Original Article

Validity of clinical, radiological and pathological tests of thyroid swellings, a descriptive cross-sectional study

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Abstract

Background: Thyroid diseases bear a high burden in India. Thyroid enlargement needs further evaluation to rule out the neoplasm. With existing different evaluation tests, eliciting their validity would help in further management of thyroid swellings.

Objective: To assess the clinical and pathological correlation of thyroid swellings.

Methodology: A cross sectional study was conducted among fifty patients who presented with thyroid swellings to surgery department and Otolaryngology department, in a tertiary care hospital for a period of 21 months. The data was collected using a semi-structured questionnaire and all the patients were subjected to clinical examination, blood investigations, USG neck and fine needle aspiration cytology (FNAC) and histo-pathological examination. Results of each were evaluated against histo-pathological examination.

Results: The mean age of the study subjects was 39.7±10.8 years. Multinodular goitre was the commonest thyroid swelling detected clinically (66.0%), on USG (36.0%) and histopathplogical examination (40.0%). However, FNAC showed colloid nodular goitre as the commonest (40.0%). Among the clinical examination, USG and FNAC, USG showed significant moderate agreement (κ=0.59, P<0.05)and FNAC showed significant perfect agreement (κ=0.91, P<0.05) with 88.2% sensitivity, 100.0%, specificity and positive predictive value 94.3% negative predictive value and 96.0% accuracy (P<0.05).

Conclusion:FNAC is a good tool to evaluate thyroid swellings for malignancy.

Keywords: thyroid swellings, Multinodular goitre, USG, FNAC.

INTRODUCTION

Thyroid gland diseases manifest as a spectrum and there is rapid increase such diseases in India [1, 2]. The prevalence of self-reported goitre or thyroid disorder was 2.9% based on National Family Health Survey V (2019-2021) compared to NFHS IV (2015-2016) there is rise in 0.7%[3]. Females are predominantly affected and most commonly presents as localized or diffuse or generalized thyroid enlargement [1]. Most of the thyroid swellings are benign and nearly 5% are malignant [4].Some of the causes of unilateral thyroid swelling include colloid nodules, inflammatory nodules, thyroid cysts and thyroid neoplasms [5]. Around 71 million people are suffering from goiter and other Iodine deficiency disorders in India [6]. Malignant nodules are to be distinguished from the harmless onesfor which there are different modalities to diagnose the thyroid swelling either clinically, sonologically, with fine needle aspiration cytology and even histo-pathological examination [5, 7].

Clinical examination of thyroid gland has a limitation in detecting the multi-nodularity and staging of thyroid malignancy [8]. Estimation of serum total T3, T4 and TSH (Thyroid stimulating hormone), thyroid ultrasonography (USG) and fine needle aspiration cytology (FNAC) are some common diagnostic tests to assess the severity of thyroid nodules. Measuring TSH is used to evaluate thyroid functioning and its values within the reference range excludes overt thyroid disease. Ultrasound scan being non-invasive, less expensive and with no ionizing radiation hazard is being widely used to look for thyroid associated abnormalities. However, it cannot determine the functioning status of thyroid gland as it needs a blood test or radioactive isotope uptake test. FNAC is generally the first choice of diagnostic test because of it is simple, has good patient compliance and is a quick test can be done in outpatient department, cost-effective and has superiority in thyroid evaluation. It also has reduced unnecessary thyroid surgeries being performed [9, 10]. Good and adequate knowledge about these tests helps in diagnosing them early and in their further management [4].

With this background, the present study was conducted to evaluateclinical examination, USG and FNAC findings with the histopathological diagnosis.

METHODOLOGY:

This is a cross-sectional descriptive study conducted for a period of 21 months from November 2019 to August 2021 among fifty patients who presented with thyroid swellings either at outpatient department or admitted s inpatient under surgery and/or ENT department in a tertiary care setting for the management of benign and malignant thyroid diseases and consented to participate in the study. Patients with history of congenital thyroid anomalies, history of pubertal goitre and in pregnancy and those with debilitating comorbidities were excluded from the study.Considering 4% prevalence of thyroid diseases and a 10% non-response rate, the sample size of 45 was estimated with 5% alpha error, 6% absolute precision and it was rounded off to 50 [11].

