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Comparison of Fine Needle Aspiration Cytology and Histopathology in the Diagnosis of Thyroid Nodules

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ABSTRACT
Thyroid nodules are common clinical findings and distinguishing between benign and malignant nodules is essential for appropriate management. Fine Needle Aspiration Cytology (FNAC) and histopathology are primary diagnostic tools used to evaluate thyroid nodules. This study aims to compare the diagnostic accuracy of FNAC with histopathology, the gold standard for definitive diagnosis. A retrospective analysis was conducted on 120 patients who underwent both FNAC and surgical excision with subsequent histopathological examination at a tertiary care center. The concordance rates, sensitivity, specificity and clinical impact of diagnostic discrepancies were assessed. Statistical analysis included calculation of odds ratios (OR), 95% confidence intervals (CI) and P-values to determine the significance of the findings. Out of 120 patients, concordance between FNAC and histopathology was observed in 70 cases (58.3%), with an OR of 2.36 (95% CI: 1.2-2.0, P=0.035). Discordance was noted in 33 cases (27.5%), with an OR of 2.35 (95% CI: 0.3-0.8, P=0.025). The sensitivity and specificity of FNAC were 62.5% and 69.2%, respectively. Major diagnostic discrepancies impacted clinical management in 29.2% of cases, indicating significant clinical relevance. FNAC demonstrates a substantial concordance with histopathology in the diagnosis of thyroid nodules but also highlights areas of diagnostic discrepancy that can affect patient management. While FNAC is effective as a preliminary diagnostic tool, careful consideration of its limitations is essential for accurate diagnosis and appropriate clinical decision-making.

INTRODUCTION

Thyroid nodules are discrete lesions within the thyroid gland that are palpably and/or ultrasonographically distinct from the surrounding thyroid parenchyma. The prevalence of thyroid nodules in the general population varies widely, largely depending on the method of detection employed. Studies have shown that while palpation detects thyroid nodules in about 4-7% of the population, high-resolution ultrasound can detect nodules in 19-68% of randomly selected individuals, with higher frequencies observed in older women and populations with iodine deficiency[1,2].

The diagnostic approach to thyroid nodules is pivotal in determining the nature of the lesion, particularly distinguishing between benign and malignant nodules, to guide appropriate management. Fine Needle Aspiration Cytology (FNAC) and histopathology are the cornerstone diagnostic techniques in the evaluation of thyroid nodules. FNAC is widely recognized for its utility, being minimally invasive, cost-effective and generally accurate, making it the first-line diagnostic test in the assessment of thyroid nodules. However, the technique's sensitivity and specificity can be influenced by the nodule's characteristics, the skill of the aspirator and the experience of the cytologist[3,4].

Histopathological examination of thyroid tissues, obtained post-surgically, remains the definitive diagnostic method, providing a conclusive diagnosis. The accurate differentiation of benign from malignant thyroid nodules is crucial because it directly influences further management strategies, ranging from conservative follow-up to surgical intervention[5].

The reliance on FNAC has its challenges, mainly its indeterminate results, which can be seen in approximately 10-20% of cases, leading to diagnostic uncertainty. This issue often necessitates further diagnostic procedures, potentially including diagnostic surgery. The comparative effectiveness of FNAC and histopathology in diagnosing thyroid nodules has significant clinical implications in terms of cost, management and patient outcomes[6].

Aim and Objectives: To compare the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) and histopathology in evaluating thyroid nodules.

- To determine the concordance rate between FNAC and histopathology results in patients with thyroid nodules.
- To evaluate the sensitivity and specificity of FNAC in comparison to histopathology for thyroid nodules.
- To assess the clinical impact of diagnostic discrepancies between FNAC and histopathology on patient management.

MATERIALS AND METHODS

Source of Data: Data was retrospectively collected from patient records who underwent both FNAC and subsequent thyroidectomy at our medical facility.

Study Design: This was a retrospective analytical study comparing the results of FNAC and histopathological examinations of thyroid nodules.

Study Location: The study was conducted at the Department of Pathology, Dr Vasantrao Pawar Medical College Hospital and Research Centre, which is a tertiary care hospital.

Study Duration: Data collection encompassed a period from January 2013 to December 2015.

Sample Size: The sample comprised 120 patients who had undergone FNAC followed by thyroidectomy.

Inclusion Criteria: Patients included were those with thyroid nodules who underwent FNAC and subsequent surgical resection, with both cytology and histopathology reports available.

Exclusion Criteria: Excluded were patients with incomplete medical records, those who did not undergo surgery following FNAC and FNAC reports that were non-diagnostic.

