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Original Research Article

Comparison of conventional and ultrasonologically guided fine needle aspiration cytology of the solitary nodule of the thyroid gland

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ABSTRACT

Background: Solitary nodule of the thyroid can be a manifestation of a diversity of diseases affecting the thyroid gland. FNAC is the initial diagnostic investigation of choice in the work up of such patients. The study aimed to assess the impact of adding ultrasonographic assistance to FNAC in patients with such nodules.
Methods: 100 patients with solitary nodule of thyroid were included in the study. 50 patients each underwent ultrasound guided FNAC and conventional FNAC. The patients proceeded to definitive surgery and the histopathological report was compared to the FNAC report.
Results: The sensitivity (90.0 % v/s 83.3 %), negative predictive power (97.6 % v/s 95 %) and accuracy (98 % v/s 96%) of USG guided FNAC was higher than that of conventional FNAC. The false positivity rate (10 % v/s 16.7 %) of USG guided FNAC was found to be lower than that of conventional FNAC. These findings, which apparently showcase the advantages of USG guided FNAC, were not proven to be statistically significant.
Conclusions: The database of our retrospective study regarding age and sex incidence, clinicopathological features and therapeutic outcome was comparable to other studies in various literatures.

Keywords: Fine needle aspiration cytology, Papillary carcinoma, Thyroid, Ultrasound

INTRODUCTION

Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide. A patient presenting with a thyroid swelling is a common problem that a clinician has to encounter. Thyroid disorders can vary from innocent physiologic enlargements of the gland to life threatening thyrotoxic crises which require emergency medical interventions and thyroid cancers which require skilful surgical management.

Carcinoma of the thyroid gland is the most common endocrine malignancy in the world, and worldwide it constitutes about 1% of human neoplasms.[1] Thyroid carcinoma accounts for 1-5% of all malignancies in females and less than 2% of all malignancies in males.[2] Papillary carcinoma is the most common thyroid neoplasm accounting for 70-80% of thyroid carcinoma.[3] The incidence of thyroid carcinoma and particularly papillary carcinoma has been on the rise around the globe.[2] Clinically discrete swellings in the thyroid gland known as solitary nodules of the thyroid have a higher incidence of malignancy than a non-solitary nodule.[4]

The incidence of malignancy in solitary thyroid nodule ranges from 5 to 15%.[3,5,6] Khadilkar UN and Maji P in a study found that among malignant solitary nodules, the incidence of papillary carcinoma thyroid is 13%.[7] Khan S.A. et al in their study on SNT detected papillary carcinoma in 11% of these nodules.[6] Whereas, Kessler et al in a retrospective cohort study on 170 patients with SNT over a period of four years detected 33% cases of papillary carcinoma.[8] Most patients with papillary carcinoma can expect an excellent prognosis with 10-year

survival rates above 95% for the most favourable stages.[3] Therefore early detection of papillary carcinoma is very important.

The appropriate management and successful outcome in thyroid disease depends on accurate diagnosis. The commonest diagnostic tool used in the diagnosis of thyroid swelling is a fine needle aspiration cytological study from the swelling.

Fine needle aspiration cytology (FNAC) of the thyroid gland is a rapid, inexpensive and technologically simple procedure for the initial evaluation of thyroid nodules and has a sensitivity of 86%, and 91% specificity.[3] Papillary carcinoma can be diagnosed by the characteristic cytomorphology of individual cells. Hence FNAC can definitively diagnose papillary carcinoma making it an essential factor in the management of patients with thyroid nodules, especially those suggestive of malignancy.[3]

However, FNAC has a false negative rate ranging between 2.3-6.2% and false positive rate ranging between 0.2-11.6%.[9] A major reason for the failure in FNAC is inadequate aspirate. As in other areas, aspirating under vision could improve the yield of FNAC in thyroid nodules. Among the modern imaging modalities, high-resolution US is the first choice and most sensitive diagnostic modality for the detection of intrathyroidal lesions and it is necessary to perform US for the nodules found after palpation.[10] High-frequency sonography facilitates the detection of even clinically non-palpable nodules of 2-3 mm size and allows a more accurate morphological characterization of the lesion.[11]

USG has the added advantage of being able to identify nodules with increased risk of malignancy based on specific radiological characteristics of the nodules including nodule size, internal content, nodule shape, nodule margin, echogenicity, calcification, extracapsular invasion, vascularity and elastography.[12] USG guided FNAC can target solid areas within thyroid nodules especially in malignancies and hence improve the diagnostic capability of FNAC. Cai X.J. et al, in a study to assess the inadequate aspirate from FNAC found that the inadequacy rate was significantly lower for USG guided FNAC (6.4%) than conventional FNAC (13%).[13] Solymosi et al, in a study comparing FNAC with and without USG guidance found that the positive predictive value of FNAC (45% v/s 16%), specificity (87% v/s 56%) sensitivity (92% v/s 57%) and diagnostic accuracy (87% v/s 66%) were all higher with USG guided FNAC.[14] The present study aimed at assessing the impact of using ultrasonography as an adjunct to FNAC in the diagnosis of solitary nodule of the thyroid gland.

