Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN: 0976-3376

Asian Journal of Science and Technology
Vol. 08, Issue, 09, pp.5574-5579, September, 2017

RESEARCH ARTICLE

THE BETHESDA SYSTEM FOR REPORTING THYROID CYTOPATHOLOGY- EXPERIENCE AT B. J. MEDICAL COLLEGE, AHMEDABAD

***Dr. Hiren Mundiya and Nishith Thakor**

Post Graduate Resident Doctor, Department of Pathology, B.J.Medical College, Civil Hospital, Ahmedabad-380016, India

ARTICLE INFO

Article History:
Received 21st June, 2017
Received in revised form
19th July, 2017
Accepted 04th August, 2017
Published online 15th September, 2017

Key words:
The Bethesda System for Reporting Thyroid Cytology (TBSRTC),
FNA, cytology,
thyroid, screening,
B.J. Medical College.

ABSTRACT

Background: FNAC is a crucial primary screening investigation for thyroid lesions nowadays. It is critical that the cyto-pathologist communicate thyroid FNA interpretations to the referring physician in terms that are succinct, unambiguous, and helpful clinically. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) functions as a link between pathologist and physician/surgeon to understand the reporting and helpful to avoid any misunderstanding. It also provides diagnostic categories according to which treatment of the patient will be undertaken to avoid unnecessary surgery in certain lesions.

Aims and Objectives: To assess the efficacy of Thyroid cytology on the basis of The Bethesda System for Reporting Thyroid Cytology (TBSRTC), to know the implied risk of malignancy in a particular category and a rational clinical management guideline on the basis of Tbsrtc. Materials and Methods: In this prospective study, 105 FNAs were carried out on patients with thyroid swelling at Pathology Department, Ahmedabad over period of 6 months and reported using TBSRTC guidelines. All the results were noted and compared with the other international studies. RESULTS: In the present study, patient presented with the thyroid swelling. The mean age of presentation was 34 years (10-82) and the Male to Female ratio was 1:9. The commonest cytological diagnosis was Category II-benign follicular lesion of thyroid followed by the malignant thyroid lesions (papillary carcinoma being the commonest one). In DC V and DC VI, all cases were of papillary carcinomas which were confirmed on histo-pathological follow up. Measures of a diagnostic accuracy of FNAC thyroid includes sensitivity and specificity which are 85% and 100% respectively. The positive predictive value (PPV) and negative predictive value (NPV) were 100% and 92.8% respectively.

Conclusion: As evidenced by its high sensitivity and high NPV, TBSRTC has proven to be an effective and robust thyroid FNA classification scheme to guide the clinical management of patients with thyroid nodules. TBSTRC reduces inter-observer variability and provides good communication between the surgeon and pathologist. It implicates guidelines for cancer risk and clinical management to the surgeons avoiding unnecessary surgery.

INTRODUCTION

Fine needle aspiration (FNA) cytology is a widely utilized tool for the diagnosis of thyroid lesions with a high degree of sensitivity, specificity and diagnostic accuracy (Leonard N *et al*., 1997), (Bakhos R *et al*., 2000).To address the terminology and other issues related to thyroid FNA, the National Cancer Institute (NCI) hosted the ‘‘the NCI Thyroid Fine Needle Aspiration State of the Science conference’’ in 2007 at Bethesda, Maryland. The conclusions of the meeting led to the Bethesda Thyroid. Atlas Project and formed the framework for The Bethesda System for Reporting Thyroid Cytology (TBSRTC) (The Bethesda System for Reporting Thyroid Cytopathology), (Baloch *et al*., 2008). The adoption of the system will facilitate communicationamong the cyto-pathologist, surgeon, endocrinologist and radiologist and also allow easy and reliable sharing of data from different laboratories for national and international collaborative studies. TBSRTC recommended certain categories and the rationale of this categorization is to implicate cancer risk associated with each category along with guidelines for clinical management. It is critical that the cyto-pathologist communicate thyroid FNA interpretations to the referring physician in terms that are succinct, unambiguous, and helpful clinically (Baloch *et al*. 2008).

