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Research article

Thyroid fine needle aspiration reporting rates and outcomes before and after Bethesda implementation: A single-center experience over 8 years

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ABSTRACT

Aim: To evaluate data from our hospital system before and after the implementation of the Bethesda System for Reporting Thyroid Cytology (TBSRTC) and comparison of our data with the previously published studies.

Methods: Seven hundred seventy-one patients with thyroid nodules who underwent fine needle aspiration biopsy (FNAB) and surgery at our institution were analyzed retrospectively. FNAB results were divided into two parts in terms of the period they related to: pre-TBSRTC (between 2005 and 2010) and TBSRTC (between 2011 and 2013).

Results: 341 FNAB were applied in the period of TBSRTC. Of the 341 FNAB, 53(16%) were non diagnostic, 82(24%) were benign, 62(18%) were atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS), 28(8%) were follicular neoplasms and/or suspicion of follicular neoplasms (FN/SFN), 95(28%) were suspicion for malignancy (SuspM), and 21(6%) were malignant. Rates of malignancy reported on follow-up histopathological examination were non diagnostic in 11%, benign in 4.9%, AUS/FLUS in 23%, FN/SFN in 32%, SuspM in 44%, and malignant in 95.3%.

Conclusions: In this study, the distribution of cases in TBSRTC categories and malignancy rates, differed from, recommended by TBSRTC and some studies. Implementation of TBSRTC did significantly affect our institution's reporting rates.

Keywords: Bethesda, fine needle aspiration, thyroid.

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Introduction

The rate of thyroid nodules which can be palpated in adult is between 3-7%. But in recent years, with more frequent use of imaging methods, asymptomatic thyroid nodules can be detected [1]. Most of the

thyroid nodule is benign. American Thyroid Association Guideline has reported in 2009 that thyroid cancer could occur in thyroid nodules at the ratios between 5-15% [2]. The basic approach in the evaluation of thyroid nodules is to identify the nodules as benign-malignant and to evaluate treatment method to be applied. Fine needle aspiration biopsy (FNAB) is assumed to be the most appropriate and least invasive method used to identify the nodules as benign or malignant [3,4].

Prior to The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), thyroid FNAB terminology varied significantly between the centers and some confusion was emerged, which caused trouble in sharing of clinical aspects between various institutes [5]. The development of a common terminology was decided in Bethesda Conference in 2007, which was arranged by National Cancer Institute (NCI). Firstly, in NCI conference held in 1988; the Bethesda System was examplified, which was developed for reporting of cervical cytology diagnosis. FNAB results has been aggregated in six different diagnostic categories in TBSRTC, and possible risks of malignancy and general approach have been determined [5,6].

In this study, FNAB results and malignancy rates for each FNAB category, false-negative (FN) rates were calculated in the periods of TBSRTC and pre-TBSRTC implementation in out clinic. We aimed to compare our data in the periods of TBSRTC and pre-TBSRTC implementation with the previously published data in the world.

Methods

In this study, 771 patients were included retrospectively, whom thyroidectomy was performed including FNAB, in Ondokuz Mayıs University, Faculty of Medicine, department of General Surgery, between the dates January 2005 and December 2013. The results of FNAB, applied in the centers other than our clinic and the head and neck malignancies except thyroid cancer, to which thyroidectomy has been performed, were not included to this study.

The nodules, evaluated by using clinical ultrasound (USG) and FNAB, were defined as index (target) nodules.

In all Patients' FNAB was performed using a 22 gauge needle with 10 or 20 mL syringe in accompany of USG, without local anesthesia following disinfection of the skin. After smears were fixed locating into the bottles with 95% ethyl alcohol, they were evaluated by using Papanicolau method. The examples, each group of which includes at least 10 cells and containing follicular cells at least within 6 groups, were considered suitable for evaluation [5,6].

Fine needle aspiration (FNA) cytology results were divided into two parts in terms of the period of TBSRTC (between 2011 and 2013) and the period of pre-TBSRTC (between 2005 and 2010). The thyroid nodules in the period of pre-TBSRTC were classified into five groups: non-diagnostic (ND), benign, follicular neoplasms and/or suspicion of follicular neoplasms (FN/SFN), suspicion for malignancy (SuspM), and malignant (7). The thyroid nodules in the period of TBSRTC were classified into six groups as ND, benign, atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS), FN/SFN, SuspM and malignant [5,6].