The objective of the study was compare the results of conventional FNAC and USG guided FNAC, with histopathology as the gold standard, in solitary nodule of the thyroid especially in the diagnosis of papillary carcinoma.

METHODS

A descriptive study was conducted in patients with solitary thyroid nodules attending the out-patient and in-patient Department of General Surgery in Government T.D. Medical College Vandanam, Alappuzha over a period of one year from January 2013 to January 2014.

Patients were divided into two groups.

Group 1: Consists of patients who underwent USG guided FNAC for solitary nodule of the thyroid.

Group 2: Consists of patients who underwent conventional FNAC for solitary nodule of the thyroid.

Inclusion criteria

- Patients with solitary nodule thyroid on clinical examination.

Exclusion criteria

- Patients with thyroid swellings proven to be malignancy
- Patients with diffuse goitre, multi-nodular goitre

Study procedure:

USG guided FNAC was done in a group of patients who attended the OPD on all Tuesdays and conventional FNAC was done in patients attending OPD on all other days. Informed consent was taken prior to the procedure. FNAC was done using 22G needle attached to 5ml syringe. USG was done using Siemens Acuson Premium Edition ultrasound system with high frequency (5-12MHz) probe.

Statistical analysis

Qualitative variables were summarized using percentages and proportions. Quantitative variables were summarized using mean with standard deviation. sensitivity and specificity of conventional FNAC and USG guided FNAC were found out by comparing it with histopathologic examination report.

Data was entered in MS Excel data sheet and analysed using SPSS software.

RESULTS

The study involved 100 patients with a mean age of 42 years (Table 1) which included 11 males and 89 females (Table 2).

Table 1: Distribution of the sample according to age.

Age (Years)	Count	Percentage
<30	16	16
30 - 39	28	28
40 - 49	25	25
50 - 59	20	20
>=60	11	11

Mean ± SD- 42.3 ± 13.1

The incidence of malignant nodules was higher in males (36.4% v/s 22.5% in females) and 66.6% of malignant nodules were in patients above 40 years of age (Tables 3, 4). However, this association was not found to be statistically significant. Among the 100 patients, there were 22 cases of papillary carcinoma and 2 cases of follicular carcinoma after histopathological examination (Table 5).

Table 2: Distribution of the sample according to sex.

Sex	Count	Percentage
Male	11	11
Female	89	89

Table 3: Relationship of age with nature of the nodules.

Age(years)	Malignant		Benign		χ^2	p
	Count	Percentage	Count	Percentage		
<40	8	18.2	36	81.8	1.46	0.227
>=40	16	28.6	40	71.4		

Table 4: Relationship of gender of the patient with the nature of the nodule.

Sex	Malignant		Benign		χ^2	p
	Count	Percentage	Count	Percentage		
Male	4	36.4	7	63.6	1.04	0.309
Female	20	22.5	69	77.5		

Table 5: Histopathology reporting of the study population.

Histopathology report	Count	Percentage
Papillary carcinoma	22	22
Colloid nodule	75	75
Follicular carcinoma	2	2
Follicular adenoma	1	1

In the study, histopathology was deemed as the gold standard for the diagnosis of the solitary nodule of the thyroid for each patient. FNAC report of each patient was compared with his/her histopathology report. 19 cases of papillary carcinoma were detected pre-operatively by FNAC whereas 3 cases were missed on cytology.

Table 6: Distribution of the USG guided FNA cytology results.

Ultrasound guided FNAC	Count	Percentage
Papillary carcinoma	9	18.0
Colloid nodule	39	78.0
Follicular adenoma	2	4.0

One case of papillary carcinoma was missed among the patients who underwent guided FNAC (sensitivity - 90%, specificity - 100%, accuracy - 98%, positive predictive value - 100%, negative predictive value - 97.6% in diagnosing papillary carcinoma) as demonstrated in Tables 6-8.

Table 7: USG guided FNAC versus histopathology report.

USG guided FNAC	Histopathology report		
	Papillary carcinoma	Others	Total
Papillary carcinoma	9	0	9
Others	1	40	41
Total	10	40	50

Table 8: Prediction of papillary carcinoma by USG guided FNAC.

Sensitivity	90.0 %
Specificity	100.0 %
False negative	10.0 %
False positive	0.0 %
Predictive value of positive test	100.0 %
Predictive value of negative test	97.6 %
Accuracy	98.0 %

Two cases of papillary carcinoma were missed among the group who underwent conventional FNAC (sensitivity - 83.3%, specificity - 100%, accuracy - 96%, positive

predictive value - 100%, negative predictive value - 95% in diagnosing) as demonstrated in Tables 9-11.

