

Diagnostic Utility of Reporting Thyroid Lesion Cytology by the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)

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Abstract:

Background : Fine needle aspiration cytology, is an initial investigation in evaluation of thyroid lesions. Due to lack of standardized system for reporting thyroid lesions in cytology; in 2007, TBSRTC was introduced. It is a six tier system.

Aim: To compare The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) with the conventional Cytopathology method and their concordance with histopathological diagnosis.

Objective: To compare the morphological diagnosis and classification of thyroid lesions as per conventional Cytopathology method & TBSRTC . Also compare the cytological diagnosis of thyroid swellings with the radiological findings and histopathological proven cases as and when possible.

Material & Methods: The study included 163 cases of thyroid swellings in which 59 cases underwent surgery. Clinical and radiological details were retrieved from the hospital database and were subjected to histopathological evaluation.

Results: In our study, out of 163 cases, majority were females (139, 85.3%) . Age ranged from 17-77 years; mean age was 43 years. Adequacy rate was 92 %. Category II had maximum cases; i.e, 122 .The sensitivity, specificity , PPV and NPV in 59 cases were 94%, 82%, 89%, 90% by conventional cytopathology method; and 97% , 86% , 92% , 95% by TBSRTC respectively. Thus overall TBSRTC was found to be better.

Conclusion: Category I and II had more accurate categorization index. Category V and VI had precision in the diagnosis, that indicates clear cut distinctions between the two ends of spectrum . Category III and IV cases had high discordant rate. This suggests that there is need for further clarity for diagnostic categorization. The findings of TBSRTC could be further refined by applying more advanced immune cytochemical methods and molecular genetic analysis.

Keywords: Fine-Needle Aspiration; Thyroid Gland; Histopathology, TBSRTC.

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Introduction

Fine-needle aspiration cytology (FNAC) of the thyroid gland is now a well-established, first-line diagnostic test for the evaluation of diffuse thyroid lesions as well as of thyroid nodules. Literature shows many classifications recommended for FNAC, like conventional system which includes following categories-

1. Unsatisfactory smears
2. Inflammatory
3. Goitre
4. Indeterminate
5. Follicular neoplasm
6. Suspicious for malignancy and
7. Positive for malignancy.

There was no uniform standardized international recognized system for reporting the thyroid FNAC. This led to confusion and discordance between the clinicians and pathologists in interpretation of thyroid cytopathology reports. Limitations in FNAC due to scant sample, vascularity of thyroid swelling, variation in sampling technique, and skill of the performing expert as well as the experience of pathologist interpreting the aspirate do pose a problem in definitive diagnosis.[1]

To overcome this, The Bethesda System For Reporting Thyroid Cytopathology (TBSRTC) was introduced in 2007 at "Thyroid Fine Needle Aspiration State of the Science Conference" held in Bethesda, Maryland, for unifying the terminology and morphologic criteria along with the corresponding risk of malignancy. [2,3]

It has been revised in 2017. [4] The 2017 revision reaffirms that every thyroid FNA report should begin with one of six diagnostic categories, the names of which remain unchanged since they were first introduced:

The Bethesda System For Reporting Thyroid Cytopathology (TBSRTC), recommended diagnostic categories [5]:

- I. Non Diagnostic Or Unsatisfactory
 - Cyst fluid / Acellular specimen / Others (blood, clotting artifacts, etc)
- II. Benign
 - benign follicular nodule (adenomatoid goiter, colloid goiter)
 - lymphocytic (Hashimoto) thyroiditis
 - granulomatous (subacute) thyroiditis
 - Other
- III. Atypia Of Undetermined Significance (AUS) Or
- IV. Follicular Lesion Of Undetermined Significance (FLUS) Follicular Neoplasm Or Suspicious For A Follicular Neoplasm
- V. Suspicious For Malignancy (Papillary / Medullary / Metastatic carcinoma / Lymphoma / others)
- VI. Malignant (Papillary carcinoma / Poorly differentiated carcinoma / Medullary carcinoma / Undifferentiated (anaplastic) carcinoma / Squamous cell carcinoma / Carcinoma with mixed features (specify) /Metastatic carcinoma / Non – Hodgkin lymphoma / Others).

This study was undertaken to report thyroid cytology smears by TBSRTC into various diagnostic categories and correlate with histology of surgical specimens received.

Materials and Methods

The present study was done at Sri Aurobindo Medical College & PG Institute, Indore (M.P.) after obtaining approval from the Institutional Ethical Committee (letter no. SAIMS/RC/IEC/2021/102) which included 163 cases, during the study period of 18 months (1 April 2021 to 30 September 2022). The cases were

included from January 2019 to March 2021 (retrospective) & April 2021 to March 2022 (prospective). For all prospective cases; a written consent was obtained for the procedure and participation in study. Consent was taken from the patient or from parents in case of minors. For retrospective cases; the slides of cytology & histopathology were retrieved from records in pathology department & relevant clinical data was taken from medical records & files.