Written informed consent was taken from all the study participants and ethical clearance was obtained from Institutional Ethics Committee. Using convenient sampling, the data was collected among fifty patients using a semi-structured questionnaire consisting of socio-demographic data, clinical history including the chief complaints, history of presenting illness, with detailed clinical features of hypothyroidism or hyperthyroidism, history of previous medical treatment for thyroid disease, history of previous surgery or irradiation of neck. General physical examination, local examination of the thyroid swelling was conducted using Lahey's method and also the Pemberton sign was elicited to look for retrosternal extension of the swelling. Systemic examination including respiratory system, cardiovascular system, abdominal examination and central nervous system was carried out. All the data were recorded in the questionnaire. All the subjects were subjected to laboratory investigations for the complete thyroid profile, ultrasound neck with TIRAD and FNAC with Bethesda classification. [Table-1] Patients with deranged thyroid profile were medically managed followed by the surgery.USG neck was done using a 8 to 12 MHz linear probe and even low frequency probe was used when required. Solid and cystic lesions were differentiated, anatomy and nodularity of gland was assessed the findings like number, size, site, echogenicity, vascularity, calcification and lymphadenopathywere also noted. TIRADS classification as based on ultrasonography by American College of Radiology (ACR) was given [12, 13].Indirect laryngoscopy was done for all. Based on the type of lesions, lobectomy, isthmectomy, hemi-thyroidectomy, subtotal and near-total thyroidectomy was performed on benign lesions and total thyroidectomy was performed on malignant lesions. General anaesthesia was given in supine position with neck extended, incision was made along the skincreaseandthesuperiorandinferior flaps were elevated, the gland was exposed and tumour was examined. Upper pole was mobilized and dissected and tumour along with the part of gland was dissected. Injury to recurrentlaryngealnerveandparathyroid glands were prevented taking adequate care. Wound closure was done and the specimen which was excised were sent for histopathologicalexaminationin40%formalinsolution and was sent for processing, staining and examination within4 to 5hoursoftheprocedure and the final diagnosis was made [12, 13, 14].

Statistical Analysis:The data was entered in Microsoft excel and analyzed using SPSS version 20.0. Results were presented either as proportions, mean ± SD, range. Categorical variables were analyzed using chi-square test and/ or Fisher's exact test. The tests were evaluated against histo-pathological diagnosis using sensitivity, specificity, positive predictive value, negative predictive value and accuracy. The extent of agreement between frequencies of two tests was assessed using Cohen's κ-coefficient [15] [Table-2].A P value < 0.05 was considered statistically significant.

Table-1: The Bethesda system for reporting thyroid cytopathology: Implied risk of malignancy and recommended clinical management [12]

Category	Description	Risk of Malignancy (%)	Usual Management
I	Non-diagnostic	1 - 4	Repeat FNAC with US
II	Benign	0 – 3	Clinical ollow-up
III	Atypia of undetermined significance or follicular lesion	5 - 15	Repeat FNAC
IV	Follicular neoplasm or suspicious for follicular neoplasm	15 - 30	Lobectomy
V	Suspicious for malignancy	60 - 75	Total thyroidectomy or lobectomy ± frozen section
VI	Malignant	97 - 99	Total thyroidectomy or lobectomy

Table-2: Cut-off scales of Kappa value [16]

<0.0	Poor
0.00 to 0.20	Slight
0.21 to 0.40	Fair
0.41 to 0.60	Moderate

0.61 to 0.80	Substantial
0.81 to 1.00	Almost Perfect

RESULTS:

The mean age of the study subjects was 39.7±10.8 years and it ranged from a minimum of 18 years to 65 years. Majority i.e. 46.0% were in the age group of 31 to 40 years and least i.e. 14.0% belonged to the age group of 41 to 50 years. Females were predominant and contributed to 90.0% of the subjects and most of them i.e. 94.0% did not give any family history of thyroid swellings. [Table-3]

Table-3: Socio-demographic profile of the study subjects (n=50)

Variables	Frequency (n)	Percentage (%)
Age-group in years		
≤30	11	22.0
31-40	23	46.0
41-50	07	14.0
>50	09	18.0
Gender		
Male	05	10.0
Female	45	90.0
Family History		
Yes	03	6.0
No	47	94.0

Most of the study subjects i.e. 64.0% of the study subjects reported the complaints for at least one year or less than that and only 10.0% reported the complaints for more than 5 years. 76.0% of them reported it to be a slow progression of the growth of thyroid swellings and 8.0% each reported thyrotoxic and pressure symptoms and majority i.e. 82.0% had silent swellings with no symptoms. On blood investigation, 12.0% had hyperthyroid and hypothyroid features. [Table-4]

