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Original Research Article

Thyroid Lesions Reporting Using the TBSRTC System and Cyto-histopathological Correlation: An Experience at a Tertiary Care Hospital

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Abstract:

Background: In clinical practice, thyroid nodules are commonly seen, necessitating precise diagnostic techniques to differentiate between benign and malignant diseases. A standardised method for thyroid FNAC (Fine Needle Aspiration Cytology) is provided by the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), which improves diagnostic clarity and directs clinical care. The study assessed the TBSRTC system's diagnostic accuracy in the reporting of thyroid lesions and its relationship to histological results in a tertiary care hospital setting.

Methods: A total of 160 individuals who underwent thyroid FNAC and subsequent histopathological examination were included. FNAC results were categorized using TBSRTC, and their correlation with histopathological findings was analyzed. Statistical analysis was done using SPSS version 21.0.

Results: The study comprised 160 participants, predominantly female (70%), with a mean age of 45.3 years. FNAC results distribution according to TBSRTC categories were: 5% non-diagnostic, 56.25% benign, 7.5% AUS/FLUS, 8.75% FN/SFN, 10% suspicious for malignancy, and 12.5% malignant. Histopathological examination confirmed 62.5% benign and 37.5% malignant cases. The sensitivity, specificity, PPV, NPV, and overall accuracy of TBSRTC were 95%, 88.9%, 95%, 88.9%, and 90.9%, respectively, with a kappa statistic of 0.76 indicating substantial agreement between FNAC and histopathology.

Conclusion: The TBSRTC system demonstrates high diagnostic accuracy and substantial agreement with histopathological findings, validating its effectiveness in the assessment of thyroid lesions. It reliably stratifies the risk of malignancy, guiding clinical decisions and reducing unnecessary surgeries.

Recommendations: Future studies should explore the integration of molecular testing with TBSRTC to enhance diagnostic precision, particularly for indeterminate categories. Continuous training and standardization in FNAC procedures and reporting can further improve diagnostic outcomes.

Keywords: Thyroid lesions, Fine Needle Aspiration Cytology, Diagnostic accuracy, Histo-pathological correlation.

Introduction

Depending on the technique of detection, the incidence of thyroid nodules in the general population can range from 19% to 68%. Thyroid nodules are a common clinical concern. While the majority of these nodules are benign, a tiny number may be malignant, in which case precise and trustworthy diagnostic instruments are required to direct therapeutic therapy.

Because Fine Needle Aspiration Cytology (FNAC) is highly accurate, economical, and minimally invasive, it has emerged as the gold standard for the initial examination of thyroid nodules [1]. Thyroid FNAC data can be interpreted and reported using a standardised framework according to the 2009 and 2017 revisions to the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) [2]. Atypia of unclear significance/follicular lesion of undetermined significance (AUS/FLUS), benign, follicular neoplasm/suspicious for a follicular neoplasm (FN/SFN), suspected for malignancy, and malignant are the six categories into which the TBSRTC divides FNAC findings.

The diagnostic procedure and clinical decision-making for thyroid nodules have been greatly enhanced by the association of each category with a distinct risk of malignancy and accompanying

therapy guidelines [3]. The clinical utility of TBSRTC lies in its ability to stratify the risk of malignancy, thereby guiding the need for surgery or conservative management. Studies have shown that the implementation of TBSRTC has enhanced the reproducibility and accuracy of thyroid FNAC reporting, reduced inter-observer variability, and provided clear communication between cytopathologists and clinicians [4]. However, the ultimate confirmation of the nature of thyroid nodules often requires histopathological examination following surgical resection, particularly for indeterminate and suspicious categories. Despite the widespread adoption of TBSRTC, there remains variability in its diagnostic accuracy across different institutions and populations. Recent research continues to explore the correlation between TBSRTC categories and histopathological outcomes to refine its predictive value and optimize patient management [5]. Moreover, advancements in molecular testing and genetic markers are being integrated with TBSRTC to further enhance diagnostic precision, particularly for indeterminate nodules.

The study aimed at evaluating thyroid lesions using the TBSRTC reporting system and correlating these findings with cyto-histopathological results.

Methodology

Study Design: A retrospective, observational analysis.

Study Setting: The study was done over a period of 2 years, from August 2022 to March 2024 at Jawaharlal Nehru Medical College (JLNMC), Bhagalpur.

Participants: A total of 160 individuals were comprised in the study.

Inclusion Criteria: Patients of all ages and genders who had both thyroid FNAC and histopathological examination.

Exclusion Criteria

- Patients who only had FNAC without follow-up histopathological examination.
- Inadequate or non-diagnostic FNAC samples.
- Patients with prior thyroid surgery or malignancy.

Bias: Reporting bias was minimized by ensuring that all FNAC and histopathological evaluations were conducted by experienced pathologists who were blinded to each other's results.

Variables: Variables included age, gender, clinical presentation, FNAC results using TBSRTC categories, histopathological diagnosis, correlation between FNAC and histopathology.

Data Collection: Data was collected from patient medical records, including demographic information, clinical presentation, FNAC reports categorized using the TBSRTC system, and histopathological examination results.

