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Correlation Between Fine Needle Aspiration Cytology with Histopathological Findings of Thyroid Gland Swellings

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Abstract

Background: Fine needle aspiration cytology (FNAC) is a minimally invasive method to assess thyroid gland swellings by extracting cells with a thin needle. It helps distinguish between benign and malignant thyroid lesions before surgery. This study aimed to assess the agreement between cytological results obtained through fine needle aspiration cytology (FNAC) and the corresponding histopathological outcomes.

Methods: This cross-sectional study was conducted in the Department of Otolaryngology and Head-Neck Surgery, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh from June 2020 to June 2021. A total of 100 patients with thyroid swelling, indicated for fine needle aspiration cytology (FNAC) and subsequent thyroid surgery, were purposively enrolled in this study. Data were analyzed and presented in both qualitative and quantitative formats using SPSS version 20.0.

Results: In the ultrasound study, most cases had benign characteristics. By thyroid scanning, 78% showed warm nodules. FNAC diagnosis found nodular goiter in 64% of cases. Histopathology revealed 76 true negatives and 4 false negatives among 80 disease-negative cases. All 10 malignant cases were confirmed as malignant (true positives). Among 10 suspicious lesions, 8 were true positives and 2 were false positives. The analysis showed specificity, PPV, NPV, and accuracy of 97.44%, 90.00%, 95.00%, and 94.00%, respectively.

Conclusion: FNAC is a sensitive, specific, and accurate initial diagnostic test for evaluating thyroid swellings. While cytodiagnostic errors can occur due to overlapping features, awareness of potential pitfalls can minimize these errors. Suspicious results should be confirmed with histopathology. Additionally, benign FNAC results should be cautiously interpreted due to the possibility of false negatives.

Keywords: Correlation, Fine needle aspiration cytology, FNAC, Histopathological, Thyroid gland swelling

Introduction

The thyroid gland and its enlargement are known from the time of Hippocrates. Among the endocrine glands, disease of the thyroid glands is the most prevalent. Patients with diffuse goiter and a family history of goiter may have a congenital dyshormonogenesis leading to a partial failure of iodide organification. This is commonly associated with deafness in Pendred's syndrome despite the organification defect, these patients are commonly euthyroid. [1] Nodular thyroid disease describes the presence of

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a single nodule or multiple nodules within the thyroid gland. These nodules are palpable or impalpable, functioning or nonfunctioning. Functioning solitary nodules are those that synthesize thyroid hormone autonomously and thus may lead thyroid hormone excess and symptoms of thyrotoxicosis. [2] Thyroid nodules are very common. The lifetime risk for the development of a palpable nodule is approximately 10%, but prevalence may be as high as 50% depending on the imaging methods used. Nodules are more frequent in women and prevalence increases with age, exposure to ionizing radiation, and decreased iodine intake. [2] A good number of diseases affect the thyroid gland and almost all of them cause thyroid swelling. Nodular goiter remains a problem of enormous magnitude all over the world, although exact data on incidence are unavailable. [3] Nodular thyroid disease (NTD) occurs more frequently than diffuse goiter.

A solitary nodule or a dominant nodule in a multi-nodular gland has a higher risk of being malignant than the multiple palpable nodules of a multinodular goiter. [3] In our country, the national prevalence of thyroid disease is 10-15%, which indicates that the whole country is endemic. The endemicity varies from one place to another. The highest prevalence rates in Bangladesh are found in the districts of Rangpur and Jamalpur, ranging from 21% to 30%. The pocket of endemicity of up to 50% exists in different locations of the country. [4] Evaluation of the thyroid swelling begins with careful history and clinical examinations. History and clinical correlation do not always lead the clinician to the accurate pathway to diagnose thyroid malignancy. Thus, the help of diagnostic tools becomes inevitable. Ultrasonographic scanning can differentiate between solid and cystic lesions but cannot distinguish between malignant and benign ones. The presence of micro-calcification has the highest positive predictive value of malignancy of 41.8-94.2%. The sensitivity of this sign is low because micro-calcification is only in 26.1-59.1%of cancers. A predominantly solid (<25% cystic change) nodule containing micro-calcification has a 31.6% likelihood of being cancer whereas a predominantly cystic nodule (>75 % cystic change) with no calcification has a 1% likelihood of being cancer. [5] An isotope scan can demonstrate the functioning capacity of the nodule but cannot predict the histopathological character. Histological examination of resected thyroid swelling is the most accurate to determine the pathology. It requires preparation and long procedures like hospitalization, anesthesia and postoperative management. On the contrary, FNAC is a simple, less expensive, readily available, yet reliable, effective and accurate diagnostic technique. [6] FNAC in expert hands is very reliable, with studies showing overall diagnostic accuracy between 85 and 100%, with specificity for the diagnosis of neoplasia of 72-100% and sensitivity of 65-98%. In a series of over 800 subjects, the accuracy of FNAC was over 95% with a false positive rate for malignancy of 2.3% and a false negative rate of 1.1%. [7] The objective of this current study was to assess the agreement between cytological results obtained through fine needle aspiration cytology (FNAC) and the corresponding histopathological outcomes.