Table-4: Distribution of the study subjects based on certain clinical variables (n=50)

Clinical Variables	Frequency (n)	Percentage (%)
Duration of complaints of swelling (n=50)		
≤1 year	32	64.0
1 - 5 years	13	26.0
>5 years	05	10.0
Rate of growth (n=50)		
Rapid	12	24.0
Slow	38	76.0
Thyroid symptoms		
Hypothyroidism features (n=50)	01	2.0
Thyrotoxic features (n=50)	04	8.0
Pressure symptoms(n=50)	04	8.0
Thyroid profile		
Euthyroid	44	88.0
Hyperthyroid	04	8.0
Hypothyroid	02	4.0

On clinical examination, 98.0% were noted to have benign thyroid swellings and most common swelling was noted to be Multi-nodular Goitre (66.0%).

On USG thyroid, 82.0% were diagnosed to have benign thyroid swellings and the most common benign swelling remained to be Multi-nodular Goitre (36.0%) and among malignant swellings, most common i.e. 16.0% were diagnosed to have papillary carcinoma thyroid.

On FNAC, 70.0% were reported to have benign thyroid swellings among which colloid nodular goitre (36.0%) was the commonest and papillary carcinoma remained to be the commonest malignant thyroid swelling among 24.0%.

On histo-pathological examination, 70.0% were reported to have benign thyroid swellings and multi-nodular goitre was highest (40.0%) and papillary carcinoma remained to be the commonest malignant thyroid swelling among 28.0%. [Table-5]

Table-5: Distribution of the study subjects based on the findings of clinical examination, USG, FNAC and HPE (n=50)

Clinical examination		
Benign		
Multi-nodular goitre	33	66.0
Simple nodular goitre	13	26.0
Grave's disease (?DG)	03	06.0
Malignant		
Carcinoma thyroid	01	02.0
USG		
Benign		
Multi-nodular Goitre	18	36.0
Simple nodular goitre/ Nodular goitre	11	22.0
Colloid goitre/ Colloid nodular goitre	09	18.0
Hashimoto's thyroiditis	03	06.0
Malignant		
Papillary carcinoma	08	16.0
Simple nodular goitre - Follicular neoplasm	01	02.0
FNAC		
Benign		
Colloid goitre/ Colloid nodular goitre/Colloid cyst	18	36.0
Hyperplastic Goitre	11	22.0
Multi-nodular Goitre	05	10.0
Hashimoto's Thyroiditis	01	02.0
Malignant		
Papillary carcinoma with or without Follicular variant	12	24.0
Follicular neoplasm or Follicular carcinoma	03	06.0
Histopathology Examination		
Benign		
Multi-nodular goitre	20	40.0
Colloid goitre	08	16.0
Hashimoto's thyroiditis	04	08.0
Colloid goitre with Hashimoto's thyroiditis	01	02.0
Malignant		
Papillary carcinoma	12	24.0
Follicular carcinoma	02	04.0
Papillary carcinoma with Follicular variant	02	04.0
Colloid goitre with Papillary carcinoma	01	02.0

Diagnosis of malignancy done based on clinical examination had only slight agreement with kappa value of 0.08. But the specificity and positive predictive values of clinical examination for diagnosing malignancy were 100.0%, negative predictive value was 67.4% and accuracy was 68.0% (P>0.05). [Table-6]

Table-6: Evaluation of clinical examination findings with HPE (n=50)

Malignancy on Clinical Examination	**Malignant on HPE**		***P*-value¥**	**Kappa-value (*P*-value)**
	Yes n (%)	**No n (%)**		
Yes	01 (5.9)	00 (0.0)	0.34	0.08 (0.16)
No	16 (94.1)	33 (100.0)		
Validity Measures				
Sensitivity	5.88% [0.15% to 28.69%]			
Specificity	100.00% [89.42% to 100.00%]			
PPV¥	100.00% [-]			
NPV¥	67.35% [64.68% to 69.90%]			
Accuracy	68.00% [53.30% to 80.48%]			

*indicates statistical significance at P<0.05; ¥Fisher's Exact Test applied; §PPV – Positive Predictive Value; §NPV - Negative Predictive Value

