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Original Research Article

Accuracy of fine needle aspiration cytology and thyroid imaging reporting and data system to predict the nature of nodular goiter and its comparison with postoperative histology

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ABSTRACT

Background: Aim of the study was to find accuracy of pre-operative fine needle aspiration cytology (FNAC) and thyroid imaging reporting and data system (TIRADS) in predicting the nature of nodular goitre and confirming it with post-operative biopsy. Objective of the study was to assess the sensitivity and specificity of FNAC compared with post-operative biopsy and to assess the sensitivity and specificity of TIRADS compared with post-operative biopsy.
Methods: This retrospective study was carried out at tertiary hospital, King George Hospital, Visakhapatnam over a period of 1 year from march 2018 to march 2019. Sensitivity and specificity are calculated based on formulae.
Results: Sample size calculated with 90% confidence interval for population of vizag is 96, a sample of 100 patients were taken in this study. Of the 100 cases, 16 had thyroid carcinoma. 15 of them were papillary carcinoma and 1 follicular carcinoma. 8 cases matched with cytology report after post op biopsy and 8 we mismatched with cytology report after post op biopsy. The incidence of malignancy in clinically and cytologically benign goitre is 8.69. In our study sensitivity of FNAC is 50%, specificity is 100% and accuracy of test is 92% and TIRADS has a sensitivity of 100% and specificity of 72.62% and an accuracy of 77%.
Conclusions: The current study has showed the disparity we see in thyroid neoplasms in FNAC test and TIRADS, which were proved to be different diagnosis in clinical and histopathology, so even if cytology is benign, we can't rule out malignancy. FNAC and TIRADS combined have more sensitivity and specificity than individual tests.

Keywords: Nodular goitre, FNAC, TIRADS, Papillary carcinoma, Follicular carcinoma, Thyroid

INTRODUCTION

Diseases of the thyroid, includes a variety of developmental, inflammatory, hyperplastic and neoplastic disorders are exceedingly common in clinical practice. Swelling of the thyroid gland is called as goiter. Thyroid lesions can present as diffuse, solitary or multinodular swellings and these can be either in euthyroid, hypothyroid and hyperthyroid state at presentation. Over a decade, the incidence rate of thyroid cancer in India has increased from 2.4% to 3.9% in women and 0.9% to 1.3% in men a relative increase of 62% and 48%.[1] The incidence of malignancy goiters has been found to vary from 4% to 17%. These studies concluded that the risk of malignancy in both multinodular goiters and solitary thyroid nodules is not negligible. Therefore, both

conditions should be carefully evaluated to detect any underlying malignant foci, which may require further surgical intervention. A hospital registry of thyroid cancer reported papillary carcinoma thyroid as most common, followed by follicular thyroid.[2]

The aim of the study was to find accuracy of pre-operative fine needle aspiration cytology (FNAC) and thyroid imaging reporting and data system (TIRADS) in predicting the nature of nodular goitre and confirming it with post-operative Biopsy.

METHODS

This study is a retrospective study. Patients who have undergone surgeries for thyroid swelling in general surgery wards over a span of 1 year in Andhra Medical College, King George Hospital, Visakhapatnam from March 2018 to March 2019 were included in the study. All data including age, gender, address, size of goiter, duration of complaint, relevant investigations like fine needle aspiration cytology, type of surgery and final histopathology report were recorded. All patients were in euthyroid state at the time of surgery. The SPSS was used to analyse the data.

Sample size calculated with 90% confidence interval for population of vizag, a sample of 100 patients were taken in this study.

Table 1: Sensitivity and specificity of disease in patient.

	Disease present	Disease absent
Test positive	True positive (tp)	False positive (fp)
Test negative	False negative (fn)	True negative (tn)

Sensitivity is the proportion of patients with disease who test positive. In probability notation: P(T+|D+) = TP/(TP+FN). Specificity is the proportion of patients without disease who test negative. In probability notation: P(T-|D-) = TN/(TN + FP).

