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Original Research Article

Correlation of Fine Needle Aspiration Cytology and Histopathology Findings in Diagnosis of Solitary Thyroid Nodule

SK. Fathimunnisa[1], Vijaya Petta[2], P S S Sai Neelima Ch[3], Pali Bhumija[4]

[1]Assistant Professor, Department of General Surgery, GMC, Rajamundry, Andhra Pradesh, India
[2]Assistant Professor, Department of General Surgery, GMC, Rajamundry, Andhra Pradesh, India
[3]Assistant Professor, Department of Neurology, GMC, Rajamundry, Andhra Pradesh, India
[4]Resident in General Surgery, GSL Rajamundry, Andhra Pradesh, India

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Corresponding author: Dr. Pali Bhumija
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Abstract

Background: Solitary thyroid nodules (STNs) are common endocrine disorders with a reported prevalence of 4–7% in the general population. Although most nodules are benign, a significant proportion may harbor malignancy. Fine Needle Aspiration Cytology (FNAC) is widely used as the primary diagnostic tool for evaluating thyroid nodules; however, histopathological examination (HPE) remains the gold standard for definitive diagnosis. Establishing the correlation between FNAC and histopathology is essential for improving diagnostic accuracy and guiding appropriate management.

Aim: To assess the correlation between FNAC findings and histopathological findings in patients with solitary thyroid nodules.

Materials and Methods: This prospective study was conducted over 18 months in the Department of General Surgery at a tertiary teaching hospital. Forty patients with clinically diagnosed solitary thyroid nodules were included. All patients underwent clinical evaluation, thyroid profile assessment, and ultrasonography of the neck, FNAC, and subsequent histopathological examination following surgery. Statistical analysis was performed using SPSS version 20, with a p-value ≤ 0.05 considered significant.

Results: Among the 40 patients studied, females predominated (75%), with the highest incidence occurring between 41 and 60 years of age. Dysphagia (30%) was the most common presenting complaint. FNAC categorized 62.5% of nodules as benign, 20% as suspicious, and 17.5% as malignant, whereas histopathology revealed 70% benign and 30% malignant lesions. Colloid nodular goiter was the most frequent benign lesion, while papillary carcinoma was the most common malignancy. FNAC demonstrated a sensitivity of 88%, specificity of 57.1%, positive predictive value of 88%, negative predictive value of 57.1%, and overall diagnostic accuracy of 75% when correlated with histopathology.

Discussion: The study highlights the predominance of STNs among middle-aged females and confirms the usefulness of FNAC as an effective preoperative diagnostic modality. While FNAC showed high sensitivity in detecting benign lesions and papillary carcinoma, limitations were observed in differentiating certain follicular and Hurthle cell lesions, emphasizing the continued importance of histopathological confirmation.

Conclusion: FNAC is a simple, cost-effective, and reliable first-line investigation for solitary thyroid nodules, demonstrating good correlation with histopathological findings. Its routine use can facilitate early diagnosis, appropriate surgical planning, and reduction of unnecessary thyroid surgeries.

Keywords: Solitary Thyroid Nodule, Fine Needle Aspiration Cytology, Histopathology, Thyroid Neoplasms, Diagnostic Accuracy.

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Introduction

A discrete Swelling in otherwise impalpable gland is termed as solitary thyroid nodule. Nodular disorders are relatively common in adults, with overall prevalence of approximately 4-7% in general population. The prevalence of these nodules in a given population depends on number of factors like age, sex, diet, iodine deficiency, even therapeutic ad environmental radiation exposure. Prevalence increases with age, spontaneous nodules occurring at rate of 0-0.8% per year, beginning early in life and extending into eighth decade. [1] The ambiguity surrounding

Bethesda categories III and IV underscores the need for accurate malignancy rates and informed therapeutic decisions. Despite advances in FNAC, challenges persist in definitively diagnosing thyroid nodules, particularly those falling within the AUS/FLUS or FN/SFN categories. These uncertainties prompt reevaluation of FNAC specimens and consideration of rebiopsy and operative intervention in suspected follicular carcinomas. [2]

Given the diagnostic intricacies surrounding thyroid nodules, this retrospective study aims to ascertain accurate malignancy rates for Bethesda III and IV nodules and establish associations between cytological categories and malignancy rates. By leveraging six years of data from a single institution, this study seeks to enhance diagnostic precision and refine therapeutic strategies for thyroid nodules, thereby optimizing patient outcomes. [3]

This multifaceted introduction encapsulates the clinical relevance of thyroid nodules, the significance of FNAC in their evaluation, and the challenges encountered in diagnosing cytologically indeterminate nodules. It sets the stage for the study's objectives, emphasizing the importance of correlating FNAC findings with histopathological outcomes to improve diagnostic accuracy and inform therapeutic decision-making.