All patients who had thyroid nodules at least10 mm on thyroid USG, underwent FNAB. In patients with thyroid nodules smaller than 10 mm on USG, those with USG findings suspicious for malignancy, underwent FNAB

as well, and they underwent surgery if they had FNA cytology findings of malignant, SuspM, ND, or FN/SFN. Patients with thyroid nodules 10 mm and <30 mm on USG underwent surgery if they had any one of the clinical or ultrasonographic features suggesting malignancy, such as palpable cervical lymph nodes, microcalcification inside the nodule, hypoechogenicity, or solid structure, or if they had FNA cytology findings of malignant, SuspM, ND, or FN/SFN. Patients with nodules 30 mm on USG, underwent surgery regardless of FNA cytology finding, because FN rate of FNA cytology has been suggested to be high in patients with nodules 3 cm [8].

Thyroidectomy was performed on the patients whose first FNAB result is AUS/FLUS and also if the second recurrence of FNAB was reported as AUS/FLUS, FN/SFN, SuspM or malignant. If second FNAB reported as benign, observation or thyroidectomy indication was implemented by taking into account clinical, suspicious features in USG, and the patient's preference.

All patients with non-diagnostic FNA cytology findings underwent a repeat FNA, and when a repeat FNA cytology was diagnostic after a non-diagnostic one, the second was used for the final clinical decision.

If a patient had multiple FNA samples in one procedure diagnosis with higher malignant potential was used for calculating malignancy follow-up rates (for example if a single FNA had a diagnosis of "benign" and "suspicious for malignancy" on two separate passes, the case was included in the calculation for the SuspM follow-up rate and not for the benign group).

The reports prepared using pathology results on thyroid follicular cancer, papillary thyroid cancer, medullary cancer, anaplastic cancer, lymphoma cases, malignant; nodular colloidal goitre, hyperplasia, adenomas, hurtle cells adenomas, thyroiditis (Hashimoto thyroiditis, De Quervain's thyroiditis, Lymphocytic thyroiditis, etc.), cystic nodular goitre were assumed indicating benign. All patients' operation pathology results and FNA cytological results were compared. We could calculate the malignancy risk for each category and compared it with that in other studies. Incidental papillary carcinomas (<1 cm) on resection were not considered malignant, except when prior cytological interpretation was SuspM or malignant.

The values of FNAB, such as, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, FN, false positive (FP) values were calculated for all patients for the period of TBSRTC and pre-TBSRTC separately.

A true-positive (TP) result was defined as FNA diagnostic findings of malignant, SuspM, FN/SFN coupled with malignant histology; a true-negative (TN) result was defined as a benign FNAB that was diagnosed as benign on histology. False-positive (FP) result was a FNAB result of malignant, SuspM, FN/SFN that had benign histology, and FN result was a benign FNAB with malignant histology (9). In the period of TBSRTC, sensitivity, specificity, PPV, NPV, accuracy was calculated using a second method. In the second method, the category of AUS/FLUS was included as FP in the calculation.

The following formulas were used to calculate the sensitivity, specificity, PPV, NPV, accuracy values;

Sensitivity of FNAB was defined as TP results divided by TP plus FN results, and specificity was defined as TN results divided by TN plus FP results. PPV was calculated as TP/ (TP + FP). NPV was TN/ (TN + FN). Diagnostic accuracy was estimated as (TP + TN)/ (TP + FP + TN + FN). Sensitivity, specificity, PPV,

NPV, and accuracy were calculated among patients with FNAB results.

Statistical analysis

The software of SPSS (Statistical Package for Social Sciences) for Windows 20.0 was used for statistical analysis required to evaluate the study findings. In the comparison of the qualitative data, Chi-square and Fisher's exact tests were used. In the present study, the p values less than 0.05 was considered significant.

Results

In our hospital between the dates January 2005 and December 2010, 430 FNA were applied in the period of pre-TBSRTC, and 5 diagnostic category was used cytologically. The diagnostic category rates for the period of pre-TBSRTC were determined as follows: ND 64(15%), benign 187(43%), FN/SFN 13(3%), SuspM 151(35%) and malignant 15(4%) (Table 1).

