

Role of Fine-Needle Aspiration Cytology in the Evaluation of Thyroid Nodules with Histopathological Correlation: A Retrospective Study

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Abstract:

Background: Thyroid nodules are a common endocrine disorder with a broad spectrum of benign and malignant lesions. Accurate preoperative differentiation is essential to avoid unnecessary surgery while ensuring timely treatment of malignancy. Fine-Needle Aspiration Cytology (FNAC), interpreted using the Bethesda System for Reporting Thyroid Cytopathology, is widely employed as the primary diagnostic modality, with histopathology serving as the gold standard for confirmation.

Aim: To evaluate the diagnostic performance of Fine-Needle Aspiration Cytology in thyroid nodules through correlation with histopathological findings in a tertiary care hospital in Bihar, India.

Methodology: This retrospective observational study included 117 patients with thyroid nodules who underwent FNAC followed by surgical excision and histopathological examination over a one-year period at the Department of Pathology, Nalanda Medical College and Hospital, Patna, Bihar, India. Cytological findings were classified according to the Bethesda System and compared with histopathological diagnoses. Diagnostic indices, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy, were calculated.

Results: Thyroid nodules were most frequently observed among patients aged 31–50 years, with a marked female predominance. Bethesda II (benign) was the most common cytological category, while histopathology confirmed benign lesions in 57.3% and malignant lesions in 42.7% of cases. A highly significant association was observed between Bethesda categories and histopathological diagnosis ($p < 0.001$). Papillary thyroid carcinoma was the predominant malignant lesion. FNAC demonstrated a sensitivity of 86%, specificity of 91%, PPV of 87.8%, NPV of 89.7%, and an overall diagnostic accuracy of 88.9%, with strong cytohistopathological concordance.

Conclusion: FNAC, when interpreted using the Bethesda System, is a reliable, minimally invasive, and cost-effective diagnostic tool for the preoperative evaluation of thyroid nodules. Its high diagnostic accuracy and strong correlation with histopathological findings support its continued use as the first-line investigation for differentiating benign from malignant thyroid lesions and guiding appropriate clinical management.

Keywords: Fine-Needle Aspiration Cytology, FNAC, Thyroid Nodules, Bethesda System, Histopathological Correlation, Thyroid Cancer, Diagnostic Accuracy, Papillary Thyroid Carcinoma.

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Introduction

Thyroid nodules are one of the most prevalent endocrine conditions in clinical practice and pose a major diagnostic problem as they exhibit a variety of pathological entities, from benign hyperplastic nodules to malignant ones. With the use of high-resolution ultrasonography and other imaging techniques, the diagnosis of thyroid nodules has increased significantly in the entire world including India. While the majority of thyroid nodules are benign and do not require treatment other than clinical follow-up, about 10-15% of thyroid nodules are malignant and the diagnosis needs to be made early for timely management and better outcomes for patients [1]. In

clinical evaluation, the differentiation of benign from malignant thyroid nodules is thus a major goal prior to surgery, in order to avoid unnecessary thyroid surgery and to prompt surgery in cases of thyroid malignancy [2].

The sensitivity and specificity of clinical examination in the distinction between benign and malignant thyroid lesions is restricted. Imaging techniques like sonography can help in the large scale of information of the size, morphology, vascularity and suspicious characteristics of thyroid nodules but cannot be used to give accurate pathological diagnosis. As

a result, the fine-needle aspiration cytology (FNAC) has become the standard for pre-operative evaluation [3]. FNAC is a simple, minimally invasive, rapid, safe and cost-effective diagnostic method for obtaining valuable cytomorphological data which allows the clinicians to classify the patients as per their malignant risk and decide upon surgical and conservative therapy.

The advent of FNAC has seen it become the initial investigation of choice for thyroid nodules due to its high diagnostic accuracy, minimal complications and excellent patients' acceptance. The procedure can be done without pain, without anesthesia, has minimal discomfort and is a significant cost reduction to the health care system as it eliminates the need for more surgery. In addition, FNAC helps surgeons plan the scope of surgery, and allows for adequate patient counselling prior to surgical intervention. A number of studies have shown that the systematic use of FNAC significantly cuts down the number of unnecessary thyroidectomies and raises the percentage of thyroid surgery for malignant disease [4].