****Corresponding author:*** **Dr. Hiren Mundiya**
Post graduate resident doctor, Department of Pathology, B.J.Medical College, Civil Hospital, Ahmedabad-380016, India.

Aims and Objectives

- To categorize various thyroid lesion according to TBSRTC.
- To study prevalence of various thyroid lesions in the community.
- To assess the efficacy of Thyroid cytology on the basis of TBSRTC.

Literature Survey

TBSRTC recommends five general diagnostic categories and suggests that each report should begin with a general diagnostic categoryHaving two alternative names and some having degree of sub-categorization.TBSRTC diagnostic categories are as follows (Cibas *et al*., 2009).

The Bethesda System for Reporting Thyroid Cytopathology: Recommended Diagnostic Categories (Baloch ZW et al., 2010).

NO	Category	Subcategories
I	Non-diagnostic or unsatisfactory (ND/UNS)	Cyst fluid only. Virtually acellular specimen. Others (obscuring blood, collecting artifacts etc.)
II	Benign	Benign follicular nodules (including adenomatoid nodules, colloid nodules etc.). Lymphocytic (hashimoto's) thyroiditis. Granulomatous thyroiditis. Others.
III	Atypia of undetermined significance or follicular lesion of undetermined significance. (AUS/FLUS)	
IV	Follicular neoplasia or suspicious for follicular neoplasia. Specify if hurthle cell (oncocytic) type. (FN/SFN)	
V	Suspicious for malignancy (SM)	Suspicious for papillary carcinoma. Suspicious for medullary carcinoma. Suspicious for metastatic carcinoma. Suspicious for lymphoma. Others.
VI	Malignant (M)	Papillary thyroid carcinoma. Poorly differentiated carcinoma. Medullary thyroid carcinoma. Undifferentiated (anaplastic) carcinoma. Squamous cell carcinoma. Carcinoma with mixed features (specify). Metastatic carcinoma. Non-Hodgkin's lymphoma. Others.

Each category has an implied cancer risk and is linked to evidence-based clinical management guidelines (Baloch ZW et al., 2010).

Category	Risk of malignancy (%)	Management guidelines[a]
ND/UNS	1-4	Repeat FNA with ultrasound guidance
Benign	0-3	Clinical follow up
AUS/FLUS	5-15	Repeat FNA
FN/SFN	15-30	Surgical lobectomy
Suspicious for malignancy	60-75	Near-total thyroidectomy or surgical lobectomy
Malignant	97-99	Near-total thyroidectomy[c]

[a] Actual management may depend on other factors (e.g., clinical and sonographic) besides the FNA interpretation.
[C] In the case of "suspicious for metastatic tumor" or a "malignant" interpretation indicating metastatic tumor rather than a primary thyroid malignancy, surgery may not be indicated.

Detail description of each category

Category I—nondiagnostic or unsatisfactory (ND/UNS)

An UNS specimen is always ND but some technically satisfactory specimens may also be considered ''nondiagnostic'' that is, showing nonspecific features not conclusively diagnostic of a particular entity. TBSRTC recommends certain criteria for adequacy, as a minimum of six groups of well visualized thyroid follicular cells with at least 10 cells per group, preferably on a single slide. Most of our cases showed only cyst fluid with plenty of foamy macrophages (Fig. 1). Exceptions to this category are solid nodules with cytologicatypia, solid nodules with inflammation and colloid nodules. ND/UNS results occur in 2–20% of cases but ideally should be limited to no more than 10% of thyroid FNAs (Yang J. *et al*., 2007), (Ravetto C. *Et al*., 2000).

Category II—benign

It includes benign follicular nodule (adenomatoid nodule, colloid nodule), lymphocytic (Hashimoto's) thyroiditis and granulomatous (sub-acute) thyroiditis. The term benign follicular nodule is applied to the most common benign pattern; where an adequate specimen is composed of varying proportion of colloid and benign follicular cells arranged as macro follicles and micro follicle fragments. The criteria for Hashimoto's thyroiditis are a polymorphic lymphoid population and occasional plasma cells and hurthle calls arranged in sheets or as isolated cells (Fig. 2).