Diagnosis of malignancy based on USG had significant moderate agreement with kappa value of 0.59. However the specificity and the positive predictive value was 100.0%, negative predictive value was 67.4% and accuracy was 84.0% (P<0.05). [Table-7]

Table-7: Evaluation of USG findings with HPE (n=50)

Malignancy on USG	**Malignant on HPE**		***P*-value¥**	**Kappa-value (*P*-value)**
	Yes n (%)	**No n (%)**		
Yes	09 (52.9)	00 (0.0)	<0.001*	0.59* (<0.001)
No	08 (47.1)	33 (100.0)		
Validity Measures				
Sensitivity	52.94% [27.81% to 77.02%]			
Specificity	100.00% [89.42% to 100.00%]			
PPV§	100.00%[-]			
NPV§	80.49% [71.36% to 87.23%]			
Accuracy	84.00% [70.89% to 92.83%]			

*indicates statistical significance at P<0.05; ¥Fisher's Exact Test applied; §PPV – Positive Predictive Value; §NPV - Negative Predictive Value

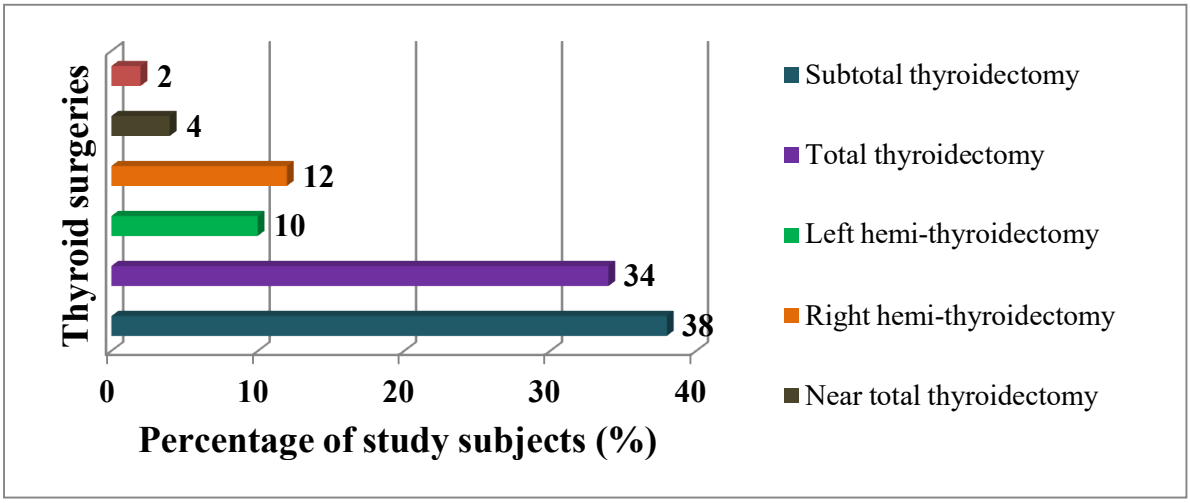
Diagnosis of malignancy on FNAC had significant almost perfect agreement with kappa value of 0.91. However the specificity and the positive predictive value was 100.0%, sensitivity was 88.2% and negative predictive value was 94.3% and accuracy was 96.0% (P<0.05). [Table-8]

Table-8: Evaluation of FNAC findings with HPE (n=50)

Malignancy on FNAC	**Malignant on HPE**		***P*-value¥**	**Kappa-value (*P*-value)**
	Yes n (%)	**No n (%)**		
Yes	15 (88.2)	00 (0.0)	<0.001*	0.91* (<0.001)
No	02 (11.8)	33(100.0)		
Validity Measures				
Sensitivity	88.24% [63.56% to 98.54%]			
Specificity	100.00% [89.42% to 100.00%]			
PPV§	100.00% [-]			
NPV§	94.29% [81.78% to 98.38%]			
Accuracy	96.00% [86.29% to 99.51%]			

*indicates statistical significance at P<0.05; ¥Fisher's Exact Test applied; §PPV – Positive Predictive Value; §NPV - Negative Predictive Value

Among the thyroid surgeries, majority underwent subtotal (38.0%) and total thyroidectomy (34.0%) and near total thyroidectomy with functional neck dissection was performed among only 2.0% of them. [Graph-1]



Graph-1: Distribution of study subjects based on the thyroid surgeries

DISCUSSION:

Thyroid lesions having high prevalence in India, there is a need to diagnose and evaluate such lesions to differentiate benign from the malignant thyroid nodules [1, 2]. There have been various modalities to diagnose the thyroid swelling either clinically, sonologically, with fine needle aspiration cytology and even histo-pathological examination [7].

