

RESEARCH ARTICLE

Efficacy of Technetium Scintigraphy as an Investigative Tool in Papillary Carcinoma of Thyroid: A Prospective Study

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ABSTRACT

Introduction and background: Thyromegaly is a common cause of physician consultation. Solitary thyroid nodules are conventionally viewed with suspicion. Clinical examination cannot reliably distinguish between a solitary thyroid nodule and a dominant nodule in multinodular goiter. Ultrasonographical examination has its own pitfalls. Technetium 99 is a commonly used modality for the functional assessment of solitary thyroid nodule detection. It has the advantage of low cost with lower radiation dose to the exposed patients. On literature search, studies on Technetium 99 scintigraphy for thyroid in context to the Indian scenario does not yield much information, and very few studies are notable. This study was conducted to correlate and qualify thyroid cold nodule as detected by technetium 99 pertechnetate thyroid scan.

Objective: This study was conducted to correlate, qualify, and compare the predictive value of technetium 99 pertechnetate scintigraphy on solitary thyroid nodule vis-à-vis fine needle aspiration cytology (FNAC) and to countercheck with histopathological examination (HPE).

Materials and methods: A prospective cohort study in a National Accreditation Board for Hospitals & Health care Providers, National Assessment and Accreditation Council, and Joint Commission International-accredited tertiary care teaching university hospital was conducted over a period of 36 months. All the subjects underwent clinical assessment of the neck that included standard examination techniques to segregate solitary thyroid nodules. They were then subjected to technetium 99 pertechnetate scintigraphy using the standard protocol. All the patients with solitary cold nodule underwent FNAC followed by nodule excision or hemi-thyroidectomy under general anesthesia. All the specimens underwent HPE by an experienced histopathologist. The results were statistically analyzed using Pearson's chi-square test.

Results: (1) Cold nodules as detected by technetium 99 pertechnetate thyroid scan is a reasonable indicator of probable malignancy vis-à-vis FNAC. (2) Occurrence of cold nodules is highest in third to fifth decade of life (21- to 50-year age group). (3) Occurrence of cold nodules is higher in females (83%), whereas occurrence of malignancy in cold nodules is higher in males (85%). (4) Occurrence of malignancy in cold

nodules is higher in subjects less than 21 and above 50 years. (5) Technetium 99m pertechnetate thyroid scintigraphy is an important preoperative tool in management of thyroid nodules, and its routine use in all such patients is recommended, especially to rule out cold nodules.

Keywords: Fine needle aspiration cytology thyroid malignancy, Solitary thyroid nodule, Technetium scintigraphy, Thyromegaly.

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INTRODUCTION

Thyromegaly is a common cause of physician consultation for the general population since it produces obvious cosmetic disfigurement.¹ Clinically detectable thyroid nodules occur in 4 to 7% of the population.² Of all the causes of thyromegaly, solitary thyroid nodule is a clinical subset of medical concern since malignancy is known to occur more frequently in solitary thyroid nodule than multinodular goiter. Solitary thyroid nodules are conventionally viewed with suspicion.³⁻⁵

Clinical examination cannot reliably distinguish between a solitary thyroid nodule and a dominant nodule in multinodular goiter. Ultrasonography can determine whether thyroid nodules are solitary and can categorize them into solid, cystic, and mixed nodules but cannot give information on the functional status and the interpretation is subjective – depending on expertise of the sonographer and also ultrasound machine dependent.⁶

Scintigraphy using isotopes has been described as one of the earliest investigational tools to detect the functional and delineate malignant behavior of the thyroid lesions. Technetium 99 is a commonly used modality for functional detection.⁷ It has the advantage of low cost with lower radiation dose to the exposed patients.

On literature search, studies on technetium 99 scintigraphy for thyroid in context to the Indian scenario do not yield much information and very few studies are notable. This study was conducted to correlate and qualify thyroid cold nodule as detected by technetium 99 pertechnetate thyroid scan.

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MATERIALS AND METHODS

Type of study

- A prospective cohort study

Study setting

- National Accreditation Board for Hospitals & Health care Providers, National Assessment and Accreditation Council, and Joint Commission International-accredited tertiary care teaching university hospital

Duration

- Period of 36 months was from May 2009 to April 2012

Techniques

Inclusion criteria

- Euthyroid state
- *Goiter*: Solitary or multinodular
- *Age*: 15 to 70 years
- *Sex*: Both sexes

Exclusion criteria

- Hypothyroidism or hyperthyroidism
- Pregnancy
- Bleeding disorders
- Patients unfit for general anesthesia
- Patients on substances and drugs known to affect thyroid uptake

Sampling size

- A total of forty patients who fulfilled the inclusion and exclusion criteria were included in the study

Statistical method

- Pearson chi-square (Student's t-test) was used to analyze this study. In this study $p < 0.05$ was considered as the level of significance.

All the patients who fulfilled the inclusion and exclusion criteria were included in the study after obtaining informed consent from the patient and with due sanction of Institutional Ethics Committee clearance.