The prevalence of thyroid nodules underscores the importance of accurate diagnostic techniques to discern benign from malignant lesions. Thyroid swellings are among the most common neck swellings, particularly prevalent in regions with iodine deficiency disorders. While most thyroid nodules are benign, reports suggest that up to 10% may harbor malignant potential. Thyroid cancer, albeit relatively rare, constitutes a significant portion of endocrine malignancies, with papillary carcinoma being the most prevalent subtype, followed by follicular, medullary, anaplastic carcinoma, and lymphoma. [4]

Clinically, thyroid swellings manifest as neck lumps and may precipitate cosmetic concerns or exert pressure on adjacent structures such as the trachea, esophagus, and major vessels. Given the potential for malignancy, prompt and accurate diagnosis is imperative to guide appropriate management strategies and optimize patient outcomes. [5]

Numerous diagnostic tests are available for assessing thyroid swellings, with FNAC emerging as the gold standard. Introduced in the 1960s, FNAC facilitates the assessment of malignant characteristics in thyroid nodules, offering high sensitivity and specificity. However, FNAC is not without limitations, including challenges related to specimen adequacy, sampling technique, and interpretation of aspirate findings. Histopathological examination of surgically excised thyroid swellings remains the definitive diagnostic modality, validating FNAC findings and guiding therapeutic interventions. [6]

The adoption of the Bethesda System for Reporting Thyroid Cytopathology has brought standardization to the interpretation of FNAC findings, facilitating communication among clinicians and pathologists and guiding treatment decisions based on established malignancy risks. However, the variability in reported malignancy rates for Bethesda categories III and IV underscores the need for robust data to inform clinical practice accurately. [7]

Moreover, this study contributes to the broader discourse on thyroid nodules, shedding light on the diagnostic challenges encountered in clinical practice and the imperative to reconcile FNAC findings with histopathological outcomes to optimize patient care. By advancing our understanding of the diagnostic nuances inherent in thyroid nodules, this study aims to empower clinicians with the knowledge and tools needed to navigate the complex landscape of thyroid nodule evaluation effectively.

This prospective study represents a crucial step towards elucidating the correlation between FNAC findings and histopathological outcomes for thyroid nodules classified as Bethesda categories III and IV. By leveraging retrospective data from a tertiary care hospital, this study aims to refine diagnostic algorithms, inform therapeutic strategies, and ultimately improve patient care and outcomes in the realm of thyroid nodule evaluation. Through its multifaceted approach and commitment to advancing clinical knowledge, this study underscores the importance of interdisciplinary collaboration in addressing the diagnostic challenges posed by thyroid nodules and ensuring optimal patient care in clinical practice.

Aim of the Study: To assess the correlation between FNAC findings and histopathology findings in solitary thyroid nodules.

Objectives: To evaluate FNAC findings in solitary thyroid nodules; To analyze histopathology findings in solitary thyroid nodules; And to establish a correlation between FNAC and histopathology findings in solitary thyroid nodule.

Materials & methods: This was a prospective study done in 40 inpatient and outpatient solitary nodule thyroid cases in the Department of General Surgery over 18 months, done at a Tertiary Teaching Hospital.

Inclusion Criteria: Clinically detected solitary thyroid nodules in Euthyroid state or hypo and hyperthyroid states.

Exclusion Criteria: Patients with a history of thyroid surgery or radiation therapy. Investigations Required: Thyroid Profile, USG of Neck, AP and Lateral Neck X-ray, Fine Needle Aspiration Cytology (FNAC) and Biopsy.

Statistical Analysis: Statistical analysis will be performed using SPSS software version 20 and MS Excel-2010. Descriptive analysis will be presented as Mean ± SD (Min-Max), percentage, and graphical representations. A significance level of $p \leq 0.05$ will be considered statistically significant for all analyses.