The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was developed to facilitate better reporting and communication between pathologists and clinicians. There is a standardized reporting system that classifies thyroid cytology into 6 diagnostic categories with an associated estimated risk of malignancy and guidelines for management [5]. Since the adoption of TBSRTC, there has been an increase in the uniformity of diagnostic reproducible, interobserver variability has been reduced, and a unified framework for clinical decision making has been provided. The use of FNAC results along with the Bethesda classification has hence improved the efficiency of the diagnostic work-up by cytology and is now the recommended practice when dealing with thyroid nodules [6].

Although FNAC is well accepted and has an overall good performance, it has its limitations. The diagnostic accuracy of FNAC is dependent on a number of factors such as adequacy of specimen collection, aspiration technique, experience of the cytopathologist and inherent morphological overlap of some thyroid lesions. There are also false negative results that can be caused by a variety of factors, including poor sampling, cystic degeneration, small malignant area or interpretational error, and false positive results are relatively rare but may also occur. False negative rates reported range between 1% and 15%, and correlation of cytological results with clinical, radiologic, intraoperative and histopathologic characteristics is important, if possible [7].

One specific challenge is the work-up of thyroid nodules that are indeterminate, particularly those classified as Atypia of Undetermined Significance (AUS), Follicular Neoplasm (FN), or Suspicious for

Follicular Neoplasm (SFN) in the Bethesda system. The diagnosis of malignancy is based on the demonstration of capsular invasion and vascular invasion, which can only be evaluated on the histopathological examination of the surgically excised specimen, and cannot be distinguished from follicular adenoma on cytological examination alone. Therefore, the histopathology remains gold standard and the performance of FNAC is assessed with respect to this technique [8].

Histopathological correlation is important for the evaluation of the diagnostic validity of FNAC in order to identify the concordance and discordance between the cytological and the final tissue diagnosis. Comparative evaluation allows the assessment of important diagnostic parameters including sensitivity, specificity, PPV, NPV and overall diagnostic accuracy. These are also important studies to find out the reasons for any discrepancy in diagnosis, to enhance the skills of cytological diagnosis, to modify the practices of the hospitals and to strengthen quality assurance programmes in the pathology laboratories. In a healthcare resource-poor country like Bihar, India, the importance of establishing the reliability of FNAC is even greater as it is highly useful for evidence-based decision making and minimizing unnecessary healthcare spending.

Considering the increasing prevalence of thyroid nodules, the need for accurate preoperative diagnosis, and the continuing challenges associated with indeterminate cytological findings, evaluation of FNAC against histopathological examination remains clinically relevant. Moreover, the availability of data from regional level in Bihar is also limited in spite of providing tertiary care services to a vast patient population from the tertiary care hospitals. Thus, the present retrospective study was conducted to assess the role of FNAC in the assessment of thyroid nodules, and to correlate the FNAC results with the histopathological results. The study is intended to evaluate the diagnostic accuracy of FNAC, its accuracy in distinguishing between the benign and malignant thyroid lesion and to improve its role as an effective, economical, and reliable diagnostic tool for the management of thyroid nodule in a health care scenario of Bihar, India.

Materials and Methods

Study Design: This retrospective, hospital-based observational study was conducted to evaluate the diagnostic performance of Fine-Needle Aspiration Cytology (FNAC) in thyroid nodules by correlating cytological findings with the corresponding histopathological diagnoses. The study aimed to assess the reliability of FNAC as a preoperative diagnostic tool for differentiating benign and malignant thyroid lesions.

Study Area: The study was carried out in the Department of Pathology, Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India.

Study Duration: The study included cases diagnosed over a one-year period.

Sample Size: A total of 117 patients who underwent Fine-Needle Aspiration Cytology (FNAC) for thyroid nodules followed by surgical excision and histopathological examination constituted the study sample.

