Accuracy of Fine Needle Aspiration Cytology of Thyroid Lesions: An 8-year Experience in Urban-based Tertiary Medical Center in Bangkok, Thailand

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Abstract

Background: The Bethesda system for reporting thyroid cytopathology (TBSRTC) is a standardized and reproducible system. It is used worldwide to interpret fine-needle aspiration cytology (FNAC) of thyroid. A crucial issue of thyroid FNA is its accuracy comparing with the final histologic outcomes. This may vary on many factors e.g., nature of lesion, quality of the cytologic specimen, pathologist's experience, etc.

Aim: To evaluate the accuracy of TBSRTC from FNAC. Nature of lesion which may impact the accuracy was also studied.

Method: A retrospective study evaluating data of TBSRTC in our hospital during January 2013 to June 2021 were reviewed and compared to its final histologic outcomes to determine diagnostic accuracy.

Results: 3714 FNA procedures were done at Vajira Hospital from January 2013 to June 2021, consisting of 3,266 (87.94%) females and 448 (12.06%) males. The female: male incidence ratio was approximately 7:1. The age at diagnosis was ranged from 14 to 86 years (median 53 years). A total of 527 patients (461 female; 87.5%, and 66 male; 12.5%) underwent surgical resection with available histopathology evaluation. From those cases, the FNAC reports revealed 172 (32.6%) cases as non-diagnostic/unsatisfactory (ND/US), 216 (41.0%) cases as benign, 87 (16.5%) cases as atypical of undetermined significant or follicular lesion of undetermined significance (AUS/FLUS), 4 (0.8%) cases as follicular neoplasm or suspicious for follicular neoplasm (FN/SFN), 36 (6.8%) cases as suspicious for malignancy (SM), and 12 (2.3%) cases as malignant. The risk of malignancy (ROM) in operated thyroid specimen was 15.7%, 15.3%, 33.3%, 0%, 91.7%, and 91.7%, respectively

Conclusions: The accuracy of thyroid FNAC at our hospital was high in malignant groups including category V and VI. However, the ROM in categories I, II, III, and V exceeded the suggested limit in TBSRTC. We strongly encourage medical practitioners in all professions to use TBSRTC because it is an international standard that shares a common understanding and helps guide patient management.

Keywords: the Bethesda system for reporting thyroid cytopathology (TBSRTC), fine-needle aspiration cytology (FNAC), thyroid nodule.

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ความแม่นยำของการตรวจทางเซลล์วิทยาด้วยการใช้เข็มเจาะดูดของโรคต่อมไทรอยด์: ประสบการณ์ 8 ปีในโรงพยาบาลตติยภูมิเขตเมืองกรุงเทพมหานคร ประเทศไทย

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บทคัดย่อ

บทนำ: ระบบเบเทสดาเพื่อการรายงานผลทางเซลล์พยาธิวิทยาของโรคต่อมไทรอยด์ (the Bethesda system for reporting thyroid cytopathology (TBSRTC)) เป็นระบบมาตรฐานที่ได้รับการยอมรับในระดับสากล เพื่อใช้สำหรับการแปลผลทางเซลล์วิทยาของโรคต่อมไทรอยด์ ที่ได้รับจากเจาะดูดด้วยเข็มขนาดเล็ก (fine-needle aspiration cytology (FNAC)) ซึ่งผลการตรวจดังกล่าวต้องมีการเพื่อประเมินถึงความแม่นยำ (accuracy) โดยเปรียบเทียบร่วมกับผลการตรวจทางจุลพยาธิวิทยา (histologic correlation) ทั้งนี้อาจมีปัจจัยหลายประการที่ส่งผลกระทบต่อการแปลผลและความแม่นยำของการตรวจได้ อาทิ ลักษณะและธรรมชาติของโรค คุณภาพของสิ่งส่งตรวจทางเซลล์วิทยา และ ความเชี่ยวชาญของพยาธิแพทย์ เป็นต้น