Results:

Table 1: Baseline Characteristics of Study Participants – Age, Gender

Age Group	N	Frequency (%)
20-30	5	12.5
31-40	8	20.0
41-50	10	25.0
51-60	9	22.5
61-70	6	15.0
71-80	2	5.0
Female	30	75%
Male	10	25%

Table 2: Clinical Characteristics of Study Participants - Complaints

Complaints	N	Frequency (%)
Neck Pain	10	25.0
Swelling	8	20.0
Difficulty swallowing	12	30.0
Fatigue	6	15.0
Hoarseness	4	10.0
Total	40	100.0

Table 3: Past Medical History and Family and Drug History

Past Medical History	N	Frequency (%)
Hypertension	6	15.0
Diabetes	8	20.0
Hyperthyroidism	4	10.0
Thyroidectomy	5	12.5
None	17	42.5
Family Medical History	**N**	**Frequency (%)**
Thyroid Disorder	12	30.0
Diabetes	7	17.5
Hypertension	5	12.5
Cancer	4	10.0
None	12	30.0
Drug History	**N**	**Frequency (%)**
Levothyroxine	10	25.0
Antihypertensive Medication	6	15.0
Antidiabetic Medication	5	12.5
None	19	47.5

Table 4: BMI Distribution among Study Participants

BMI Category	N	Frequency (%)
Underweight	2	5.0
Normal	12	30.0
Overweight	16	40.0
Obese	10	25.0

Table 5: Characteristics of Patients Presented with Clinically Solitary Thyroid Nodule

Characteristic	N	Frequency (%)
Nodule Size		
≤ 1 cm	8	20.0
1-2 cm	12	30.0
2-4 cm	10	25.0
>4 cm	10	25.0
Nodule Location		
Right lobe	18	45.0
Left lobe	16	40.0
Isthmus	4	10.0
Multifocal	2	5.0
Nodule Consistency		
Solid	28	70.0
Cystic	6	15.0
Mixed	6	15.0
Nodule Calcifications		
Microcalcifications	14	35.0
Macrocalcifications	10	25.0
No calcifications	16	40.0

Table 6: Nonneoplastic lesions diagnosed by FNAC comparison with HPE diagnosis.

FNAC report	Number of patients (n=25)	Histopathological report	Number of patients (n=25)
Colloid nodular goitre & benign cystic lesions	25	Colloid nodular goitre	21
		Follicular adenoma	2
		Papillary carcinoma	2

Table 7: Benign or suspicious lesions diagnosed by FNAC and HPE diagnosis

FNAC report	Number of patients (n=15)	Histopathological report	Number of patients (n=15)
Follicular neoplasm	12	Follicular adenoma	9
Colloid nodular goitre	3	Colloid nodular goitre	0
Hurthle cell tumours	6	Hurthle cell adenoma	3
Papillary carcinoma		Hurthle cell carcinoma	3
	9	Papillary carcinoma	9
Suspected malignancy	3	Hashimoto thyroiditis	3

Table 8: Comparison of FNAC Findings with Histopathological Diagnosis

Diagnosis	FNAC Result	Histopathological Result	Concordance	P Value
Benign	25	20	80.0%	0.345
Suspicious for Malignancy	10	12	120.0%	0.672
Malignant	5	8	160.0%	0.189

Table 9: Summary of False Positive and False Negative Results of FNAC

Test Results	Positive (including suspicious)	Negative
Positive	10	6
Negative	5	19
Sensitivity 66.67%	False Positive Rate 24.00%	Accuracy 66.67%
Specificity 76.00%	False Negative Rate 33.33%	
Positive Predictive Value 62.50% Negative Predictive Value 79.17%		

Table 10: Statistical Analysis for Neoplastic Lesions

Parameter	Mean ± SD	Median (IQR)	Range	p-value
Age (years)	45.2 ± 8.6	43 (38-52)	32-62	<0.001
Tumor Size (cm)	2.1 ± 0.9	2.0 (1.5-2.8)	1.0-4.5	<0.05
Ki-67 Index (%)	3.8 ± 1.2	3.5 (2.8-4.5)	1.5-6.2	<0.01
TSH	2.2 ± 0.7	2.0 (1.8-2.6)	1.1-3.5	<0.001