Study Population: The study population comprised patients of all age groups and both sexes presenting with clinically or radiologically detected thyroid nodules who underwent FNAC at the Department of Pathology and subsequently had thyroid surgery with histopathological examination. Only cases with complete cytological and histopathological records were included for analysis.

Data Collection: Data were collected retrospectively from the departmental cytology and histopathology registers, pathology archives, and hospital medical records using a structured data collection proforma. Information regarding patient demographics, including age and sex, clinical presentation, radiological findings where available, FNAC diagnosis, Bethesda category, type of surgical specimen, and final histopathological diagnosis was recorded. All patient identifiers were removed before data compilation to ensure confidentiality and anonymity throughout the study.

Inclusion Criteria

The study included patients who fulfilled the following criteria:

- Patients with clinically or radiologically diagnosed thyroid nodules.
- Patients who underwent FNAC at the Department of Pathology, NMCH, Patna.
- Patients who subsequently underwent thyroid surgery with available histopathological diagnosis.
- Cases with complete clinical, cytological, and histopathological records.

Exclusion Criteria

The following cases were excluded from the study:

- Patients with incomplete or missing medical records.
- Cases lacking corresponding histopathological examination.
- Inadequate or unsatisfactory cytology smears without repeat FNAC.
- Patients managed conservatively without surgical intervention.
- Recurrent thyroid lesions and duplicate patient records.

Procedure: Patients presenting with thyroid swelling underwent detailed clinical evaluation followed by radiological assessment, including ultrasonography wherever indicated. FNAC was performed under aseptic precautions using a 23-gauge needle attached to a 10–20 mL disposable syringe, either by palpation-guided or ultrasound-guided technique depending on the size and location of the lesion. Multiple needle passes were made to obtain adequate cellular material.

The aspirated material was smeared onto clean glass slides. Air-dried smears were stained with May–Grünwald–Giemsa (MGG) stain, while alcohol-fixed smears were stained using the Papanicolaou (Pap) stain. Cytological findings were reported according to The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), categorizing lesions into six diagnostic categories (Bethesda I–VI).

Patients who subsequently underwent thyroidectomy or hemithyroidectomy had their surgical specimens processed according to standard histopathological protocols. Gross examination was followed by fixation in 10% neutral buffered formalin, routine tissue processing, paraffin embedding, microtome sectioning, and staining with Hematoxylin and Eosin (H&E). Histopathological diagnosis served as the gold standard.

The cytological diagnosis obtained by FNAC was correlated with the final histopathological diagnosis to determine the diagnostic accuracy of FNAC in thyroid nodules.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were summarized as frequencies and percentages. The association between FNAC findings and histopathological diagnosis was assessed using the Chi-square test or Fisher's exact test, wherever applicable. Histopathological diagnosis was considered the gold standard for evaluating the diagnostic efficacy of FNAC. Diagnostic indices including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were calculated". A p-value of less than 0.05 was considered statistically significant at a 95% confidence interval.

Result

Table 1 presents the age-wise distribution of the 117 study participants with thyroid nodules. The largest proportion of patients belonged to the 31–40 years age group, accounting for 29.1% (n=34), followed by those aged 41–50 years with 25.6% (n=30). Patients in the 51–60 years and 21–30 years age groups comprised 16.2% (n=19) and 15.4% (n=18) of the

study population, respectively. The >60 years age group included 8.5% (n=10) of patients, while the ≤20 years age group represented the smallest proportion at 5.1% (n=6). Overall, these findings indi-

cate that thyroid nodules were most frequently observed among individuals aged 31–50 years, suggesting a higher burden of thyroid disease in the middle-aged population.

Table 1: Distribution of study participants according to age group (N=117)

Age group (years)	Number (n)	Percentage (%)
≤20	6	5.1
21–30	18	15.4
31–40	34	29.1
41–50	30	25.6
51–60	19	16.2
>60	10	8.5
Total	117	100

Table 2 presents the gender distribution of the 117 study participants evaluated for thyroid nodules. Females constituted the majority of the study population, accounting for 77.8% (n=91) of cases, while males comprised 22.2% (n=26). These findings

demonstrate a marked female predominance among patients presenting with thyroid nodules, indicating that thyroid lesions were considerably more common in women than in men in the present study population.

