

# Study of Validity and Reliability of Fine Needle Aspiration Cytology and Tc99m Scintigraphy in Thyroid Swelling

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## ABSTRACT

Cytology, radiology, and radionuclide scintigraphy are the three preoperative investigation modalities to know the probable diagnosis of thyroid mass which is usually confirmed postoperatively by histopathology examination of the excised specimen. The aim of this study was to evaluate the validity and reliability of cytology and scintigraphy in patients with thyroid swelling. It was concluded after the study that fine needle aspiration cytology (FNAC) is safe, cost effective, valid, and reliable investigation for preoperative evaluation of thyroid swelling to differentiate between benign and malignant gland lesion on pathology.

**Keywords:** Cytology, Histopathology, Radionuclide scintigraphy, Thyroid swelling.

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## INTRODUCTION

The thyroid gland is present in anterior neck and this is the only endocrine gland in body which is amenable to direct physical examination. Enlargement of the thyroid gland is termed as goiter and includes disorders of structure and function of thyroid gland. The presence of thyroid swelling causes concern to both patients and surgeon as far as the diagnosis and treatment in form of conservative or type of thyroidectomy is concerned. The goal of diagnostic workup is to select those patients for thyroidectomy who have a high likelihood of harboring malignancy in the nodule. At one extreme, the diagnosis of malignancy may be strongly suspected on clinical grounds and such patients generally require open exploration. On the other hand, one finds many patients

in whom the history and clinical findings are not so conclusive. Many investigations are used to differentiate between benign and malignant nodules so as to avoid surgery in those who do not need it. Among these fine needle aspiration cytology (FNAC), ultrasonography (USG) and thyroid nuclear scan are commonly used in association with clinical features but there are drawbacks of each technique and the final answer to the problem is still elusive. The aim of this study was to evaluate the validity and reliability of cytology and scintigraphy in patients with thyroid swelling.

## MATERIALS AND METHODS

This study was conducted in the Department of Otorhinolaryngology, in a tertiary care postgraduate teaching hospital over a period of 12 months from October 2012 to October 2013.

### Inclusion Criteria

Patients presenting to Otorhinolaryngology clinic with thyroid swellings.

### Exclusion Criteria

History of previous thyroid surgery or radiation.

### Ethics

Patients were informed of the diagnostic and therapeutic procedure that would be performed, which includes thyroid scan, FNAC, surgery and histopathological analysis of surgical specimen. Written consent was obtained from the patients in accordance with guide lines of our institutional review board and ethics committee. All the patients were evaluated by thorough clinical examination followed by investigations including thyroid profile, FNAC, thyroid scan, USG neck. A total of 106 patients presented with thyroid swelling were enrolled. All 106 patients underwent FNAC while 88 patients were operated. The aspirated material from FNAC was studied microscopically after staining with May Grunewald Giemsa (MGG) stain. Bethesda system was used for reporting the FNAC. Preoperative thyroid scan (Tc99m Pertechnetate) was done only in 54 patients due to financial constricts. The patients selected for thyroid scan were ensured to be off

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thyroid hormones at least 7 days and they must not have had intravenous or intrathecal iodinated contrast agents (IVP, CT with contrast, myelogram and angiogram) for at least 4 weeks. Data were analyzed with statistical Package for the Social Sciences (SPSS) version 19 and chi-square tests with Yate's correction was used for calculating the 'p' values.