Category III—atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS)

Thyroid FNAs that do not fit into benign, suspicious or malignant categories are included here. AUS/FLUS is reserved for specimens that contain cells (follicular, lymphoid) with architectural atypia that isn't sufficient to be classified as suspicious for a follicular neoplasm (FN) or malignancy and on the other hand atypia is more marked than benign change (Fig. 3).According to TBSRTC AUS/FLUS is a category of resort and should not be used indiscriminately.

Category IV—FN or suspicious for a FN (FN/SFN)

The aim of this category is to identify a nodule that might be a follicular carcinoma. Follicular carcinomas have cytomorphologic features that distinguish them from benign follicular nodules but do not permit distinction from a Follicular adenoma (FA). They are reportable as FN or SFN. About 15–30% of these cases called FN/SFN prove to be malignant (Yassa *et al*., 2007), (Cibas *et al*., 2009), (Yang *et al*., 2007), while the rest being FAs or adenomatoid nodules of Multi-nodular goiter (Yassa L. *et al*., 2007), (Baloch ZW *et al*., 2002). The criteria for reporting under TBSRTC category IV are significant alteration in the follicular cell architecture characterized by cell crowding, micro follicles, dispersed isolated cells and scant or absent colloid (Fg. 4). The criteria for FN Hurthle cell type/suspicious for a FN Hurthle cell type FNHCT/SFNHC (subcategory of TBSRTC IV) are a sample consisting exclusively of hurthle cells, usually little or no colloid or virtually no lymphocytes or plasma cells (Fig. 4).

Category V—suspicious for malignancy

Many thyroid cancers, especially PTC can be diagnosed with certainty by FNA. But the nuclear and architectural changes of some PTCs are subtle and focal. This is particularly true of the follicular variant of PTC, which can be difficult to distinguish from a benign follicular nodule. If only one or two characteristic features of PTC are present, if they are only focal, or if the sample is sparsely cellular a malignant diagnosis cannot be made with certainty (Fig. 5). Such cases are best classified as suspicious for malignancy. Most (60–75%) of these cases prove to be papillary carcinomas and the rest are usually FAs (Yassa L. *et al*., 2007), (Yang J. *et al*., 2007), (Logani S *et al*., 2000). The same general principle applies to other thyroid malignancies like medullary carcinoma and lymphoma, where ancillary tests help.

Category VI—malignant

It is used whenever the cyto-morphologic features are conclusive for malignancy.

- The criteria for reporting PTC are follicular cells arranged in papillae/syncytial like monolayers, altered follicular cells exhibiting characteristic nuclear features like enlarged oval or irregular molded nuclei, longitudinal nuclear grooves, intranuclear cytoplasmic pseudo inclusions, pale nuclei with powdery chromatin and psammoma bodies (Fig. 6).
- The criteria for reporting medullary carcinoma are moderate to markedly cellular smears, with plasmacytoid, polygonal, round or spindle shaped cells. Amyloid is often present and appears as dense amorphous material.
- The criteria for reporting anaplastic thyroid carcinoma are neoplastic cells arranged in groups or discretely. Individual cells being epitheloid, spindled, plasmacytoid or rhabdoid in shape. Nuclear pleomorphism, multinucleation and neutrophilic infiltration of tumor cell cytoplasm are other features. Mitotic activity will be numerous and abnormal (Fig. 6).
- The criteria for reporting a lymphoma are markedly cellular smears composed of noncohesiveround to slightly oval cells with vesicular chromatin and prominent nucleoli.