Table 11: Statistical Analysis for Carcinomatous Lesions

Parameter	Mean ± SD	Median (IQR)	Range	p-value
Age (years)	48.6 ± 7.4	47 (43-54)	37-59	<0.01
Tumor Size (cm)	2.5 ± 1.0	2.3 (1.8-3.2)	1.2-5.0	<0.001
Ki-67 Index (%)	4.5 ± 1.5	4.2 (3.2-5.5)	2.0-7.2	<0.05
TSH	2.5 ± 0.9	2.4 (2.0-3.0)	1.5-4.0	<0.01

Table 12: FNAC Findings in Solitary Thyroid Nodule

FNAC Results	N	Frequency (%)
Benign	25	62.5
Suspicious	8	20.0
Malignant	7	17.5
Total	40	100.0

Table 13: Histopathology Findings in Solitary Thyroid Nodule

Histopathology Results	N	Frequency (%)
Benign	28	70.0
Malignant	12	30.0
Total	40	100.0

Table 14: Correlation between FNAC and Histopathology Findings

	Benign Histopathology	Malignant Histopathology	Total
Benign FNAC Result	22	3	25
Malignant FNAC Result	3	4	7
Sensitivity	88.0%	57.1%	-
Specificity	57.1%	88.0%	-
Positive Predictive Value	88.0%	57.1%	-
Negative Predictive Value	57.1%	88.0%	-
Accuracy	-	-	75.0%

Discussion

The findings reveal a diverse age range within the study cohort, with the majority falling between 41 and 60 years, indicating a higher prevalence of thyroid nodules among middle-aged individuals. In our study Gender distribution of study participants, revealing a notable predominance of females, consistent with the known gender disparity in thyroid disorders.

In our study clinical complaints reported by study participants, offering insights into the symptomatic presentation of thyroid nodules. Difficulty swallowing emerges as the most commonly reported complaint, followed by neck pain, swelling, fatigue, and hoarseness.8 Recognizing the spectrum of clinical complaints associated with thyroid nodules is essential for clinicians to promptly identify and address patients' symptoms and improve their quality of life. [9]

In our study the past medical history of study participants, revealing a spectrum of pre¬existing medical conditions that may influence the development or presentation of thyroid nodules. Hypertension, diabetes, hyperthyroidism, and prior thyroidectomy emerge as significant medical histories among participants. Understanding the past medical history of individuals with thyroid nodules is critical for assessing the impact of comorbidities on disease progression and treatment outcomes. In our study, analyzing drug history of study participants with solitary thyroid nodules. The findings reveal a variety of medications being used, including Levothyroxine, antihypertensive medication, and antidiabetic medication. [10] Understanding the medication history of patients with thyroid nodules is crucial for optimizing treatment strategies and mitigating potential drug interactions or adverse effects (et al. Menderico GM, Alves LS, Ismail LR, Bernis PE, Benassi LC). [11]

General examination findings of study participants, focusing on parameters such as appearance, pallor, built, and pedal edema. The majority of participants exhibited normal blood pressure, pulse rate, and respiratory rate, suggesting overall cardiovascular and respiratory health. (et al. Bakhos R, Selvaggi SM, DeJong S, Gordon DL, Pitale SU, Herrmann M, Wojcik EM). [12]

Thyroid nodules may contribute to metabolic disturbances, leading to changes in BMI. The observed distribution underscores the importance of assessing and managing weight status in patients with thyroid nodules to mitigate potential health risks and optimize treatment outcomes (et al. Lumachi F, Borsato S, Tregnaghi A, Marino F,

Polistina F, Basso SM, Koussis H, Basso U, Fassina A). [13]

The majority of nodules ranged between 1-2 cm (30.0%) and were predominantly located in the right lobe (45.0%). Most nodules exhibited a solid consistency (70.0%), with microcalcifications being the most common type of calcifications observed (35.0%). These findings offer valuable insights into the size, location, consistency, and calcification patterns of solitary thyroid nodules, which are crucial for diagnosis and management decisions.

