*Original Article*

# Diagnostic Accuracy of Fine Needle Aspiration Cytology in Thyroid Nodules in Thammasat University Hospital

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***Background***: Fine needle aspiration (FNA) cytology is a key investigation of thyroid nodules. There are several reports of FNA accuracy, which ranges from 75.0% to 94.8%, while false negative rates are 5.8% to 21.5%. In Thailand, there is no available data of FNA accuracy according to the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC). The present study reported single-institute data of FNA accuracy, that could be used in thyroid nodule management.

***Objective***: To determine the diagnostic accuracy of FNA cytology results of thyroid nodules collected in Thammasat University (TU) Hospital.

***Materials and Methods***: The present study was a retrospective study collected cytologic results of all thyroid nodules that subsequently had definitive histopathologic diagnoses. The data were gathered from clinics at TU Hospital that performed thyroid nodule FNA between May 2011 and November 2014. The FNA cytology results were classified according to TBSRTC. Each cytopathologic result was compared with its postoperative tissue histopathology. The malignancy rate, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated.

***Results***: The present study included 197 thyroid nodule FNA cytology results. The sensitivity and specificity were 77.8% and 65.4%, respectively. The calculated PPV was found to be 47.7%, and the NPV was 87.9%. The accuracy of these results was 69.0%. The malignancy rate of the unsatisfactory group was 6.25%, benign group 8.05%, atypia of undetermined significance or follicular lesion of unknown significance 22.22%, follicular neoplasm/suspicious for follicular neoplasm 14.20%, suspicious for malignancy 73.68%, and malignant 100%.

***Conclusion***: The FNA cytology in TU Hospital has comparable sensitivity to the other studies. Interestingly, the malignancy rate in the follicular neoplasm category is lower than that of the other institutes because of a high false positive rate in this category. This causes lower specificity and accuracy, which may cause a higher rate of unnecessary operations.

***Keywords***: FNA; Thyroid nodule; Diagnostic accuracy

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The incidence of thyroid nodule is gradually increasing due to the common use of neck diagnostic imaging for its versatility. The incidence of palpable thyroid nodule in females is 5% and 1% in males[1]. It has been found that approximately 5% to 15% of these thyroid nodules are cancerous[2]. Therefore, it is imperative to distinguish thyroid cancer from a benign thyroid nodule. Apart from clinical and ultrasonographic evaluation, fine needle aspiration (FNA) cytology is an important diagnostic tool to determine the malignant possibility of each thyroid nodule. The United State National Cancer Institute (NCI) recommends the use of The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) for worldwide communication in FNA cytology results. The TBSRTC can be divided into six categories characterized by differences in malignancy rate and management: 1) non-diagnostic or unsatisfactory, 2) benign, 3) atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS), 4) follicular neoplasm or suspicious for follicular neoplasm (FN/SFN), 5) suspicious for malignancy, and 6) malignant[3,4]. Based on literature review of similar studies, sensitivity of FNA cytology of thyroid nodules ranges from 78.4% to 96.7%, specificity 85.9% to 98.2%, positive predictive value (PPV) 76.6% to 99.0%, negative predictive value (NPV) 66.3% to 98.2%, and total accuracy 75.0% to 94.8%[5-9].

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## Materials and Methods

The present study was conducted in a

retrospective, descriptive format. FNA cytology results were collected from different departments (General Surgery, Internal Medicine, Otolaryngology, and Radiointervention) in Thammasat University (TU) hospital between May 2011 and November 2014. The calculated sample size could be more than 161 by formula. The project was approved by the Human Research Ethics Committee of Thammasat University (MTU-EC-SU-0-167/57).

Inclusion criteria were FNA cytology of thyroid nodules including both blind and ultrasound-guided techniques, collected by clinics in TU Hospital that subsequently underwent thyroid surgeries for final histological diagnoses. Positive FNA cytology consisted of the following categories, AUS/FLUS, FN/SFN, suspicious for malignancy, and malignant categories. Negative FNA cytology included the benign category. Furthermore, positive histopathologies were classified as all forms of carcinoma including, but not limited to papillary thyroid carcinoma, follicular carcinoma, or medullary carcinoma. Negative histopathologies were defined as thyroid cyst, thyroiditis, diffused hyperplasia, nodular hyperplasia, follicular adenoma, and any types of goiters. Indications for surgery in the unsatisfactory and benign groups were compressive symptoms, evidence of air way compression, growing nodule, or for definite diagnosis of suspicious lesions.

### Statistical analysis

The data was collected in approved case-record form in accordance with patient privacy policies. The collected data was calculated for sensitivity, specificity, PPV, NPV, and accuracy with 95% confidence interval (CI) estimation.

## Results

One hundred ninety-seven FNA samples from 186 patients, with a female-to-male ratio of 9.2:1, were collected. The patient age ranged from 12 to 84 years old, with a median age of 49 years. Thyroid nodule sizes ranged from 7 to 190 mm, with an average of 33.64 mm. The most frequent thyroid operation was unilateral lobectomy, which accounted for 60.2% of the total number of surgeries. FNA cytology results were classified using TBSRTC as shown in Table 1.