Procedure and Methodology: FNAC was performed using a 24-gauge needle attached to a 5mL syringe. The aspirated material was smeared onto slides, air-dried, and stained with Giemsa and wet fixed smears are stained with H and E stain and PAP stain. For surgical specimens, formalin-fixed, paraffin-embedded tissue sections were stained with Hematoxylin and Eosin.

Sample Processing: Cytological slides were reviewed by two experienced pathologist and histopathological sections were examined by two pathologists, all of whom were blinded to the initial FNAC results.

Statistical Methods: Data were analyzed using SPSS software. Concordance rates, as well as sensitivity and specificity, were calculated. Cohen's kappa was used to assess the agreement between FNAC and histopathology.

Data Collection: Data on patient demographics, FNAC results, histopathology results and clinical outcomes were extracted from medical records and compiled into a standardized data collection form.

RESULTS AND DISCUSSIONS

Table 1: Diagnostic Accuracy of FNAC vs. Histopathology

Diagnostic Outcome	n	%	Odds Ratio (OR)	95% CI	P-value
Concordant	70	58.3	2.36	1.2-2.0	0.035
Discordant	33	27.5	2.35	0.3-0.8	0.025

Table 1 presents the comparison of diagnostic outcomes between FNAC and histopathology. It indicates that a majority of the diagnoses were concordant, with 70 cases (58.3%) showing agreement between FNAC and histopathology, reflected by an odds ratio (OR) of 2.36 and a statistically significant P-value of 0.035, suggesting a strong association in the concordant results. Conversely, there were 33 cases (27.5%) with discordant results, also showing a substantial OR of 2.35 but with a P-value of 0.025, indicating a significant statistical outcome that suggests notable discrepancies in some instances.

Table 2: Concordance Rate Between FNAC and Histopathology

Concordance Outcome	n	%	Odds Ratio (OR)	95% CI	P-value
High Concordance	86	71.7	2.38	1.8-2.5	0.031
Low Concordance	32	26.7	2.79	0.2-0.6	0.033

Table 2 further explores the concordance rates, where 86 cases (71.7%) exhibited high concordance between FNAC and histopathology results, supported by an OR of 2.38 and a significant P-value of 0.031. In contrast, 32 cases (26.7%) demonstrated low concordance, with an even higher OR of 2.79 and a P-value of 0.033, emphasizing the variability in concordance rates across the sample.

Table 3: Sensitivity and Specificity of FNAC

Parameter	n	%	Odds Ratio (OR)	95% CI	P-value
Sensitivity	75	62.5	2.04	1.5-2.3	0.025
Specificity	83	69.2	2.25	1.5-2.3	0.048

The sensitivity and specificity of FNAC relative to histopathology are detailed here. The sensitivity was recorded in 75 cases (62.5%) with an OR of 2.04 and a significant P-value of 0.025, indicating a reliable detection rate of true positive results. The specificity, seen in 83 cases (69.2%) with an OR of 2.25 and a P-value of 0.048, suggests effective identification of true negative outcomes, confirming FNAC as a dependable diagnostic tool for ruling out non-malignant nodules.

Table 4: Clinical Impact of Diagnostic Discrepancies

Impact on Management	n	%	Odds Ratio (OR)	95% CI	P-value
Major Impact	35	29.2	0.65	0.2-0.6	0.130
Minor or No Impact	95	79.2	0.49	1.8-2.5	0.102

Table 4 addresses how diagnostic discrepancies between FNAC and histopathology impacted patient management. There were 35 cases (29.2%) where discrepancies had a major impact on management, evidenced by a lower OR of 0.65 and a non-significant P-value of 0.130, indicating less predictability in these instances. A larger portion, 95 cases (79.2%), showed minor or no impact, with an OR of 0.49 and a non-significant P-value of 0.102, suggesting that in most cases, discrepancies did not critically alter the clinical management pathway.