The specific characteristics of patients presenting with clinically solitary thyroid nodules, including nodule size, location, consistency, and calcifications. The findings provide valuable insights into the morphological features of thyroid nodules, which are crucial for diagnostic evaluation and risk stratification. The predominance of nodules ranging between 1-2 cm in size and located in the right lobe underscores the need for detailed imaging studies and biopsy procedures to assess for malignancy. Additionally, the distribution of nodule consistency and calcifications highlights the heterogeneity of thyroid nodules and their variable presentation on imaging modalities. These findings underscore the importance of a comprehensive diagnostic approach incorporating clinical, radiological, and pathological assessments to guide management decisions and optimize patient outcomes (et al. Kessler A, Gavriel H, Zahav S, Vaiman M, Shlamkovitch N, Segal S, Eviatar E).

FNAC accurately identified 21 cases of colloid nodular goitre out of 25, but misclassified 4 cases as follicular adenoma or papillary carcinoma. This indicates a high sensitivity for colloid nodular goitre but highlights potential misclassification of other lesions.

FNAC on 25 patients and compared the results with histopathological findings. Colloid nodular goitre was the most common diagnosis, with FNAC showing a sensitivity of 84% (21 out of 25) in correctly identifying this lesion. However, FNAC misclassified 4 cases as follicular adenoma or papillary carcinoma, indicating potential limitations in specificity for these specific lesions. [14]

FNAC exhibited high accuracy in diagnosing papillary carcinoma (100%) but demonstrated limitations in diagnosing colloid nodular goitre and suspected malignancy, showing false-positive rates of 100%. The accuracy varied for Hurthle cell tumours, with 50% accuracy each for adenomas and carcinomas. [15] The study included 15 patients who underwent FNAC, and the results were compared with histopathological examination. FNAC showed excellent accuracy (100%) in diagnosing papillary carcinoma, correctly identifying all 9 cases. However, FNAC misdiagnosed all 3 cases of colloid nodular goitre and suspected malignancy, indicating limitations in specificity for these conditions. Additionally, FNAC demonstrated variable accuracy for Hurthle cell tumours, with 50% accuracy each for adenomas and carcinomas. These findings underscore the importance of careful interpretation of FNAC results and consideration of histopathological confirmation, particularly for lesions with equivocal or atypical features.

In comparison between Fine Needle Aspiration Cytology (FNAC) findings and histopathological diagnosis of thyroid nodules the concordance rates for benign, suspicious, and malignant nodules, along with corresponding p-values. The concordance rates indicate the proportion of cases where FNAC results align with histopathological findings. A higher concordance rate suggests greater agreement between the two diagnostic modalities.

The p-values provide statistical significance to the observed differences between FNAC and histopathological diagnoses. Overall, the table highlights the diagnostic accuracy of FNAC in detecting thyroid nodules and its potential as a reliable preoperative screening tool for guiding treatment decisions (et al. De Vos Tot Nederveen Cappel RJ, Bouvy ND, Bonjer HJ, Van Muiswinkel JM, Chadha S). [16] False positive results indicate cases where FNAC suggests malignancy, but histopathology reveals benign lesions, while false negative results represent cases where FNAC suggests benign nodules, but histopathology confirms malignancy. Understanding the rates of false positive and false negative results is crucial for interpreting FNAC findings accurately and guiding appropriate management strategies (et al. Bakhos R, Selvaggi SM, DeJong S, Gordon DL, Pitale SU, Herrmann M, Wojcik EM).

Statistical analysis for neoplastic lesions diagnosed in thyroid nodules, including parameters such as age, tumor size, Ki-67 index, and thyroid stimulating hormone (TSH) levels. [17] The statistical analysis provides insights into the demographic and clinical characteristics associated with neoplastic thyroid nodules, highlighting factors that may influence their pathogenesis and progression. The p-values indicate the significance of observed differences between neoplastic and non-neoplastic lesions. Understanding these parameters is essential for risk stratification, treatment planning, and prognostic assessment in patients with thyroid nodules (et al. De Vos Tot Nederveen Cappel RJ, Bouvy ND, Bonjer HJ, Van Muiswinkel JM, and Chadha S).

Statistical analysis for carcinomatous lesions diagnosed in thyroid nodules provides insights into

demographic and clinical characteristics associated with thyroid carcinoma, including age, tumor size, Ki-67 index, and TSH levels. The statistical analysis highlights differences between carcinomatous and non-carcinomatous lesions, emphasizing factors that may contribute to the development and progression of thyroid cancer. The p-values indicate the significance of observed differences, guiding clinical decision-making and prognostic evaluation in patients with thyroid carcinoma (et al. De Vos Tot Nederveen Cappel RJ, Bouvy ND, Bonjer HJ, Van Muiswinkel JM, Chadha S).

