

Role of FNAC in Risk Stratification of Thyroid Lesions Using the Bethesda System for Reporting Thyroid Cytopathology

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Conflict of interest: Nil

Abstract

Introduction: 3-7% of people have palpable thyroid nodules, which are a common finding. The majority of these nodules are benign, however between 5 and 15% of instances are malignant, depending on the patient's age, sex, history of radiation exposure, family history, and other circumstances that call for additional investigation. Due to its low cost and minimally invasive nature, thyroid FNA followed by cytological evaluation is thought upon as the standard of therapy. Interpretation of FNA results thus becomes the key step in order for clinicians to advise if more invasive evaluation is necessary. The best diagnostic method for assessing thyroid nodules prior to surgery is fine-needle aspiration cytology (FNAC). The introduction of The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) provided the opportunity to establish a worldwide standard for reporting and terminology guidelines for diagnostic categories.

Aim and Objectives: To determine the distribution of diagnostic categories and subcategories of reported thyroid nodules in our institute according to TBSRTC. To assess the rate of risk of malignancy of thyroid lesion by using TBSRTC and its importance in preoperative as well as therapeutic management.

Material And Method: This is retrospective study for a period of 6 months of all the cases of thyroid lesions that were referred to pathology department for FNAC.

Results: In this 6 months study we received a total 60 cases of thyroid nodules, including 57 females (95%) and 3 males (5%) and there was female predominance. As per our study middle aged female (33-44 year) are more affected with thyroid lesion. In this study, Utilising TBSRTC, the outcomes of cytological reports were categorised.: (i) 2 cases (3.3%) of Nondiagnostic, (ii) 52 cases (86.7%) of Benign, (iii) 1 case (1.7%) of Atypia of undetermined significance or follicular lesion of undetermined significance, (iv) 3 cases (5.1%) of Follicular neoplasm suspicious for follicular neoplasm, (v) 1 case (1.7%) of Suspicious for malignancy - Suspicious for papillary carcinoma, (vi) 1 case (1.7%) of Malignant - Papillary thyroid carcinoma.

Conclusion: In conclusion, fine needle aspiration cytology is a useful test that is regarded as the gold standard for assessing thyroid nodules. The prognostic usefulness of FNAC is improved by combining it with additional and more sophisticated diagnostic procedures, such as immunocytochemical studies and molecular pathology techniques. As the Bethesda system is a tiered classification, it provides an effective approach for the categorisation of lesion, clinical/surgical management of thyroid lesion. In the present study, the malignancy rate of thyroid lesions is less compared to other study, as many patients are either lost in follow up or referred to a higher centre. Poor socio economic status (iodine deficiency) has also contributed more towards diagnosis of Benign lesion.

Keywords: Thyroid, FNAC, TBSRTC.

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Introduction

3-7% of people have palpable thyroid nodules, which are a common finding [1–3]. The majority of these nodules are benign, however between 5 and 15% of instances are malignant, depending on the patient's age, sex, history of radiation exposure, family history, and other circumstances that call for additional investigation [4–6]. Since the majority of patients with thyroid nodules are asymptomatic, clinical and thyroid ultrasound risk factors are regularly examined to evaluate whether additional thyroid fine needle aspiration (FNA) is necessary [7]. Due to its low cost and minimally invasive nature, thyroid FNA followed by cytological evaluation is thought upon as the standard of therapy. Interpretation of FNA results thus becomes the key step in order for clinicians to advise if more invasive evaluation is necessary. The best diagnostic method for assessing thyroid nodules prior to surgery is fine-needle aspiration cytology (FNAC). [8] The introduction of The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) provided the opportunity to establish a worldwide standard for reporting and terminology guidelines for diagnostic categories. [8] All fine needle aspiration cytology (FNAC) diagnoses were classified according to the features given in the monograph of TBSRTC into

nondiagnostic/unsatisfactory (ND/UNS), benign, atypia of undetermined significance/follicular lesion of undetermined significance (AUS/FLUS), follicular neoplasm/suspicious of a follicular neoplasm (FN/SFN), suspicious for malignancy (SFM), and malignant.

Aims and Objectives:

1. To determine the distribution of diagnostic categories and subcategories of reported thyroid nodules in our institute according to TBSRTC.
2. To assess the rate of risk of malignancy of thyroid lesion by using TBSRTC and its importance in preoperative as well as therapeutic management.