For all prospective cases, FNAC was done under aseptic conditions using 23G needles with 10 cc or 20 cc disposable syringes. The material aspirated was immediately transferred onto glass slides. Two slides were air dried and two slides were alcohol fixed for Giemsa and Papanicolaou staining respectively. Slides were labeled with cytopathology number (case number) and then were stained and reported by conventional method by assigned consultant and categorized as mentioned.

The relevant clinical data was captured with help of proforma. Radiological & biochemical findings were noted for all cases. The cytology slides were then coded and reporting was done independently by another assigned consultant using Bethesda system and categorized as mentioned.

The relevant clinical details & radiology findings were provided to the consultant without disclosure of patient or sample identity and report done by conventional method. For all the retrospective cases, the cytology slides were retrieved, coded and were provided to both the consultants without disclosure of previous cytology report for reviewing and reporting independently with respective methods. The histopathology reports of all cases that had undergone biopsy reporting were noted.

All the results were entered in master chart along with clinical & radiological

details. Analysis of data was done and data was distributed as per gender, age, duration of disease, radiological findings, FNAC categories as per conventional and Bethesda system of reporting using SPSS software.

Results

In the present study, a total of 163 cases were included, out of which 139 (85.3%) were females and 24 (14.7%) were males. Age group of these cases ranged from 17 to 77 years with a mean age of 43 years. Majority of the patients were in the age group of 40-50 years. An adequacy rate of 92 % (Table 1) was obtained in the study.

Radiologically 107 cases were non neoplastic out of 163 cases. The benign category (category II of TBSRTC) had the maximum number of cases (122 – Table 2), out of which colloid goiter (Figure 1) was the predominant diagnosis (97 cases – Table 3), followed by Bethesda category IV (follicular neoplasm / suspicious for follicular neoplasm – Figure 2) – 15 cases. A total of 59 cases underwent surgery and in which histopathology study was done , out of which 34 cases were reported as colloid goiter (Table 4). The sensitivity, specificity , positive predictive value (PPV) and the negative predictive value (NPV) in 59 cases which underwent surgery and in which histopathology study was done; was 94%, 82%, 89% and 90% respectively with conventional method of reporting thyroid cytopathology; 97% , 86% , 92% and 95% respectively by TBSRTC and 83%, 91%, 3% and 77% respectively according to radiology (Table 5). Thus overall The Bethesda System of Reporting Thyroid Cytology (TBSRTC) was found to be better in terms of sensitivity, specificity, NPV & PPV compared to the Conventional Method of reporting thyroid cytology.

Table 1: Distribution of Cases According to Adequacy of Smears In TBSRTC (N= 163)

Adequacy	Number	Percentage (%)
Satisfactory	150	92
Non Satisfactory	13	8
Total	163	100

Table 2: Distribution of Cases According to TBSRTC (N= 163)

Categories	Number	Percentage (%)
Category I	13	7.97
Category II	122	74.8
Category III	5	3.1
Category IV	15	9.3
Category V	3	1.8
Category VI	5	3.1
TOTAL	163	100

Table 3: Distribution of Cases under Category II of TBSRTC (N= 122)

Categories	Number	Percentage (%)
Colloid goitre	84	68.8
Adenomatous goitre	15	12.2
Hashimoto's Thyroiditis	23	19
Total	122	100

Table 4: Distribution of Cases According to Histopathological Diagnosis (N = 59)

Categories	Number	Percent (%)
Colloid goitre	34	57.6
Thyroglossal cyst	2	3.5
Follicular adenoma	12	20.3
Follicular carcinoma	1	1.6
Papillary carcinoma	8	13.5
Anaplastic carcinoma	2	3.5
Total	59	100

Table 5: Comparison of Sensitivity, Specificity, PPV, NPV of Conventional Method of Reporting Thyroid Cytopathology, TBSRTC and Radiological Diagnosis

Methods	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Conventional	94	82	89	90
TBSRTC	97	86	92	95
Radiological	83	91	93	77

