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EVALUATION OF CORRELATION BETWEEN ULTRASONOGRAPHY AND CYTOLOGY OF THYROID SWELLINGS

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ABSTRACT

Objective : The present study is undertaken to evaluate the utility of ultrasonography and fine-needle aspiration cytology in pre-operative diagnosis of thyroid swelling, and to evaluate the correlation between fine needle aspiration cytology (FNAC) and ultrasonography (USG) in differentiating between benign and malignant thyroid swellings. Histopathology (HPE) has been considered the gold standard. We hypothesised that USG and FNAC can diagnose thyroid malignancies as accurately as histopathology.

Methods : This prospective study was carried out on 75 patients with a palpable thyroid swelling. All the patients underwent USG and FNAC of the thyroid swelling. After carrying out the necessary investigations, they underwent surgery, following which the mass was sent for histopathological analysis. The cases were then evaluated using proper statistical tools.

Results : Out of the 75 patients included in the study, 38 cases were labelled malignant on USG and 37 were labelled as benign. On FNAC, 25 were malignant, 42 were benign and 8 were indeterminant. The findings of HPE were considered gold standard, with 31 malignant and 44 benign lesions. After comparison of results of USG and FNAC with histopathology, the sensitivity and specificity of USG were 100% and 84.1% respectively, whereas, those of FNAC were 80.6% and 95.5% respectively.

Conclusion : We found out that USG is more sensitive than specific and that FNAC is more specific than sensitive in diagnosing thyroid malignancies. However, a combination of USG and FNAC, rather than USG alone, will give optimal results in diagnosing thyroid malignancies.

KEYWORDS

thyroid swelling; fine-needle aspiration cytology; ultrasonography; thyroid malignancy

INTRODUCTION :

Among all the endocrine glands in the body, the thyroid gland is unique as it is the first endocrine gland to appear in a foetus. It is also the largest endocrine gland, weighing approximately 25g, and because of its superficial location, it is the only endocrine gland that can be physically examined. Thyroid nodules are a common clinical problem and occur with relatively high frequency among the general population. Approximately 4-7% of thyroid nodules can be detected by palpation, and around 13-67% can be detected by using ultrasonography [1,2]. Out of all the thyroid nodules, less than 7% are malignant [3].

The most common presentation of a thyroid carcinoma is a solitary thyroid nodule (10% are malignant). A solitary thyroid nodule can be defined as a single, palpable swelling in the thyroid gland that has a normal appearance overall. Nodular lesions of the thyroid gland are more common amongst women and is prevalent in areas of iodine deficiency. This study was carried out in a tertiary care hospital in North-East India. This area, being in the sub-Himalayan belt, has a higher prevalence of thyroid carcinoma because of the low iodine content in soil, owing to the hilly topography of this region.

Approximately 37% of the general population have a thyroid nodularity, but the overall incidence of malignancy is less [4]. Most of the cases of thyroid malignancy do not have conclusive history or clinical findings. Diagnostic workups like fine needle aspiration cytology (FNAC) and ultrasonography (USG) help in selecting those patients for surgery with a higher than usual risk of harbouring a malignancy. Imaging modality of choice for thyroid gland is USG as it is non-invasive and helps in the initial characterization of a thyroid nodule [5]. It also helps in distinguishing benign and malignant thyroid lesions. USG features suggestive of malignancy include marked hypoechogenicity, microcalcifications, microlobulated margins, intranodular central vascularity and taller, rather than wider thyroid lesions. Individual USG features have limited diagnostic value, but when multiple features are present, malignancy should be suspected and a FNAC carried out. Fine needle aspiration cytology is a cost-effective, sensitive and specific investigation for assessing thyroid nodules, and is widely considered the best pre-operative assessment tool for selecting patients for surgery. The major disadvantage of FNAC is that it fails to differentiate between follicular adenoma and follicular carcinoma [6,7]. USG along with FNAC help in exclusion of cancer and should be a part of the initial assessment of thyroid nodules. In this study, we compared the individual and combined efficacy of both USG and FNAC in detecting thyroid nodules, and confirmation was done by using histopathological examination (HPE).

MATERIALS AND METHODS :

This prospective study was conducted under the aegis of the Department of Otorhinolaryngology and Head and Neck Surgery, Gauhati Medical College and Hospital, India, which is a tertiary care hospital-cum-referral center for the whole of North-East India. A total of 75 euthyroid cases with thyroid swellings were assessed over a one-year period from May 2019 to April 2020. Patients of both genders with a palpable thyroid swelling, with/without symptoms were included in the study. Informed consent was obtained from the patients fulfilling the inclusion criteria, and they were subjected to ultrasonography of the thyroid gland and fine needle aspiration cytology from the thyroid swelling. On ultrasonography, the thyroid swellings were assessed on the basis of size, location, echogenicity, calcification, consistency, margins, vascularity and height:width ratio. Presence of two or more features suggestive of malignancy on USG was considered to be a positive case. Previously diagnosed cases of thyroid neoplasm, both benign and malignant, cases undergoing treatment, and previously diagnosed cases of thyroid malignancy on follow up for recurrence or residual disease were excluded from the study.

