



Role of Tc99m Pertechnetate Scintigraphy in Evaluation of thyroid Nodules with FNAC Results Suspicious for Neoplasm

KEYWORDS

Thyroid nodule, Tc99m pertechnetate thyroid scan, FNAC

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ABSTRACT Various diagnostic techniques have been successfully used in the clinical management of cold nodules; however, the decision on whether to employ surgery or a conservative treatment is not always easy. This was prospective case study to determine the diagnostic value of Tc99m pertechnetate thyroid scan in evaluation of thyroid nodules having FNAC results suspicious for neoplasm and to compare results of Nuclear medicine based scans in preoperative assessment of thyroid nodules with standard imaging modalities considering histopathology report as gold standard. This study was conducted on 100 patients with thyroid nodules. After clinical examination these patients were subjected to various diagnostic tests. Cases were operated and evaluated for histopathological changes. Combined use of FNAC and thyroid scan will reduce the number of patients solitary thyroid nodules undergoing unnecessary surgery and will lead to proper planning of surgery in malignant cases

INTRODUCTION

Thyroid nodules are common clinical findings and have a reported prevalence of 4% to 7% of the adult population (1-3), however fewer than 5% of adult thyroid nodules are malignant (4). The vast majority of these nodules are non-neoplastic lesions or benign neoplasms. It is preferred to operate only on those patients with suspicion of cancer, thereby avoiding unnecessary surgery and possible complications. However, the distinction of these benign lesions from a malignant nodule cannot be based reliably on the clinical presentation alone. Several diagnostic tests such as scintigraphy, ultrasonography and fine needle aspiration cytology (FNAC) have been used to differentiate benign from malignant thyroid nodules pre operatively.

Combination of FNAC and three-phase pertechnetate scan could be helpful in preoperative assessment of thyroid nodules. Cold nodules on pertechnetate scan have a malignancy rate of 5% to 15%. Three-phase thyroid pertechnetate has improved the specificity of detecting malignancy. However, this technique has a significant false-positive rate. Hence, it can bias the referring surgeons to perform needless surgery. FNAC is conclusive in a number of cases such as colloid goiter and papillary carcinoma, although it is not suitable for differentiating follicular adenoma from follicular carcinoma. This necessitates operative procedures before a final diagnosis on follicular lesions. If FNAC results are showing inconclusive pattern and having follicular cells, then the Tc 99m TcO4 scan is done to further evaluate the lesion. The clinical management of patients with one or more cold thyroid nodules may be difficult, and the decision on whether to employ surgery or a conservative therapeutic scheme requires a wide array of diagnostic techniques. At present, there is no radiopharmaceutical with satisfactory specificity in the detection of thyroid malignancy (6).

Perfusion/uptake mismatch (increased perfusion with non-functioning nodule) is regarded as positive for malignancy, whereas perfusion/uptake match (uniform perfusion with no uptake or normal uptake) is regarded as negative for malignancy(7-8).

We suggest a combination of FNAC and Tc99m TcO4 thyroid scan as diagnostic approach in cases where FNAC is suspicious of neoplasm in order to know the exact status of nodule i.e. benign or malignant which are essential for surgeons in planning mode of surgery.

MATERIAL AND METHODS:

This was a prospective analysis of 100 patients with clinical diagnosis of STN who presented to outpatient department of ENT SKNMC, Pune between Dec 2010 up to April 2012. The study was done in collaboration with Nuclear Medicine Department of SKNMC. All patients were evaluated by thorough clinical examination followed by routine investigations including haemogram, RFT, LFT, X ray chest, X ray Neck, Thyroid function test, USG neck, FNAC and Tc99m pertechnetate scan. The study was focussed on those thyroid nodules where FNAC was suspicious for malignancy.

Inclusion criteria: Clinically palpable thyroid nodules and euthyroid on thyroid function test with suspicious FNAC reports for malignancy

Exclusion criteria: diffuse thyroid swellings, toxic goitres, hyper and hypothyroidism, previous surgery or radiotherapy, pregnancy.

Data collection: All patients presenting with STN in OPD and fulfilling the inclusion criteria were included in the study.

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.

History of present illness was obtained and Clinical examination was done and then patients were subjected to various diagnostic procedures.

FNAC: it was performed and results were categorized into three groups.

1. Negative for malignancy
2. Positive for malignancy
3. Indeterminate or suspicious malignancy(target group of study)

Thyroid scan:

The thyroid scan was obtained after IV administration of 5 mCi of Tc99m TcO4. Perfusion images were acquired immediately after injection of tracer. And delayed static images were acquired after 20 min of injection in anterior, LAO and RAO views.

Interpretation criteria:

Thyroid scans were categorized in two groups

1. Perfusion uptake mismatch: Increased uniform perfusion with non functioning nodule- this was regarded as positive for malignancy.
2. Perfusion uptake match: no perfusion of tracer with non functioning nodule.-this was regarded as negative for malignancy.