วัตถุประสงค์: เพื่อประเมินความแม่นยำของการรายงานผลตามระบบเบเทสดาเพื่อการรายงานผลทางพยาธิเซลล์วิทยาของโรคต่อมไทรอยด์ (TBSRTC) และ ลักษณะของโรคที่มีผลต่อความแม่นยำของการตรวจ

วิธีการดำเนินการวิจัย: งานวิจัยนี้เป็นการศึกษาวิจัยแบบย้อนหลัง โดยศึกษาเปรียบเทียบประเมินความแม่นยำของผลการตรวจทางเซลล์วิทยาของโรคต่อมไทรอยด์ กับผลการตรวจทางจุลพยาธิวิทยาของโรคต่อมไทรอยด์ที่รับการผ่าตัดรักษา ในคณะแพทยศาสตร์ชิรพยาบาล ระหว่าง เดือนมกราคม 2556 ถึงมิถุนายน 2564

ผลการวิจัย: มีการตรวจทางเซลล์พยาธิวิทยาของต่อมไทรอยด์ด้วยเข็มเจาะดูดขนาดเล็กในผู้ป่วยทั้งหมด 3,714 ราย ในช่วงเวลาที่ศึกษา คิดเป็น เพศหญิง 3,266 คน (ร้อยละ 87.94) และ ชาย 448 คน (ร้อยละ 12.06) ซึ่งสามารถคิดเป็นอัตราส่วนหญิงต่อชายได้ประมาณ 7:1 ผู้ป่วยมีอายุระหว่าง 14 ปี ถึง 86 ปี (ค่ากลาง 53 ปี) ผู้ป่วยที่ได้รับการผ่าตัดและมีผลการตรวจทางจุลพยาธิวิทยามีจำนวน 527 คน เป็นหญิง 461 คน คิดเป็นร้อยละ 87.5 ผลการวินิจฉัยทางเซลล์พยาธิวิทยาสามารถจำแนกหมวดหมู่ตามระบบเบเทสดาเพื่อการรายงานผลทางพยาธิเซลล์วิทยาของโรคต่อมไทรอยด์ (TBSRTC) คือ non-diagnostic/unsatisfactory (ND/US), benign, atypical of undetermined significant or follicular lesion of undetermined significance (AUS/FLUS), follicular neoplasm or suspicious for follicular neoplasm (FN/SFN), suspicious

for malignancy (SM), malignant ตามลำดับจำนวน (ร้อยละ) ดังนี้ 172 (32.6), 216 (41.0), 87 (16.5), 4 (0.8), 36 (6.8) และ 12 (2.3) โดยแต่ละหมวดหมู่มีอัตราความเสี่ยงโรคมะเร็ง (risk of malignancy (ROM) ตามลำดับร้อยละ ดังนี้ 15.7, 15.3, 33.3, 0, 91.7 และ 91.7

สรุป: ผลการตรวจทางเซลล์วิทยาด้วยการใช้เข็มเจาะดูดของโรคต่อมไทรอยด์มีความแม่นยำสูงในหมวดหมู่ผลวินิจฉัย suspicious for malignancy (SM) และ malignancy สำหรับในหมวดหมู่ผลวินิจฉัย non-diagnostic/ unsatisfactory (ND/US), benign, atypical of undetermined significant or follicular lesion of undetermined significance (AUS/FLUS) และ suspicious for malignancy (SM) พบว่ามีอัตราความเสี่ยงโรคมะเร็งสูงกว่าเกณฑ์ตามระบบเบเทสดาเพื่อการรายงานผลทางเซลล์พยาธิวิทยาของโรคต่อมไทรอยด์ ผู้วิจัยสนับสนุนให้ใช้ระบบเบเทสดาเพื่อการรายงานผลทางเซลล์พยาธิวิทยาของโรคต่อมไทรอยด์ เพื่อความเข้าใจที่ตรงกันในบุคลากรทางการแพทย์สาขาต่างๆ และยังเป็นการช่วยให้แนวทางในการจัดการและวางแผนการรักษาของผู้ป่วยอีกด้วย