Committee V of the NCIThyroid Fine Needle Aspiration State of the Science Conference has provided guidelines for indications of ancillary studies, specific ancillary studies to be performed and sample preparation for each study. Immunohistochemistry panels have been suggested for suspicious malignancies which include medullary carcinoma (calcitonin, thyroglobulin, CEA, and chromogranin), anaplastic carcinoma (pan-cytokeratin), and metastatic carcinoma (TTF-1). These are to be done on cell block from FNA, preferably including at least one dedicated pass for the study. For suspicious lymphoma, flow cytometricimmunophenotyping is suggested. Dedicated passes are also needed for studies to detect genetic alterations such as BRAF mutation or RET/PTC chromosomal rearrangements, which are very promising for the diagnosis of papillary carcinoma. Immunocytochemistry on cytospin, direct smear, or prefixed monolayer may also be utilized, but protocols should be carefully validated (A. C. Filie *et al*., 2008).

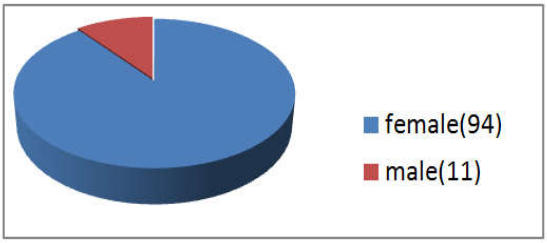
MATERIALS AND METHODS

A prospective study of 105 cases of thyroid FNAs was done in the Department of pathology, B.J.M.C., Civil hospital, Ahmedabad over a period of 6 months.

Procedure: The relevant clinical details will be collected from the patient and general physical examination along with local examination of thyroid will be done. Informed written consent will be obtained from the patient for FNAC. Patient will be made to lie supine with a pillow behind the neck for hyperextension. Taking all aseptic precautions FNAC will be performed after instructing the patient to refrain from swallowing, using disposable syringe (10ml) and 19-24G needle. Minimum of 2-3 passes depending on size of the lesion will be done. Smears will be prepared and 95% Ethyl Alcohol will be used as fixative for wet smears. Air dried smears will be stained with Giemsa and wet smears with Papanicolaou stains and H&E. Ultrasound guided FNAC will be done whenever indicated. Histo-pathological follow up was gathered and results were noted. FNAs were reported using TBSRTC and cancer risk with guidelines for further management were communicated to the surgeon. All the results were noted and compared with the other international studies.

RESULTS AND DISCUSSION

A total of 105 cases of FNA of thyroid lesions were studied in the department of Pathology at B.J. Medical College, Ahmedabad and the results are discussed below.



	Male: Female
Present study	1:9
Naz et al.	1:4
Al dawish et al.	1:5

In the present study, male to female ratio was approximately 1:9 and age at presentation varied from 10 to 82 years with mean age being 34 years. Most common clinical presentation was a neck swelling of variable measurements and consistency. Similar results were recorded in a study by Naz *et al*. and Al dawish *et al*. with male to female ratio of 1:4 and 1:5 while the mean age of presentation being 39 years and 46 years respectively.10 Besides, the male to female ratio reported in this study for thyroid cancer (1:9) concurs with the concept that thyroid cancer occurs more commonly among women. The commonest cytological diagnostic category in our study was benign (DC II) with 81.90% of total cases followed by DC V + DC VI having 9.51% of total cases. ND/UNS (DC I) includes 5 cases (4.76%) out of total 105 cases while FN/SFN (DC IV) showed 3 cases (2.85%). Only a single case had been reported in the AUS/FLUS (DC III) category.

Table 2. Distribution of Cases in Each Diagnostic Category Of Tbsrtc

Serial no	Diagnostic Category (DC)	No of cases	Percentage
I	ND/UNS	5	4.76
II	Benign	86	81.90
III	AUS/FLUS	1	0.95
IV	FN/SFN	3	2.85
V	Suspicious for malignancy	6	5.71
VI	Malignant	4	3.80
	TOTAL	105	100

Table 3. Comparision of case distribution (%) according to tbsrtc with other studies

Study	ND/ UNS	Benign	AUS/ FLUS	FN/ SFN	SM	Malignant
Present	4.76	81.90	0.95	2.85	5.71	3.80
M. Bongiovani et al.	13	59	9.6	10.1	2.6	5.4
Naz et al.	4.7	76.3	12.7	2.1	3.4	0.8
Payal et al.	7.2	80	4.9	2.2	3.6	2.2
AL Dawish MA et al.	3.2	75.3	9.1	5	2.2	5.1
Mondal SK et al.	1.2	87.5	1	4.2	1.4	4.7
Mufti ST et al.	11.6	77.6	0.8	4	2.4	3.6