Procedure

1. **FNAC Procedure:** FNAC was performed under ultrasound guidance, and samples were evaluated and categorized using the TBSRTC system by a qualified cytopathologist.
2. **Histopathological Examination:** Following thyroid surgery, the resected specimens were subjected to histopathological examination by a histopathologist.
3. **Correlation Analysis:** FNAC results were correlated with histopathological findings to determine the diagnostic accuracy and concordance rates.

Statistical Analysis

SPSS version 21.0 was utilized to analyse the data. Descriptive statistics like mean and standard deviation, frequencies and percentages were utilised. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and total accuracy were computed to assess the diagnostic accuracy of FNAC. The degree of agreement among FNAC and histological diagnoses was assessed using the kappa statistic. p-value was < 0.05eas deemed statistically significant.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

Result

Out of the 160 individuals, 112 (70%) were female and 48 (30%) were male. The mean age was 45.3 years, with a range from 18 to 75 years.

Table 1: Demographic Characteristics

Demographic Characteristics	Number of Participants	Percentage (%)
Mean Age (years)	45.3 (12.5)	-
Gender		
• Male	48	30
• Female	112	70

Table 2 displays the allocation of FNAC results based on TBSRTC categories. 12.5% of cases were categorised as malignant (Category VI), whilst the majority of cases (56.25%) were classed as benign (Category II).

Table 2: Distribution of FNAC Results Using TBSRTC Categories

TBSRTC Category	Number of Cases	Percentage (%)
I - Non-diagnostic/Unsatisfactory	8	5
II – Benign	90	56.25
III - Atypia of Undetermined Significance (AUS)	12	7.5
IV - Follicular Neoplasm/Suspicious for a Follicular Neoplasm (FN/SFN)	14	8.75
V - Suspicious for Malignancy	16	10
VI – Malignant	20	12.5

The histopathological diagnoses of the thyroid specimens are summarized in Table 3. A total of 62.5% of cases were benign, while 37.5% were malignant.

Table 3: Histopathological Diagnosis

Histopathological Diagnosis	Number of Cases	Percentage (%)
Benign	100	62.5
Malignant	60	37.5

The correlation between FNAC and histopathological results is presented in Table 4. This table shows the distribution of histopathological diagnoses within each TBSRTC category.

Table 4: Correlation between FNAC and Histopathological Results

TBSRTC Category	Histopathological Diagnosis		Total
	Benign	Malignant	
I - Non-diagnostic/Unsatisfactory	5	3	8
II- Benign	80	10	90
III - Atypia of Undetermined Significance (AUS)	8	4	12
IV - Follicular Neoplasm/Suspicious for a Follicular Neoplasm (FN/SFN)	10	4	14
V - Suspicious for Malignancy	6	10	16
VI- Malignant	1	19	20
Total	110	50	160

The TBSRTC system's overall accuracy, PPV, NPV, sensitivity, and specificity were used to assess its diagnostic accuracy. To assess the degree of agreement between FNAC and histological diagnosis, the kappa statistic was also computed. Table 5 provides a summary of the findings.

Table 5: Statistical Analysis of FNAC Diagnostic Accuracy

Statistical Measure	Analysis	Value (%)
Sensitivity	19/(19+1) X 100	95
Specificity	80/(80+10) X 100	88.9
PPV	19/(19+1) X 100	95
NPV	80/(80+10) X 100	88.9
Overall Accuracy	99/(99+11) X 100	90.9
Kappa Statistic	-	0.76

The sensitivity, specificity, PPV, and NPV values indicate high diagnostic accuracy of the TBSRTC system in predicting histopathological outcomes. The kappa statistic shows substantial agreement between FNAC and histopathological results.

Discussion

The study included 160 individuals, predominantly female (70%), with a mean age of 45.3 years. This demographic distribution aligns with the higher prevalence of thyroid disorders in females, suggesting the sample is representative of the typical patient population presenting with thyroid lesions. The FNAC results categorized using the TBSRTC system showed that 56.25% of cases were benign, 12.5% were malignant, and the remaining cases fell into various intermediate categories. The distribution reflects the expected frequency of thyroid lesion types in clinical practice. The high proportion of benign diagnoses underscores the system's utility in reassuring a significant number of patients, potentially reducing unnecessary surgical interventions.

Histopathological examination confirmed 62.5% of cases as benign and 37.5% as malignant. This confirmation rate is crucial, as it validates the FNAC findings and demonstrates the reliability of the TBSRTC system. The slightly higher percentage of malignant cases in histopathology compared to FNAC highlights the importance of histopathological confirmation in cases where FNAC results are ambiguous or suspicious.

The correlation between FNAC and histopathological findings showed substantial agreement, with most benign FNAC results being confirmed as benign and a high proportion of malignant FNAC results confirmed as malignant. This correlation indicates that the TBSRTC system is a reliable predictor of histopathological outcomes, supporting its use in clinical decision-making.