RESULTS

Sample size calculated with 90% confidence interval for population of Vizag is 100. Of the 100 patients analysed, 85 were females, which shows significance of goitre in females. of which 54% of patients were between 21 and 40 years, 35% were between 41 and 60 years, 6% were below 20 years, 5% above 60 years mean age in our Study is 33.92 years of the nodular enlargement of thyroid 49% were multinodular goitre and 40% were solitary nodule thyroid and 11% were diffuse thyroid enlargement (Figure 1). All 100 cases presented with complaint of swelling in the neck and 3 cases presented with complaint of dysphagia. Most of the patients were from Visakhapatnam urban area.

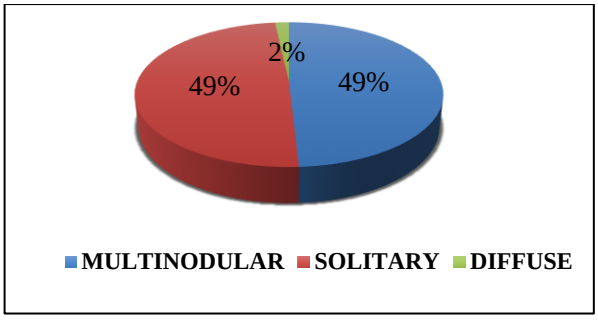

Figure 1: Type of goitre.

Table 2: Patients region.

Region	Urban	Rural
Visakhapatnam	39	25
Vijaynagaram	8	11
Srikakulam	5	8
East godavari	2	1
Elluru	1	0

Table 3: Cytology reports (FNAC) of 100 cases.

FNAC	Number of cases
Nodular goitre	44
Follicular neoplasm	19
Adenomatous goitre	14
Colloid cyst	12
Papillary carcinoma	9
Hashimoto thyroiditis	2

Table 4: TIRADS of 100 cases.

Tirads grading	Number of patients
Tirads 1 (benign)	0
Tirads 2 (not susiucious)	61
Tirads 3 (mildly susiucious)	23
Tirads 4 (moderately susiucious)	12
Tirads 5 (highly susiucious)	4

Table 5: Postoperative histopathology report.

Histo-pathology report	Number of cases
Benign	
Multinodular goitre	50
Follicular adenoma	20
Colloid goitre	5
Adenomatous goitre	5
Colloid cyst	3
Lymphocytic thyroiditis	1
Malignant	
Papillary carcinoma thyroid	15
Follicular carcinoma thyroid	1

Size of goitre was compared and 38% of patients had goitre size between 2 and 4 cm which was most common among them. Surgery was done for all 100 cases.

Of the 100 cases under study 16 cases are malignant on postoperative histopathology report, of which 8 cases matches with cytology report and 8 cases don't match with cytology (Table 6).

Table 6: Cytology reports.

Cytology reports	Number of cases		
Mismatched	8	Papillary carcinoma	
Matched	8	Papillary carcinoma	7
		Follicular carcinoma	1

Table 7: TIRADS of matched cases of FNAC and post-op biopsy.

Tirads grade	Patients		
Tirads 3	1		
Tirads 4	**4a**	2	All matched malignancies
	4b	2	
Tirads 5	**5a**	1	
	5b	1	
	5c	1	

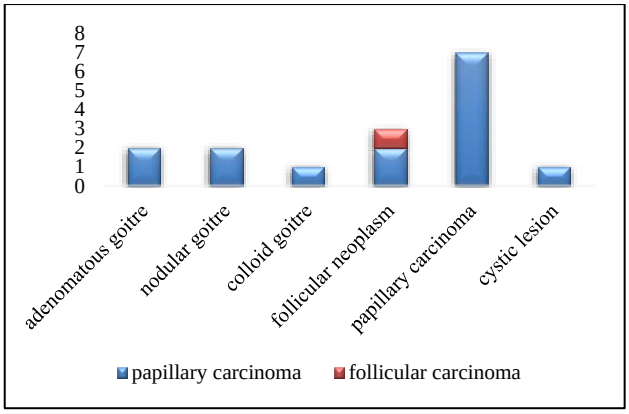

Figure 2: Pre-operative FNAC compared with post-operative histopathology.

