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Classification of Thyroid Lesions FNAC by Bethesda System (2007) for reporting Thyroid Cytopathology–A meta-analysis

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Abstract:
Fine needle aspiration cytology (FNAC) is a screening test used to identify thyroid nodules and aid in subsequent clinical management. However, the benefits have been overshadowed by the variety of reporting systems and nomenclature used. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was developed in 2007 to provide the world with a uniform thyroid cytology reporting system that would allow clinicians to easily interpret the data. In this paper, we examine the status of thyroid FNAC in India in terms of the various reporting systems used, as well as a conceptual analysis of previously published data. Using internet search engines, a thorough review of the literature was conducted. Thyroid cytology reports with detailed classification systems were included. Over 50 studies were found and evaluated. TBSRTC is currently the most widely used reporting system, with numerous studies demonstrating its efficacy and inter-observer concordance. Ancillary techniques have limited applicability and acceptability in thyroid cytology in India as of now. This review included 16 published articles that met the criteria.. Thyroid FNAC is used throughout India. TBSRTC has gained widespread acceptance, with the majority of institutions using it for routine thyroid cytology reporting. The review has discussed a number of potential contributing factors.

Key Words: Cytology, Fine-needle aspiration cytology, Thyroid FN, The Bethesda System, Malignant.

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I. Introduction:

Thyroid nodules are a reasonably common clinical issue. It is critical to distinguish between benign and malignant nodules. For classifying patients with thyroid nodules, fine needle aspiration (FNA) is used as a preoperative diagnostic technique that is safe, simple, and cost effective [1].

Thyroid knobs are normal and can influence up to 60% of the populace. Thyroid knob fine-needle goal cytology (FNAC) has the most noteworthy affectability and prescient worth of any single analytic strategy. It is a fast, practical, and exceptionally valuable strategy for characterizing thyroid knobs as harmless, keeping away from pointless medical procedure, or threatening, requiring a medical procedure. [2-7]

The cytological assessment of thyroid swellings is a fast, basic, and minimal expense analytic strategy that is generally utilized as a screening device. It helps with arranging patients as contender for careful or traditionalist administration. Notwithstanding, the procedure has constraints, basically because of between onlooker and intra-eyewitness fluctuation, especially in uncertain cases. Besides, there is an absence of consistency in the detailing frameworks utilized, which contrast from one country to another as well as from one research facility to another and even between people working at a similar lab. This makes exact understanding by the clinician troublesome, influencing patient consideration. To resolve this normal issue, the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was created dependent on the procedures of the 2007 "Public Cancer Institute Thyroid Fine Needle Aspiration State of the Science Conference" held in Bethesda, Maryland.

TBSRTC incorporates six thyroid cytology classifications, each with a suggested disease hazard and the best method of the board.

I—non-diagnostic, II—benign, III—atypia of unknown significance (AUS)/follicular lesion of unknown significance (FLUS), IV—follicular neoplasm (FN)/suspicious for follicular neoplasm (SFN), V—suspicious for malignancy (SM), and VI—malignant had 1–4%, 0–3%, 5–15%, 15–30%, 60–75%, and 97–99%, respectively

[8].

We present a review of the available Indian literature on the status of thyroid aspiration cytology in India, as well as a meta-analysis of the data.

II. Methodology:

We conducted a thorough literature search in the PubMed and Google Scholar databases using the following keywords: "thyroid," "cytology," "Cytopathology," "audit," "cytology-histology correlation," "the Bethesda system," "TBSRTC," and "FNAC." Included were reports in which a recognizable classification system was used to categories thyroid cytology smears. Case reports and case series were not considered. Cross-references in the chosen articles were also checked for additional studies. Publications with available histopathological correlation were considered for meta-analysis. Publications that did not use TBSRTC but did use a four-tier or higher system (including the "unsatisfactory" category) were reclassified to fit into one of the TBSRTC categories. As a result, "indeterminate cases" were classified as "atypia of unknown significance/follicular lesion of unknown significance" (AUS/FLUS, category III), whereas "follicular neoplasm", "follicular patterned lesion", and "Hurthle cell lesion/neoplasm" were classified as "follicular neoplasm/suspicious for follicular neoplasm" (category IV).. Papers that only provided statistical measures of cytology's performance (sensitivity, specificity, negative and positive predictive values) in comparison to histopathology but did not provide details on histopathological diagnoses were also excluded from the meta-analysis. According to our assessment, the studies used for this review contained a sufficient amount of raw or processed data, making them eligible for inclusion in Bethesda system and otherwise meet our above-mentioned criteria (Table 1).