Study Type:

Retrospective & Observational.

Duration:

10th May 2022 to 10th December 2022.

Inclusion Criteria:

Reports of thyroid FNA cytology, Reports of blood thyroid function tests, USG characteristics of thyroid nodules, For patients undergoing thyroid surgeries, also included are surgical pathology.

Methodology

In this study a total 60 patients were selected with thyroid lesions that were referred to Department of Pathology in Parul Sevashram Hospital, Vadodara from 10th May 2022 – 10th December 2022. Information about patients age, sex, USG findings was recorded. Consent of the patient and aseptic precaution was taken. Fine needle aspiration cytology was carried out with a 22 to 24 gauge needle attached to a 10-ml syringe with two to six passes in each nodule. Smears were air-dried, and then

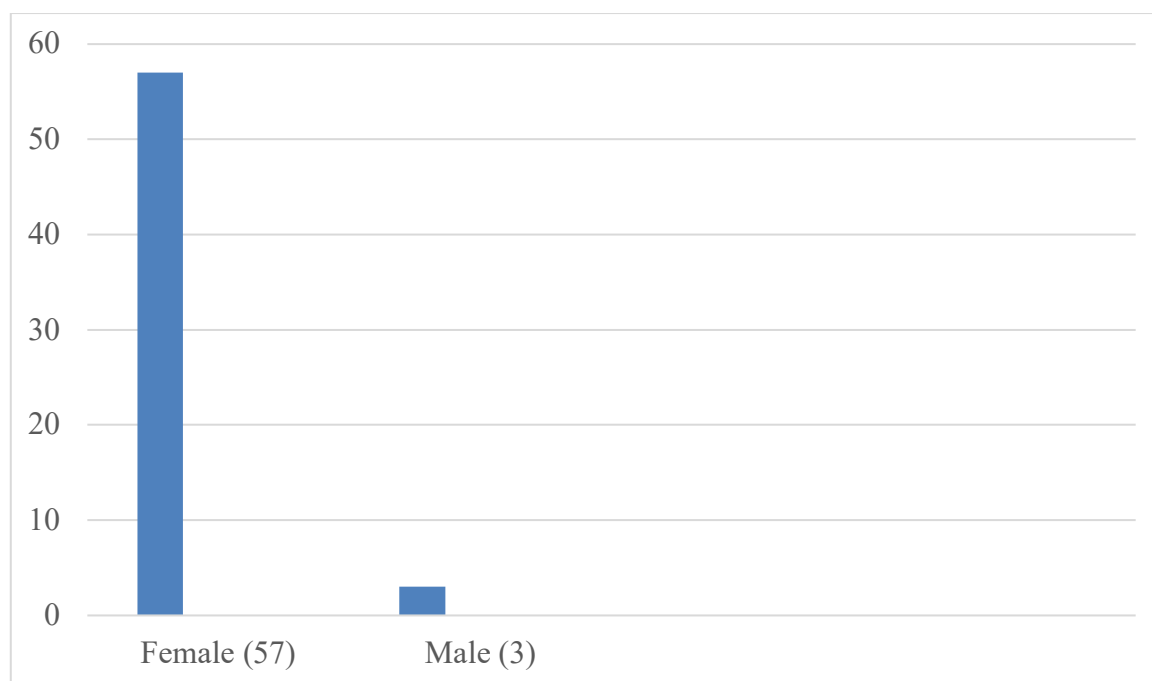
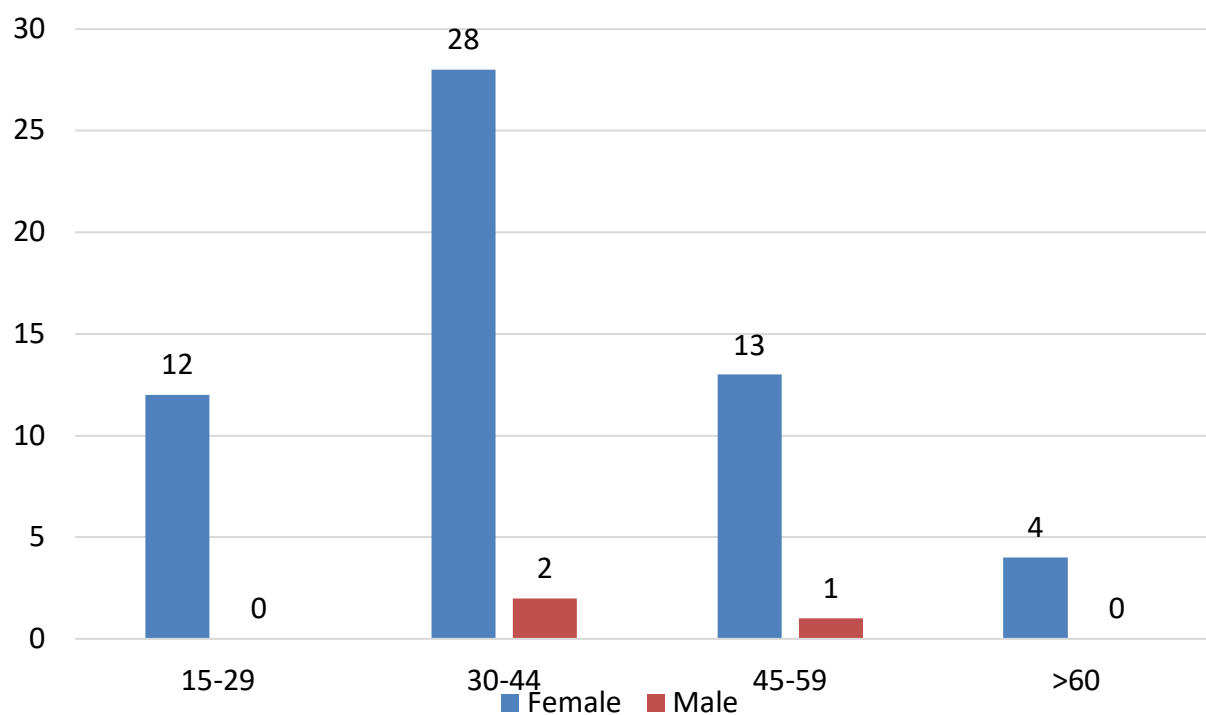
they were fixed with 95% alcohol. The slides were stained using Pap, Giemsa, and H&E stains.