คำสำคัญ: ระบบเบเทสดาเพื่อการรายงานผลทางเซลล์พยาธิวิทยาของโรคต่อมไทรอยด์, การตรวจทางเซลล์พยาธิวิทยาด้วยเข็มเจาะดูดขนาดเล็ก, ความแม่นยำของการรายงานผล, โรคต่อมไทรอยด์

วันที่รับบทความ 7 กันยายน 2564 **วันแก้ไขบทความ** 1 พฤศจิกายน 2564 **วันตอบรับบทความ** 1 พฤศจิกายน 2564

Introduction

The American Thyroid Association (ATA) had defined thyroid nodule as an abnormal growth of cells that forms a lump within thyroid gland[1]. According to the International Agency for Research on Cancer in 2020, more than 500,000 new cases and over 40,000 deaths of thyroid cancer were reported worldwide[2]. In Thailand, thyroid cancer was the 15th most common cancer[2].

The major goal of thyroid nodule diagnosis was to differentiate non-neoplastic lesion, benign tumors, and malignant tumors e.g., nodular goiter, Grave's disease from malignant tumors. The majority of these lesions were derived from thyroid follicular epithelium[3].

The most widely used method for an initial diagnosis of thyroid lesions was cytopathologic examination of specimen obtained by fine-needle aspiration, so called fine-needle aspiration cytology aspiration (FNA). As a standard practice, a cytopathologist examines all cellular aspects including quantity, quality, and morphology. The results were then reported according to a standardized reporting system. The Bethesda system for reporting thyroid cytopathology (TBSRTC) was the most widely used system to report cytologic results. This system categorizes FNAC sample into 6 groups based on the nature of lesion or risk of cancer: I-Non-diagnostic/Unsatisfactory, II-Benign, III-Atypia of Undetermined Significance/Follicular Lesion of Undetermined Significance, IV-Follicular Neoplasm/ Suspicious for a Follicular Neoplasm, V-Suspicious for Malignancy and VI-Malignant (Appendix 1)[3]. Further management mainly depends on the cytologic diagnosis.

Although FNAC was a fast, minimally invasive, and effective diagnostic procedure[4-10] whereas the report by TBSRTC was a standard and widely accepted reporting system[3], there were some limitations in both parts. The interpretation may be limited due to several factors, such as, proficiency of a clinician, use of ultrasound to locate specific site of lesion, techniques during the procedure, quality of specimens, specimen handling and preparation, and experience of pathologists[5-10].

Our objective was to evaluate the accuracy of FNAC with TBSRTC compared with the histopathologic examination of surgically removed thyroid lesions.

Methods

Study settings

An approval from the institutional review board of the Faculty of Medicine Vajira Hospital was obtained (COA107/2564). All thyroid FNAC smears from January 2013 to June 2021 in our institution were identified. In any cases with multiple FNAC reports, the most severe FNAC result before surgery was selected for analysis. Cytologic slides which had only descriptive diagnoses from previous reports were reviewed and re-classified independently by 2 pathologists into each TBSRTC category (N.B & S.S). Only those with available histopathology in the same setting were included. Final histologic diagnosis of resected thyroid lesion was used as a gold standard. All cases with discordant cytologic and pathologic results were reviewed (N.B).

Statistical analysis

All statistical analysis was carried out using SPSS for Windows Evaluation Version 26.0 (IBM Corp. 2019, Armonk, NY). Continuous data were presented as mean and standard deviation for variables with normal distributions and median (IQR) for variables with non-normal distributions. Categorical data were expressed as absolute numbers and percentages. Cytologic diagnosis of each case was compared to the histopathology.

Accuracy and a risk of malignancy for each cytologic category were analyzed. The risk of malignancy (ROM) was determined by the ratio between histologically confirmed malignant neoplasms and all cases with cytologic diagnosis that had surgical specimen in that category according to TBSRTC. Data were compared by Fisher' exact test or chi-square test as appropriated. P-value < 0.05 was considered statistically significant.

Appendix 1:

The Bethesda System for Reporting Thyroid Cytopathology: Diagnostic Categories[3]

I. Non-diagnostic or Unsatisfactory

- Cyst fluid only/ Virtually acellular specimen/ Other (obscuring blood, clotting artifact, drying artifact, etc.)