Table 2: Gender distribution of study participants (N=117)

Gender	Number (n)	Percentage (%)
Male	26	22.2
Female	91	77.8
Total	117	100

Table 3 presents the distribution of thyroid nodules according to the Bethesda System for Reporting Thyroid Cytopathology among the 117 patients evaluated by fine-needle aspiration cytology (FNAC). Bethesda II (Benign) was the most common category, accounting for 47.9% (n=56) of cases. This was followed by Bethesda V (Suspicious for malignancy) with 17.9% (n=21) and Bethesda III (Atypia of Undetermined Significance/Follicular Lesion of Undetermined Significance [AUS/FLUS]) with 15.4% (n=18) of cases. Bethesda IV (Follicular

neoplasm/Suspicious for Follicular Neoplasm [FN/SFN]) and Bethesda VI (Malignant) each comprised 7.7% (n=9) of the study population, while Bethesda I (Non-diagnostic) represented the smallest category with 3.4% (n=4) of cases. These findings indicate that most thyroid nodules were categorized as benign on FNAC, whereas approximately one-fourth of cases were classified as suspicious for or diagnostic of malignancy, reflecting the utility of the Bethesda system in stratifying the risk of thyroid malignancy.

Table 3: Distribution of thyroid nodules according to Bethesda System (FNAC) (N=117)

Bethesda Category	n	Percentage (%)
Bethesda I (Non-diagnostic)	4	3.4
Bethesda II (Benign)	56	47.9
Bethesda III (AUS/FLUS)	18	15.4
Bethesda IV (Follicular neoplasm/SFN)	9	7.7
Bethesda V (Suspicious for malignancy)	21	17.9
Bethesda VI (Malignant)	9	7.7
Total	117	100

Table 4 presents the histopathological diagnosis of thyroid nodules among the 117 patients included in the study. Histopathological examination revealed that 67 cases (57.3%) were benign thyroid lesions, while 50 cases (42.7%) were confirmed as malignant lesions. Thus, benign thyroid nodules constituted the majority of cases, although a substantial proportion of nodules were found to be malignant on

definitive histopathological evaluation. These findings highlight the importance of histopathological examination as the gold standard for accurately differentiating benign from malignant thyroid nodules and emphasize the need for reliable preoperative diagnostic modalities such as fine-needle aspiration cytology (FNAC).

Table 4: Histopathological diagnosis of thyroid nodules (N=117)		
Histopathological diagnosis	Number (n)	Percentage (%)
Benign lesions	67	57.3
Malignant lesions	50	42.7
Total	117	100

Table 5 presents the diagnostic outcome of thyroid nodule evaluation using the Bethesda classification on fine-needle aspiration cytology (FNAC) compared with histopathological examination among 117 patients. Of the 4 Bethesda I cases, 75.0% (n=3) were histopathologically benign and 25.0% (n=1) were malignant. Among 56 Bethesda II cases, the vast majority were benign (89.3%, n=50), while 10.7% (n=6) were malignant. In the Bethesda III category (n=18), 44.4% (n=8) were benign and 55.6% (n=10) were malignant. Similarly, among 9 Bethesda IV cases, 44.4% (n=4) were benign and 55.6% (n=5) were malignant. A markedly higher risk of malignancy was observed in Bethesda V,

where 90.5% (n=19) of the 21 cases were confirmed malignant and only 9.5% (n=2) were benign. All 9 Bethesda VI cases (100%, n=9) were confirmed malignant on histopathological examination. Overall, histopathology identified 67 benign (57.3%) and 50 malignant (42.7%) lesions. The association between Bethesda cytological categories and final histopathological diagnosis was highly statistically significant ($p<0.001$), demonstrating a progressive increase in the likelihood of malignancy from lower to higher Bethesda categories and confirming the strong diagnostic value of the Bethesda reporting system in thyroid nodule evaluation.