III. Results

In distributed examinations, the most regularly utilized needle was 23G, trailed by 24G. Thyroid is an exceptionally vascular organ, and given the danger of hemorrhagic entanglements, it is ideal to start the system with a little bore needle (25–27 check). The clean smear would then be able to be outwardly inspected for tissue pieces and additionally colloid, and a bigger bore needle can be utilized for ensuing goals if fundamental [15-16].

In the vast majority of the foundations material is spread onto the glass slide and either air-dried for Romanowsky stains (May-Grünwald-Giemsa, Leishman, Giemsa) or wet-fixed with normal fixatives (95% ethyl liquor, 95% methanol, 95% isopropyl liquor, or an answer of ether and 95 percent liquor) for Papanicolaou as well as hematoxylin-e (H&E). The stains Papanicolaou and H&E help to portray atomic provisions, while Romanowsky stains help to depict cytoplasmic properties. Suctioned liquid is centrifuged and spreads are acquired from the dregs on account of cystic knobs. Romanowsky and Papanicolaou stains are utilized by most of cytopathologists in India. Barely any organizations, be that as it may, pick H&E due to its expense adequacy and unrivaled knowledge of the stain from careful pathology.

Each FNA from any organ framework should be evaluated for sufficiency with regards to clinical and radiological discoveries in cytology. The TBSRTC has set up adequacy prerequisites to diminish the bogus negative rate. Any thyroid FNA example ought to be considered agreeable for assessment if somewhere around six gatherings of very much protected, very much stained, and all around imagined follicular cells are seen on the suction, each gathering containing something like 10 follicular epithelial cells, ideally on a solitary slide, as per TBSRTC [5]. Strong knobs with cytologic atypia, strong knobs with aggravation, and colloid knobs are largely special cases for this standard. Except if clinical and radiological discoveries uncover a harmless growth, pimple liquid with under six gatherings is considered nondiagnostic/inadmissible.

Table1.method of slide preparation and staining ofthepublishedstudiesonthyroidFNA using TBSRTC

No.	Study	Needle sizeandtechnique	Staining technique used		Reporting system followed
			Wet smear	Air-dried smears	
01	Shankar et al. (2016)	n/s+aspiration	Pap	n/s	TBSRTC
02	Prathima et al. (2016)	n/s, USG in some	Pap, HE	Giemsa	TBSRTC
03	Mehrotra et al. (2016)	n/s±aspiration, USG in some	HE	MGG	TBSRTC
04	Tagore et al. (2016)	22G+ aspiration	Pap	MGG	TBSRTC
05	Kalita and Das (2016)	23G± aspiration	n/s	MGG	TBSRTC
06	Bhartiya et al. (2016)	23–24G+ aspiration, USG in somea	Pap	Leishman- Giemsa	TBSRTC

07	Kulkarni et al. (2016)	n/s	Pap	n/s	TBSRTC
08	Lohiya et al. (2016)	23/24G	n/s	MGG	TBSRTC
09	Kasliwal et al. (2016)	24–26G+ aspiration	HE	MGG	TBSRTC
10	Khatib et al. (2016)	n/s, USG if unsatisfactory	Pap	Giemsa	TBSRTC
11	Pantola et al. (2016)	23 G	Pap, HE	MGG	TBSRTC
12	Solanki et al. (2016)	n/s	HE	MGG	TBSRTC
13	Kannan et al. (2017)	n/sa,b	n/s	n/s	TBSRTC
14	Mahajan et al. (2017)	n/s	n/s	n/s	TBSRTC
15	Chandra et al. (2017)	26–28G	Pap, HE	MGG	TBSRTC
16	Laishram et al. (2017)	n/s	n/s	MGG	TBSRTC