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

III. Atypia of Undetermined Significance or Follicular Lesion of Undetermined Significance

IV. Follicular Neoplasm or Suspicious for a Follicular Neoplasm

Specify if Hurthle cell (oncocytic) type

V. Suspicious for Malignancy

- Suspicious for papillary carcinoma
- Suspicious for medullary carcinoma
- Suspicious for metastatic carcinoma
- Suspicious for lymphoma
- Other

VI. Malignant

- Papillary thyroid carcinoma
- Poorly differentiated carcinoma
- Medullary thyroid carcinoma
- Undifferentiated (anaplastic) carcinoma
- Squamous cell carcinoma
- Carcinoma with mixed features (specify)
- Metastatic malignancy
- Non-Hodgkin lymphoma
- Other

Results

From the study period, 3,714 FNA procedures were performed in our hospital. A total of 527 specimens (1 from each patient) met inclusion criteria and were included in the study. The majority were female (461; 87.5%). Age of the patients ranged from 14 to 86 years (median 53 years).

More than half of our initial cytologic diagnoses were not according to the TBSRTC. These included indeterminate lesions and atypical follicular lesions (58 cases), suggestive of atypical follicular lesion or atypia (18 cases), or suggestive of nodular goiter (199 cases). The authors reclassified them into the TBSRTC categories.

We found approximately one third of the cytologic specimens were non-diagnostic/ unsatisfactory (ND/US), whereas nearly half had benign cytologic diagnosis. Equivocal diagnoses of atypia of undetermined significance/follicular lesion of undetermined significance (AUS/FLUS) and follicular neoplasm/suspicious for a follicular neoplasm (FN/SFN) were diagnosed in 87 cases (16.5%) and 4 cases (0.8%) respectively. The other cytologic diagnoses suspected of malignancy (SM) and malignant lesions were found in 36 cases (6.8%) and 12 (2.3%) cases respectively. Characteristics of the patients, cytologic and histopathologic diagnoses are shown in Table 1.

The identification of noninvasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP) had recently been introduced in the WHO Classification of Tumors of Endocrine Organs 2017[11]. NIFTP was a new name for a very low risk thyroid tumor previously known as an encapsulated

Table 1:

Demographic data and TBSRTC Categories and histologic types

Variable	Total (n = 527)
Gender	
Male	66 (12.5)
Female	461 (87.5)
Cytologic Category	
Category I. Non-diagnostic or Unsatisfactory	172 (32.6)
Category II. Benign	216 (41.0)
Category II. AUS/FLUS	87 (16.5)
Category IV. Follicular Neoplasm or Suspicious for a Follicular Neoplasm	4 (0.8)
Category V. Suspicious for Malignancy	36 (6.8)
Category VI. Malignant	12 (2.3)
Histologic Type	
Non-neoplastic lesion	
Nodular goiter	330 (62.6)
Chronic lymphocytic thyroiditis	18 (3.4)
Benign neoplastic lesion	
Follicular adenoma	45 (8.5)
NIFTP	1 (0.2)
Malignant neoplastic lesion	
Papillary thyroid carcinoma	106 (20.1)
Follicular carcinoma	17 (3.2)
Oncocytic carcinoma	1 (0.2)
Poorly differentiated thyroid carcinoma	6 (1.1)
Anaplastic thyroid carcinoma	1 (0.2)
Medullary thyroid carcinoma	2 (0.4)

Abbreviation: Atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS)

non-invasive follicular variant papillary thyroid carcinoma. Although the cells in a NIFTP had features that look like papillary thyroid carcinoma, this finding alone did not mean NIFTPs were malignant. Because NIFTP tumors were not invasive and were contained within the tumor capsule, they were considered to have an uncertain malignant potential.

Histologic examination of resected thyroid specimens showed the followings: 330 (62.6%) of colloid nodular goiter, 106 (20.1%) of papillary carcinoma, 45 (8.5%) of follicular adenoma, 18 (3.4%) of chronic lymphocytic thyroiditis.