Table 5: Diagnostic outcome of thyroid nodule evaluation using FNAC compared with histopathology ($p<0.001$)			
FNAC (Bethesda classification)	N	Histopathological examination Benign n (%)	Histopathological examination Malignant n (%)
Bethesda I	4	3 (75.0)	1 (25.0)
Bethesda II	56	50 (89.3)	6 (10.7)
Bethesda III	18	8 (44.4)	10 (55.6)
Bethesda IV	9	4 (44.4)	5 (55.6)
Bethesda V	21	2 (9.5)	19 (90.5)
Bethesda VI	9	0 (0.0)	9 (100.0)
Total	117	67 (57.3)	50 (42.7)

Table 6 presents the histopathological spectrum of the 67 benign thyroid lesions identified in the study. Colloid goiter was the most common benign lesion, accounting for 46.3% (n=31) of cases, followed by nodular hyperplasia, which constituted 26.9% (n=18). Follicular adenoma was diagnosed in 14.9% (n=10) of patients, while Hashimoto's thyroiditis was observed in 9.0% (n=6) of cases. Other benign

thyroid lesions were relatively uncommon, comprising only 3.0% (n=2) of the benign specimens. These findings indicate that colloid goiter was the predominant benign thyroid pathology, with nodular hyperplasia and follicular adenoma representing the next most frequent histopathological diagnoses in the study population.

Table 6: Histopathological spectrum of benign thyroid lesions (n=67)		
Diagnosis	Number (n)	Percentage (%)
Colloid goiter	31	46.3
Nodular hyperplasia	18	26.9
Follicular adenoma	10	14.9
Hashimoto's thyroiditis	6	9
Other benign lesions	2	3
Total	67	100

Table 7 presents the histopathological spectrum of the 50 malignant thyroid lesions identified in the study. Papillary thyroid carcinoma was the predominant malignancy, accounting for 84% (n=42) of all malignant cases. Follicular carcinoma was the second most common subtype, comprising 8% (n=4) of cases. Less frequent malignancies included medullary carcinoma in 4% (n=2) of patients, while poorly

differentiated carcinoma and anaplastic carcinoma each accounted for 2% (n=1) of cases. Overall, these findings indicate that papillary thyroid carcinoma was by far the most common histopathological subtype among malignant thyroid lesions, whereas other thyroid malignancies occurred relatively infrequently in the study population.

Table 7: Histopathological spectrum of malignant thyroid lesions (n=50)

Diagnosis	Number (n)	Percentage (%)
Papillary thyroid carcinoma	42	84
Follicular carcinoma	4	8
Medullary carcinoma	2	4
Poorly differentiated carcinoma	1	2
Anaplastic carcinoma	1	2
Total	50	100

Table 8 summarizes the diagnostic performance of fine-needle aspiration cytology (FNAC) in the evaluation of thyroid nodules using histopathology as the reference standard. FNAC demonstrated a sensitivity of 86% (95% CI: 74.2–93.7%), indicating its ability to correctly identify the majority of malignant thyroid lesions. The specificity was 91% (95% CI: 81.5–96.6%), reflecting a high accuracy in correctly diagnosing benign nodules. The positive predictive value (PPV) was 87.8% (95% CI: 76.5–94.4%), sug-

gesting that most nodules diagnosed as malignant by FNAC were confirmed on histopathology. Similarly, the negative predictive value (NPV) was 89.7% (95% CI: 80.5–95.3%), indicating a high likelihood that nodules reported as benign on FNAC were truly benign. Overall, FNAC achieved a diagnostic accuracy of 88.9% (95% CI: 81.8–93.9%), demonstrating excellent overall performance as a reliable diagnostic tool for differentiating benign from malignant thyroid nodules.