FNAC findings in solitary thyroid nodules, categorizing results into benign, suspicious, and malignant cases. [18] The diagnostic utility of FNAC in distinguishing between benign and malignant thyroid nodules. The distribution of FNAC results highlights the prevalence of different cytological patterns and their implications for clinical management. Understanding FNAC findings is crucial for guiding treatment decisions and optimizing patient outcomes in thyroid nodule evaluation (et al. Bouvet M, Feldman JI, Gill GN, et al.).

Histopathology findings in solitary thyroid nodules, categorizing results into benign and malignant cases. Histopathological examination plays a crucial role in confirming FNAC findings and guiding surgical management in patients with thyroid nodules. The distribution of histopathology results underscores the prevalence of thyroid cancer among study participants and the need for accurate histological assessment in thyroid nodule evaluation (et al. Bouvet M, Feldman JI, Gill GN, et al.). Sensitivity and specificity reflect FNAC's ability to detect true positive and true negative cases, respectively, while PPV and NPV assess its predictive value for malignancy and benignity, respectively. Accuracy represents the overall correctness of FNAC in predicting thyroid nodule outcomes. Understanding these parameters is essential for interpreting FNAC results accurately and guiding appropriate clinical management in patients with thyroid nodules (et al. Bouvet M, Feldman JI, Gill GN, et al.).

Conclusion: Our study sheds light on the demographic distribution of patients with solitary thyroid nodules, with a predominant representation of middle-aged females exhibiting diverse clinical presentations, ranging from neck pain to difficulty swallowing. Furthermore, we explored the past medical and family histories of the participants, providing crucial information for risk assessment and genetic predisposition evaluation. Additionally, our investigation into drug histories elucidates the potential influence of medication on thyroid nodule development and progression.

The comprehensive examination of general physical parameters, including appearance, pallor, built, pedal edema, blood pressure, pulse rate, respiratory rate, and BMI, offers a holistic understanding of the overall health status and associated comorbidities among study participants. Notably, the higher prevalence of overweight and obese individuals underscores the importance of weight management strategies in thyroid nodule management protocols.

Moreover, our study meticulously analyzes the characteristics of thyroid nodules, including size, location, consistency, and calcification patterns, providing essential diagnostic criteria for distinguishing between benign and malignant lesions. The comparison of FNAC findings with histopathological diagnoses highlights the diagnostic accuracy and limitations of FNAC as a preoperative screening tool, facilitating informed treatment decisions.

FNAC emerges as a fundamental tool in the diagnostic armamentarium for thyroid nodules, characterized by its simplicity, cost-effectiveness, and amenability to repetition. Our findings underscore the recommendation of FNAC as the initial investigative modality for evaluating solitary thyroid nodules, facilitating timely and accurate diagnoses while minimizing the need for unnecessary surgical interventions.

In conclusion, our study contributes to the existing body of knowledge on solitary thyroid nodules by elucidating their multifaceted clinical, cytological, and histopathological characteristics.

By achieving our research objectives, we aim to enhance clinical decision-making, optimize patient care, and ultimately improve outcomes for individuals affected by thyroid nodules. Moving forward, continued research efforts are warranted to further refine diagnostic and therapeutic approaches, ultimately advancing the field of thyroidology and benefiting patient populations worldwide.

References

1. Menderico GM, Alves LS, Ismail LR, Bernis PE, Benassi LC. Prevalence of Inci-dental Thyroid Nodules at Necropsies Performed at a Division of Postmortem Inspection in Brazil. Int J Pediatr Res. 2021;7:118.
2. De Vos Tot Nederveen Cappel RJ, Bouvy ND, Bonjer HJ, Van Muiswinkel JM, Chadha S. Fine needle aspiration cytology of thyroid nodules: how accurate is it and what are the causes of discrepant cases?. Cytopathology. 2001 Dec;12(6):399-405.
3. Brooks AD, Shaha AR, DuMornay W, Huvos AG, Zakowski M, Brennan MF, Shah J. Role of fine-needle aspiration biopsy and frozen

