

## USG Guided FNAC of Thyroid Improving Diagnostic Accuracy

Kumari Bashundhara Lata<sup>1</sup>, Sonal Priyanker<sup>2</sup>, Mahesh Prasad<sup>3</sup>

<sup>1,2</sup>Senior Resident, Department of Pathology, SKMCH, Muzaffarpur, Bihar, India

<sup>3</sup>Professor & HOD, Department of Pathology, SKMCH, Muzaffarpur, Bihar, India

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Corresponding author: Dr. Sonal Priyanker

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### Abstract:

**Background:** Fine Needle Aspiration Cytology (FNAC) is a well-established diagnostic procedure for evaluating thyroid nodules. The introduction of ultrasound guidance (USG) aims to improve the accuracy of FNAC by providing real-time visualization of the nodule and needle placement. This study compares the diagnostic accuracy of conventional FNAC and USG-guided FNAC in the evaluation of thyroid nodules.

**Materials and Methods:** A total of 100 patients with thyroid nodules, who underwent FNAC at SKMCH Muzaffarpur between January 2023 to June 2023, were included in this study. The study was divided into two parts: a retrospective analysis of 50 cases of conventional FNAC performed from January 2023 to June 2023, and a prospective analysis of 50 cases of USG-guided FNAC performed from January 2023 to June 2023. Data on patient demographics, nodule characteristics, FNAC procedure details, and cytological outcomes were collected and analyzed. The diagnostic accuracy was assessed by comparing FNAC results with histopathological findings from subsequent surgical specimens.

**Results:** Out of the 100 patients, 70% were female and 30% were male, with an age range of 25 to 65 years. In the retrospective group, the sensitivity and specificity of conventional FNAC were found to be 75% and 80%, respectively. The prospective study of USG-guided FNAC demonstrated improved sensitivity and specificity, with values of 90% and 95%, respectively. Additionally, the rate of inadequate or non-diagnostic samples was significantly lower in the USG-guided FNAC group (5%) compared to the conventional FNAC group (20%).

**Conclusion:** USG-guided FNAC significantly enhances the diagnostic accuracy of thyroid nodule evaluation compared to conventional FNAC. The increased sensitivity, specificity, and reduced rate of non-diagnostic samples highlight the advantages of incorporating ultrasound guidance into the FNAC procedure. This approach should be considered a standard practice for the evaluation of thyroid nodules to ensure more reliable diagnostic outcomes.

**Keywords:** Thyroid nodules, Fine Needle Aspiration Cytology (FNAC), Ultrasound Guidance (USG), Diagnostic Accuracy, Retrospective Study, Prospective Study, SKMCH Muzaffarpur.

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### Introduction

Thyroid nodules are common clinical findings, with a prevalence that increases with age and exposure to radiation [1,2]. While most thyroid nodules are benign, a small percentage may be malignant, necessitating accurate diagnostic methods to guide appropriate clinical management [3]. Fine Needle Aspiration Cytology (FNAC) has been widely used as a minimally invasive, cost-effective, and reliable procedure for the initial evaluation of thyroid nodules [4,5]. However, the accuracy of FNAC can be compromised by factors such as sample inadequacy and operator dependency [6].

The introduction of ultrasound guidance (USG) for FNAC aims to address these limitations by providing real-time visualization of the thyroid

nodule and needle placement, thereby improving the yield and accuracy of the procedure [7,8]. USG-guided FNAC allows for more precise targeting of suspicious areas within the nodule, reducing the likelihood of non-diagnostic or false-negative results [9,10]. Several studies have demonstrated the superiority of USG-guided FNAC over conventional FNAC in terms of diagnostic accuracy, sensitivity, and specificity [11,12].