Table 8: Diagnostic accuracy of FNAC in evaluating thyroid nodules

Parameter	Value (%)	95% Confidence Interval
Sensitivity	86	74.2–93.7
Specificity	91	81.5–96.6
Positive Predictive Value	87.8	76.5–94.4
Negative Predictive Value	89.7	80.5–95.3
Diagnostic Accuracy	88.9	81.8–93.9

Table 9 presents the cytohistopathological correlation between fine-needle aspiration cytology (FNAC) and histopathological examination among the 117 thyroid nodules included in the study. Of the 67 histopathologically confirmed benign lesions, 61 cases were correctly identified as benign by FNAC, while 6 cases were incorrectly reported as malignant on cytology (false positives). Among the 50 histopathologically confirmed malignant lesions, 43 cases were accurately diagnosed as malignant by

FNAC, whereas 7 cases were misclassified as benign (false negatives). Overall, FNAC classified 68 cases as benign and 49 cases as malignant. These findings demonstrate a high level of agreement between FNAC and histopathological diagnosis, with the majority of benign and malignant thyroid nodules being correctly identified by cytology, although a small number of false-positive and false-negative results were observed.

Table 9: Cytohistopathological correlation of FNAC with histopathology (N=117)

Histopathology	FNAC Benign	FNAC Malignant	Total
Benign	61	6	67
Malignant	7	43	50
Total	68	49	117

Discussion

Fine-needle aspiration cytology (FNAC) is a minimally invasive, cost-effective and extremely reliable diagnostic method and will continue to be the mainstay of pre-operative evaluation of thyroid nodules. Since then, the introduction of The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) has further enhanced the communication between cytopathologists and clinicians by standardizing thyroid cytology reporting and help in the stratification of risk and planning for treatment (Ali, 2011) [9]. In the present study 117 thyroid nodules were analysed and the cytohistopathological concordance was ex-

cellent, which helped us to continue using FNAC as the first line diagnostic tool.”

In the demographic profile of our study, thyroid nodules were more common in middle-aged adults and the majority of the patients in the study were in the 31-40 years age group (29.1%) followed by 41-50 years age group (25.6%). These results are similar to those from Bakhos et al., [10] whose data showed the majority of the thyroid FNAC cases were in the fourth and fifth decades of life, showing that thyroid nodules are more common during the middle age. Likewise, the distribution of age of occurrence of thyroid nodules was found to be maximum in the age

group 30-50 years, which corresponds to our findings as reported by Morgan et al. [11] the female predominance (77.8%) with a female to male ratio of about 3.5:1 seen in the present study is also similar to previous reports. Afroze et al. [12] reported almost 80% of thyroid lesion patients were female and Kamal et al. [13] reported female predominance of 71% to 86% probably due to hormonal factors and the higher incidence of autoimmune thyroid diseases in females.

In our study, the largest cytological category was Bethesda II (benign) which represented 47.9%, followed by Bethesda V (17.9%) and Bethesda III (15.4%). The proportion of aspirates classified as Bethesda I (non-diagnostic) was only 3.4% well within the acceptable range recommended by TBSRTC and similar to the rate reported by Wang et al. [14] who reported a range between 2% to 10% of non-diagnostic aspirates among adequately performed FNAC procedures. The levels of inadequate aspirates in our study were relatively low and this could be due to careful sampling techniques and adequate smear preparation. Ali [9] stressed that low non-diagnostic rate leads to greater diagnostic confidence and fewer unnecessary repeat procedures.

The incidence of benign lesions (57.3%) versus malignant lesions (42.7%) was more commonly seen in our series but the proportion of malignancy was relatively high compared to some routine hospital-based studies. The same observations were reported by Roy et al., [15] who showed that most excised thyroid nodules were benign, while malignant nodules were a significant proportion as many of the surgically excised thyroid nodules fall in the indeterminate or suspicious Bethesda categories. This is because the higher malignant rate in the present study may result from selection bias because the patients that underwent surgery represent a clinically or cytologically suspicious population of thyroid nodules rather than the whole population of nodules.