## OBSERVATIONS

In present study there were 88 patients in whom we have preoperative cytology and postoperative histopathology. Out of these 88 patients radionuclide scan was available with 54 patients. Out of 88 FNACs 63 (71.5%) were reported as colloid goiter while 4 (4.5%) as thyroiditis, 15 (17%) as malignancy and 6 (7%) were reported as follicular neoplasm. Out of 15 malignancies 11 were papillary carcinoma, 2 as medullary carcinoma and 1 each for lymphoma and anaplastic carcinoma. Out of 6 patients of follicular of 5 were reported as malignancy while one as thyroiditis. Out of 54 thyroid scans, 30 (55.5%) were reported as hypofunctioning, 15 (27%) as hyperfunctioning while 9 (17.5%) scans were reported as normal functioning thyroid glands. All these results of FNACs and scans were compared with histopathology reports. Out of total 88 histopathology reports 52 (59%) were reported as benign pathology while 36 (41%) as malignant. These reports were differentiated as 47 (53%) colloid goiter, 5 (5.7%) thyroiditis, 19 (21.6%) papillary carcinoma, 11 (12.5%) follicular carcinoma, 3 (3.4%) medullary carcinoma, 2 (2.23%) anaplastic carcinoma and 1 (1.1%) was lymphoma. Total 67 patients FNAC reports were not changed on histopathology, so overall sensitivity of FNAC was calculated as 76.14% in present study. Out of 30 (55.5%) hypofunctioning nodules histopathology showed 18 (33.3%) cases as malignant, while out of 15 (27%) hyperfunctioning nodules histopathology showed 03 (5.56%) cases as malignant. In our study 9 patient's thyroid scan were normal functioning scan. On histopathology 3 came as malignant and 6 as benign pathology. So these 3 were also taken as false negative. Total 36 thyroid scan reports were same as on histopathology, so overall sensitivity of thyroid scan was calculated as 66.67% in this study.

To look for validity and reliability in detecting malignancy with FNAC and thyroid scan cross tables were prepared (Tables 1 to 4). So in our study sensitivity of thyroid scan in detecting malignancy was more than FNAC. But other than sensitivity all other statistical parameters for validity and reliability and feasibility for a FNAC were better than thyroid scan as specificity, accuracy, positive predictive value and negative predictive value. Although 'p'-value for both thyroid scan and FNAC was less than

**Table 1:** Cross Table-FNAC for detecting malignancy (n = 88)

True positive 20	False positive 01
False negative 16	True negative 51

**Table 2:** Cross Table-thyroid scan for detecting malignancy (n = 54)

True positive 18	False positive 12
False negative 06	True negative 18

**Table 3:** Cross Table-FNAC for detecting papillary carcinoma (n = 36)

True positive 11	False positive 00
False negative 8	True negative 17

**Table 4:** Statistical analysis

Statistical analysis	FNAC for detecting malignancy	Thyroid scan for detecting malignancy	FNAC for detecting papillary carcinoma
Sensitivity	55.56%	75%	57.89%
Specificity	98.08%	60%	100%
Accuracy	80.68%	66.67%	77.78%
Positive predictive value	95.24%	60%	100%
Negative predictive value	76.12%	75%	68%
'p'-value	0.0001	0.0217	0.007

0.05, which is statistically significant. Overall 36 (41%) cases were reported as malignancy in histopathology report out of which 19 (53%) were diagnosed as papillary carcinoma. On statistical analysis of FNAC in detecting papillary carcinoma specificity and positive predictive value was 100%, and 'p'-value came to 0.007 which is also statistically significant.

## DISCUSSION

Unique features of thyroid gland are that it is first endocrine gland to appear in fetus, largest endocrine gland and have important physiological function in growth and development and also in calcium metabolism. There may be solitary nodule, multinodular goiter or diffuse enlargement of thyroid gland. There might be neoplastic or non neoplastic pathology in thyroid gland.

Various diagnostic protocols are preferred in different centers. After clinical evaluation, FNAC is most widely accepted test because of its cost effectiveness, availability, sensitivity, and specificity.<sup>1</sup> Majority of thyroid nodules can be correctly diagnosed by FNAC; only follicular neoplasm and hurthle cell neoplasm cannot be identified. When the results are inconclusive or it is suspicious for malignancy, further diagnostic steps are necessary in order to decide whether surgery would be appropriate