Between the dates January 2011 and December 2013, during which TBSRTC was used, it was seen that, 341 FNA were applied in our hospital, and the results of FNAB were divided into 6 diagnostic categories in accordance with TBSRTC. FNAB diagnostic category ratios for the period of TBSRTC were determined as follows: ND 53(16%), benign 82(24%), AUS/FLUS 62(18%), FN/SFN 28(8%), SuspM 95(28%) and malignant 21(6%) (Table1).

It was seen that a total of 771 FNA were applied for the period of TBSRTC and pre-TBSRTC in our hospital. FNAB diagnostic category ratios for the pre-TBSRTC and for the period of TBSRTC were determined as follows: ND 117(15%), benign 269(35%), AUS/FLUS 62(8%), FN/SFN 41(5%), SuspM 246(32%) and malignant 36(5%) (Table1).

When we review the FNAB category results for the pre-TBSRTC period and postoperative histopathology results, it was seen that histopathology results for the categories of

Table 1. Thyroid fine needle aspiration biopsy reporting rates by diagnostic category before and after Bethesda implementation.

Time Frame	ND, N (%)	Benign, N (%)	AUS/FLUS, N (%)	FN/SFN, N (%)	SuspM, N (%)	Malign, N (%)	Total Cases, N (%)
2005-2010*	64 (15)	187 (43)	-	13 (3)	151 (35)	15 (4)	430 (56)
2011-2013**	53 (16)	82 (24)	62 (18)	28 (8)	95 (28)	21 (6)	341 (44)
Total Cases, No. (%)	117 (15)	269 (35)	62 (8)	41(5)	246 (32)	36 (5)	771 (100)

AUS/FLUS; Atypia of undetermined significance for follicular lesion of undetermined significance, FN/SFN; Follicular neoplasm/suspicious for follicular neoplasm; SuspM; Suspicious for malignancy; UNS/ND; unsatisfactory/non-diagnostic. *2005-2010: Before Bethesda, ** 2011-2013: Bethesda.

ND, benign, FN/SFN, SuspM, malign FNAB were determined as malignant in the ratios 6%, 3.2%, 15%, 29%, 100% (Table 2). The FN ratio was 3.2% for the period of pre-TBSRTC. FNAB results for the pre-TBSRTC were seen as follows: sensitivity 91%, specificity 60%, PPV 34%, NPV 97%, accuracy 66% (Table 3). FNAB diagnostic category rates for the period of TBSRTC and postoperative histopathology results were seen in Table 2; the histopathology results of ND, benign, AUS/FLUS, FN/SFN and SuspM, malignant FNAB results were determined as malignant in the ratios as follows: 11%, 4.9%, 23%, 32%, 44% and 95.3%. The FN ratio for the period of TBSRTC was 4.9%. FNAB results for the period of TBSRTC; the following values were seen in Table 3 that sensitivity 95%, specificity 52%, PPV 49%, NPV 95%, accuracy 66%. The sensitivity, specificity, PPV, NPV and accuracy were calculated using a second method for the period of TBSRTC. In the second method, AUS/FLUS category was included as FP in the calculation. In the second calculation, the values were determined as follows: sensitivity (95%), specificity (39%), PPV (41%), NPV (95%), and accuracy (57%) as seen sensitivity and NPV kept their previous ratios. FNAB diagnostic category ratios including all FNABs for the period of pre-TBSRTC and TBSRTC were determined as follows as indicated in Table 3: sensitivity 93%, specificity 57.5%, PPV 41%, NPV 96%, accuracy 66%.

Our cytology and histopathology results for the period of TBSRTC and cytology and histopathology results related to the studies at literature were indicated in Table 4 and Table 5 (10-17).

Table 2. Malignant outcome by cytologic-histologic correlation category, before and after Bethesda implementation.

Time Frame	ND	Benign	AUS/FLUS	FN/SFN	SuspM	Malign
2005-2010*	6	3.2	-	15	29	100
2011-2013**	11	4.9	23	32	44	95.3

AUS/FLUS; Atypia of undetermined significance for follicular lesion of undetermined significance, FN/SFN; Follicular neoplasm/suspicious for follicular neoplasm; SuspM; Suspicious for malignancy; UNS/ND; unsatisfactory/non-diagnostic. *2005-2010: Before Bethesda, ** 2011-2013: Bethesda.