Methodology

This was a cross-sectional study that was conducted in the Department of Otolaryngology and Head-Neck Surgery, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh from June 2020 to June 2021. A total of 100 patients with thyroid swelling, who were indicated for fine needle aspiration cytology (FNAC) and subsequent thyroid surgery, were enrolled in this study. A purposive sampling technique was used in sample selection. The study was approved by the hospital's ethical committee. Written consent was obtained from all participants before data collection. The entire intervention was conducted following the principles of human research specified in the Helsinki Declaration [8] and was executed in compliance with current regulations and the provisions of the General Data Protection Regulation (GDPR) [9].

Inclusion criteria:

a) All the patients with thyroid swelling and clinical and sonological indications for FNAC and subsequent thyroid surgery.

b) Patients of all age groups, sexes, and demographic distribution.

c) Patient with normal thyroid function test.

Exclusion criteria:

a) Patients with abnormal thyroid function test.

b) History of previous surgery in the thyroid and parathyroid region.

c) History of radiation in the head and neck region in the past.

The outcome variables include patient-specific factors such as age, sex, thyroid swelling symptoms, and clinical signs. Goiter-related variables include the number of nodules, results from thyroid function tests, ultrasonography, thyroid scans, and FNAC and histopathological reports. Data were analyzed and presented in both qualitative and quantitative formats using SPSS version 20.0. In the statistical analysis, a P value of less than 0.05 was considered significant.

Results

In this study, the male-female ratio of the participants was 1: 5.25. The mean (+SD) age of the study subjects was 31.5 (+16.22) years. As a symptom, swelling in front of the neck was found in all of our participants (100%). Additionally, discomfort and occasional pain were observed in 72% and

64% of the cases, respectively. As signs, a single nodule was found in 62% of cases, consistency was firm in 80% of cases, and a palpable lymph node was observed in 12% of participants. Among 100 patients, 58 were diagnosed with simple solitary nodular goiter (34 right-sided and 24 left-sided), 32 with simple multinodular goiter, and 10 with thyroid carcinoma. As in the ultrasound study, most of the cases had benign characteristics. By thyroid scanning, in most of the cases (78%), worm nodule was found. In the FNAC diagnosis of participants, nodular goiter was found in most of the cases (64%). The final histopathology report revealed that among the 80 disease-negative cases, 76 were non-neoplastic (true negatives) and 4 were neoplastic (false negatives). All 10 malignant cases were confirmed as malignant on histopathology, resulting in a true positive value of 10 and a false positive value of 0. Among 10 suspicious lesions, 8 were neoplastic (true positives) and 2 were non-neoplastic (false positives). The specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of this analysis were 97.44%, 90.00%, 95.00%, and 94.00%, respectively.