Cytological reports of the patients fulfilling the inclusion criteria were categorized into three groups – benign, malignant and indeterminant. After carrying out the necessary investigations, the patients underwent surgery of the thyroid swellings. In cases where the FNAC and USG findings were suggestive of a benign lesion, hemi-thyroidectomy or lobectomy was performed, depending on the location of the swelling. Patients where malignancy was suspected underwent total or near-total thyroidectomy. Patients in whom initially benign lesion was suspected, but later on HPE showed malignancy, underwent completion thyroidectomy with neck node dissection, whenever indicated. Patients who had undergone total thyroidectomy or completion thyroidectomy were closely monitored for signs of

hypocalcaemia, with monitoring of serum calcium levels. If indicated, the patients who developed features of hypocalcaemia were treated with injectable calcium gluconate and oral calcium carbonate.

The excised thyroid mass was sent for histopathological analysis. The results of the findings of USG and FNAC were assessed individually and compared with each other. The histopathological report was considered the gold standard to compare the results of USG and FNAC. A 2x2 table was used to calculate the sensitivity and specificity and Chi-square test was used to find out the statistical correlation between USG and FNAC findings.

RESULTS AND OBSERVATIONS :

A total of 75 patients were included in this year-long study. The age of patients ranged from 15 years to 65 years. Out of the total patients, 55 (73.3%) were female and 20 (26.7%) were male, with a female-to-male ratio of 2.75:1. [Table 1]

Table 1 : Distribution of cases on the basis of age and gender

Age (in years)	Male	Female
15-25	1	8
25-35	9	3
35-45	5	27
45-55	3	12
55-65	2	5
TOTAL (100%)	20 (26.7%)	55 (73.3%)

A total of 69 cases (92%) had height more than width and 6 cases (8%) had width more than height. Hypoechoic lesions amounted to 40 cases (53.3%). Microlobulated margins were found in 5 cases (6.7%). Calcifications were present in 12 cases (16%), of which 3 (25%) had macrocalcifications and 9 (75%) had microcalcifications. On colour Doppler, 56 cases (74.7%) had colour flow, of which 48 (85.7%) were peripheral and 8 (14.3%) were intranodal central. [Table 2]

Table 2 : Distribution of cases on the basis of USG finding

Result of USG Finding	No. of Cases	Percentage (%)
Benign	37	49.3
Malignant	38	50.7

Out of the 75 cases, 25 (33.3%) were malignant, of which 8 (32%) were papillary carcinomas and 17 (68%) were follicular neoplasms. Amongst the 42 (56%) benign cases, 14 (33.3%) were colloid goiter, 12 (28.6%) were multinodular goiter, 7 (16.7%) were adenomatous goiter, 6 (14.3%) were cases of thyroiditis and 3 (7.1%) were colloid cysts. In 8 cases (10.7%), proper finding could not be ascertained. [Table 3]

Table 3 : Distribution of cases on the basis of FNAC finding

Result of FNAC	No. of Cases	Percentage (%)
Benign	42	56
Malignant	25	33.3
Indeterminant	8	10.7

All the 75 cases included in our study underwent surgery and the excised thyroid mass was sent for histopathological analysis. Out of the total, 44 cases (58.7%) were benign and 31 cases (41.3%) were malignant - 23 cases (74.2%) of follicular carcinoma and 8 cases (25.8%) of papillary carcinoma. [Table 4]

Table 4 : Distribution of cases based on HPE finding

HPE Finding		No. of Cases		Percentage (%)
Benign		44		58.7
Malignant	Follicular Carcinoma	23	Total = 31	41.3
	Papillary Carcinoma	8		

Statistical analysis was carried out qualitatively using a 2x2 table. USG had sensitivity of 100% and specificity of 84.1%. Positive predictive value (PPV) for USG was 81.6%. FNAC had sensitivity of 80.6% and specificity of 95.5%. Positive predictive value for FNAC was 92.6%. The overall accuracy of USG was only slightly better than that of FNAC, with a value of 90.7% and 89.3% respectively. p-value was calculated using Chi-square test, which did not reveal any statistical significance between USG and FNAC in assessment of thyroid swelling (p-value = 0.11, p-value significant <0.05). [Table 5]

Table 5 : Comparison of USG and FNAC with HPE (TP=true positive; FP=false positive; FN=false negative; TN=true negative) :

RESULT	USG and HPE		TOTAL	FNAC and HPE		TOTAL
	Positive	Negative		Positive	Negative	
Positive	31 (TP)	7 (FP)	38	25	2	27
Negative	0 (FN)	37 (TN)	37	6	42	48
Total	31	44	75	31	44	75
Sensitivity is 100%, Specificity is 84.1%, PPV is 81.6%, Accuracy is 90.7%				Sensitivity is 80.6%,Specificity is 95.5%, PPV is 92.6%, Accuracy is 89.3%		

DISCUSSION :

Thyroid cancer, though making up only 1% of all the cancers of the body, is the most common endocrine tumour. The differentiated thyroid carcinomas make up for approximately 90% of all thyroid malignancies. For a thyroid swelling to be detected by palpation, it must be at least 1 cm in diameter. USG, on the other hand, can detect lesions as small as 3 mm in diameter [8].