Comparison of FNAC with histological findings was performed. Among 216 cases were diagnosed as benign lesions by FNAC, 160 were non-neoplastic lesions, 23 benign neoplastic lesions (follicular adenoma), and 33 as malignant lesions revealed from subsequent histologic examination. On the other hand, only one case out of 12 cases which were non-neoplastic lesions whereas the remaining 11 case were carcinoma on histologic examination (Table 2). False positive and false negative results are shown in Table 3.

The highest malignancy rate in our operated thyroid nodule was 91.7% for both categories V and VI. Our ROM results in comparing to the acceptable range by the TBSRTC are shown in Table 4.

Discussion

The age range of the patients included in our study (14 to 86 years) was slightly wider and higher compared with previous Thai studies which reported 45.7±13.1 years[6]. Nevertheless, female preponderance (7 times more common than male) having both non-neoplastic and neoplastic thyroid lesions was consistent with other studies which found thyroid nodules 6–8 times more common in female than males[4,10, 12-13]. Nodular goiter was the most common non-neoplastic diagnosis whereas papillary thyroid carcinoma was the most prevalent malignant tumor in our study.

Table 2:

The details of cyto-histologic correlations of FNAC thyroid according to the TBSRTC system. [p-value < 0.001]

TBSRTC Diagnostic Category n (%)	Histologic type n (%)									
	NG	CLT	FA	PTC	FC	OC	PDTC	ATC	MTC	NIFTP
I-ND/US 172 (32.6)	123 (71.5)	8 (4.7)	14 (8.0)	21 (12.2)	6 (3.5)	-	-	-	-	-
II-Benign 216 (41.0)	155 (71.8)	5 (2.3)	23 (10.6)	24 (11.1)	6 (2.8)	-	2 (0.9)	-	1 (0.5)	-
III-AUS/FLUS 87 (16.5)	46 (52.9)	4 (4.6)	8 (9.2)	22 (25.3)	5 (5.7)	-	2 (2.3)	-	-	-
IV-FN/SFN 4 (0.8)	4 (100)	0	0	-	-	-	-	-	-	-
V-SM 36 (6.8)	1 (2.8)	1 (2.8)	0	32 (88.9)	-	-	1 (2.8)	-	-	1 (2.8)
VI-Malignant 12 (2.3)	1 (8.3)	0	0	7 (58.3)	-	1 (8.3)	1 (8.3)	1 (8.3)	1 (8.3)	-

Abbreviation: Non-diagnostic or Unsatisfactory (ND/US), Atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS), Follicular Neoplasm or Suspicious for a Follicular Neoplasm (FN/SFN), nodular goiter (NG), follicular adenoma (FA), chronic lymphocytic thyroiditis (CLT), papillary thyroid carcinoma (PTC), follicular carcinoma (FC), oncocytic carcinoma (OC), poorly differentiated thyroid carcinoma (PDTC), anaplastic thyroid carcinoma (ATC), medullary thyroid carcinoma (MTC), Noninvasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP)

Table 3:

Benign and malignant categories diagnosed by FNAC and their comparison with histopathological diagnosis.

FNAC TBSRTC Diagnostic Category	Number of patients	Histologic type	Number of patients	Remarks %
II-Benign	216	Nodular goiter	155	True negative (74.1%)
		Chronic lymphocytic thyroiditis	5	
		Follicular adenoma	23	False negative (25.9%)
		Papillary thyroid carcinoma	24	
		Follicular carcinoma	6	
		Poorly differentiated thyroid carcinoma	2	
		Medullary thyroid carcinoma	1	
VI-Malignant	12	Nodular goiter	1	False positive (8.3%)
		Papillary thyroid carcinoma	7	True positive (91.7%)
		Oncocytic carcinoma	1	
		Poorly differentiated thyroid carcinoma	1	
		Anaplastic thyroid carcinoma	1	
		Medullary thyroid carcinoma	1	

Table 4:

Comparison between malignant and benign thyroid lesion groups and implied risk of malignancy from TBSRTC [3]