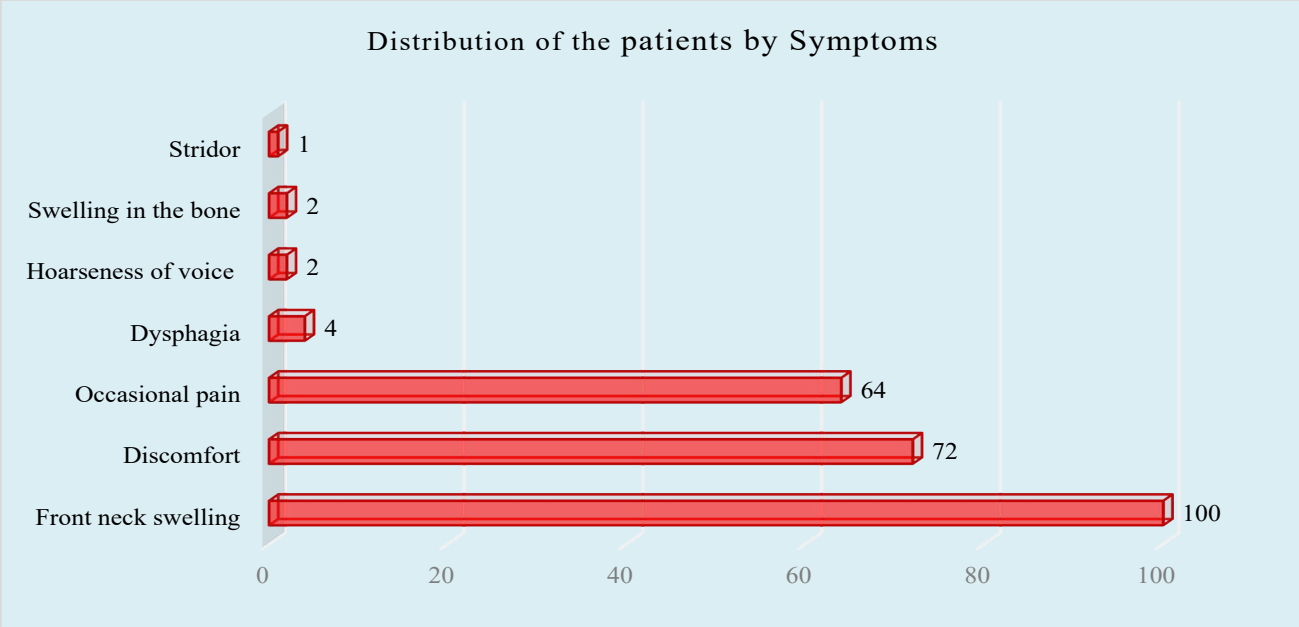

Figure I: Bar chart showed clinical symptoms wise patients (N=100)

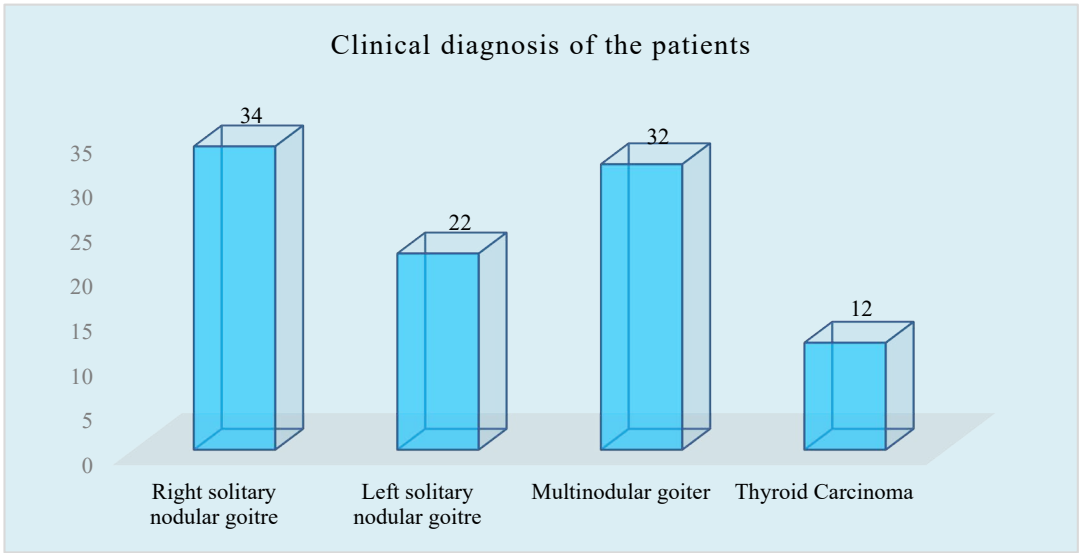

Figure II: Column chart showed clinical diagnosis of patients (N=100)

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Table 1: Clinical signs (N=100)