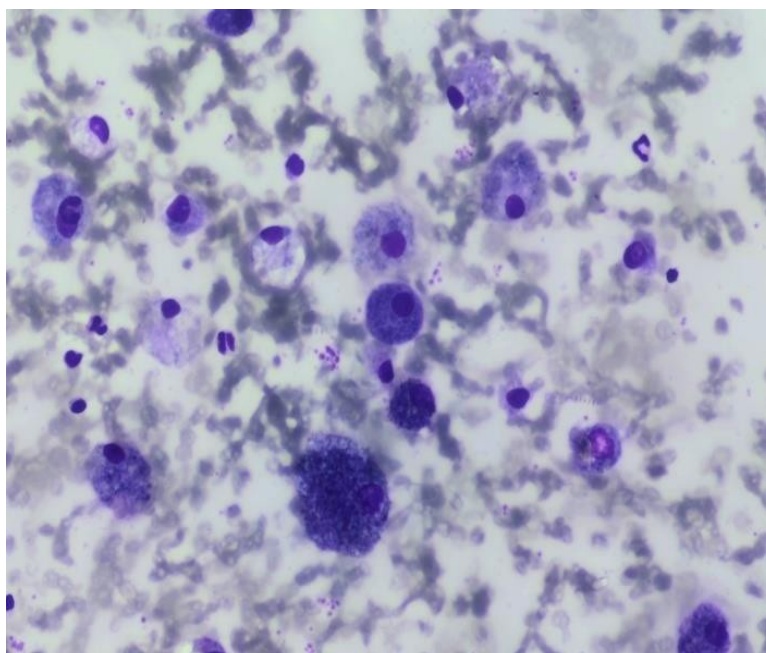


Figure 1: Smear showing cyst macrophages in colloid goitre with cystic degeneration. (40X, Giemsa)

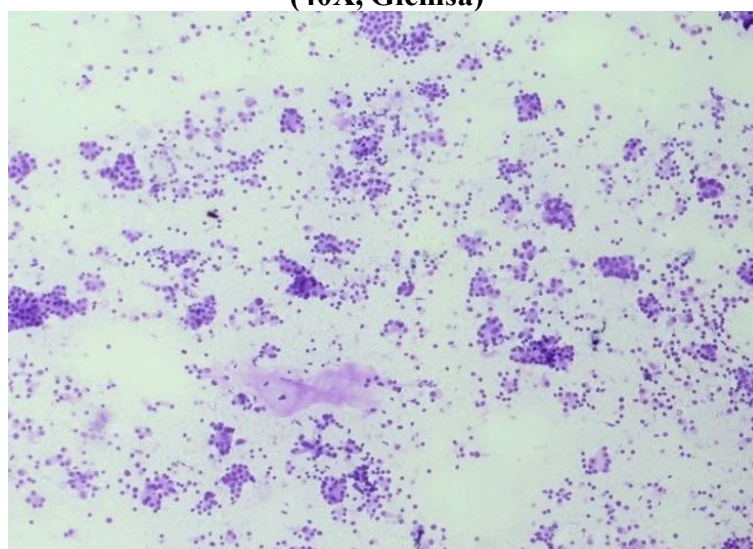


Figure 2 - Smear showing small cohesive sheets of follicular cells with repetitive microfollicle formation in follicular neoplasm (10X, Giemsa)

Discussion

In the present study, the benign category (category II TBSRTC) had the maximum number of cases (122), out of which colloid goitre was the predominant diagnosis (97 cases) which is in concordance with the previous studies (Table 6) done by Leelavathy G et al 6 (2017) and Verma N et al 7 (2018). This was followed by Bethesda category IV (follicular neoplasm / suspicious for follicular neoplasm) that

ranged from 1.5 % to 9.1% in different studies. Similarly in present study 9.2 % cases were reported as category IV.

Study done by Pandey et al 10 (2022) reported 24.5 % cases in category IV which is much high compared to present study and other studies. This could be due to categorizing more cases as follicular neoplasm as compared to benign lesions (55.8 %) in their study.

Table 6: Comparison of The Thyroid Lesions by TBSRTC Categories

Study	Bethesda I(%)	Bethesda II (%)	Bethesda III (%)	Bethesda IV (%)	Bethesda V (%)	Bethesda VI (%)	Total cases
Leelavathy G et al [6] (2017)	3.5	83	0	9.1	2.1	2.1	142
Verma N et al [7] (2018)	2.5	86.2	2.5	1.5	1	6	464
Agrawal D et al [8] (2019)	8.8	60.2	8.1	8.4	8.1	6.1	259
Saleheen et al [9] (2020)	1.3	61.6	5.4	4.1	11	16.4	73
Pandey P et Al [10] (2022)	8.3	55.8	4.5	24.5	2	4.5	240
Present study	7.9	74.8	3	9.2	1.8	3	163