TBSRTC[3]		Present study		
Diagnostic Category, n	Risk of malignancy (ROM) (%)	Histopathology, n		ROM (%)
		Nonneoplastic/ Benign lesions	Malignant lesions	
I. Non-diagnostic or Unsatisfactory, 172	5 to10	145	27	15.7
II. Benign, 216	0 to 3	183	33	15.3
III. Atypia of undetermined significance or follicular lesion of undetermined significance, 87	~10 to 30	58	29	33.3
IV. Follicular Neoplasm or Suspicious for a Follicular Neoplasm, 4	25 to 40	4	0	0
V. Suspicious for Malignancy, 36	50 to 75	3	33	91.7
VI. Malignant, 12	97 to 99	1	11	91.7

Approximately one-third (32.6%) of total FNAC were classified as non-diagnostic/ unsatisfactory. Despite the ROM of this category (15.7%) was lower than reported from previous studies in Thailand (about 19.2-22.6%)[6,13-15], these figures were higher than an acceptable range of 5-10 stated by TBSRTC[3] (Table 5). This could possibly be due to various factors such as nature of disease, collection methods, quality of the specimen, and competency of an interpreting pathologist. Some studies suggested a use of rapid onsite evaluation by cytotechnologist or cytopathologist to determine specimen adequacy or assisting devices such as ultrasound guided FNAC[16-17]. These techniques were expected to increase the diagnostic yield and decrease rate of re-aspiration. Although we could not determine the methods used in specimen collection for cytological examination, it would be important to provide feedback to the responsible departments and clinicians, such as interventional radiologists, endocrinologists, otolaryngologist, or surgeons to ensure quality control and improve patient management.

In this study, benign category was the most commonly found (41%). However, the ROM in benign category (15.3%) was approximately 5 folds higher than the expected range specified in TBSRTC[3]. The possible reasons varied. Nature of the disease including its characteristic features may affect the cytological assessment. For example, papillary microcarcinoma which is less than 1 cm in size is certainly a challenge for a clinician to obtain representative sample. This factor was especially important if the procedure was executed without a guiding-image or performed by an untrained physician. Furthermore, this microcarcinoma may be an incidental finding in thyroid nodule resected for the treatment of non-malignant thyroid disease[20-21].

Table 5:

Comparison of percentages of distribution of FNAC diagnoses using TBSRTC among published studies.

TBSRTC Diagnostic Category	Risk of malignancy (ROM)								
	Vajira Hospital 2013-2021	Theptarin Hospital[6] 2010-2017	Rajvithi Hospital[12] 2013-2015	KCMH[13] 2010–2015	Srinagarind Hospital[14] 2011–2015	Chiang Mai University[14] 2011–2015	University Medical Center at Princeton, Princeton[17] 1999 -2013	Yamashita Thyroid Hospital[18] 2016	TBSTC, risk of malignancy[3] 2018
I-ND/US	15.7	20	22.1	19.2	22.6	21.7	12	20.6	5 to10
II-Benign	15.3	4	2.8	14	15.2	14.8	5	12.4	0 to 3
III-AUS/FLUS	33.3	9	46.2	37.9	32.9	44.4	17	14.9	~10 to 30
IV-FN/SFN	0	24	37.3	20.9	58.3	54.5	25	24.7	25 to 40
V-SM	91.7	57	74.3	81.5	78.1	70.4	72	92.3	50 to 75
VI-Malignant	91.7	90	90	93.6	92.5	91.9	98	100	97 to 99

Abbreviation: The Bethesda System for Reporting Thyroid Cytopathology(TBSTC), Non-diagnostic or Unsatisfactory (ND/US), Atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS), Follicular Neoplasm or Suspicious for a Follicular Neoplasm (FN/SFN), Suspicious for Malignancy (SM), King Chulalongkorn Memorial Hospital (KCMH)

Although the prevalence of papillary carcinoma in our study (20.1%) was lower than a range of 22.6% to 38.8% reported in other two previous studies in Thailand[6,13], this type of cancer was the most frequent malignant thyroid neoplasm found in our study and other studies. The different prevalence in each study was possibly due to the number of cases recruited for each study.