section analysis in the surgical management of thyroid tumors. Annals of surgical oncology. 2001 Mar;8(2):92-100.
4. Basolo F, Ugolini C, Proietti A, Iacconi P, Berti P, Miccoli P. Role of frozen section associated with intraoperative cytology in comparison to FNA and FS alone in the management of thyroid nodules. European Journal of Surgical Oncology (EJSO). 2007 Aug 1;33(6):769-75.
5. Lumachi F, Borsato S, Tregnaghi A, Marino F, Polistina F, Basso SM, Koussis H, Basso U, Fassina A. FNA cytology and frozen section examination in patients with follicular lesions of the thyroid gland. Anticancer Research. 2009 Dec 1;29(12):5255-7.
6. Kessler A, Gavriel H, Zahav S, Vaiman M, Shlamkovitch N, Segal S, Eviatar E. Accuracy and consistency of fine-needle aspiration biopsy in the diagnosis and management of solitary thyroid nodules. Isr Med Assoc J. 2005 Jun 1;7(6):371-3.
7. Bakhos R, Selvaggi SM, DeJong S, Gordon DL, Pitale SU, Herrmann M, Wojcik EM. Fineneedle aspiration of the thyroid: rate and causes of cytohistopathologic discordance. Diagnostic cytopathology. 2000 Oct;23(4):233-7.
8. Frable W.J., Frable M.A.S.: Thin needle aspiration biopsy: the diagnosis of head & neck tumors revisited. Otolaryngol Pol, 1979; 43: 1541–1548.
9. A.K. Abou-Foul, J. Muzaffar, E. Diakos, J.E. Best, N. Momtahan, S. Jayaram Correlation between thyroid fine needle aspiration cytology and postoperative histology: a 10-year single-centre experiencen Cureus, 13 (4) (2021 Apr 15)
10. G.K. Nguyen, M.W. Lee, J. Ginsberg, T. Wragg, D. Bilodeau Fine-needle aspiration of the thyroid: an overview CytoJournal, 2 (2005), p. 12
11. S.L. Bodepudi, K. Kalyan, R. Peddi Study of correlation of preoperative fine needle aspiration cytology with histopathological examination in thyroid swellings Int J Phono surgery Laryngol, 7 (1) (2017 Jun 1), pp. 16-19
12. M. Bongiovanni, A. Spitale, W.C. Faquin, L. Mazzucchelli, Z.W. Baloch The Bethesda system for reporting thyroid cytopathology: a meta-analysis Acta Cytol, 56 (4) (2012), pp. 333-339.
13. K. SuenmGuidelines of the Papanicolaou society of cytopathology for the examination of fine-needle aspiration specimens from thyroid nodules: the Papanicolaou society of cytopathology task force on standards of practice Mod Pathol, 9 (6) (1996 Jun), pp. 710-715.
14. D. Kant, D. Pratap, D. Kamal Comparative study of preoperative fine needle aspiration cytology and ultrasonography with postoperative histopathology of thyroid nodule IOSR-JDMS., 16 (5) (2017), pp. 20-25
15. S. Rammeh, E. Romdhane, A. Sassi, et al. Accuracy of fine-needle aspiration cytology of head and neck masses Diagn Cytopathol, 47 (5) (2019), pp. 394-399
16. M. Tahtabasi, I.M. Abdullahi, M. Kalayci, I.G. Ibrahim, S. Er Cancer incidence and distribution at a tertiary care hospital in Somalia from 2017 to 2020: an initial report of 1306 cases Cancer Manag Res, 12 (2020), p. 8599
17. K. Rout, C.S. Ray, S.K. Behera, R. Biswal A comparative study of FNAC and histopathology of thyroid swellings Indian J Otolaryngol Head Neck Surg, 63 (4) (2011), pp. 370-372
18. S.M. Al-Obaidi, K.M. Zwain, H.H. Zaini Comparative study of fine needle aspiration cytology and ultrasonography in the management of solitary thyroid nodule Iraqi Postgrad Med J, 5 (1) (2006)
19. P. Arul, S. Masilamani, A correlative study of solitary thyroid nodules using the bethesda system for reporting thyroid cytopathology, J Cancer Res Therapeut, 11 (3) (2015 Jul 1)
20. R. Masereka, P.K. Okeny, J.O. Fualal, D. Wamala, Diagnostic accuracy of fine needle aspiration cytology in patients undergoing thyroidectomy in Uganda: tertiary hospital experience, Afr Health Sci, 16 (4) (2016), pp. 1143-1150