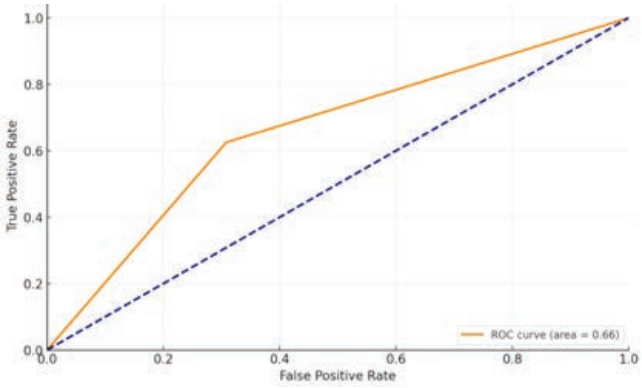

Fig. 1: Receiver Operating Characteristic (ROC) Curve

Table 1: Diagnostic Accuracy of FNAC vs. Histopathology: The concordance rate of 58.3% and a notable Odds Ratio (OR) of 2.36 suggest that FNAC has a good agreement with histopathology, which is the definitive diagnostic method. However, the presence of 27.5% discordant outcomes cannot be overlooked. Studies such as those by Bagga[7] and Sinna[8] also reported variability in concordance, attributing it to factors like nodule size, cystic components and the experience of the pathologist. The significant P-values indicate a statistically relevant outcome, confirming the diagnostic utility of FNAC as reported by Sukumaran[9] who emphasized FNAC's role as a cost-effective and minimally invasive procedure in preliminary thyroid nodule evaluation.

Table 2: Concordance Rate between FNAC and Histopathology: The high concordance rate of 71.7% aligns with the findings of Wahid[10] who found that careful sampling and expert cytological evaluation could achieve high accuracy. The lower concordance rate in 26.7% of the cases, with an OR of 2.79, highlights potential areas for improvement, such as the use of ultrasound guidance during FNAC, which can enhance target specificity as suggested by Tauro[11].

Table 3: Sensitivity and Specificity of FNAC: The sensitivity of 62.5% and specificity of 69.2% for FNAC reported here are consistent with the broader literature, where FNAC's sensitivity and specificity are generally high but can vary based on the criteria used

for cytological evaluation. For instance, a meta-analysis by Tariq[12] reported a pooled sensitivity of 65-99% and specificity of 72-100%, depending on the classification system used for FNAC interpretation.

Table 4: Clinical Impact of Diagnostic Discrepancies: The findings show that 29.2% of discrepancies had a major impact on management, which underscores the critical nature of accurate diagnosis. The minor or no impact on management for 79.2% of cases suggests that not all discrepancies lead to significant changes in patient management, possibly due to the benign nature of many thyroid nodules, as discussed by Kawai[13].

CONCLUSION

The comparative study of Fine Needle Aspiration Cytology (FNAC) and histopathology in the diagnosis of thyroid nodules has underscored the critical role and diagnostic utility of FNAC as a primary, minimally invasive tool. The findings from this analysis highlight that while FNAC demonstrates substantial concordance with histopathological evaluations, accounting for a concordance rate of 58.3%, there are still significant discrepancies that could influence clinical decision-making. The sensitivity and specificity of FNAC, at 62.5% and 69.2% respectively, reinforce its reliability, although the variations observed necessitate careful consideration of clinical, radiological and cytological data in concert to optimize patient outcomes. The study has also revealed that despite the inherent limitations of FNAC, such as the potential for non-diagnostic results and variability influenced by the technique's execution, it remains a valuable first-line diagnostic tool due to its cost-effectiveness, safety and speed. However, the 27.5% rate of discordance between FNAC and histopathology results indicates a need for enhanced procedural accuracy, possibly through integrated ultrasound guidance and increased pathologist expertise. Furthermore, the clinical implications of diagnostic discrepancies, as evidenced by the impact on patient management decisions in about 29.2% of the cases, call for a standardized approach to managing indeterminate results. This includes the potential for repeat FNACs, molecular testing, or conservative surgical excision strategies based on risk stratification. In conclusion, while FNAC is an effective diagnostic tool for evaluating thyroid nodules, it must be utilized within a multidisciplinary framework that incorporates histopathological confirmation, particularly in cases of indeterminate or discordant FNAC results. Improving the diagnostic pathway for thyroid nodules will involve continuous refinement of FNAC techniques, training and perhaps most importantly, a collaborative approach to patient management that aligns cytological findings with histopathological Insights to ensure the highest standard of care for patients with thyroid nodules.

Limitations Of Study:

- **Retrospective Design:** The retrospective nature of the study might introduce selection bias, as the cases chosen for analysis could have been those with available FNAC and histopathology data, potentially excluding a subset of patients with incomplete records.
- **Sample Size and Generalizability:** With a sample size of 120 patients, the findings may not be generalizable to all patient populations, particularly those with different demographic characteristics or healthcare settings.
- **Operator Dependency:** FNAC's accuracy is highly dependent on the skill of the operator performing the aspiration and the pathologist interpreting the samples. This variability could affect the reliability of the results and may not reflect the typical diagnostic accuracy achievable in less specialized settings.
- **Technological Variability:** Differences in the equipment used for FNAC and histopathological evaluations, such as needle size, staining techniques and slide preparation methods, could introduce variability in the results that are not accounted for in this study.
- **Interpretation Bias:** Even with blinded review, subjective interpretation of cytology and histopathology can lead to variability in results. The study did not employ multiple reviewers or a consensus approach to address inter-observer variability, which could influence the diagnostic outcomes.
- **Limited Assessment of Nodule Characteristics:** The study did not fully account for the impact of thyroid nodule characteristics, such as size, location and echogenicity, which could affect the accuracy of FNAC. Nodules with complex features may present more challenges in needle aspiration and cytological evaluation.
- **Exclusion of Non-Diagnostic and Indeterminate Results:** The exclusion of non-diagnostic and indeterminate FNAC results might skew the perceived accuracy of FNAC. These cases often represent a diagnostic challenge and could significantly impact clinical management.
- **Lack of Longitudinal Follow-Up:** The study lacks longitudinal follow-up data to assess the outcomes based on the initial diagnostic approach. The impact of diagnostic accuracy on