The authors evaluated the diagnostic accuracy determined by correlation between cytological diagnosis according to FNAC TBSRTC category and final histological diagnosis was evaluate in clearly defined diagnostic categories. In TBSRTC category II showed 74% true negative (nodular goiter and chronic lymphocytic thyroiditis) which was lower than previous studies (78.3-96%)[6,13-15,18-19,22]. While TBSRTC category VI was 91.7% true positive (carcinoma) which was comparable to previous studies (90-100%)[6,13-15,18-19,22].

According to the TBSRTC, the upper limit for AUS/FLUS category should be lower than 30% of total thyroid FNAC. A higher ROM in this category in our study (33.3%) was comparable to data from previous studies in Thailand which showed a range of ROM between 9 to 46.7%[6,13-15]. Interestingly, there were Thai studies[13-15] showing a higher percentage than the recommended standard by TBSRTC; besides, three of them had higher number than the present one. On the other hand, our number exceeded that of in the studies by American[18] and Japanese[19] institutions. A possible cause that had could affect in our data was some of the primary FNAC diagnosis were re-categorized from to follow TBSRTC in our study. The AUS/FLUS were re-interpreted from descriptive and non-decisive lesions. Although there were criteria using cyto-morphological features according to TBSRTC, this gray zone of diagnostic category was commonly found especially for a cytopathologist who works alone and prefers to be on a safe side. Due to the higher number in Thai studies, these might imply that Thai pathologists had tendency toward a gray-zone diagnostic category rather than clear-cut one. We recommend implementing a consultation system for a second opinion which may eventually reduce this equivocal diagnostic category.

The ROM of follicular or suspicious for follicular neoplasm (category IV) in our study was 0%. This was because there were only 4 cases reported under this category and none were malignant. Regarding the category V of suspicious for malignancy, our ROM was quite high (91.7%). This was comparable to 92.3% of the Japanese study[17] but was higher than 57-87.5% reported in other studies[6,13–15,18]. With the same reason as described above in the AUS/FLUS category, a non-confident cytopathologist may be reluctant to make a definite diagnosis of cancer from cytologic specimen. Continual education and training with a consultation among team members with an equivocal diagnosis would enhance the competency of individuals. The ROM of other categories (III, V, and VI) were comparable to the tertiary medical centers in Thailand[6,13-15] and Japan[19].

Another concern was the identification of NIFTP. The NIFTP had recently been introduced in the WHO Classification of Tumors of Endocrine Organs 2017[11]. This diagnosis entity had been studied to determine its nature as a benign or malignant tumor. This uncertainty affects the ROM in TBSRTC. According to TBSRTC, if NIFTP is considered a malignant tumor, the ROM of was 10–30% in AUS/FLUS category; however, excluding NIFTP from the malignant entity, the ROM is 6-18% in the same diagnostic category. In our study, we determined the ROM considering NIFTP as a benign neoplastic lesion.

Conclusion

Our research found that the accuracy of thyroid FNAC was high in the malignant groups, including categories V and V. While, in comparison to TBSRTC, the ROM was higher in diagnostic categories I, II, III, and V but lower in category VI. The findings also demonstrated that our data was comparable to other published studies including from local and international ones.

We encourage the use of fine needle aspiration cytology (FNAC) to assess individuals with thyroid nodules prior to surgery. The TBSRTC had a well-developed set of reliable diagnostic criteria for examining thyroid cytologic characteristics.

We strongly recommend that all cytotechnologists, cytopathologists, and pathologists use the TBSRTC as it is a standard system. The system allowed medical practitioners of to make a cytologic diagnosis according to the TBSRTC, so every medical personnel with various expertise would share common understanding and communicate to one another under the same concept leading to the most appropriate management for the patients.

Ethics approval

This study was conducted with the approval of the Institutional Review Board of Faculty of Medicine Vajira Hospital, Navamindradhiraj University. (COA 107/2564). No informed consent to participants was required as a retrospective study.

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Disclosure

The authors declare that they have no competing interests.

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