Matched cases

Of the 8 matched cases 7 cases (87.5%) were papillary carcinoma thyroid and 1 case (12.5%) were follicular carcinoma.

Mismatched cases

All mismatched cases were papillary carcinoma thyroid and were compared based on age, sex, size, surgery done.

Table 8: Cytology, TIRADS and post-operative histopathology comparison for the 16 malignant thyroid cases.

Cytology	Tirads		Post operative histopathology		
			Papillary	**Follicular**	**Medullary**
Adenomatous Goitre	Tirads 3	1	2	0	0
	Tirads 4a	1			
Nodular goitre	Tirads 4b	2	2	0	0
Colloid goitre	Tirads 3	1	1	0	0
Follicular neoplasm	Tirads 4a	2	2	1	0
	Tirads 4b	1			
Papillary carcinoma	Tirads 3	1	7	0	0
	Tirads 4a	1			
	Tirads 4b	2			
	Tirads 5	3			
Cystic lesion	Tirads 4b	1	1	0	0

DISCUSSION

Globally incidence of thyroid has increased by five folds in the last few decades. Thyroid enlargement, which is a common disorder in India, commonly presents as multinodular thyroid swelling (49%). Hanumanthappa et al reported 45.5% cases were multinodular goitre.[3,4]

The most common presenting complaint in this study was swelling in the neck (100%), while Tarrar et al reported a finding of 100% and 3% (3 cases) presented with dysphagia which is similar to Priyadarshi et al, the number of cases presented with dysphagia in 3 percent of the cases (1 case).[5,6] Size of goitre 2 to 4 cm is found to be most common (38%) ,which is similar to Venkatrao et al.[7]

Solitary and multinodular goitres were more common in women (84%) in our Study. Similarly, Hanumanthappa et al reported a striking female predominance in their study.[4] In the Wickham study, 26% of women had a goitre, compared to 7% of men.[8] Thyroid nodules are less frequent in men than in women, but when found, they are more likely to be malignant. Majority of the cases showing female preponderance as compared to males in the study of Popivanov et al and Tabaqchali et al and were very much similar to the present study.[9,10] In Popivanov et al, female were 94.2 percent of the cases and males were 5 percent of the cases. In Tabaqchali et

al, females were 89.1 percent of the cases and males were 10.8 percent of the cases.[10]

Age distribution in this study showed a preponderance of patients in the second and third decades of life (54%) for both solitary and multinodular goitres. The mean age of our patients with nodular thyroid was 33.92 years. This is in variance to the other Indian reports, namely Hanumanthappa et al who reported a majority of patients in the third and fourth decades of life and Nanjappa et al who reported a mean age of 47.4 years, another study Merla et al reported mean age of 36.7 years.[4,11,12]

In our study benign lesions are 84% (84 cases) and malignant lesions are 16% (16 cases). In Champa et al study, the neoplastic lesions of the thyroid were found in 11 percent of the cases (15 cases) and non-neoplastic lesions of the thyroid were found in 89 percent of the cases (125 cases).[13] In Tabaqchali et al study, the neoplastic lesions of thyroid were found in 39.3 percent of the cases (94 cases) and non-neoplastic lesions of the thyroid were found in 60.7 percent of the cases (145 cases).[10] The non-neoplastic lesions of the thyroid were maximum number of the cases in the present Study and were similar to the other studies. Of the 100 patients with thyroid goitre, 49 had multinodular goitre and 40 solitary nodule thyroids of the 16 malignant thyroid goitre 15 are papillary and one follicular carcinoma thyroid. Of the 15 papillary thyroid carcinomas, 7 are SNT and 8 are MNG. Of the remaining follicular carcinoma is MNG. Of the 40 SNT, 7 are malignant (17.5%), Nanjappa et al reported a malignancy rate of 23.47% in solitary nodules.[11] Of 49 MNG, 9 are malignant (18.36%), Nanjappa et al reported a 18.18% malignancy rate in multinodular thyroid.[11]