Table 4. Distribution of cases in benign category (dc ii) of tbsrtc

Subcategory	No of cases	Present study (%)	Payal et al. (%)
Benign follicular nodule	62	75.06	76.7
Hashimoto's thyroiditis	23	26.75	20
Granulomatous/ subaacutethyroiditis	1	1.16	1.1
Others	0	0	2.2
Total	86	100	100

Table 5. Details of lesions categorized as suspicious of malignancy (tbsrtc primary category v)

subcategory	No of cases	Present study (%)	Payal et al. (%)
Suspicious for papillary thyroid carcinoma	4	66.7	75
Suspicious for medullary thyroid carcinoma	0	0	0
Suspicious for lymphoma	0	0	12.5
Other	2	33.3	12.5
total	86	100	100

Results of case distribution in six categories of TBSRTC in our study were in highly concordance with other international studies. Most of the literature/studies showed highest percent distribution of cases in benign category (DC II) of TBSRTC which imparts clinical follow up only as a further management reducing the unnecessary surgical procedure and providing better patient compliance.In the ND/UNS category, all cases were subcategorized as cyst fluid only. There was no case in subcategory virtually acellular specimen or other (obscuring blood, clotting artifact, etc.). Payal *et al*. showed similar results with 7.2% (16/225 cases) as cyst fluid only.we recorded highest no of cases in Benign category which included benign follicular nodule (colloid nodule, adenomatoid nodule, cystic lesion), hashimoto's (lymphocytic) thyroiditis and granulomatous (subacute) thyroiditis showing 75.06%, 26.75% and 1.16% of total cases. Similar distribution was noted by Payal *et al*. showing majority of cases of benign follicular nodule(76.7%) followed by hashimoto's thyroiditis (20%) in the benign category which are comparable to the results noted in the present study. None of cases were assigned to the subcategory 'others' in our study while Payal *et al*. showed 2.2% cases as 'others'. A single case (0.95% of total cases) was noted in the AUS/FLUS category in our study while Payal *et al*. showed 4.9% cases of total for the same. There were 2.85% cases in category FN/SFN (Figure 5) and there was no case of FN, Hurthle cell type. 2.2% cases were assigned category SF/SFN in a study done by Payal *et al*.

The cases of suspicious papillary thyroid carcinomas (PTCs) formed the majority of the cases (66.7%). Remaining 2 cases were assigned to the subcategory 'other' as it was having the features suspicious for malignancy but not characteristic of any particular diagnostic subcategory. Concordance in the results was noted between present study and a study done by Payal *et al*. which had one additional case subcategorized as "suspicious for lymphoma".

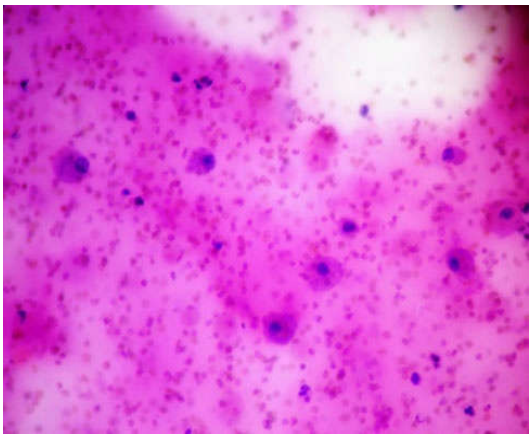


Figure 1. microscopic photograph showing cystic macrophages in a bloody background (TBSRTC DC I). (H&E, 40X)