and such measures include ultrasound, radionuclide imaging, and clinical risk stratification by means of age, gender, nodule size, nodule growth rate, and previous use of neck radiation.<sup>1,2</sup> Although thyroid cancers account for 90% of all endocrine malignancies, it causes only 0.4% of cancer death. Usually less than 10% of patients with thyroid nodules may have thyroid cancer.<sup>3</sup> When FNAC results are clearly suggestive of benign lesions, one can go for conservative surgery like lobectomy and when suggestive of malignancy, total thyroidectomy is advocated. Nondiagnostic thyroid FNAC remains significant problem in taking the decision regarding management of patients regarding the management, because if lobectomy or hemithyroidectomy is done and histopathology report comes malignant, then one has to do completion thyroidectomy and radical surgery has its own disadvantages, such as hypocalcemia, tetany, hypothyroidism, and recurrent laryngeal nerve damage.<sup>4</sup> In our study out of 88 FNACs 67 (76%) were reported as benign disease, 6 (7%) as follicular neoplasm and 15 (17%) as malignancies. Out of 15 malignancies 11 (12.5%) were reported as papillary carcinoma, 2 (2.27%) as medullary carcinoma and each 1 (1.14%) was anaplastic carcinoma and lymphoma. On comparing with histopathology diagnosis of 67 FNACs reports was same and confirmed. Overall sensitivity of FNAC for thyroid disease in our study is 76.14%. Similarly overall sensitivity of thyroid scan in our study is 66.67%.

A comparatively high number of false negative cases (17%) were found in this study. This could be attributed mainly to the fact that since our set up is a tertiary care teaching hospital there are different levels of skill, seniority and experience among reporting cytologist. Moreover all the FNACs were done without USG guidance and majority of the patients had multinodular goiter which could lead to the sampling error. A Single false positive case was detected where one patient was diagnosed as malignancy on FNAC which was reported benign on histopathology.

In present study histopathology revealed malignancy in 36 (41%) patients, out of which 20 (22.7%) were diagnosed on FNAC also, so sensitivity of FNAC in detecting malignancy was low as 55.56%, but specificity, accuracy, positive predictive value and negative predictive values were high as 98.08, 80.68, 95.24, and 76.12% respectively. On statistical analysis 'p'-value was 0.0001, which is highly significant (Table 4).

For these postoperative 36 (41%) malignancies thyroid scan was able to detect hypofunctioning gland in 18 (33.3%) patients only, so sensitivity, specificity, accuracy, positive predictive value and negative predictive values were as 75, 60, 66.67, 60, and 75% respectively. On statistical analysis 'p'-value was 0.0217, which is significant (Table 4).

In present study histopathology revealed papillary carcinoma in 19 (21.6%) patients, out of which 11 (12.5%) were also correctly diagnosed by FNAC so sensitivity, specificity, accuracy, positive predictive value, and negative predictive values of aspiration cytology for detecting papillary carcinoma were as 57.89, 100, 77.78, 100, and 68% respectively. On statistical analysis 'p'-value was 0.0007, which is highly significant (Table 4).

The sensitivity and specificity of FNAC were 71.43 and 100% respectively according to Altavilla et al,<sup>5</sup> 98 and 99% according to Goellner et al,<sup>6</sup> 93.5 and 75% according to Bouvet et al.<sup>7</sup> The results from our study were also in parallel to these studies. Cox and Marshall et al<sup>8</sup> reported an overall incidence of 73% of cold nodules in their series out of which 12.2% were found to be malignant. The overall sensitivity of detecting malignancy in their series was 100% but specificity was only 12.2%. Kapur and Sarin et al<sup>9</sup> reported in their series 16% incidence of malignancy in cold nodules. It was observed in a study by Sharma et al<sup>10</sup> that radionuclide perfusion study is useful to differentiate benign from malignant solitary thyroid nodules, with a high degree of sensitivity (95%) and specificity (87.9%). Our study also showed almost similar results. At the same time, performing scintigraphy in all patients with nodular goiter is not recommended by experts, since adequate assessment obtained with ultrasound and cytology is sufficient in most cases.<sup>11</sup> Positron emission tomography (PET) imaging plays a role in evaluation of equivocal thyroid nodules by scanning and cytology.<sup>12</sup>

## CONCLUSION

Early and proper evaluation of thyroid swelling is important. Thyroid ultrasound, scintigraphy and FNAC are simple and safe procedures and provide high accuracy for precise diagnosis. In present study specificity of FNAC was more than 90% but sensitivity of both FNAC and thyroid scan was less than 75%. Thus, it can be concluded that none of the investigations are absolutely confirmatory and a combination of investigations is usually required. The final diagnosis can be made by histopathological examination only. However, a combination of various diagnostic modalities, rather than any single modality, will give optimal results and avoid inappropriate or revision surgery in a great number of patients without missing any malignancy.

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