Table 3. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of the malignancy rate by diagnostic category before and after Bethesda implementation.

Time Frame	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
2005-2010*	91	60	34	97	66
2011-2013**	95	52	49	95	66
Total Cases	93	57.5	41	96	66

PPV; Positive predictive value, NPV; negativ predictive value. *2005-2010: Before Bethesda, ** 2011-2013: Bethesda

Table 4. Incidence of reported Bethesda categories from literature.

Diagnostic Category	Current Study	Mondal et al. 2013	Wu et al. 2011	Harvey et al. 2013	Marchevsky et al. 2010	Broome et al. 2011	Nayarve Ivanovic 2009	Özlük et al. 2011	Jo et al. 2010
ND	16	1.2	20.1	1.8	12.9	NA	5	8	18.6
Benign	24	87.5	39	89	71.6	34	64	51	59
AUS/FLUS	18	1	27.2	2.1	9.8	29	18	6	3.4
FN/SFN	8	4.2	8.4	3.1	1.5	12	6	8	9.7
SuspM	28	1.4	2.6	1	2.3	10	2	9	2.3
Malignant	6	4.7	2.7	3.2	2	11	5	18	7

AUS/FLUS; Atypia of undetermined significance for follicular lesion of undetermined significance, FN/SFN; Follicular neoplasm/suspicious for follicular neoplasm; SuspM; Suspicious for malignancy; UNS/ND; unsatisfactory/non-diagnostic.

Table 5. Malignant outcome by cytologic-histologic correlation for Bethesda diagnostic categories from literature.

Diagnostic Category	Current Study	Mondal et al. 2013	Wu et al. 2011	Harvey et al. 2013	Marchevsky et al. 2010	Broome et al. 2011	Nayar and Ivanovic 2009	Ozluk et al. 2011	Jo et al. 2010	Bethesda range
ND	11	0	14	NA	75	0	9	25	8.9	1-4
Benign	4.9	4.5	9.5	NA	32.2	9	2	10	1.1	0-3
AUS/FLUS	23	20	22	19	37.9	20	6	36	17	5-15
FN/SFN	32	30.6	27	20.5	27.3	36	14	66	25.4	15-30
SuspM	44	75	67	81.3	100	52	53	81	70	60-75
Malignant	95.3	97.8	100	NA	100	97	97	95	98.1	97-99

AUS/FLUS; Atypia of undetermined significance for follicular lesion of undetermined significance, FN/SFN; Follicular neoplasm/suspicious for follicular neoplasm; SuspM; Suspicious for malignancy; UNS/ND; unsatisfactory/non-diagnostic.

Discussion

Thyroid FNAB is a very valuable method in evaluation of thyroid nodules. FNAB reduces unnecessary surgery ratio of the patients with benign nodule. The ratio of malignancy of thyroid nodules that was removed surgically has exceeded the 50% after routine use of the thyroid FNAB [18].

When thyroid FNAB is evaluated, it is important to benefit from cytopathology report. For the result of FNAB being useful in respect of clinical management, the terminology used must be short, concise, and clear. Previously, thyroid FNAB terminology used to vary from one laboratory to another. This situation used to cause confusion and prevent data sharing among different institutions. Since 2007, these problems have been attempted to eliminate through TBSRTC. Our study is a comprehensive representation about thyroid FNAB and the associated malignancy rates performed by our surgical center which is a tertiary referral center in

Turkey. Our data was compared with the findings of 8 studies that was previously reported and the data recommended for TBSRTC. While some of our data are compatible with the literature, some of them were different from it, which we tried to explain below.

All FNAB results we obtained were respectively as follows: ND 15%, benign 35%, AUS/FLUS 8%, FN/SFN 5%, SuspM 32% and malignant 5%. In spite of applying all FNABs accompanying with USG, non-diagnostic FNAB results aren't lower.

It was seen in Table 1 that benign rate reduced in the period of TBSRTC comparing to the period of pre-TBSRTC (24% versus 43%), FN/SFN rate increased (8% versus 3%), SuspM ratio decreased (28% versus 35%) the other categories didn't change so much. When these results examined, it must be considered that some FNAB which had to be classified in the category of benign, might be classified as AUS/FLUS, some FNAB which had to be classified in the category of SuspM, might be classified as FN/SFN.