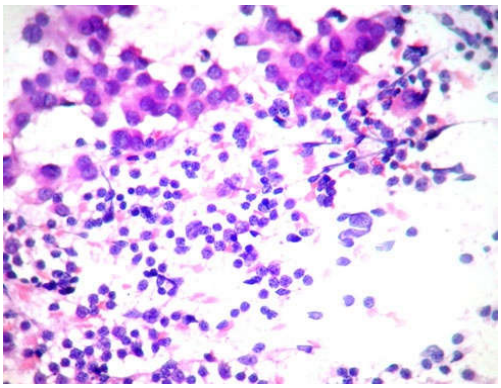


Figure 2. microscopic photograph showing TBSRTC category II Benign-Hashimoto's thyroiditis, Hurthle cells with abundant pink cytoplasm and lymphocytes. (H&E, 40X)

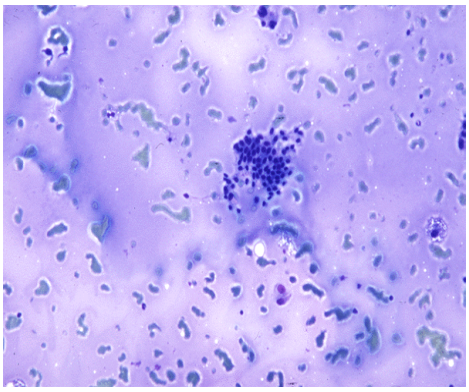


Figure 3. microscopic photograph showing colloid nodule- benign epithelial cells with macrophages (tbsrtc dc ii). (h&e, 20x)

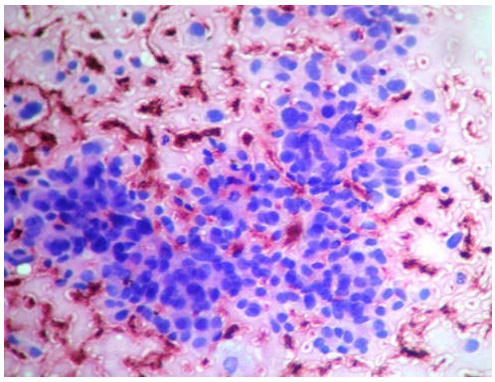


Figure 4. Microscopic photograph showing thyroid follicular cells with cyto-architectural atypia (TBSRTC DC III). (H&E, 40X)

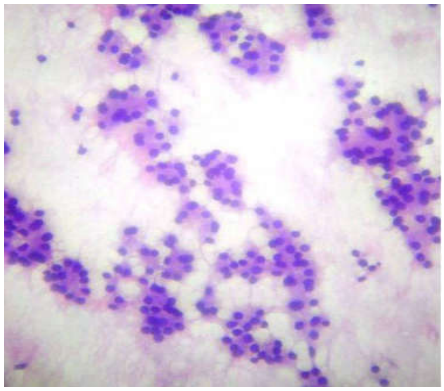


Figure 5. Microscopic photograph showing micro-follicles with colloid, FN (TBSRTC DC IV). (H&E, 20X)

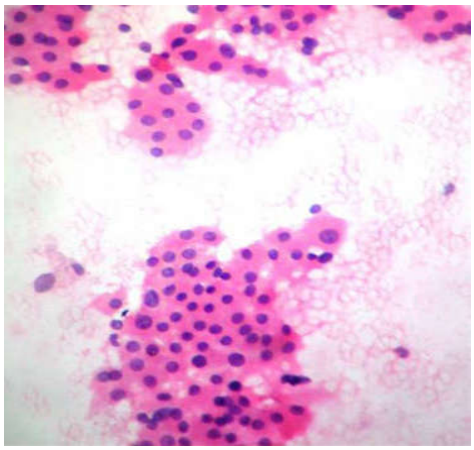


Figure 6. Microscopic photograph showing neoplastic hurthle cells (TBSRTC DC IV). (H&E, 20X)