The Sensitivity according to conventional method of reporting thyroid cytopathology ranged from 70 % to 91 % while according to TBSRTC ranged from 44% to 93 %. In the present study Sensitivity by both the methods were 94% and 97% (Table 7) respectively. Studies by Verma N et al [7], Saleheen et al[9] and Pandey et al[10] showed better sensitivity of TBSRTC method compared to conventional reporting method of thyroid cytology, which is similar to findings in the present study. In study by Agrawal D et al[8] , the sensitivity of TBSRTC (44%) was much lower than conventional method (88.8%). This could be due to high percentage of cases reported in category I (8.8%) as non-satisfactory smears and category III (8.1%). As TBSRTC is relatively newer method of reporting thyroid cytology, adaptability and expertise of reporting pathologist can also affect the reporting pattern and outcome. Independent reporting of thyroid cytology by these two methods; if done by two different pathologists, can further reduce any kind of personal bias.

The Specificity according to conventional method of reporting thyroid cytopathology ranged from 40 % to 100 % in different studies, while according to TBSRTC ranged from 30% to 100 %. In studies by

Agrawal D et al[8] & Verma N et al[7]; reporting of thyroid cytology by two methods showed comparable specificity, while study by Saleheen et al[9] showed better specificity by TBSRTC method compared to conventional method which is concordant with present study that showed specificity of 86 % by TBSRTC compared to 82 % by conventional method (Table 7).

The PPV of reporting thyroid cytology by two methods was calculated by only two out of 4 other studies. Study by Agrawal D et al[8] had similar PPV i.e 100% by both methods, while in study by Saleheen et al[9], PPV of TBSRTC (95.6%) was better than conventional method (77%). Similarly in present study PPV was better in TBSRTC (92%) compared to conventional method (89%). The NPV of reporting thyroid cytology by two methods was calculated by only two out of 4 other studies. Study by Agrawal D et al[8] had NPV of 95.1 % by conventional cytology reporting method that was higher than TBSRTC (79.5 %), while in study by Saleheen et al[9], NPV of TBSRTC (95.6%) was better than conventional method (89.1%). Similarly in present study NPV was better in TBSRTC (95%) compared to conventional method (90%).

Table 7: Comparison of Sensitivity, Specificity, PPV, NPV of Conventional Method of Reporting Thyroid Cytopathology and TBSRTC.

Study		Sensitivity (%)	Specificity(%)	PPV (%)	NPV (%)
Agrawal D et al[8] (2019)	Conventional	88.8	100	100	95.1
	TBSRTC	44	100	100	79.5
Verma N et al[7] (2018)	Conventional	90	88	-	-
	TBSRTC	93	86	-	-
Saleheen et al[9] (2020)	Conventional	80.7	87.2	77.7	89.1
	TBSRTC	91	97	95.6	95.6
Pandey P et al[10] (2022)	Conventional	69.91	40.25	-	-
	TBSRTC	84	29.9	-	-
Present study	Conventional	94	82	89	90
	TBSRTC	97	86	92	95

Conclusion

Thyroid swellings are still an enigma to the surgeon and the pathologist. Diagnostic accuracy of cytopathology is proven by the present study with 86% specificity and 92% PPV with TBSRTC. While 82% specificity and 89 % PPV with conventional system. 91% specificity and 93 % PPV with radiology. Thus, as a screening test before surgery, FNAC still needs to be followed as a routine procedure for successful patient management.

Adequacy rate of the present study is 92%. This can be further enhanced by further imaging technique like ultrasound. Category I and II in the non-neoplastic category of The Bethesda system have more accurate categorization index. Similarly category V and VI had precision in the diagnosis. This indicates that there are clear cut distinctions between the two ends of the spectrum of non- neoplastic and neoplastic lesions. However category III and category IV cases had high discordant rate. This suggests that there is need of further clarity for diagnostic categorization.

The findings of TBSRTC could be further refined by applying more advanced immune cytochemical and molecular genetic analysis to these cases. Comparison

of TBSRTC with conventional method of reporting thyroid cytology shows that TBSRTC is better method in terms of sensitivity, specificity, PPV & NPV. It helps to have more objectivity in reporting thyroid cytology and help to avoid over reporting in cases with inadequate FNAC material. TBSRTC also helps to categorize the cases in multiple categories that can have overlapping cytology findings making them difficult to be put in benign or neoplastic category by conventional method. Also the category IV (follicular lesion of undetermined significance) is additional category that is absent in reporting terms of conventional method, which help to avoid over reporting of cases as follicular neoplasms.

Further studies involving larger sample size and with specialized techniques is the need of the hour for cases with thyroid swelling. Till that time applying TBSRTC in routine reporting of thyroid cytology can be better alternative to reduce false positive or negative reporting of non-neoplastic and neoplastic lesions of thyroid there by avoiding unwarranted surgeries.

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