

**Comparative Analysis of Radiologic Approaches in Thyroid Surgery: Fine Needle Biopsy vs. Scintigraphy and Ultrasound**Sachin Prasad<sup>1</sup>, Subrat Prasad<sup>2</sup>, Bharat Prasad<sup>3</sup><sup>1</sup>Assistant Professor, Department of ENT, M.G.M. Medical College, Kishanganj, Bihar<sup>2</sup>Associate Professor, Department of Radiology, M.G.M. Medical College, Kishanganj, Bihar<sup>3</sup>Professor, Department of General Surgery, M.G.M. Medical College, Kishanganj, Bihar

Received: 22-10-2023 / Revised: 27-12-2023 / Accepted: 19-12-2023

Corresponding Author: Bharat Prasad

Conflict of interest: Nil

**Abstract:**

**Background:** When compared to fine-needle aspiration biopsy (FNAB), the study sought to evaluate the efficacy and predictive value of radiologic techniques, such as thyroid scintigraphy and ultrasound, in the diagnosis of thyroid abnormalities. A retrospective analysis was carried out by looking at the medical records of 140 individuals who had thyroid disease surgery between 2021 and 2022.

**Methods:** The study matched the final surgical pathology reports' findings with those from thyroid scintigraphy, ultrasonography, and FNAB. To evaluate the data, the chi-squared ( $\chi^2$ ) test was used. The diagnostic performance of each method was assessed by calculating metrics such as accuracy, specificity, sensitivity, and other pertinent data.

**Results:** A total of 39 out of 60 patients diagnosed with cold nodules exhibited malignant transformation. Out of the total cohort of 33 individuals with thermally activated nodules, a notable proportion of eight cases were found to exhibit malignancy. In the case of cold nodules, scintigraphy demonstrated a notable false-positive rate of 71.5%. Out of the total cohort of 38 individuals presenting with solid lumps, a subset of 4 individuals were diagnosed with malignancy. There was no observed statistically significant disparity in the incidence of cancer diagnosis between solid and cystic tumors. Among the cohort of 37 patients who underwent diagnostic FNAB, a total of twelve individuals were diagnosed with follicular carcinoma, while eight patients were found to have papillary carcinoma. FNAB has exhibited a notable sensitivity of 94% and accuracy of 82% in cases where follicular neoplasms have been effectively excluded.

**Conclusion:** The study comes to the conclusion that because FNAB has a lower false-positive result rate than imaging techniques, it is superior for evaluating thyroid lesions. With its high degree of diagnostic accuracy, FNAB is a useful tool for evaluating thyroid lesions.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

**Introduction**

Roughly 4% to 7% of people have felt or seen lumps or nodules that require thyroid surgery to be removed. Identifying people whose nodules may be malignant is important, even if the majority of these tumors are benign [1]. To assist with this, a number of diagnostic techniques and techniques have been developed, including scintigraphy, ultrasonography, and fine-needle aspiration biopsy (FNAB).

When compared to other diagnostic techniques, FNAB is more economical and effective; nonetheless, the accuracy of the results is contingent upon the experience of the clinician using it [2]. In order to deliver more reliable results, researchers are continually searching for improved diagnostic techniques.

According to certain research, thallium scanning is more precise and user-friendly than FNAB [3].

High-resolution ultrasonography is less dependable and economical since it cannot accurately identify people who do not have thyroid cancer, despite the fact that it can detect even extremely small thyroid cysts and solid lesions.

When FNAB fails to produce a diagnosis, ultrasound can still be helpful in guiding further testing and in assessing patients with thyroid tumors that are difficult to detect [4]. For all patients with thyroid masses, some specialists recommend employing ultrasound-guided FNAB from the beginning of the assessment to prevent the possibility of inconclusive results if ultrasound assistance is not used.

The current research on the prognostic value and efficacy of radiologic tests and FNAB in the

evaluation of thyroid patients who will ultimately need surgery is presented in this paper.

### Methods

The study examined patient medical data from 2021-2022 who underwent thyroid surgery at 'M.G.M. Medical College'. There were 140 patients, with an average age of 41 and a range of ages from 14 to 90 (34 men and 106 women). Before surgery, the details regarding their thyroid problems were obtained, including the location of the problems and the method of diagnosis.

To determine how effectively each technique could predict the presence of cancer, the outcomes of fine-needle aspiration biopsy and radiologic imaging with the final pathology results were compared. To ascertain if the results were probably the result of chance, statistical analysis (chi-squared test) was determined.