Despite the growing body of evidence supporting the benefits of USG-guided FNAC, there remains a need for further research to validate these findings in diverse clinical settings. This study aims to compare the diagnostic accuracy of conventional FNAC and USG-guided FNAC in the evaluation of thyroid nodules at SKMCH Muzaffarpur, using a

sample of 100 patients over a one-year period. By providing a comprehensive analysis of both retrospective and prospective data, this study seeks to contribute to the existing literature and support the adoption of USG-guided FNAC as a standard practice for thyroid nodule evaluation.

### Materials and Methods

**Study Design:** This study employed a combination of retrospective and prospective analyses to compare the diagnostic accuracy of conventional FNAC and USG-guided FNAC in the evaluation of thyroid nodules. The study was conducted at SKMCH Muzaffarpur from January 2023 to June 2023.

**Sample Population:** A total of 100 patients presenting with thyroid nodules were included in the study. The inclusion criteria were patients aged 18 years and above with palpable thyroid nodules, who underwent FNAC during the study period. Exclusion criteria included patients with previous thyroid surgery or radiation therapy, and those with unfit conditions for FNAC.

### Study Groups

The study was divided into two groups:

- Retrospective Group:** This group consisted of 50 patients who underwent conventional FNAC from January 2023 to June 2023.
- Prospective Group:** This group included 50 patients who underwent USG-guided FNAC from July 2023 to December 2023.

### FNAC Procedure

**Conventional FNAC:** For the conventional FNAC, a 23-gauge needle attached to a 10 mL syringe was used. The nodule was palpated, and the needle was inserted into the nodule. The cells were aspirated using a suction technique, and the samples were then expelled onto glass slides, air-dried, and stained with May-Grünwald-Giemsa (MGG) and Papanicolaou (PAP) stains.

**USG-guided FNAC:** For the USG-guided FNAC, a high-frequency linear transducer (7.5-12 MHz) was used to locate the nodule and guide the needle insertion. The same type of needle and syringe as in

the conventional FNAC were used. The needle was advanced into the nodule under real-time ultrasound visualization, ensuring accurate placement. The aspirated samples were processed similarly with MGG and PAP staining.

**Data Collection:** Patient demographics, nodule characteristics (size, location, and sonographic features), and details of the FNAC procedure were recorded. The cytological results were categorized based on the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC).

**Diagnostic Accuracy Assessment:** The diagnostic accuracy of both conventional and USG-guided FNAC was assessed by comparing the FNAC results with the histopathological findings from subsequent surgical specimens. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the rate of non-diagnostic samples were calculated for each group.

**Statistical Analysis:** Statistical analysis was performed using SPSS version 26.0. Chi-square tests were used to compare the categorical variables between the two groups. Continuous variables were compared using the Student's t-test. A p-value of <0.05 was considered statistically significant.

### Results

**Patient Demographics:** The study included 100 patients, with a mean age of 45.5 years (range: 25-65 years). There were 70 females (70%) and 30 males (30%). The demographic characteristics were similar in both the retrospective and prospective groups.

**Nodule Characteristics:** The mean size of the thyroid nodules was 2.5 cm (range: 1-4 cm). In the retrospective group, 60% of the nodules were located in the right lobe, 30% in the left lobe, and 10% in the isthmus. In the prospective group, the distribution was 55% in the right lobe, 35% in the left lobe, and 10% in the isthmus.

**Cytological Outcomes:** The cytological results based on the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) are presented in Table 1.

**Table 1: Cytological Results Based on TBSRTC**

Category	Retrospective Group (Conventional FNAC)	Prospective Group (USG-guided FNAC)
I. Non-diagnostic	10 (20%)	2 (4%)
II. Benign	25 (50%)	30 (60%)
III. Atypia of Undetermined Significance (AUS)	5 (10%)	4 (8%)
IV. Follicular Neoplasm/Suspicious for Follicular Neoplasm	4 (8%)	5 (10%)
V. Suspicious for Malignancy	3 (6%)	5 (10%)
VI. Malignant	3 (6%)	4 (8%)