After correlating results of thyroid scan with FNAC, benign cases were managed by conservative surgeries and malignant cases were treated by total thyroidectomy.

Statistical analysis:

Sensitivity, specificity, PPV and NPV were calculated for each thyroid scan and FNAC individually and for combined FNAC and thyroid scan in those cases where FNAC was inconclusive.

RESULTS:

The age of patients ranged from 20 to 80 years. Out of 100 patients 82 patients (82%) were females and 18 (18%) were males (male to female ratio 1:4.5). The highest incidence of solitary thyroid nodule in our study was seen in third decade of life i.e. in 30 patients

On technetium 99m pertechnetate scan, Out of 100 solitary thyroid nodules 52 nodules showed perfusion uptake mismatch i.e. cold perfusion with cold uptake suggestive of positive for malignancy and 48 nodules showed perfusion uptake match i.e. uniform perfusion and no uptake suggestive of negative for malignancy, (Figure 1&2)

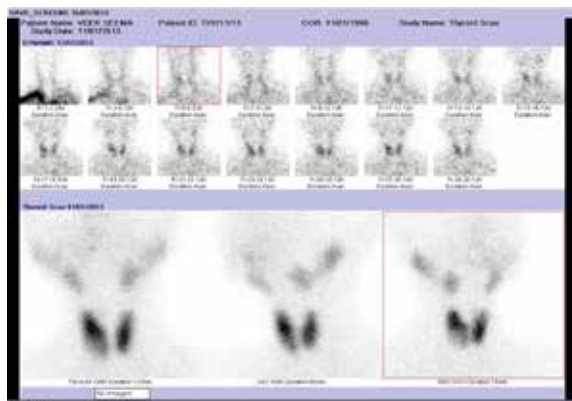


Figure 1 : Tc 99m TcO4 scan showing perfusion and uptake mismatch. Perfusion is increased and uptake is decreased in the corresponding lesion in left lobe lower pole.

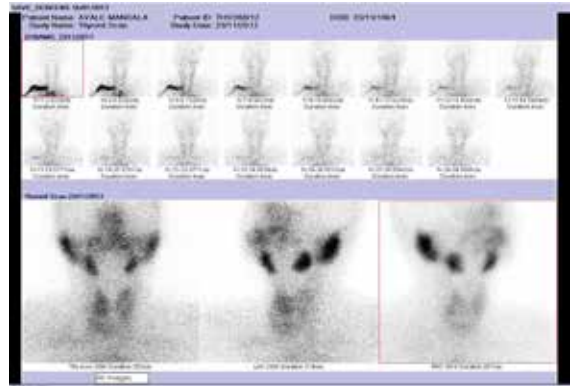


Figure 2 :Tc 99m TcO4 scan showing perfusion and uptake match. Perfusion images do not show any increase in tracer perfusion and delayed images show non functioning nodules.

On comparison of results of thyroid scan with histopathology taken as gold standard in 36 cases with inconclusive FNAC results, thyroid scan showed perfusion uptake mismatch in 15 cases, in that 13 cases came out as malignant on histopathology (true positive cases) and 2 were lymphocytic thyroiditis(false positive).In 2 cases, scan showed perfusion uptake match which is negative for malignancy but it was malignant on histopathology(false negative) and remaining 19 cases were negative for malignancy on scan and histopathology was also negative for malignancy.(true negative).

TABLE 1: Comparison of FNAC & Thyroid scan with FINAL HPR in 36 patitnts with inconclusive FNAC reports

FNAC& Thyroid scan	NO.	MALIGNANT HPR	BENIGN HPR
POSITIVE	15	13(TP)	2(FP)
NEGATIVE	21	19(FN)	2(TN)
TOTAL	36	32	4

The sensitivity of thyroid scan was found to be 100%, specificity 69.20%, diagnostic accuracy 81.3%, positive predictive value 67.5% and negative predictive value was 100 .

TABLE 2: COMPARISON OF PARAMETERS OF FNAC AND THYROID SCAN (Individual&Combined)

	FNAC(%)	SCAN(%)	FNAC + scan (%)
SENSITIVITY	66.6	100	86.6
SPECIFICITY	96.1	69.2	90.4
PPV	80	67.5	86.6
NPV	93	100	90.4
ACCURACY	91	81.25	89

Out of 100 patients, 54 patients showed non neoplastic FNAC reports). In 36 patients FNAC reports were suspicious for malignancy and in 10 patients FNAC was suggestive of malignancy.

Out of the 10 patients with malignant FNAC, 6 patients had papillary carcinoma, 2 patients had medullary carcinoma and 2 patients had anaplastic carcinoma.

Out of the 36 patients with suspicious FNAC reports, 15 nodules showed perfusion uptake mismatch i.e. cold perfusion with cold uptake suggestive of positive for malignancy and those 15 patients had malignant lesions (7 papillary carcinomas and 8 follicular carcinomas) on histopathology. 21 nodules showed perfusion uptake match i.e. uniform perfusion and uniform uptake suggestive of negative for malignancy and on histopathology those 21 patients had benign lesions(5 colloid cysts,9 colloid goiters,2 thyroiditis and 5 follicular adenomas) .

