010), indicating nodular goiter in about 27–30% of FNAC and histopathology-checked patients [7]. The lower percentage of follicular neoplasm and papillary carcinoma in our series merely mirrors a relative incidence of malignant thyroid diseases seen in the general populace, corroborating Sharma (2015), indicating papillary carcinoma in about 2–3% of FNAC patients [8].”

This study's concordance between FNAC and histopathology shows both advantages and disadvantages of cytology. Of 43 FNAC-diagnosed colloid goiters, 31 were histopathology-confirmed to be a colloid goiter, 7 as nodular goiter, and 5 as thyroiditis, none being malignant on histopathology. Such a high concordance for FNAC's accuracy of benign lesions agrees with results published by Handa et al. (2008), noting true negatives of over 90% for benign thyroid lesions for a large study group of 434 patients [9]. Of 20 confirmed nodular goiters, 18 confirmed their histology, but a case of follicular carcinoma of thyroid remained missed by FNAC. This reveals a known limitation of inability of FNAC to differentiate, cytologically, follicular neoplasms, including carcinomas, from benign nodules, respectively, for capsular or vascular invasion, noted under the Bethesda criteria (Cibas & Ali, 2009) [10]. Likewise, Baloch and LiVolsi (2008) noted that follicular lesions are problematic for a reliable histopathologic diagnosis, based on their overlapping cytologic criteria, whence their occasional false negatives [6].

Of the five cytologically confirmed follicular neoplasms, histopathology showed two carcinomas of the follicular type, an adenoma of the follicular type, and two nodular goiters, demonstrating preoperative difficulty of differentiation. This picture holds true for previous studies, which indicate that about 30–40% of follicular neoplasms diagnosed by FNAC should be submitted for surgical excision for clear-cut histopathology (Cibas & Ali, 2009) [10]. Papillary carcinoma, on the other hand, was correctly identified both by FNAC, affirming its high positive predictive value and high specificity, a picture reinforced by multiple published reports (Sharma, 2015) [8]. Overall performance by FNAC for our study, correlating with 2 true positive, 0 false positive, 3 false negatives, and 65 true negatives, signifies a sensitivity of 66.6%, a specificity of 100%, and a diagnostic accuracy of 98.6%, closely mirroring the report of high specificity and positive predictive

value by Baloch et al. (2008) for malignant thyroid nodules by FNAC (Baloch et al., 2008) [6].

Surgical treatment for this group of patients mirrored the dominance of benign lesions. Hemithyroidectomy was used for 64.29% of patients, mirroring the high incidence of ipsilateral benign nodules. Total thyroidectomy represented 32.86% of patients, of which one underwent total thyroidectomy by sternotomy for retrosternal extension and a second for neck dissection for nodal metastasis. The dominance of hemithyroidectomy is consistent with international practice, where benign nodules are treated by conservatism with limited resection (Haugen et al., 2016) [11]. Total thyroidectomy for malignant or suspected lesions mirrors consensus recommendations for total gland excision, to allow for postoperative radioactive iodine therapy and prevent recurrence (Randolph et al., 2012) [12]. Of interest, a single patient needed completion thyroidectomy for a postoperative histopathologic diagnosis of follicular carcinoma, supporting the inability of FNAC to predict malignancy for follicular lesions (Luo et al., 2017) [13]. The exceptional case requiring median sternotomy underscores preoperative evaluation and surgical planning for retrosternal goiters (Pradhan & Agarwal, 2022) [14].

In brief, our study results justify FNAC as a preoperative, highly specific, and reliable test for thyroid lesions, i.e., for differentiating benign lesions from malignant lesions, by a minimally invasive method. Nevertheless, the occurrence of false negatives, particularly regarding follicular neoplasms, highlights the critical importance of histopathologic study for definitive diagnosis and surgery. Our findings correspond closely with previous studies, all reporting high specificity and diagnostic value of FNAC for papillary carcinoma and other malignancies but recognizing its limitations for follicular neoplasms and indeterminate nodules. The combination of cytology, histopathology, and individualized surgical treatment provides the necessary management of the thyroid swellings and the best practice of endocrine surgery.

Conclusion

The research confirmed that the great majority of thyroid lesions examined were non-neoplastic with a frequency of colloid goiter and nodular goiter as the most common preoperative diagnoses on FNAC. Cytological diagnoses correlated extremely well with histopathological findings in most samples which demonstrate the utility of FNAC as a preoperative diagnostic modality, particularly useful in distinguishing benign from malignant lesions. Although several samples had discrepancies, this simply highlights limitations of FNAC in classifying some neoplastic disease processes such as follicular neoplasms where histopathology remains the gold standard in diagnosis. Surgical methods were also primarily considered hemithyroidectomy which suggests a method of choice for localized benign lesions, while total thyroidectomy, in some cases along with neck dissection or sternotomy remains a method of choice for diagnosis of confirmed or suspected malignancy. Overall, certain studies provide validation to correlate clinical assessment, cytological assessment and appropriate surgical approach for optimal patient outcomes for thyroid swellings while for lesions where cytology may be inconclusive still advocate judicious preoperative planning.

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