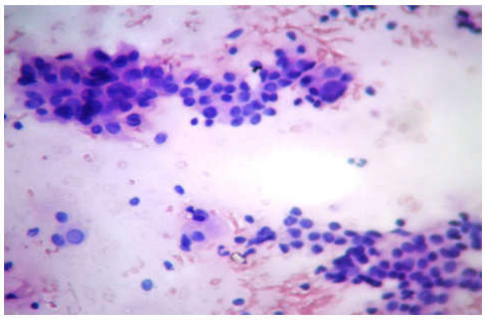


Figure 8. Microscopic photograph showing follicular cells with focal nuclear grooving suspicious for malignancy (TBSRTC DC V). (H&E, 20X)

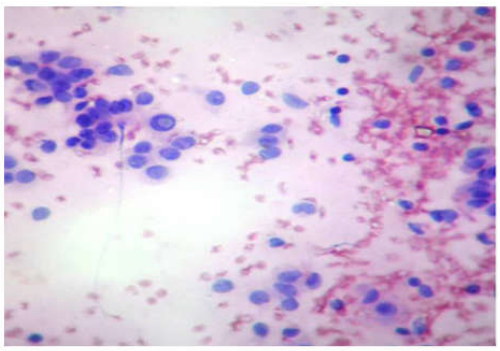


Figure 9. Microscopic photograph showing papillary carcinoma with cells having intra-nuclear inclusions and grooving (TBSRTC DC V). (H&E, 40X)

In the present study, all 4 cases (100%) were of papillary carcinoma in the category VI while payal *et al*. noted them in majority of cases (80%) with one case (20%) of medullary carcinoma of thyroid out of total 5 cases. Out of total 105 cases, histo-pathological resection specimen was received in 20 cases (DC I- 0, DC II- 6, DC III- 1, DC IV- 3, DC V- 6, DC VI- 4 cases). In DC II, all 6 cases were benign on histology thus risk of malignancy was nil, while in DC III, a single case turned out to be of papillary carcinoma on follow up with 100% risk of malignancy. 3 cases of DC IV included 2 cases of papillary carcinoma and one case of lymphocytic thyroiditis showing 66% risk of malignancy. DC V and DC VI showed 100% risk of malignancy with all cases reported as malignant on histology. Results of the present study are comparable with the study done by M. Bongiovani *et al*. In the present study

easures of a diagnostic accuracy of FNAC thyroid includes sensitivity and specificity which are 85% and 100% respectively showing similarity with the results of the studies done by M. Bongiovani *et al*.(sensitivity- 97% and specificity- 50.7%) and Payal *et al*.(sensitivity- 78% and specificity- 81%). The positive predictive value(PPV) and negative predictive value(NPV) were 100% and 92.8% respectively which are in concordance with M. Bongiovani *et al*. and Payal *et al*. As evidenced by its high sensitivity and high NPV, TBSRTC has proven to be an effective and robust thyroid FNA classification scheme to guide the clinical management of patients with thyroid nodules. Most of the studies conducted to date revealed a good outcome of FNAC concordant with the results of our study and thus it has become a prime investigation of choice for initial evaluation of patients with thyroid nodule.

Conclusion

FNA of the thyroid remains the safest and most cost-efficient manner in which thyroid nodules are stratified for surgical excision. TBSRTC has standardized reporting nomenclature for thyroid FNA that corresponds with specific cyto-morphologic criteria and risk of malignancy. It also provides clear management guidelines to clinicians to go for follow-up FNA or surgery and also the extent of surgery. Thus we concluded that a 6-tier reporting system for thyroid FNAC (TBSRTC) was effective for determining which patients needed surgery versus follow up FNA and also guided clinician on the extent of surgery

REFERENCES

Al Dawish MA, Robert AA, Muna A, Eyad A, Al Ghamdi A, Al Hajeri K, Thabet MA, Braham R. 2017. Bethesda System for Reporting Thyroid Cytopathology: A three-year study at a tertiary care referral center in Saudi Arabia. *World J ClinOncol,* 8(2): 151-157.

Bakhos R, Selvaggi SM, DeJong S, Gordon DL, Pitale SU, Herrmann M, Wojcik EM 2000. Fine-needle aspiration of the thyroid: rate and causes of cytohistopathologicdiscordance.DiagnCytopathol 23:233–237

Baloch ZW, Alexander EK, Gharib H, Raab SS, Overview of Diagnostic Terminology and Reporting. In:Ali SZ, Cibas ES, editors.The Bethesda System for Reporting Thyroid Cytopathology. New York: Springer; 2010 p. 1-3.