All cases of thyroid FNAC verified by microscopic examination by 2 expert pathologists in the department of pathology. Cytological classification was done according to the guidelines of TBSRTC. Data was collected and the frequency of various thyroid lesions & Age-wise distribution of benign and malignant thyroid lesions were calculated.

Table 1: The Bethesda system for reporting thyroid cytopathology

DIAGNOSTIC CATEGORY		RISK OF MALIGNANCY(%)	USUAL MALIGNANCY
(I) Nondiagnostic or unsatisfactory.(ND/ UNS)	Cyst fluid only, Virtually acellular specimen Other (obscuring blood, clotting artifact etc.)		Repeat FNA with ultrasound guidance
(II) Benign	Consistent with a benign follicular nodule(includes adenomatoid nodule,colloid nodule, etc), Consistent with lymphocytic(Hashimoto) thyroiditis in the proper clinical context, Consistent with granulomatous(subacute) thyroiditis, Other	0-3	Clinical follow up
(III) Atypia of undetermined significance or follicular Lesion of undetermined significance (AUS/FLUS)		5-15	Repeat FNA
(IV) Follicular neoplasm or suspicious for follicular neoplasm(FN/SFN)	Specify if Hurthle cell (oncocytic) type	15-30	Surgical lobectomy
(V) Suspicious for malignancy (SFM)	Suspicious for papillary carcinoma Suspicious for medullary carcinoma Suspicious for metastatic carcinoma, Other	60-75	Near-total thyroidectomy or surgical lobectomy
(VI) Malignant	Papillary thyroid carcinoma, Poorly differentiated carcinoma, Medullary thyroid carcinoma Undifferentiated (anaplastic) carcinoma Squamous cell carcinoma, Carcinoma with mixed feature Metastatic carcinoma, Non - Hodgkin lymphoma, Other	97-99	Near- total thyroidectomy

Result

**Graph 1 : Gender distribution****Graph 2: Age and Gender Wise Distribution**

As per our study, middle aged female are more affected with thyroid lesion.