Sign	Features	n	%
No. of nodule	Single	62	62%
	Multiple	38	38%
Consistency	Firm	80	80%
	Hard	12	12%
	Cystic	8	8%
Mobility	Mobile	88	88%
	Fixed	12	12%
Palpable lymph node		12	12%
Vocal cord palsy		2	2%
Bone swelling		2	2%

Table 2: Results of the ultrasound study (N=100)

Findings	**Histopathological**		**Total**
	Benign	**Malignant**	
Solid	34	12	46
Mixed	44	2	46
Cystic	0	8	8
Total	78	22	100

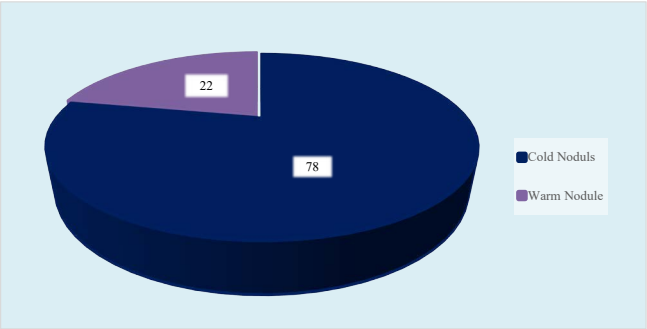

Figure III: Pie chart showed results of thyroid scan (N=100)

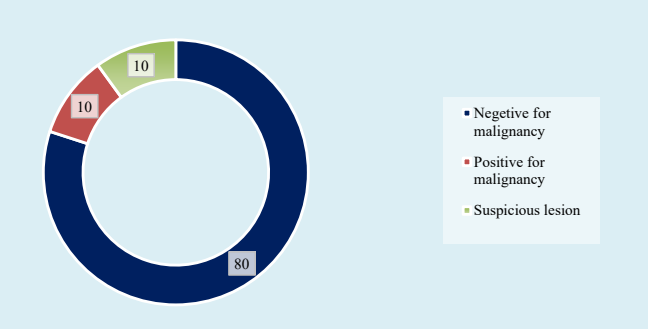

Figure IV: Ring chart showed FNAC outcome of participants (N=100)

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Table 3: FNAC diagnosis of participants (N=100)

Findings	%
Nodular goiter	64%
Colloid goiter	16%
Papillary carcinoma	9%
Follicular neoplasm	8%
Medullary carcinoma	1%
Suspicious for malignancy	2%

Table 4: Histopathological diagnosis (N=100)

FNAC	Histopathology							
	N. G	C.G	F.H	F. A	Thyroiditis	P.C	F.C	M.C
Nodular goiter (64)	40	2	16	2	4			
Colloid goiter (16)	10	4				2		
Papillary Ca. (10)						9		
Follicular Neoplasm (8)			2	4			2	
Medullary carcinoma (1)								1
Suspicious for Malignancy (2)						2		
Total	50	6	18	6	4	13	2	1

Table 5: Histopathological outcome of the study population (N=100)

Status	Result	n	Total
Positive	True positive (a)	18	20
	False positive (a)	2	
Negative	False negative (c)	4	80
	True negative (c)	76	

Table 6: Performance of the study (N=100)

Sensitivity	81.82%
Specificity	97.44%
Positive predictive value	90.00%
Negative predictive value	95.00%
Accuracy	94.00%

Discussion

Regarding presenting complaints, all patients had neck swelling of varying durations. Additional symptoms included neck discomfort (72%), occasional pain (64%), dysphagia (4%), hoarseness of voice (2%), bone swelling (2%), and stridor (1%). The duration of symptoms ranged from 2 months to 3 years, consistent with findings from other studies [10,11]. On FNAC, among 58 cases of simple solitary nodular goiter, 4 were diagnosed as follicular lesions, 2 as papillary carcinomas, 2 were suspicious for malignancy, and 50 were non-neoplastic. Among 38 cases of simple multinodular goiter, 4 were diagnosed as follicular neoplasm, 2 as papillary carcinomas, and 32 as non-neoplastic. Of the 12 clinically diagnosed cases of thyroid carcinoma, FNAC showed 9 as papillary carcinomas, 2 as follicular neoplasms, and 1 as medullary carcinoma. In this series, we found that nodules were more prevalent in the right lobe than the left. There is currently no reported predilection for any specific site, and no reason has been proposed for this tendency. Similar findings have been noted by many authors [12,13].