When FNAB diagnostic category results are compared with our postoperative histopathology results, it is seen that our histopathology malignancy results in all categories in the period of TBSRTC is higher than the ones in the period of pre-TBSRTC (Table 2). This indicates that malignancy rate is increased in the post period of TBSRTC. This increase in the rate of malignancy results in very important consequences in patient care and surgical decision making.

In this study, for all FNABs applied in our clinic, the following results have been obtained: sensitivity 93%, specificity 57.5%, PPV 41%, NPV 96% and accuracy 66% (Table 3). In the period of TBSRTC, while sensitivity (95% versus 91%), and PPV (49% versus 34%) increased, specificity (52% versus 60%) and NPV (95% versus 97%) decreased. Accuracy (66%) didn't change. In the second calculation where AUS/FLUS was included in the study as FP, when compared to the period of pre-TBSRTC, it was seen that specificity (39% versus 60%) and accuracy (57% versus 66%) were decreased. This situation indicates that inclusion of AUS/FLUS category in the calculation, caused FP to be increased.

Ozluk et al., Yang et al., Wang et al., Bongiovanni et al., Park et al. have reported the sensitivity for the period of TBSRTC as follows: respectively; 85%, 94%, 95%, 97%, 79.8%. In the same studies, specificity was reported respectively as 94%, 98.5%, 47%, 50.7%, 99.3%; PPV was reported respectively as 89%, NA (not available in published study), 52%, 55.9%, 99.3%; NPV was reported respectively as 92%, NA, 94%, 96.3%, 79.1%. Ozluk et al. reported accuracy as 90%, Bongiovanni et al. reported as 68.8%, but accuracy hasn't been reported in other studies [16,19-22]. While in our study, for the period of TBSRTC, sensitivity (95%) and NPV (95%) rates were determined to be similar to the above studies, specificity (52%), PPV (49%) and accuracy (66%) rates were determined lower than the ones reported in above studies. FNAB separates successfully benign thyroid nodules from malignant nodules. In our study, the reason why the specificity, PPV and accuracy yielded lower values was that FP was high in our FNAB results. This situation can cause unnecessary surgery to be performed to the patients with nodules. The reason why sensitivity and NPV was high, associated with that FN was low in our FNAB results. Since FN value is low, we may not have to operate the patients whose FNAB result is benign if clinically there is not suspicious features and USG findings. If we have clinical doubt, we

prefer using lobectomy and isthmectomy together instead of total thyroidectomy. Our study indicates that FNAB is an effective entity to determine the patients who are candidate of surgery due to the risk of thyroid malignancy.

We compared FNAB results for the period of TBSRTC with the data of Mondal et al., Wu et al., Harvey et al., Marchevsky et al., Broome et al., Nayar and Ivanoviç, Ozluk et al., and Jo et al. as seen in Table 4 [10-17]. It was found out that our ND (16%), FN/SFN (8%) and malignant (6%) rates for the period of TBSRTC were similar with the values reported in other studies. Our FNAB benign (24%) rate for the period of TBSRTC is lower than the ones reported by Cibas and Ali [5] (60-70%) and the ones (range between 34-89%) indicated in Table 4, reported in other studies. Our AUS/FLUS results, in all FNAB and in the period of TBSRTC (respectively 8%, 18%) are higher than the recommended rate (3-6%) for the period of TBSRTC [5]. However, our AUS/FLUS rate, as shown in Table 4, was not higher than the rates (range from 1% to 29%), reported in other studies. Also our SuspM (28%) rate for the period of TBSRTC is higher the ones reported in other studies (range from 1% to 10%). The results in Table 4 other than Broome et al. [14] and Ozluk et al. [16] include all nodules with FNAB regardless operation. Our results, as reported by Broome et al. and Ozluk et al., are data only belonged to nodules operated. The patients whom FNAB has been applied but not undergone surgery performed, were not included in our study. This is why our AUS/FLUS and SuspM results are higher than the ones recommended for TBSRTC period, and are lower than our benign results [5]. In the data included in the pathology department of our hospital, AUS/FLUS rate in all thyroid FNAB is about 11%. This suggests that AUS/FLUS diagnosis was higher than it supposed to be.