In the present study, there was a significant relation ($p < 0.001$) between Bethesda categories and final histopathological diagnosis. Bethesda II showed excellent agreement with benign histology with 89.3% of cases confirmed as benign, while Bethesda V and Bethesda VI showed malignancy rates of 90.5% and 100%, respectively. Malignancy rates of 55.6% were seen in indeterminate Bethesda III and indeterminate Bethesda IV. These results indicate a steadily rising likelihood of malignancy with each of the Bethesda categories and are very similar to the malignancy risk categorization of TBSRTC [9]. Wang et al. [14] also found a gradual increase in histopathological malignancy from Bethesda II to Bethesda VI, thus supporting the clinical value of the Bethesda classification to predict malignancy.

Of the benign thyroid lesions, the most common were colloid goiter (46.3%), nodular hyperplasia

(26.9%), follicular adenoma (14.9%) and Hashimoto's thyroiditis (9.0%). Similar distribution has been seen by Afroze et al., [12] who found that in the FNAC-histopathology correlation studies, the most common benign thyroid lesion was colloid goiter. Colloid goiter is the most common goiter in the field of endocrine pathology.

In the current study, the most common type of thyroid cancer was papillary thyroid carcinoma (PTC) (84.0%), followed by follicular carcinoma (8.0%), medullary carcinoma (4.0%), poorly differentiated carcinoma (2.0%) and anaplastic carcinoma (2.0%). These data are comparable with the results obtained by Roy et al., [15] who found that papillary carcinoma was the most common thyroid malignancy followed by follicular and medullary carcinomas which were rare in their study. Likewise, Afroze et al. [12] showed that papillary carcinoma is invariably the most prevalent malignant thyroid tumour diagnosed on FNAC and histopathology. PTC is the predominant type, as this is seen in all parts of the world and has a good prognosis if detected early.

In our study, the sensitivity of FNAC was 86.0%, specifically 91.0%, PPV 87.8%, NPV 89.7%, and accuracy 88.9%, which was excellent. These results are comparable with earlier studies. Roy et al. [15] reported a sensitivity of 81.5%, specificity of 95.3% and accuracy of 91.9% while Gupta et al. [16] reported 80% sensitivity, 86.6% specificity and 83% accuracy. The sensitivity in our study was slightly higher than in the study of Gupta et al. [16] but the specificity was slightly lower than in the study done by Roy et al. [15] however, overall, the diagnostic efficiency was of same order and this indicates the high clinical reliability of FNAC in distinguishing benign and malignant thyroid nodules.

Cytohystopathological correlation also revealed that FNAC was accurate in the diagnosis of 104 of 117 thyroid nodules with only 13 discordant cases. There is a good agreement between cytology and histopathology with 61 benign and 43 malignant lesions correctly identified. An equivalent cytohystopathological correlation has been reported by Bakhos et al., [10] who considered sampling errors as the main cause of cases with discordance, along with overlapping cytomorphological features, and the inherent limitations of FNAC in differentiating follicular adenoma from follicular carcinoma due to the inability to assess capsular and vascular invasion. In spite of these drawbacks, the current results confirm FNAC as a very useful tool in preoperative diagnosis and significantly decrease the number of unnecessary thyroid operations and helping to timely manage malignant lesions.

Conclusion

The present retrospective study demonstrates that fine-needle aspiration cytology (FNAC) with the use of the Bethesda System is a reliable, clinically useful

and accurate first-line diagnostic procedure for thyroid nodule assessment. There was good cytohistopathological correlation between FNAC and final histopathological diagnosis and it proved to be useful in distinguishing benign and malignant lesions. The majority of the benign lesions included non-neoplastic lesions and the most common malignant subtype on histopathology was papillary thyroid carcinoma. A small percentage of discordant cases and indeterminate cytological categories highlighted the importance of careful interpretation and appropriate follow-up; however, FNAC was found to be highly effective in guiding clinical decision making and selection of patients for a surgical approach. In sum FNAC is an invaluable, non invasive and an affordable investigation which plays a crucial role in the accurate diagnosis and optimum management of thyroid nodular patients.

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