The mean age of the study subjects according to Patel S et al.,was 40.82 years and the age ranged from 10 to 71 years with female preponderance of 86.0% which almost are in line with our study findings and the slight differences in terms of the age range might be due to different study settings. Six percent of the subjects gave family history of thyroid lesions in this study and Hariprasad S et al., also have found the same among 6.9% [7, 17].

40.0% of our subjects complained of neck swelling since a duration of less than 1 year and similarly Chaudhary M et al., reported 60% patients to have presented with the thyroid swelling in less than 1 year duration which [12]. Bhargava A et al., have observed majority to have euthyroid status followed by hypothyroid and least cases of hyperthyroid however in our study, similar to their findings most of them had euthyroid status but for hyperthyroid was more common than hypothyroid status. The difference may be due to the difference in the study setting and study subjects [9].

Chauhan HH et al., found 90.0%, 76.7%, 76.7% and 80.0% as benign thyroid lesions and in our study it was noted to be 98.0%, 82.0%, 70.0% and 70.0% based on clinical examination, USG, FNAC and histo-pathological examination respectively. Though in theirs, USG and FNAC have found similar proportion, our study has identified similar proportions of lesions on FNAC and histo-pathological examination [14]. Kartha PP and Sadasivan S have noted multi-nodular goitre to be the most common disease clinically, radiologically on USG and on HPE, however in FNAC colloid nodular goitre was found to be the commonest which are consistent to our findings [18].Patel S et al., have identified colloid goitre to be commonest on FNAC and similar to ours, however, on histo-pathological examination, colloid goitre was most common benign lesion contrasting to ours but papillary carcinoma was most common malignant lesion similar to the current finding. The difference can be explained due to different study subjects it caters to in the study [7]. On FNAC, nearly 13.0% were diagnosed to have malignant thyroid lesions with follicular and papillary being equally noted among 5.0% each and maximum cases were diagnosed as multi-nodular goitre and colloid goitre [19]. However in ours, on FNAC, 70.0% were reported to have benign thyroid swellings among which colloid nodular goitre (36.0%) was the commonest and papillary carcinoma remained to be the commonest malignant thyroid swelling among 24.0%.

According to Chauhan HH et al., clinical examination was found to be 50% sensitive and 100% specific, USG was 67% sensitive and 100% specific FNAC was 50% and 96% sensitive and specific respectively, however in our study, clinical examination showed least sensitivity of nearly 6.0%, but 100.0% specific, USG was nearly 53.0% sensitive and 100.0% specific and FNAC was 88.0% sensitive and 100.0% specific among ours [14]. Patel S et al., have notedthe sensitivity, specificity, positive predictive value and negative predictive value of FNAC in diagnosing thyroid swellings to be 55.56%, 100%, 100% and 90% respectively [7]. Abbaraju SR et al., found the overall efficacy of FNAC to be higher (88.3%) than USG (76.6%) and clinical diagnosis (56.6%) similar to ours except for clinical diagnosis which was least sensitive and the difference may be due to the difference in the type of lesions in different study setting [20].

Kartha PP and Sadasivan S revealed that ultrasonogram and fine needle aspiration cytology showed moderate agreement with histo-pathology with a kappa value of 0.6, similar to ours but for FNAC which showed perfect agreement in ours with a kappa value of 0.9 [18]. FNAC has been reported to have superior diagnostic reliability and in our study it has a perfect agreement with histopathology [9].

In our study majority underwent subtotal (38.0%) and total thyroidectomy (34.0%) and Tyagi M et al., majority underwent hemithyroidectomy followed by subtotal thyroidectomy and total thyroidectomy similar to our study [11].

However, the study needs to be conducted in a larger setting and it lacks generalizability as it was conducted using convenient sampling.

CONCLUSION:

Clinical correlation with the histopathological findings was poor with poor sensitivity (5.9%) and slight agreement. USG is better compared to clinical correlation with moderate agreement and sensitivity of 53.0%. However FNAC has highest sensitivity (88.0%) and is in perfect agreement with HPE. Though clinical diagnosis, USG and FNAC all can diagnose the disease when positive, FNAC can rule out the disease if negative. Hence FNAC is a better tool to diagnose thyroid swellings.

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