Due to the fact that our hospital is a third step institution, the patients are selected ones, which may be the one of the reasons why benign FNAB results is low in the period of TBSRTC.

In Table 5, we compared the cancer results in respect of histopathology in the period of TBSRTC with the malignancy risk rates that Cibas and Ali reported for the period of TBSRTC, and data related to various studies in literature [5,10-17]. In our study, the rate of the patients with benign outcome of FNAB and malignant (false negative) as a result of histopathology in the period of TBSRTC is 4.9%. According to the data that Wu et al., Marchevsky et al., Broome et al. and Ozluk et al. [13,14,16], FN rate was 9.5%, 32.2%, 9%, 10%, respectively. These results are higher than FN rate (0-3%) that reported by Cibas and Ali for the period of TBSRTC. Accordingly, our FN rate was under 5% and within acceptable limits.

While the result of FNAB is AUS/FLUS, malignant histopathology ratio is 23% in our study, it changes in other actual studies between 6-37.9%. Cibas and Ali reported risk of malignancy for AUS/FLUS category between 5-15% for the period of TBSRTC [5,6,10-17], (Table 5). At first sight, even it comes into mind that malignancy rate is high because of that the results of our, Broome et al., and Ozluk et al. [14,16] (respectively 23%, 20%, 36%) include only the data of the patients operated, except for Nayar and Ivanoviç (reported rate of malignancy as 6% in the category of AUS/FLUS), rate of malignancy in category of AUS/FLUS was reported higher than the risk of malignancy that Cibas and Ali had reported for the period of TBSRTC in all other studies [5,6]. All of these results indicate

that specific clinical data is very important in treatment planning of the patients.

Cibas and Ali reported [5,6] the malignancy rate of the patients who became SuspM as a result of FNAB as between 60-75% (5). While this rate was reported as between 52-100% in other studies, it was 44% in our study. Since our SuspM rate (28%) in FNAB is higher than the other (range between 1 and 10%) reported in other studies, and the rates of patients, became SuspM as a result of FNAB, and became malignant as a result of histopathology, is lower than the ones that Cibas and Ali reported [5,6] and also the ones reported in other studies, it brings into mind that some benign FNAB results was defined as SuspM. Also since the rate of the patients who became AUS/FLUS as a result of FNAB, and became malignant as a result of histopathology (23%) is higher than the malignant rate that Cibas and Ali reported (5-15%), it brings into mind that some FNAB which supposed to be SuspM, would have been defined as AUS/FLUS [5,6].

The experience of pathologist will be increased through using of TBSRTC. Through increase of the experience and knowledge of pathologist about TBSRTC, our data can reach to the values that Cibas and Ali suggested [5,6]. As a result, FNAB is a method with high specificity and sensitivity for assessment of thyroid nodular disease. However, the performing way of FNAB and the experiences of pathologist and clinicians, affect the result directly. In cytological examination, corporate or even individual differences can exist. Reduction error rate can be possible with the development of a common language between clinician, radiologist and pathologist. The success of cytological results will be increased with knowledge, experience and development of the technical equipment. TBSRTC was developed for the purpose of creating a standard terminology and useful, however, our clinics haven't enough information and experience about TBSRTC. Through the studies like ours, every clinic will increase its own experience by comparing its own FNAB data with histopathology reports and data in the literature thus reaching more reliable and precise results.

Conclusions

Although FNAB is the most cost effective and least invasive method in the evaluation of thyroid nodules in terms of malignancy, the data that we obtained in our study indicates that FNAB is very important in surgical indications but not sufficient alone. Even if a lower rate, in case FNAB results in FN may cause misdiagnose of cancer. The reduction of error rate may be possible with development of a common language between clinician, pathologist, and radiologist. The success of cytological results is related with development of standard terminology in terms of knowledge, experience, technical equipment and pathology.

TBSRTC was developed for the purpose of creating a standard terminology and are known to be useful. The experience of the related disciplines of our hospital about TBSRTC, will be increased steadily through analysis of the results of this study. In our opinion, a surgeon should use their own institution of data in addition to FNAB data of other institutions while giving treatment recommendations and consulting for patients.

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