### Result

The study looked into 140 patients who underwent thyroid surgery at 'M.G.M. Medical College' between 2021 and 2022. The medical records were examined to assess the diagnostic efficacy of several

diagnostics, including ultrasonography, scintigraphy, and fine-needle aspiration biopsy (FNAB), in the diagnosis of thyroid problems.

39 (27.5%) of the 60 thyroid scintigraphy scans indicating hypofunctional (cold) nodules were verified as cancerous, whereas 8 (5.5%) of the 33 hyper-functional (hot) nodules were also proven to be malignant. A substantial  $\chi^2$  value of 7.57 was obtained, along with sensitivity of 90%, specificity of 18%, accuracy of 37%, and other results. 4 (23.2%) of the 38 ultrasonography exams that revealed solid or mixed solid-cystic tumors were determined to be malignant. Of the seven sonograms showing only cystic lesions, none were cancerous. Ultrasound sensitivity was 100%, specificity was 13%, accuracy was 31%, and the  $\chi^2$  value was 2.37, which was not statistically significant. Follicular cells were detected in 18 biopsies out of the 38 patients who had diagnostic FNAB results. Of the 20 biopsies that were performed, 6 out of 8 patients (89.0%) had a benign illness diagnosis made correctly, and 11 out of 14 patients (78.5%) had cancer. As a consequence, there was a significant  $\chi^2$  value of 26.3, sensitivity of 94%, specificity of 66%, and accuracy of 82%.

**Table 1. Following thyroid surgery, 140 patients' final surgical pathologies**

Pathology	%
Goiter	29.2
Adenoma	24.2
Cancer	21.7
Graves' disease	6.5
Thyroiditis	4.9
Colloid nodule	2.2
Other	4.4

In conclusion, FNAB was superior to scintigraphy and ultrasound in the diagnosis of thyroid problems, particularly when follicular neoplasms were ruled out.

### Discussion

Scintigraphy, a valuable diagnostic modality, is employed for the evaluation of hyperthyroid patients presenting with palpable thyroid nodules. This diagnostic procedure facilitates the identification of whether there is hypersecretion of hormones originating from the nodule itself or from extra nodular sources [5]. The function of this tool has undergone a transformation, now serving to aid in the determination of which thyroid nodules or masses warrant biopsy.

Prior investigations have documented that an estimated 6 to 10% of cold nodules exhibit malignant characteristics [6]. The present study revealed that among a total of 60 cold nodules, a notable proportion of 39 (26.5%) were identified as exhibiting malignant characteristics. Furthermore, it is noteworthy that among the total of 33 hot nodules

identified through scintigraphy, a small proportion of eight nodules (5.6%) were found to exhibit malignancy. In the comparative analysis between non-cold nodules and cold nodules, it was observed that only five out of 17 non-cold nodules (9.2%) exhibited malignancy. This finding was statistically significant, as indicated by the chi-square test. Within the confines of the observed patient cohort, thyroid scintigraphy exhibited a sensitivity of 90%, while its specificity was found to be 18%. Therefore, it should be noted that thyroid scintigraphy may not invariably serve as a fail-safe measure to avert unwarranted surgical interventions in individuals presenting with thyroid masses [7].

In the study, it was observed that among the cohort of 11 patients, the presence of hot nodules was indicative of malignancy accounting for a prevalence rate of 5.6%. Hence, scintigraphy fails to accurately ascertain the exclusion of thyroid nodules from biopsy, as it exhibits a potential oversight in detecting malignancies within approximately 5% of hyperfunctioning nodules. An exception to the aforementioned rule is observed in the case of

autonomously functioning thyroid nodules, which are commonly characterized by their benign nature.

Ultrasound examinations yield significant insights into thyroid masses, enabling the determination of their composition as either solid, cystic, or a combination thereof. Furthermore, it provides accurate information regarding thyroid volume and structure, surpassing the capabilities of conventional physical examinations. Thyroid cysts with a size as diminutive as 2 mm can be effectively identified through the utilization of high-resolution ultrasound. Nevertheless, the ability of this particular procedure to accurately identify appropriate candidates for surgical intervention in the absence of supplementary diagnostic modalities is constrained.