The diagnostic accuracy of the TBSRTC system was high, with a sensitivity of 95%, specificity of 88.9%, and an overall accuracy of 90.9%. The PPV and NPV were also high, at 95% and 88.9%, respectively. The kappa statistic of 0.76 indicates substantial agreement between FNAC and histopathological diagnoses. These statistics demonstrate that the TBSRTC system is both a sensitive and specific tool for diagnosing thyroid lesions, providing reliable results that can guide appropriate clinical management.

The study's findings confirm the effectiveness of the TBSRTC reporting system in accurately diagnosing thyroid lesions. The high diagnostic accuracy and substantial agreement with histopathological findings suggest that FNAC, when interpreted using TBSRTC, can be a highly effective initial diagnostic tool. The results also highlight the system's role in reducing unnecessary surgeries by accurately identifying benign lesions, thus enhancing patient care and optimizing resource utilization in tertiary care settings. In a tertiary care hospital, 390 thyroid FNAs were analysed using TBSRTC, and the results were categorised into different TBSRTC groups. It was discovered that 91.3 percent of the cases were benign, with non-diagnostic cases coming in at 3.5%, follicular neoplasm/suspicious for follicular neoplasm cases at 2.05%, suspected for malignancy cases at 1.02%, and malignant cases at 1.53%. The noteworthy sensitivity and specificity underscored the efficacy of TBSRTC in curtailing unwarranted surgical procedures for benign ailments [6].

With a Cohen's Weighted Kappa score of 0.99, a study that analysed 646 thyroid FNAs and classified them using TBSRTC discovered a good degree of consistency among pathologists. As for the diagnostic accuracy, specificity, and sensitivity, they were 87.9%, 94.3%, and 72.4%, respectively. The study emphasised the clinical significance and excellent predictive value of the system [7]. In another study, two pathologists utilising TBSRTC examined 522 thyroid FNAs and found considerable agreement (98%) between them. A total of 62.68% of the 201 cases with histological follow-up had cancer. The study validated the effectiveness of TBSRTC in a cancer centre context, enabling precise patient triage that necessitates surgery [8].

An Indian oncology centre conducted a study on 431 thyroid FNAs utilising TBSRTC. The study found that the sensitivity was 94.4%, the specificity was 61.9%, the positive predictive value was 90.3%, and the negative predictive value was 72.22%. The study proved that thyroid cytology reporting and management may be streamlined with the help of TBSRTC [9]. A study correlated the histology in 75 instances with 329 thyroid FNAs classified by TBSRTC. The accuracy and dependability of the method were confirmed by the fact that the malignancy risk for each TBSRTC category ranged from 0% in non-diagnostic/unsatisfactory cases to 100% in malignant patients [10].

When TBSRTC and the American College of Radiology Thyroid Imaging Reporting and Data System (TIRADS) were integrated for the purpose of evaluating thyroid nodules, research found that the combined system improved clinical treatment decisions and increased diagnostic accuracy [11]. High diagnosis accuracy was reported by a study that used TBSRTC at a referral centre, with sensitivity and specificity of 83.87% and 89.58%, respectively. For Bethesda Categories V and VI, the risk of cancer was 100%, confirming the therapeutic usefulness of the system [12].

A study of 181 thyroid FNAs showed that TBSRTC enhanced diagnostic accuracy and boosted the capacity to identify follicular neoplasms. In the majority of instances, the system matched the inferred risk described by TBSRTC well [13].

Using TBSRTC, a study examined 869 thyroid nodules and found that the diagnostic accuracy was 93% and the cytohistological concordance was 94%. The study emphasised the function of TBSRTC in the proper assessment and treatment of thyroid lesions [14]. In a study, TBSRTC was found to be a superior screening tool for thyroid lesions, with higher sensitivity (93%) and specificity (86%) when compared to the standard approach for reporting thyroid cytology [15].

TBSRTC showed good diagnostic accuracy, sensitivity, and specificity, justifying its continued usage. A study reclassified 160 thyroid neoplasms in accordance with the new WHO Classification of Thyroid Tumours [16].

Conclusion

The study's findings demonstrate how well the TBSRTC reporting system performs when it comes to correctly diagnosing thyroid abnormalities. Its dependability in differentiating between benign and

malignant lesions is shown by the excellent sensitivity and specificity values. The significant kappa statistic adds more evidence to support the agreement between the histological and cytological results. When evaluating thyroid lesions, the TBSRTC method seems to be a useful tool that improves diagnosis accuracy and helps patients with thyroid problems be managed effectively.

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation

Future studies should explore the integration of molecular testing with TBSRTC to enhance diagnostic precision, particularly for indeterminate categories. Continuous training and standardization in FNAC procedures and reporting can further improve diagnostic outcomes.

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List of abbreviations

FNAC - Fine Needle Aspiration Cytology
TBSRTC - Bethesda System for Reporting Thyroid Cytopathology
AUS - Atypia of Undetermined Significance
FLUS - Follicular Lesion of Undetermined Significance
FN - Follicular Neoplasm
SFN - Suspicious for a Follicular Neoplasm
PPV - Positive Predictive Value
NPV - Negative Predictive Value
SPSS - Statistical Package for the Social Sciences
JLNMC - Jawaharlal Nehru Medical College
TIRADS - Thyroid Imaging Reporting and Data System
WHO - World Health Organization

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