Clinical assessment of the neck included standard examination techniques to segregate solitary thyroid nodules. They were then subjected to technetium 99 pertechnetate scintigraphy using the standard protocol with necessary radiological precautions and were classified into cold nodule functionally.

All the patients with solitary cold nodule underwent fine needle aspiration cytology (FNAC) followed by nodule excision or hemi-thyroidectomy under general

anesthesia.⁸ All the specimens underwent histopathological examination (HPE) by an experienced histopathologist.

RESULTS

Age Groupwise Classification of Cold Nodule

In our study of 40 patients, youngest patient was 19 years, eldest being 66 years. Most of the patients were in age groups of 21 to 50 years. Chi-square value with Yate's correction = 2.928 at degrees of freedom (df) = 2 (not significant: $p > 0.05$). There is no significant difference between "different age groups" with regard to "cold nodule."

Sexwise Incidence of "Cold Nodule"

Chi-square value with Yate's correction = 6.233 at df = 1 (highly significant: $p < 0.001$). There is a high degree of significant difference between males and females with regard to "cold nodule." Hence, we can conclude that solitary thyroid nodule is more common in females.

Genderwise incidence	
Males	Females
7	33

Correlation between Cold Nodules and FNAC

Preoperative FNAC showed 35 patients to be benign, and malignancy in five patients; 87.5% of cold nodules are benign and 12.5% are malignant as per FNAC in our study.

Cold nodules	FNAC (preoperative)	
	Benign	Malignant
40	35	5

Correlation between Cold Nodules and HPE

Nineteen (out of 40), i.e., 47%, of the cases with cold nodules were reported as malignant with postoperative histopathology report.

Cold nodules	Histopathological examination	
	Benign	Malignant
40	21	19

Genderwise Prevalence of Malignancy in Cold Nodules in Different Age Groups

Chi-square value with Yate's correction = 0.910 at df = 2 (not significant: $p > 0.05$). There is no significant gender difference with regard to the presence of malignancy in cold nodules in different age groups.

Sex of the patient	Age			Total
	Up to 20 years	21-50	51 and above	
Males	1	3	2	6
Females	2	10	1	13
Total	3	13	3	19

Correlation between FNAC, HPE, and Technetium 99m Perchnetate Scan

Out of the 40 patients with cold nodules on FNAC, 35 were benign, 5 were malignant. Nineteen (out of 40) cases with cold nodules were reported as malignant on HPE. Incidence of malignancy in cold nodules is 47.5% in this study.

Technetium 99 scan	Fine needle aspiration cytology		Histopathological examination	
	Benign	Malignant	Benign	Malignant
Cold nodules: 40	35	5	21	19

This data reveal that FNAC has less positive predictive value with regard to malignancy, whereas scintigraphy has more positive predictive value.

DISCUSSION

On literature scan, most studies on management of thyroid nodules are retrospective and therefore, are prone to all the drawbacks of retrospective analysis. Hence, a prospective study and analysis is undertaken.

- *Age:* In our study of 40 patients with cold nodules, 4 were below 20 years and 4 were above 50 years; 80% of our patients were in 21 to 50 year age group, which is almost in synchronization with current literature studies.^{9,10}
- *Gender:* In our study, 7 (17%) were males and 33 (83%) were females. Thyroid nodules were found to occur 4.8 times higher in females than in males in our study. Thus, according to our study, the occurrence of cold nodules is higher in females, whereas the occurrence of malignancy in cold nodule is higher in males. This is comparable to other studies that showed a higher incidence of thyroid nodules in women than in men.^{9,11,12}
- *Laterality:* In 19 patients, cold nodules involved right lobe of thyroid. In 10 patients left lobe was involved, both the lobes were involved in 11 patients. There is no significant difference between males and females with regard to location of cold nodules ($p > 0.05$). Right lobe of thyroid was most commonly involved in all age groups followed by both the lobes and then left lobe. This is consistent with previous studies.¹³
- *Cold nodule characteristics:* In our study, out of 40 patients with cold nodules, 47.5% of patients had papillary carcinoma, 20% had adenomatous goiter, 10% nodular goiter, 10% colloid goiter, 7% follicular adenoma, 2.5% lymphocytic thyroiditis, 2.5% Hürthle cell adenoma on histopathology. The incidence of malignancy in cold nodules was 47.5% in our study. This is comparable to the study done by Kresnik et al¹⁴ where the incidence was 38.5%. Lowest incidence was reported by Belfiore et al² in 4.6%.

CONCLUSION

- Cold nodules as detected by technetium 99 pertechnetate thyroid scan is a reasonable indicator of probable malignancy vis-à-vis FNAC.¹⁴
- Occurrence of cold nodules is highest in third to fifth decade of life (21–50 year age group).
- Occurrence of cold nodules is higher in females (83%), whereas occurrence of malignancy in cold nodules is higher in males (85%).
- Occurrence of malignancy in cold nodules is higher in subjects less than 21 and above 50 years.
- Technetium 99m pertechnetate thyroid scintigraphy is an important preoperative tool in management of thyroid nodules, and its routine use in all such patients is recommended especially to rule out cold nodules.

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