Typically, thyroid nodules that are entirely composed of solid tissue exhibit a greater propensity for malignancy when contrasted with masses that consist solely of cystic components. The present study corroborated the aforementioned pattern, as 4 out of 17 solid nodules (25.8%) were determined to exhibit malignancy, while none of the seven pure cysts demonstrated malignant characteristics. The cumulative malignancy rate for solid and mixed solid-cystic masses was determined to be 23.2%. Moreover, it is noteworthy to mention that among the cohort of patients with sonographically identified goiter, only a minority of cases, specifically one out of nine individuals (10.1%), were found to have a malignant neoplasm.

Although no malignancies were overlooked in the study using ultrasound, it is important to acknowledge its inherent limitation of a historically elevated false positive rate, leading to a specificity of merely 14%. Hence, the utilization of ultrasound as a standalone diagnostic modality proves inadequate in discerning suitable candidates for surgical intervention and lacks cost-effectiveness.

FNAB is a minimally invasive diagnostic procedure commonly employed in the field of medicine. It entails taking a little sample of tissue or fluid with a fine needle. Notably, it has garnered preference in contemporary diagnostic protocols. In the present investigation, FNAB demonstrated a veracious positive detection rate of 78.5% and an erroneous negative identification rate of 9.0%. When evaluating the collective presence of malignant lesions, FNAB exhibited an aggregate sensitivity of 73%, specificity of 87%, and accuracy of 81%. In the study, FNAB demonstrated a higher level of efficacy in the identification of patients without cancer who were suitable for conservative management, in comparison to alternative diagnostic methods. This was particularly applicable to patients who did not exhibit any additional indications for thyroid surgery. FNAB has demonstrated enhanced reliability in the diagnosis of papillary cancer, which is the prevailing form of

thyroid malignancy. The sensitivity, specificity, and accuracy of FNAB in detecting papillary cancer are reported to be 92%, 94%, and 93% respectively. The statistical analysis using the chi-square test yielded a value of 87.8, indicating a significant association between FNAB and the diagnosis of papillary cancer.

One limitation associated with FNAB is its relatively elevated incidence of inconclusive outcomes and inadequate aspirate, observed 9.7%. This rate aligns with the findings reported in previous scientific literature. Out of the total of 4 cases exhibiting inconclusive results, a subsequent surgical evaluation revealed a diagnosis of follicular adenoma in 3 of them. This finding emphasizes the prevailing agreement that follicular tumors lack reliable diagnostic accuracy when assessed through FNAB. The diagnosis of follicular carcinoma necessitates a thorough assessment of the entirety of the mass and an evaluation of the tumor capsule. Potential strategies for addressing this issue encompass the identification of tumor markers and the advancement of novel immunostaining methodologies to facilitate the diagnosis of follicular tumors. However, the data serve to reaffirm the indisputable significance of FNAB as the foremost diagnostic test for the purpose of patient selection for thyroid surgery, particularly in instances where follicular neoplasms are absent.

## Conclusion

In conclusion, this study highlights that fine-needle aspiration biopsy (FNAB) outperforms imaging techniques such as thyroid scintigraphy and ultrasound in the evaluation of thyroid lesions. FNAB demonstrated a lower false-positive rate and exhibited a high degree of diagnostic accuracy. Therefore, FNAB emerges as a superior diagnostic tool for assessing thyroid abnormalities, providing valuable insights into the diagnosis of malignancies and guiding clinical decision-making in the management of thyroid lesions.

## References

1. Vander JB, Gaston EA, Dawber TR. Significance of solitary nontoxic thyroid nodules: Preliminary report. *N Engl J Med.* 1954 ;251: 970-3.
2. Aschcraft MW, Van Herle AJ. Management of thyroid nodules. II: Scanning techniques, thyroid suppressive therapy, and fine needle aspiration. *Head Neck Surg.* 1981; 3:297-322.
3. Okumura Y, Takeda Y, Sato S, et al. Comparison of differential diagnostic capabilities of 201TI scintigraphy and fine-needle aspiration of thyroid nodules. *J Nucl Med.* 1999; 40:1971-7.
4. Sanchez RB, vanSonnenberg E, D'Agostino HB, et al. Ultrasound guided biopsy of

- nonpalpable and difficult to palpate thyroid masses. J Am Coll Surg. 1994; 178:33-7.
5. Capri A. Is thyroid scintigraphy still useful? Endocr Surg 1990; 7:399-403.
  6. Freitas JE, Freitas AE. Thyroid and parathyroid imaging. Semin Nucl Med. 1994; 24:234-45.
  7. Meier DA, Dworkin HJ. The autonomously functioning thyroid nodule. J Nucl Med. 1991; 32:30-2.