Table 2 : Bethesda category wise distribution

DIAGNOSTIC CATEGORY	NO OF CASES
I) Nondiagnostic or unsatisfactory (ND/ UNS) Cystic fluid only	02
II) Benign Consistent with a benign follicular nodule	50
Consistent with lymphocytic (Hashimoto) thyroiditis	01
Consistent with granulomatous (subacute) thyroiditis(IN)	01
III) Atypia of undetermined significance or follicular Lesion of undetermined significance (AUS/FLUS)	01
IV) Follicular neoplasm or suspicious for follicular neoplasm(FN/SFN)	03
V) Suspicious for malignancy (SFM) Suspicious for papillary carcinoma	01
VI) Malignant Papillary thyroid carcinoma	01
TOTAL NO OF CASES	60

In this 6 months study we received a total 60 cases of thyroid nodules, including 57 females (95%) and 3 males (5%) [Graph 1] and there was female predominance. As per our study middle aged female (33-44 year) are more affected with thyroid lesion [Graph 2]. Results from cytological reports were classified using TBSRTC: (i) 2 cases (3.3%) of Nondiagnostic, (ii) 52 cases (86.7%) of Benign, (iii) 1 case (1.7%) of Atypia of undetermined significance or follicular lesion of undetermined significance, (iv) 3 cases (5.1%) of Follicular neoplasm or suspicious for follicular neoplasm, (v) 1 case (1.7%) of Suspicious for malignancy - Suspicious for

papillary carcinoma, (vi) 1 case (1.7%) of Malignant - Papillary thyroid carcinoma.

Discussion

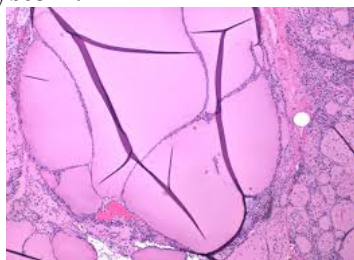
The most prevalent endocrine cancer is thyroid cancer, and its incidence is rising globally. More recent research revealed that the incidence has nearly tripled annually from 4.9 per 100,000 in 1975 to 14.3 per 100,000 in 2009, translating to an estimated 63,000 new cases of thyroid cancer expected to be detected in 2014[7] compared with 37,200 in 2009 when the last ATA guidelines were published[4]. An established method for the preoperative examination of thyroid nodules is fine needle aspiration cytology[8] The

procedure is a noninvasive, affordable, and effective way to distinguish benign thyroid nodules from malignant thyroid nodules.[9] Numerous studies have demonstrated that fine needle aspiration cytology is the most sensitive, accurate, and economical technique for examining solitary thyroid nodules. Its wide use has significantly decreased the number of unnecessary surgeries and other side increase of malignant specimens revealed after thyroidectomies. FNAC lasts an operative-dependent technique, it depends on the skill and experience of the clinician as well as the cytopathologist's expertise. Another limitation of FNAC is allied to the

histological type of the lesion, indeed, unlikely papillary carcinoma can be easily diagnosed on FNAC, and some lesions may not be recognized, example of the presence of micro follicular structures or crowded cellular clusters is a challenge to diagnosis, particularly in low-quality specimens.

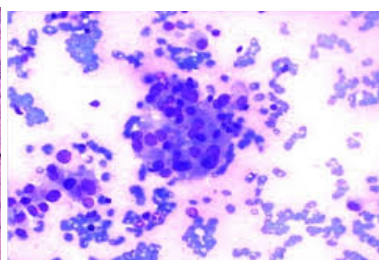
In this 6 months study we received a total 60 cases of thyroid nodules, including 57 females (95%) and 3 males (5%) [Graph 1] and there was female predominance. As per our study middle aged female (33-44 year) are more affected with thyroid lesion [Graph 2].