The sensitivity of FNAC was 67%, specificity 96.1%, diagnostic accuracy 91%, positive predictive value 80%, and negative predictive value 93%. When parameters of FNAC and thyroid scan were combined overall sensitivity was 86.6%, specificity was 90.4%, positive predictive value was 86.6%. Negative predictive value was 90.4% and diagnostic accuracy was 89%

DISCUSSION

Nodular disease of thyroid gland is one of the most frequent problems in endocrinology. 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 (1). Majority of thyroid nodules can be correctly diagnosed by FNAC; only follicular 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 (1,2) 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 (3). 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. Non diagnostic thyroid FNAC remains significant problem in taking the decision regarding management of patients regarding the management, because if lobectomy or hemithyroidectomy is done and HPR comes malignant, then one has to do completion thyroidectomy and radical surgery has its own disadvantages such as hypocalcaemia, tetany, hypothyroidism and recurrent laryngeal nerve damage (4).

In our study, in all, we evaluated 100 patients of solitary thyroid nodules. There were 82 females and 18 males. In general most of the studies have shown that females have predominance in incidence of thyroid nodules. In our study, age of the patients ranged from 20- 80 years. The highest number of patients were aged between 20 to 30 years i.e. 30 patients. Female to male ratio was 4.5:1 (9).

In this study, on thyroid scan, 52 patients had perfusion / uptake mismatch regarded as positive for malignancy and 48 had perfusion / uptake match regarded as negative for malignancy. A photon void area tells us about the trapping defect. Usually the areas which have lost the normal architecture and are not able to trap iodine/ TcO₄ are visualized as photon void. 15 % of the photon void areas are potentially malignant lesions and cystic lesions and focal thyroiditis and focal adenomas constitute rest of the 85%. Further if we compare the vascularity pattern of the gland, obvious increased vascularity is noted in the focal thyroiditis and malignant lesions. Cystic lesions do not show vascularity. This further trims down differential diagnosis of the solitary thyroid nodules. Perfusion/uptake match may be seen in cystic lesions, functioning adenomas. Perfusion/uptake mismatch may be seen in malignancies, focal thyroiditis. The findings of Tc 99m TcO₄ scan are correlated with the FNAC reports and vice versa. After

comparing our results of thyroid scan with histopathology, overall sensitivity of scan was 100% , specificity was 69.2, positive predictive value 67.5 and negative predictive value 100% and the overall accuracy was 81.25% Our findings are consistent with Proud G et al (10).

In our study, FNAC revealed 54 patients with benign lesions, 10 patients with malignant lesion and 36 patients FNAC was inconclusive. Out of 36 patients with inconclusive FNAC, on histopathology 15 cases found to have malignancy (8 papillary carcinomas and 7 follicular carcinomas) and 21 cases were of benign pathology (9 colloid goiters, 5 colloid cysts, 5 follicular adenomas and 2 were thyroiditis. (11-13).

Out of 36 cases with inconclusive FNAC results, thyroid scan showed perfusion uptake mismatch in 15 cases, in that 13 cases came out as malignant on histopathology (true positive cases) and 2 were lymphocytic thyroiditis (false positive). In 2 cases, scan showed perfusion uptake match which is negative for malignancy but it was malignant on histopathology (false negative) and remaining 19 cases were negative for malignancy on scan and histopathology was also negative for malignancy (true negative).

On comparing results of FNAC and scintigraphy with final histopathology, over all sensitivity was 86.6% and specificity was 94.4%. In 36 patients with inconclusive results on FNAC, perfusion / uptake mismatch was found in 15 cases who underwent total thyroidectomy and rest of 21 patients with perfusion/ uptake match were managed with conservative surgeries. Our findings are consistent with RD Bapat et al (11).

CONCLUSION

Early and proper evaluation of solitary thyroid nodule is important. Thyroid ultrasound, scintigraphy and FNAC are simple safe and non invasive procedures and provide high accuracy for precise diagnosis of nodules. FNAC is more specific than sensitive where as thyroid scan is more sensitive than specific in detecting thyroid malignancy. Follicular neoplasms are common in patients with STN and cause diagnostic problem for both cytopathologists and surgeons regarding their management.

In inconclusive FNAC results, we suggest combined use of thyroid scan cytology in detecting malignant nodules and in our study sensitivity of combined thyroid scan and FNAC is 86.6% and specificity was 90.4 %.

Patients with perfusion uptake mismatch and FNAC suggestive of follicular neoplasm should be considered at risk of having malignancy and should undergo total thyroidectomy. Other risk factors like age, gender and previous neck radiations should also be considered before subjecting patient for total thyroidectomy. Combined use of FNAC and thyroid scan will reduce the number of patients with solitary thyroid nodules undergoing unnecessary surgery and will lead to proper planning of surgery in malignant cases.

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