Table 9: Distribution of conventional FNA cytology results.

FNAC	Count	Percentage
Papillary carcinoma	10	20.0
Colloid nodule	40	80.0

Table 10: Conventional FNAC versus histopathology report.

FNAC	Histopathology report		
	Papillary carcinoma	Others	Total
Papillary carcinoma	10	0	10
Others	2	38	40
Total	12	38	50

Table 11: Prediction of papillary carcinoma by conventional FNAC.

Sensitivity	83.3 %
Specificity	100.0 %
False negative	16.7 %
False positive	0.0 %
Predictive value of positive test	100.0 %
Predictive value of negative test	95.0 %
Accuracy	96.0 %

Table 12: Comparison of USG guided and conventional FNAC in the detection of papillary carcinoma.

Test character	USG guided FNAC	Conventional FNAC	P value
Sensitivity	90.0 %	83.3%	0.327
Specificity	100.0 %	100 %	
False Negative	10.0 %	16.7 %	0.327
False positive	0.0 %	0.0 %	
Predictive value of positive test	100.0 %	100 %	
Predictive value of negative test	97.6 %	95 %	0.503
Accuracy	98.0 %	96.0 %	0.562

On comparing the diagnostic capability of USG guided FNAC over conventional FNAC for the diagnosis of papillary carcinoma, the following observations were made (Table 12.) There was a higher rate of detection of papillary carcinoma (sensitivity 90% v/s 83.3%) and a lower chance of making a falsely benign diagnosis (false negative rate of 10% v/s 16.7) with USG guided FNAC as compared to conventional FNAC. Also, it could be deduced that a benign diagnosis obtained on USG guided FNAC was more reliable and reassuring than on conventional FNAC (neg. pred. value of 97.6% v/s 95%). Overall USG guided FNAC had a higher diagnostic accuracy (98%) than conventional FNAC (96%). However, the sensitivity, specificity, false positivity, false negativity, predictive powers of positive and negative tests were compared with each other using the 'Z test for proportions' and the difference in these statistical parameters were not found to be significant.

DISCUSSION

There were 100 patients included in the study. They were grouped into age above and below 40 years. Most of the patients (56%) were above the age of 40 years. The group above 40 years had more malignant nodules (66.6%) than the group below 40 years (33.3%). However, on applying the chi square test, the association of increasing age with malignancy was proven to be statistically insignificant (p value of 0.227) in this study.

Most of the study population (89 %) were females. Out of total 24 malignant nodules 86 % (20) were in females. However, the malignancy rate in males of 36.4 % (4 out of 11nodules were malignant) was higher than in females 22.5 % (20 out of 89 nodules). This association was also tested using the chi square test but was found not to be statistically significant (p value of 0.309). The predominant diagnosis in solitary nodule of the thyroid according to this study was nodular colloid goitre (75%). The predominant malignancy in solitary nodule of the thyroid according to this study was papillary carcinoma, which was detected in 22% of the nodules. Among the malignancies papillary carcinoma accounted for 91.66% of cases (22 out of 24 malignant nodules).

In the group who underwent USG guided FNAC, one case of papillary carcinoma was missed by FNAC and in the group who underwent conventional FNAC, two cases of papillary carcinoma were missed by FNAC. Using this data, the sensitivity, specificity, false negative rate, false positive rate, positive and negative predictive value of USG guided and conventional FNAC were calculated. In the context of diagnosis of papillary carcinoma by aspiration cytology in solitary nodule of the thyroid, the sensitivity (90.0 % v/s 83.3 %), negative predictive power (97.6 % v/s 95 %) and accuracy (98 % v/s 96%) of USG guided FNAC was found to be higher than that of conventional FNAC.

And the false negativity rate (10 % v/s 16.7 %) of USG guided FNAC was found to be lower than that of conventional FNAC. Thus, from the above results it can be seen that USG guided FNAC increases the detection of papillary carcinoma in solitary thyroid nodule and also that the results obtained with USG guided FNAC are more reliable. The 'Z test for proportions' was applied to these results to assess whether the improvement in the above-mentioned parameters in USG guided FNAC were statistically significant. The p value obtained for each of

these parameters were more than 0.05, hence these results were not found to be significant on statistical analysis

Both USG guided FNAC and conventional FNAC has a false negative rate above 10%. Hence FNAC reports cannot be relied on summarily in committing the diagnosis of a benign pathology. However false negativity rate is lesser (10 % v/s 16.7 %) with USG guided FNAC than conventional FNAC. Also, the negative predictive value of USG guided FNAC (97.6 %) is higher than that of conventional FNAC (95%). Hence, on prima facie assessment it seems that a benign diagnosis in solitary nodule of the thyroid with USG guided FNAC has more chance of being correct than a benign diagnosis made on conventional FNAC. The 'Z test for proportions' applied to the above data showed that according to this study the difference was not statistically significant.

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