Baloch ZW, Cibas ES, Clark DP, Layfield LJ, Ljung BM, Pitman MB, *et al*. 2008. The National Cancer Institute Thyroid fine needle aspiration state of the science conference: a summation. Cytojournal5:6.

Baloch ZW, Fleisher S, LiVolsi VA *et al*. 2002. Diagnosis of ‘‘follicular neoplasms’’: a gray zone in thyroid-fine needle aspiration cytology. DiagnCytopathol 26:41–44

Baloch ZW, LiVolsi VA, Asa SL, Rosai J, Merino MJ, Randolph G, *et al*. 2008. Diagnostic terminology and morphologic criteria for cytologic diagnosis of thyroid lesions: a synopsis of the National Cancer Institute Thyroid Fine-Needle Aspiration State of the Science Conference. *DiagnCytopathol,* 36(6):425–37.

Cibas ES, Ali SZ 2009. The Bethesda system for reporting thyroid cytopathology. Am J ClinPathol 132:658–665

Filie, A. C., Asa, S. L., Geisinger, K. R. *et al*. 2008. “Utilization of ancillary studies in thyroid fine needle aspirates: a synopsis of the national cancer institute thyroid fine needle aspiration state of the science conference,” *Diagnostic Cytopathology*, vol. 36,no. 6, pp. 438–441.

Leonard N, Melcher DH 1997. To operate or not to operate? The value of fine needle aspiration cytology in the assessment of thyroid swellings. J ClinPathol 50:941–943

Logani S, Gupta PK, LiVolsi VA *et al*. 2000. Thyroid nodule with FNA cytology suspicious for follicular variant of papillary thyroid carcinoma: follow-up and management. DiagnCytopathol 23:380–385

Massimo Bongiovanni, Alessandra Spitale, William C. Faquin, Luca Mazzucchelli, Zubair W. Baloch, 2012. The Bethesda System for Reporting Thyroid Cytopathology: A Meta-Analysis; ActaCytologica 56:333–339

Mondal SK, Sinha S, Basak B, Roy DN, Sinha SK. 2013. The Bethesda system for reporting thyroid fine needle aspirates: A cytologic study with histologic follow-up. *J Cytol*; 30: 94-99 [PMID: 23833397 DOI: 10.4103/0970-9371.112650]

Mufti ST, Molah R. 2012. The bethesda system for reporting thyroid cytopathology: a five-year retrospective review of one center experience. *Int J Health Sci*(Qassim); **6**: 159-173 [PMID: 23579269 DOI: 10.12816/0005991]

Naz *et al*. 2014. Diagnostic accuracy of Bethesda system for reporting thyroid cytopathology: an institutional perspective. International Archives of Medicine, doi:10.1186/1755-7682-7-46.

PayalMehra and Anand Kumar Verma; 2015. Thyroid Cytopathology Reporting by the Bethesda System: A Two-Year Prospective Study in an Academic Institution; Pathology Research International Volume, Article ID 240505, 11 pages

Ravetto C, Colombo L, Dottorini ME 2000. Usefulness of fine needle aspiration in the diagnosis of thyroid carcinoma: a retrospective study in 37,895 patients. Cancer 90:357–363

The Bethesda System for Reporting Thyroid Cytopathology; ISBN 978-0-387-87665-8 e-ISBN 978-0-387-87666-5; DOI 10.1007/978-0-387-87666-5; Springer New York Dordrecht Heidelberg London

Yang J, Schnadig V, Logrono R *et al*. 2007. Fine needle aspiration of thyroid nodules: a study of 4703 patients with histological and clinical correlations. Cancer 111:306–315

Yassa L, Cibas ES, Benson CB *et al*. 2007. Long-term assessment of a multidisciplinary approach to thyroid nodule diagnostic evaluation. Cancer 111:508–5164.

****