Table 2. Descriptive data with the risk of malignancy

S.No.	Study	No. Thyroid FNAC	% Distribution according to the Bethesda system and Risk of malignancy(%)					
			ND/UNS	BENIGN	AUS	SFN	SFM	MALIGNANT
01	Shankar *et al.* (2016)	402	10.7 (0)	81.6 (1.6)	1.2 (0)	1.7 (28.6)	2 (71.4)	2.7 (80)
02	Prathima *et al.* (2016)	178	11.7 (33.3)	77.5 (7.1)	1.1 (50)	3.9 (25)	2.2 (66.7)	3.3 (100)
03	Mehrotra *et al.* (2016)	175	4.6	68.6 (0)	5.7	17.1 (0)	1.1[c](0)	2.9[‡] (100)
04	Tagore *et al.* (2016)	100	3	81	0	9	3	4
05	Kalita and Das (2016)	664	12	72.3	1.8	4.8	1.5	7.5
06	Bhartiya *et al*. (2016)	238	5.9	84 (2)	1.3	2.9 (0)	2.5	3.4 (100)
07	Kulkarni *et al.* (2016)	151	11.2 (0)	76.8 (0)	0	9.3 (25)	0.7	2 (100)
08	Lohiya *et al.* (2016)	250	4	88	2	1.6	0.8	3.6
09	Kasliwal *et al.* (2016)	411	0.5	94.2 (2.6)	0	3.5 (22.2)	0	1.7 (100)
10	Khatib *et al*. (2016)	287	0.7 (0)	87.8 (3.3)	3.5 (20)	4.2 (25)	1.7 (80)	2.1 (100)
11	Pantola *et al.* (2016)	218	5.5 (0)	69.3 (0)	10.5 (8.3)	8.2 (10)	2.3 (100)	4.1 (100)
12	Solanki *et al.* (2016)	1287	22 (18.2)	73.9 (2.6)	0.7 (0)	1.5 (50)	0.4 (50)	1.3 (100)
13	Kannan *et al*. (2017)	404	7.7 (28.6)	40.8 (13)	24.3 (41.7)	10.6 (46.9)	6.9 (96.3)	9.7 (100)
14	Mahajan *et al*. (2017)	4532	3.5 (50)	79.6 (7.8)	2.5 (50)	3.9 (23.6)	0.5 (75)	9.8 (85.4)
15	Chandra *et al.* (2017)	971	5.5	74.9	6.4 (51.4)	2.6	3.2	7
16	Laishram *et al.* (2017)	576	5.2	89.9	0	2.2 (40)	0.3	2.2 (100)

IV. Discussion

The motivation behind thyroid FNA is to recognize harmless from dangerous growths and to focus on patients who need a medical procedure. The six-tired Bethesda strategy gives uniform classification to detailing thyroid FNA spreads, permitting specialists and pathologists to impart and see each other better.Pathologists, endocrinologists, radiologists, and specialists should all convey obviously when revealing thyroid

cytopathology. Subsequently, steady and reproducible indicative wording is basic. The few characterization plans were proposed before the reception of the TBSRTC in 2007 by different expert associations, Japan, the United States (Papanicolaou Society of Cytopathology and American Thyroid Association), the United Kingdom (British Thyroid Association-Royal College of Physicians (BTA-RCP), and Italy (Italian Society for Anatomic Pathology and Cytopathology-International) (SIAPEC-IAP). Most of these grouping plans appear to be 5-layered, instead of the 6-layered plan utilized in the Bethesda framework.

In light of the logical writing, a 6 layered demonstrative grouping framework, like TBSRTC or different plans, ended up being a fantastic device for the finding and the executives of thyroid sores. The fundamental advantage of TBSRTC is the consistency of thyroid cytology announcing wordings. The six TBSRTC indicative classifications were created dependent on the probability of showing proof of threat if a thyroid sore was alloted to a particular classification. The upside of this methodology is that every one of these symptomatic classifications is related with a consecutively expanding inferred hazard of danger, which converts into a clinical and careful administration proposal. Different frameworks, then again, don't unmistakably determine a danger of threat for each demonstrative classification, in spite of the way that their symptomatic classifications are connected to an administration calculation.

As to the danger of harm related with each Bethesda framework classification on follow-up, higher dangers of threat in Category I, II, and III have been noted in investigations with low number of follow-up cases.

Shockingly, when contrasted with different investigations, our review shows the most elevated danger of threat in the harmless class. A portion of these examinations even show a higher danger of threat in Category III than in Category IV, which negates the TBSRTC proposition of a successively expanding inferred hazard of harm.

This could be due to the difficulty pathologists have in categorising lesions into Category III or IV. It could also be linked to an increase in the number of indeterminate FNACs undergoing surgery.

Finally, our study, like most other published investigations, is hampered by the fact that it is a retrospective observational study. This could explain some of the discrepancies between diagnostic category frequencies and malignancy risks. Prospective research employing the Bethesda System will provide a better understanding of the suggested nomenclature's utility. Furthermore, doctors should be aware of the malignancy rate in Bethesda categories in their individual hospitals in order to better management options for patients with thyroid nodules.

V. Conclusion

Thyroid FNAC is used at academic and private institutes, as well as private hospitals and laboratories, all over India and worldwide.TBSRTC is currently the most extensively utilized reporting system. Different studies shows good efficacy and inter-observer concordance. Previous studies including core biopsy and molecular testing, as of now, have limited applicability and acceptability in thyroid cytology. According to this meta-analysis, Category III is the most heterogeneous category with a wide range of ROM and RON. Hence case to case discussion among the clinicians and pathologists supplemented by radiological correlation may aid in better patient care.

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