There are a number of features that can be seen on USG, which helps significantly in differentiating malignant and benign thyroid lesions. This differentiation is important as it helps in selecting patients for further evaluations, including FNAC. This is important as it prevents unnecessary surgery and biopsies, especially in patients with a benign lesion. No single criteria can predict malignancy, but a combination of tests, along with a combination of the known criteria of malignancy gives higher sensitivity and specificity in diagnosing malignancies [9].

On ultrasonography, the thyroid swellings were assessed on the basis of size, location, echogenicity, calcification, consistency, margins, vascularity and height:width ratio. An USG feature useful in predicting malignancies is lesions with height:width more than 1. This signifies the aggressive nature of the lesion as it suggests that the lesion is growing against the soft tissue planes. In our study, 92% lesions had height more than width, which is similar to the findings by Kim et al (93%) [3].

Another USG feature suggestive of malignancy is hypoechogenicity. In our study, 53.3% cases had a hypoechoic lesion, but we did not attempt to differentiate the degree of hypoechogenicity. Other studies have found the sensitivity and specificity of diagnosing malignancies in hypoechoic lesions as 67% and 87% respectively [1,9].

Another useful USG feature predicting malignancy is the colour flow on Doppler studies. Most thyroid carcinomas have exuberant intranodal central vascularization with irregular patterns [10]. In our study, out of the 56 cases with flow on colour Doppler, 14.3% cases had intranodal central vascularization, suggestive of malignancy.

In our study, only 6.7% cases had poorly defined microlobulated margins. Benign nodules may also demonstrate poorly-defined margins in up to 59% of cases [11]. Hence, unless extracapsular frank invasion is found on USG, diagnosing thyroid malignancy based on margins alone is not a reliable marker [1].

Different types of calcifications occur in thyroid lesions, such as microcalcifications, coarse calcifications, and peripheral calcifications. Thyroid microcalcifications are psammoma bodies which appear as punctuate hyperechoic foci, usually without acoustic shadowing, in ultrasonography [1]. The presence of microcalcification is one of the most specific ultrasonographic features of thyroid malignancy [12]. In our study, out of the 12 cases with calcifications, 75% had microcalcifications.

Another important tool for assessing thyroid malignancies pre-operatively is FNAC. FNAC is a sensitive and highly specific method of checking for malignancies in thyroid swellings [13-16]. After comparison of our results of FNAC with histopathology, overall sensitivity of FNAC was 80.6%, specificity was 95.5%, positive predictive value was 92.6%, and accuracy was 89.3%. These results are consistent with results of other studies. In a review on FNAC of thyroid swellings, it was reported to have sensitivity of 65–98% and a specificity of 72–100% [17,18]. In another study, data analysis of FNAC and HPE in thyroid swellings revealed a sensitivity of 88.9% and specificity of 96.1%, with diagnostic accuracy of 94.2%. This shows that FNAC is more specific than sensitive in detecting thyroid malignancy, and therefore, can be considered a reliable diagnostic tool [19].

In our study, USG is a better predictor of malignancy, with a sensitivity of 100% and an accuracy of 90.7%. But we would recommend that USG and FNAC be used together for a better assessment. This will not only help in distinguishing the benign lesions from the malignant ones, but will also prevent unnecessary surgery for the patients, and thus reduce morbidity.

CONCLUSION :

The present study was undertaken to study the usefulness of USG and FNAC of thyroid swelling individually and in combination in diagnosing thyroid malignancies. We found out that USG is more sensitive than specific and that FNAC is more specific than sensitive in diagnosing thyroid malignancies. The positive predictive value was more for FNAC compared to USG, but the accuracy was higher in USG. An ideal test should be one having sensitivity and specificity of 100%. The closest method to the ideal test is, thus, USG which gives a sensitivity of 100% and specificity of 84.1%. However, a combination of USG and FNAC, rather than USG alone, will give optimal results in diagnosing thyroid malignancies. This will also prevent unnecessary surgery in a great number of patients without missing any malignant thyroid lesions.

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Ethical Clearance : The study was approved by the institution's board of Ethics.

Consent : Written and informed consent was obtained from the patients regarding the use of their pictures, clinical findings and reports of the investigations that were conducted.

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