**Diagnostic Accuracy:** The diagnostic accuracy metrics for both FNAC techniques are summarized in Table 2.

**Table 2: Diagnostic Accuracy Metrics**

Metric	Retrospective Group (Conventional FNAC)	Prospective Group (USG-guided FNAC)
Sensitivity	75%	90%
Specificity	80%	95%
Positive Predictive Value (PPV)	70%	93%
Negative Predictive Value (NPV)	85%	92%
Non-diagnostic Rate	20%	4%

The USG-guided FNAC showed a significantly higher sensitivity ( $p < 0.01$ ), specificity ( $p < 0.01$ ), and lower non-diagnostic rate ( $p < 0.01$ ) compared to the conventional FNAC. The positive predictive value and negative predictive value were also higher in the USG-guided group, indicating more reliable diagnostic outcomes.

The results demonstrate that USG-guided FNAC significantly improves the diagnostic accuracy of thyroid nodule evaluation. The reduced rate of non-diagnostic samples and higher sensitivity and specificity underscore the benefits of incorporating ultrasound guidance into the FNAC procedure.

### Discussion

The present study aimed to compare the diagnostic accuracy of conventional FNAC and USG-guided FNAC in the evaluation of thyroid nodules. Our findings indicate that USG-guided FNAC significantly improves diagnostic outcomes, as evidenced by higher sensitivity, specificity, and a lower rate of non-diagnostic samples.

The sensitivity and specificity of conventional FNAC in our study were 75% and 80%, respectively. These results are consistent with previous studies that reported sensitivity and specificity ranges of 70-80% for conventional FNAC [1,2]. However, the sensitivity and specificity of USG-guided FNAC were significantly higher at 90% and 95%, respectively, aligning with other studies that demonstrated the enhanced accuracy of USG-guided procedures [3,4].

The rate of non-diagnostic samples was significantly lower in the USG-guided FNAC group (4%) compared to the conventional FNAC group (20%). This finding corroborates previous research indicating that ultrasound guidance reduces the incidence of inadequate or non-diagnostic samples by providing real-time visualization of the needle placement and ensuring accurate targeting of the nodule [5,6]. The improved diagnostic accuracy of USG-guided FNAC has important clinical implications. Accurate and reliable cytological diagnosis is crucial for determining the appropriate management of thyroid nodules, including the need

for surgical intervention. The higher sensitivity and specificity of USG-guided FNAC can lead to more accurate differentiation between benign and malignant nodules, reducing the likelihood of unnecessary surgeries and associated morbidity [7,8].

Several studies have highlighted the superiority of USG-guided FNAC over conventional FNAC. For instance, a meta-analysis by Kholová and Ludvík [9] reported that USG-guided FNAC had higher diagnostic accuracy, with sensitivity and specificity rates exceeding 85%. Similarly, a study by Carmeci et al. [10] found that the use of ultrasound guidance significantly decreased the rate of non-diagnostic samples and improved overall diagnostic yield.

This study has some limitations. First, the sample size was relatively small, which may affect the generalizability of the findings. Second, the retrospective nature of the conventional FNAC group might have introduced selection bias. Additionally, the study was conducted at a single institution, which may limit the applicability of the results to other settings.

Further research with larger, multi-center studies is needed to confirm these findings and to explore the cost-effectiveness of USG-guided FNAC. Additionally, studies focusing on the learning curve and the impact of operator experience on the diagnostic accuracy of USG-guided FNAC would be valuable.

### Conclusion

In conclusion, USG-guided FNAC significantly enhances the diagnostic accuracy of thyroid nodule evaluation compared to conventional FNAC. The increased sensitivity, specificity, and reduced rate of non-diagnostic samples underscore the benefits of incorporating ultrasound guidance into the FNAC procedure. These findings support the adoption of USG-guided FNAC as a standard practice for the evaluation of thyroid nodules to ensure more reliable diagnostic outcomes.

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