The malignancy rate of each category according to TBSRTC in comparison to the malignancy rate of each FNA category in TU Hospital was quite similar. However, the incidence rates for AUS and FN/SFN were statistically different. As shown in Table 2, the malignancy rate of AUS (22.22%) was higher at TU Hospital than the TBSRTC malignancy rate of AUS, while the malignancy rate of FN/SFN (14.20%) was lower at TU Hospital. In the FN/SFN group, there were 20% of adenoma and 65.7% of other benign pathologic lesions such as thyroiditis, nodular goiter, or hyperplasia.

The FNA results of thyroid nodules collected in TU Hospital showed sensitivity as 77.8% (95% CI 64.4 to 88.0), specificity as 65.4% (95% CI 56.7 to 73.4), PPV as 47.7% (95% CI 37.0 to 58.6), NPV as 87.9% (95% CI 79.8 to 93.6), and accuracy as 69.0% (95% CI 65.0 to 79.0).

**Table 1.** The number of FNA cytology classifications in each category by TBSRTC

| Category | n (%) |
|---|---|
| Unsatisfactory | 16 (8.1) |
| Benign | 87 (44.2) |
| AUS | 18 (9.1) |
| Follicular neoplasm or suspicious | 37 (18.8) |
| Suspicious for malignancy | 18 (9.1) |
| Malignant | 21 (10.7) |

AUS=atypia of undetermined significance

**Table 2.** Comparison of malignancy rate between TBSRTC study and TU Hospital[3]

| Diagnostic category | Malignancy rate (%) | |
|---|---|---|
| | TBSRTC | TU Hospital |
| Unsatisfactory | 1 to 4 | 6.25 |
| Benign | 0 to 3 | 8.04 |
| Atypia of undetermined significance | 5 to 15 | 22.22 |
| Follicular neoplasm or suspicious | 15 to 30 | 14.20 |
| Suspicious for malignancy | 60 to 75 | 73.68 |
| Malignant | 97 to 99 | 100 |

TBSRTC=the Bethesda System for Reporting Thyroid Cytopathology; TU=Thammasat University

The FNA interpretation in this study was based on TBSRTC 2009, which did not include noninvasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP).

## Discussion

Apart from clinical and radiologic evaluation, FNA cytology of thyroid nodule is the most reliable non-surgical technique for diagnosing malignancy. Thyroid nodule FNA is a simple and quick procedure while posing very few complications[7,10]. Therefore, FNA plays a key role in management of patients with thyroid nodule(s).

In comparison to the blind technique, FNA performed with ultrasound-guidance produced a lower false negative rate because of more accurate needle placement within a nodule, which decreased sampling error[10]. Due to limitations of hospital resources in the past, the decision of choosing between the blind technique and the ultrasound-guided FNA technique depended on the physician's judgment. In the future, training in the ultrasound-guided FNA technique and increase in medical staff may increase the number of ultrasound-guided FNA technique.

Even though recent studies showed TBSRTC system did not improve diagnostic accuracy for malignancy detection in thyroid nodules when compared with the previous practice[4], the present study categorized FNA results according to TBSRTC for universal communication and comparison of malignancy rate of each category.

At TU Hospital, there are lower specificity and lower accuracy for FNA cytology results of thyroid nodules when compared to the other studies[5-9], as shown by a lower reported malignancy rate in the FN/SFN category of the present study. The low malignancy rate in FN/SFN category was the result of a high false positive rate in this group. A high false positive rate in FN/SFN category may cause a higher rate of unnecessary operations. On the other hand, the FNA cytology results of thyroid nodules had a comparable sensitivity to other studies. Therefore, malignant thyroid nodules can be detected in TU Hospital's current practice in accordance with the international standard. However, an interdepartmental conference, including Pathology, Surgery, Otolaryngology, Internal Medicine, and Radiointervention, is needed to review the management and interpretation of FNA cytology results of thyroid nodules. After the interdepartmental conference, revision of diagnostic accuracy in FNA cytology results of thyroid nodules may be useful for future study.

## Conclusion

FNA cytology in thyroid nodules in TU Hospital showed sensitivity 77.8%, specificity 65.4%, PPV 47.7%, NPV 87.9%, and accuracy 69.0%.

## What is already known on this topic?

The diagnostic accuracy of FNA cytology for thyroid nodules according to TBSRTC were reported from several studies, sensitivity ranges from 78.4% to 96.7%, specificity 85.9% to 98.2%, PPV 76.6% to 99.0%, NPV 66.3% to 98.2%, and total accuracy 75.0% to 94.8%. Thyroid nodule management will follow the recommendation along the risk of malignancy in each category. There is no available data of FNA diagnostic accuracy in Thailand, so the data of FNA report and its correlation to the final pathological result are very helpful for thyroid nodules management in Thailand.

## What this study adds?

This research reports the FNA diagnostic accuracy in thyroid nodule and provides clinicians the evidence-based data for decision making in thyroid nodules management. Furthermore, this study result could be compared with the international studies and used to improve quality of FNA diagnoses of thyroid nodules in Thailand.

## Conflicts of interest

The authors declare no conflict of interest.

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