In this study, we observed multinodular goitre with microscopic malignant foci in 9 (18.36%) patients of which 8 (88.8%) were papillary carcinoma and 1 follicular carcinoma (11.11%), while Chen et al reported 57 (21.2%) nodular goitres with malignant foci, of which 44 were papillary carcinomas (77.19%), 5 (8.77%) were follicular carcinoma, and 5 (8.77%) were medullary carcinomas.[14] Stoffer et al and Pelizzo et al have also reported increased incidence of papillary carcinoma in MNGs.[15,16]

The correlation of cytological diagnosis and histopathological diagnosis of the present study were correlated with the other study. In Safirullah et al study, the cytological diagnosis were benign cases in 83.3 percent of the cases (250 cases) and when compared to histopathology, benign were 82.6 percent of the cases (248 cases), 0.66 percent of the cases (2 cases) were confirmed as malignant.[17] The cytologically diagnosed benign cases 92 (92%) and compared to histopathology diagnosis, 84 (84%) benign cases were confirmed and remaining 8(8%) cases were confirmed to be malignant. In Safirullah et al study, the cytologically diagnosed malignant cases were 11.6 percent of the cases (35 cases) and when compared to histopathological diagnosis, benign were 1.66 percent of the cases, 10 percent of the cases (30 cases) were malignant. In the present study, the cytologically diagnosed malignant cases were 8 cases (8%) and when compared to histopathology diagnosis all the cases were confirmed to be malignant.

Of the 92 cases diagnosed as benign clinically and cytologically, 8 were diagnosed as malignant in postoperative biopsy. Incidence of malignancy in clinical and cytologically benign goitre is 8.69%. Of which all are papillary carcinoma thyroid. Patients were of 2nd to 3rd decade of life. Of which 75% were MNG and 25% SNT with increased incidence in females compared to males.

In this study, we observed that the incidence of malignancy in multinodular goitre was almost similar to that in solitary nodules. Thyroid goitres clinically and cytologically diagnosed as benign lesions had malignant tumours in histology, as the nodularity possibly masked the existence of a solitary focus of cancer. Hence, thyroid cancers are best diagnosed through clinical, radiological, and cytological analysis. It is also important that all nodules of the thyroid, whether solitary or multinodular, should be sampled in fine-needle aspiration (FNAC) and similarly all nodules need to be studied for malignancy in histopathology.

Sensitivity of FNAC is 50% and specificity of 100%, accuracy is 92%. We have taken TIRADS 3, 4 and 5 as malignant and compared it with post-operative biopsy, we got a sensitivity. Based on formulae the sensitivity and specificity and accuracy of TIRADS are sensitivity is 100%, specificity is 72.62%, and accuracy is 77%. Bindman R et al reported a sensitivity of 88% with high false positive rate.[18]

Limitations

This study is a retrospective observational study and not a prospective study so we could not do any intervention. The grading of TIRADS is entirely operator dependent and may vary when interpreted by a different operator and may lead to bias.

CONCLUSION

Thyroid swelling most commonly presents as multinodular goitre and main complaint is swelling in the neck. Thyroid goitre is more common in females between the age of second to third decade. The current study has showed the disparity we see in thyroid neoplasms in Fine Needle Aspiration Cytology test, which were proved to be different diagnosis in clinical and histopathology, so even if cytology is benign, we can't rule out malignancy. We need to be careful when treating a patient conservatively in goitre of benign cytology.