Finally, histopathological examination diagnosed 16 cases as thyroid carcinoma, with 14 being papillary carcinoma and 2 being follicular carcinoma. Of the 14 papillary carcinoma cases, 4 presented as multinodular and 10 as solitary nodular. Both cases of follicular carcinoma presented as multinodular. In areas with adequate dietary iodine, papillary thyroid carcinoma typically presents as a solitary nodule, consistent with our findings [14]. However, while follicular carcinoma commonly presents as a solitary nodule, our single case of follicular carcinoma was multinodular, which is inconsistent with other studies. We found that among malignant lesions, 62.5% were hard, 25% were firm, and 12.5% were cystic. Similarly, Islam and colleagues reported that up to 70% of malignant thyroid nodules were hard [15]. In this study, out of 14 histopathologically diagnosed cases of papillary carcinoma, 10 had clinically positive metastatic lymph nodes, 2 had vocal cord palsy, and 10 had fixed nodules. The

only histopathologically diagnosed case of follicular thyroid carcinoma presented with bone metastasis and metastatic lymph node involvement. Overall, 10 out of 14 papillary carcinoma cases (71.23%) presented with metastatic lymph nodes, though positive lymph nodes can be detected in up to 90% of patients with papillary thyroid carcinoma [16]. In summary, 12 out of 16 malignant cases presented features of distant metastasis, findings that are somewhat aligned with the study by Takashima and colleagues [16]. The ultrasound study found that among benign lesions, 40.48% were solid, 52.38% were mixed, and 7.14% were cystic. For malignant lesions, 75% were solid, 12.5% were mixed, and 12.5% were cystic. Steven and colleagues reported that 42% of benign lesions were solid and 58% were mixed and cystic, while 85.5% of malignant lesions were solid and 14.5% were mixed and cystic [17].

The ultrasound study found that among benign lesions, 40.48% were solid, 52.38% were mixed, and 7.14% were cystic. For malignant lesions, 75% were solid, 12.5% were mixed, and 12.5% were cystic. Steven and colleagues reported that 42% of benign lesions were solid and 58% were mixed and cystic, while 85.5% of malignant lesions were solid and 14.5% were mixed and cystic [17]. As in other literature, benign cases (80%) represented the major FNAC finding in our study. The incidence of specific histology in both the benign and malignant groups showed no difference from other reports [18]. Our study revealed a sensitivity of 81.82% and a specificity of 97.44%, translating into a diagnostic accuracy of 94%. The positive predictive value (PPV) was 90%, and the negative predictive value (NPV) was 95%. These results are comparable to published data, where FNAC of the thyroid shows sensitivity ranging from 65–98%, specificity from 72–100%, PPV from 34–100%, and NPV from 83–100%. The variation in these metrics is due to differences in case numbers, diagnostic category planning, and inclusion/exclusion criteria. Some investigators included follicular lesions in disease-positive groups, while others excluded them from overall calculations [19]. Our study revealed a sensitivity of 81.82% and a specificity of 97.44%, translating into a diagnostic accuracy of 94%. The positive predictive value (PPV) was 90%, and the negative predictive value (NPV) was 95%. These results are comparable to published data, where FNAC of the thyroid shows sensitivity ranging from 65–98%, specificity from 72–100%, PPV from 34–100%, and NPV from 83–100%. The variation in these metrics is due to differences in case numbers, diagnostic category planning, and inclusion/exclusion criteria. Some investigators included follicular lesions in disease-positive groups, while others excluded them from overall calculations [19].

Limitation of the Study

The present study was conducted over a very short period with a small sample size. Additionally, the study population was selected from a single hospital in Dhaka, which may limit the generalizability of the results to the entire country.

Conclusion and Recommendation

Our study's results align with current published data, demonstrating that FNAC is a sensitive, specific, and accurate initial diagnostic test for evaluating patients with thyroid swellings. While cytodiagnostic errors may occur in cases with overlapping cytological features, these can be minimized by being aware of potential pitfalls. Suspicious results should be confirmed with histopathology. Additionally, a benign FNAC must be approached with caution due to the possibility of false negative results. Overall diagnostic accuracy can be enhanced by combining FNAC with ultrasonography, providing a more comprehensive assessment for better clinical decision-making.

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