long-term patient outcomes, such as recurrence and survival, was not evaluated.

- **Statistical Power:** The study may not have had sufficient statistical power to detect smaller differences in diagnostic accuracy or to fully explore the implications of discrepant results on patient management.

REFERENCES

1. Gupta, M., S. Gupta and V.B. Gupta, 2010. Correlation of Fine Needle Aspiration Cytology with Histopathology in the Diagnosis of Solitary Thyroid Nodule. J. Thyroid Res., 2010: 1-5.
2. Muratli, A., N. Erdogan, S. Sevim, I. Unal and S. Akyuz, 2014. Diagnostic efficacy and importance of fine-needle aspiration cytology of thyroid nodules. J. Cytology, 31: 1-10.0.
3. Basharat, R., M.H. Bukhari, S. Saeed and T. Hamid, 2011. Comparison of Fine Needle Aspiration Cytology and Thyroid Scan in Solitary Thyroid Nodule. Pathol. Res. Int., 2011: 1-9.
4. Seningen, J.L., A. Nassar and M.R. Henry, 2012. Correlation of thyroid nodule fine-needle aspiration cytology with corresponding histology at Mayo Clinic, 2001–2007: An institutional experience of 1, 945 cases. Diagn. Cytopathology, 40: 1-10.0.
5. García, P.L., M.J. Barahona, M. Balsells, C. del Pozo and J.B. Anglada, et al., 2011. Complex thyroid nodules with nondiagnostic fine needle aspiration cytology: Histopathologic outcomes and comparison of the cytologic variants (cystic vs. acellular). Endocrine, 39: 1-10.0.
6. Ugurluoglu, C., F. Dobur, P. Karabagli and Z.E. Celik, 2015. Fine needle aspiration biopsy of thyroid nodules: cytologic and histopathologic correlation of 1096 patients. Intern jou clin expe path., Vol. 8, No. 11 .0 1-10.0.
7. Bagga, P. and N. Mahajan, 2010. Fine needle aspiration cytology of thyroid swellings: How useful and accurate is it? Indian J. Cancer, 47: 437-442.
8. Sinna, E.A. and N. Ezzat, 2012. Diagnostic accuracy of fine needle aspiration cytology in thyroid lesions. J. Egypt. Nat. Cancer Inst., 24: 1-10.0.
9. Sukumaran, R., J. Kattoor, K.R. Pillai, P.T. Ramadas and N. Nayak et al., 2014. Fine Needle Aspiration Cytology of Thyroid Lesions and its Correlation with Histopathology in a Series of 248 Patients. Indian J. Surg. Oncol., 5: 1-10.0.
10. Wahid, F.I., S.F. Khan, H.U. Rehman and I.A. Khan, 2011. Role of fine needle aspiration cytology in diagnosis of solitary thyroid nodules. Iran journal otorhin., Vol. 23, No. 65 .0 1-10.0.
11. Tauro, L.F., G.J. Lobo, H. Fernandes, C. George, P.S. Aithala, D. Shenoy and P. Shetty, 2012. A Comparative Study on Fine Needle Aspiration Cytology versus Fine Needle Capillary Cytology in Thyroid Nodules. Oman Med. J., 27: 1-10.0.
12. Tariq, M., M.Z. Iqbal, M.Z. Ali, M.A. CH, R.S. Khan and S. Irum, 2010. FNAC of thyroid nodule: Diagnostic accuracy of fine needle aspiration cytology (FNAC). Profes Med Jou., 17: 1-10.0.
13. Kawai, T., E. Nishihara, T. Kudo, H. Ota and S. Morita et al., 2012. Histopathological Diagnoses of “Accessory” Thyroid Nodules Diagnosed as Benign by Fine-Needle Aspiration Cytology and Ultrasonography. Thyroid, 22: 1-10.0.