There may be a histological surprise as malignant focus in goitre may be missed on cytology. Although incidence is low but it can't be ignored, so every thyroid swelling

need to be evaluated and kept under surveillance. FNAC and TIRADS combined have are more sensitive and specific than individual test.

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REFERENCES

1. Trends in thyroid cancer incidence in India. Available at 0.1200/JCO.2018.36.15_suppl.e18095. Accessed on 12 May 2020.
2. Gangadharan P, Nair MK, Pradeep VM. Thyroid cancers in Kerala. In: Shah AH, Samuel AM, Rao RS, editors, Thyroid Cancer. An Indian Perspective. Mumbai: Quest Publications. 1999:17-32.
3. Whelan SL, Parkin DM, Masuyer E. Patterns of cancer in five continents. IARC Sci Publ. 1990;102:152-3.
4. Hanumanthappa MB, Gopinathan S, Suvarna R. Incidence of malignancy in multi-nodular goitre: prospective study at a tertiary academic Centre. J Clin Diagn Res. 2012;6:267-70.
5. Mulaudzi TV, Ramdial PK, Madiba TE, Callaghan RA. Thyroid carcinoma at King Edward VIII Hospital, Durban, South Africa. East Afr Med J. 2001;78(5):242-5.
6. Priyadarshi N, Mistry D, Kharadi N. Study of management of solitary thyroid nodule. J Sci Res. 2013;2(3):181-4.
7. Venkatarao B, Subramanyam S, Kollu S. Study of association between serum TSH and thyroid nodules. J Evid Med Healthcare. 2016;3(94):5181-4.
8. Tunbridge WM, Evered DC, Hall R, Appleton D, Brewis M, Clark F, et al. The spectrum of thyroid disease in a community: The Whickham survey. Clin Endocrinol. 1977;7:481-93.
9. Popivanov P, Boianov M, Temelkova N, Manolov D, Chavrakov G. Fine needle aspiration biopsy and cytologic diagnosis in thyroid disease: A 3 years' experience. Vutr Boles. 2000;32(3):31-5.
10. Tabaqchali MA, Hanson JM, Johnson SJ, Wadehra V, Lennard TWJ, Proud G. Thyroid aspiration cytology in Newcastle: a six year cytology/histology correlation study. Ann R Coll Surg Engl. 2000;82:149-55.
11. Nanjappa BA, Mohanty A, Aroul T, Smile S, Kotasthane D. Thyroid carcinoma (TC) in nodular goiter. Thyroid Disorders Ther. 2012;1:115.
12. Merla J, Kalyanaraman S. Thyroid cancer and nodular goitre of thyroid: an analysis of patients in rural South Tamil Nadu. Thyroid Res Pract. 2017;14:106-11.
13. Sushel C, Khanzada TW, Zulfikar I, Samad A. Histopathological pattern of diagnoses in patients undergoing thyroid operations. Rawal Med J. 2009;34(1):1-7.
14. Pang HN, Chen CM. Incidence of cancer in nodular goitres. Ann Acad Med. 2007;36:241-3.
15. Stoffer RP, Welch JW, Hellwig CA, Chesky VE, Mccusker EN. Nodular goiter. Incidence, morphology before and after iodine prophylaxis, and clinical diagnosis. Arch Intern Med. 1960;106:10-4.
16. Pelizzo MR, Piotto A, Rubello D, Casara D, Fassina A, Busnardo B. High prevalence of occult papillary thyroid carcinoma in a surgical series for benign thyroid disease. Tumori. 1990;76:255-7.
17. Safirullah J, Mumtaz N, Khan A. Role of fine needle aspiration cytology (FNAC) in the diagnosis of thyroid swellings. J Postgraduate Med Inst. 2004;18(2):196-201.
18. Bindman SR, Lebda P, Feldstein VA. Risk of thyroid cancer based on thyroid ultrasound imaging characteristics: results of a population-based study. JAMA Intern Med. 2013;173(19):1788-96.

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