Cytological features of thyroid lesions and its categorization according to Bethesda system:



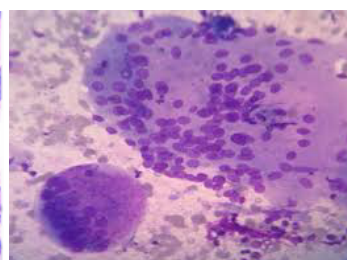
Few benign follicular cells, abundant colloid material

Colloid nodule



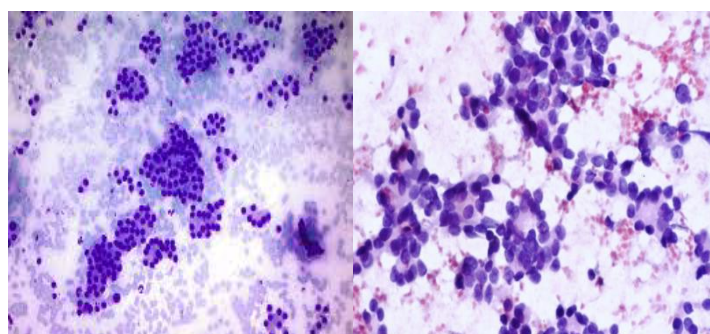
Aggregates of oncocytes and lymphocytic infiltration

Hashimoto's thyroiditis



Few granulomas, multinucleated giant cells, many lymphocytes

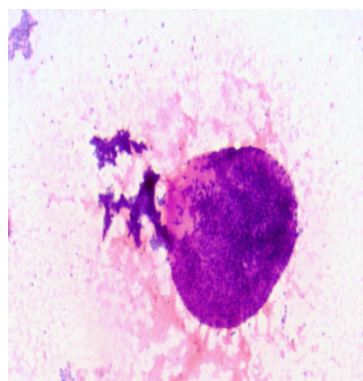
Subacute thyroiditis



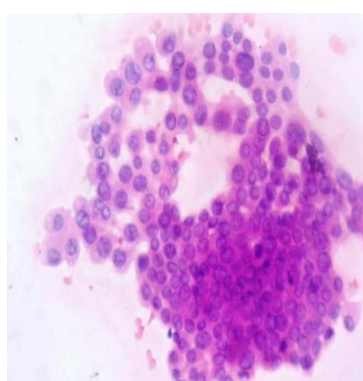
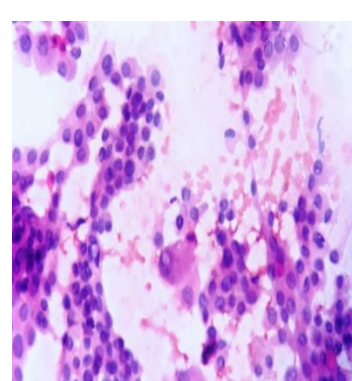
Follicle are small and almost uniform in size

Follicle are small and almost uniform in size

Follicular neoplasm



Papilla like structure

Nuclear grooving, crowding
& overlapping

Intranuclear inclusion

Papillary thyroid carcinoma

Currently, it is highly recommended the use the 2017 Bethesda system for reporting thyroid cytopathology, according to this system, FNAC results are classified into one of six categories: unsatisfactory (Bethesda I), benign (Bethesda II), Atypia of undetermined significance or follicular lesion of undetermined significance (Bethesda III), suspicious for follicular neoplasm (Bethesda IV), suspicious for

malignancy (Bethesda V) and malignant (Bethesda VI). There is a patient treatment choice and a risk for malignancy ascribed to each of these categories. (Table -1)

In this retrospective analysis, we discovered that the TBSRTC preoperative diagnosis of thyroid nodules in our hospital was equivalent to other studies in both earlier local and international studies. (Summarized in Table 3).

Table 3: comparison with other study. ND-Nondiagnostic; AUS/FLUS-Atypia of undetermined significance or follicular lesion of undetermined significance; FN/SFN-follicular neoplasm or suspicious for follicular neoplasm; SFM-Suspicious for malignancy. Cases provided by Z.W.B University of Pennsylvania medical center. Philadelphia, Pa., USA.

	Bchir ^[9]	Mehra ^[10]	Bongiovanni ^[11]	Thewjitcharoen ^[8]	Our study
ND	3.4%	7.1%	12.9%	21.1%	3.3%
BENIGN	74%	80%	59.3%	66.6%	86.7%
AUS/FLUS	0%	4.8%	9.6%	4.7%	1.7%
FN/SFN	12%	2.2%	10.1%	2.4%	5.1%
SFM	0%	3.5%	2.7%	1.8%	1.7%
MALIGNANT	10%	2.2%	5.4%	3.3%	1.7%

In this study, Utilising TBSRTC, the outcomes of cytological reports were categorised.: (i) 2 cases (3.3%) of Nondiagnostic, (ii) 52 cases (86.7%) of Benign, (iii) 1 case (1.7%) of Atypia of undetermined significance or follicular lesion of undetermined significance, (iv) 3 cases (5.1%) of Follicular neoplasm suspicious for follicular neoplasm, (v) 1 case (1.7%) of Suspicious for malignancy - Suspicious for papillary carcinoma, (vi) 1 case (1.7%) of Malignant - Papillary thyroid carcinoma.

86.7% of cases are benign, and 1.7 % of cases are malignant, in comparison to other studies like Bchir et al[9], Mehra et al[10], Bongiovanni et al[11] and Thewjitcharoen et al[8] malignancy rate of thyroid lesions is less as compared to benign lesions. (table -3)

As per our study, the major number of cases fall under category II, which has a lower risk of malignancy and clinical follow-up as further management, which doesn't require aggressive surgical management.

Conclusion

In conclusion, fine needle aspiration cytology is a useful test that is regarded as the gold standard for assessing thyroid nodules.[9].The prognostic usefulness of FNAC is improved by combining it with additional and more sophisticated diagnostic procedures, such as immunocytochemical studies and molecular pathology techniques. As the Bethesda system is a tiered classification, it provides an effective approach for the categorisation of lesion, clinical/surgical management of thyroid lesion. In the present study, the malignancy rate of thyroid lesions is less compared to other study, as many patients are either lost in follow up or referred to a higher centre. Poor socio economic status (iodine

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References:

1. H. Gharib and E. Papini, Thyroid nodules: clinical importance, assessment, and treatment, Endocrinology and Metabolism Clinics of North America, 2007; 36(3): 707–735.
2. D. S. Dean and H. Gharib, Epidemiology of thyroid nodules, Best Practice Research Clinical Endocrinology Metabolism, 2008; 22(6): 901–911.
3. H. Gharib, E. Papini, R. Paschke et al., AACE/AME/ETA Task Force on Thyroid Nodules, Endocrine Practice, 2010; 16(Supplement-1): 1–43.
4. D. S. Cooper, G. M. Doherty, B. R. Haugen et al., Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer, Thyroid, 2009; 19(11): 1167–1214.
5. L. Hegedus, Clinical practice. The thyroid nodule, New England Journal of Medicine, 2004; 351(17): 1764–1771.
6. S. J. Mandel, A 64-year-old woman with a thyroid nodule, Journal of American Medical Association, 2004; 292(21): 2632–2264.
7. B. R. Haugen, E. K. Alexander, K. C. Bible et al., 2015 American Thyroid Association Management Guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer, Thyroid, 2015; 26(1): 1–133.
8. Thewjitcharoen Y., Butadej S., Nakasatien S., Chotwanvirat P., Porramatikul S., Krittiyawong S., Lekpittaya N. and Himathongkam T., Incidence and malignancy rates

- classified by The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)-An 8-year tertiary center experience in Thailand. *Journal of clinical & translational endocrinology*, 2019; 16:100175.
9. Bchir A., Bdioui A., Zammel H., Missaoui N., Hmissa S. and Mokni M., 2021. The importance of using fine-needle aspiration cytology in the diagnosis of thyroid nodules. *Annals of Medicine and Surgery*, 2021; 63:102153.
 10. Mehra, P. and Verma, A.K., 2015. Thyroid cytopathology reporting by the Bethesda system: a two-year prospective study in an academic institution. *Pathology research international*, 2015.
 11. Bongiovanni M., Spitale A., Faquin W.C., Mazzucchelli L. and Baloch Z.W., The Bethesda system for reporting thyroid cytopathology: a meta-analysis. *Acta cytologica*, 2012; 56(4): 333-339.
 12. Cibas, E.S. and Ali, S.Z., The 2017 Bethesda system for reporting thyroid cytopathology. *Thyroid*, 2017; 27(11):1341-1346.
 13. Fine-needle aspiration cytology of nodular thyroid lesions: A 1-year experience of the thyroid cytopathology in a large regional and a university hospital, with histological correlation.
 14. Sridev, M.B., Clinicopathological study and Management of Thyroid Malignancies (Doctoral dissertation, Madras Medical College, Chennai). 2013.