

# Incidental Finding of Thyroid Cancer during Dual-tracer Parathyroid Scintigraphy

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## Abstract

*Non-medullary thyroid cancer occurs concomitantly in a small portion of patients with hyperparathyroidism. This retrospective study evaluates the role of Iodine-123/Tc-99m Sestamibi dual-tracer imaging in the detection of thyroid cancer in those patients referred for evaluation of hyperparathyroidism. Clinical records of two hundred ninety-seven patients (aged 26-81 years) who had undergone previously I-123/Tc-99m Sestamibi dual-tracer imaging for hyperparathyroidism were reviewed. The results of the scintigraphic studies were correlated with histopathologic findings. In addition to the pathologies in the parathyroid glands, 9 patients demonstrated areas in the thyroid gland showing concomitant focal decreased I-123 uptake and increased Tc-99m Sestamibi concentration. The histopathologic results confirmed thyroid malignancy in 7 and benign thyroid adenomas in 2 of these cases. None of these patients were suspected of having thyroid cancer prior to the study. It may be noted that hypo-functioning thyroid nodule has increased risk of cancer, while Sestamibi is known to concentrate in a variety of malignancies. Hence a combined finding of persistent Sestamibi activity in a cold thyroid nodule would further increase the likelihood of thyroid malignancy. Although I-123/Tc-99m Sestamibi dual tracer scintigraphy is better designed for the assessment of parathyroid pathology, its ability in detecting thyroid abnormalities should not be overlooked. The incidental early finding of unexpected thyroid cancer can have important effect on the treatment and prognosis of these patients.*

*Key words: Parathyroid imaging, Thyroid cancer, I-123, Tc-99m Sestamibi*

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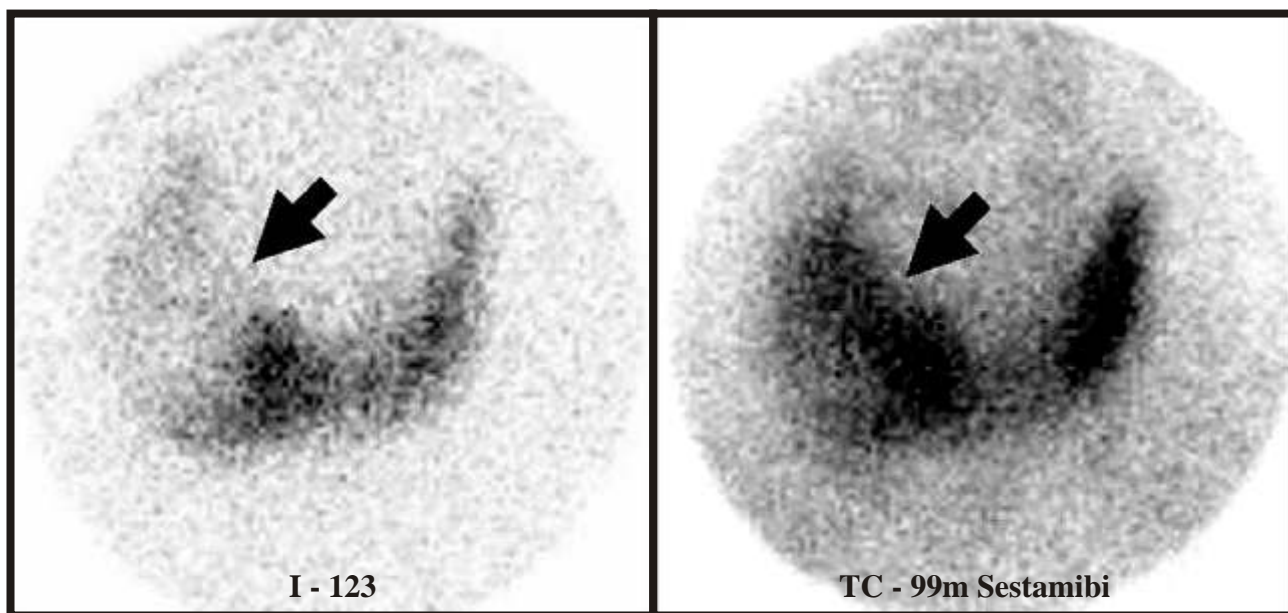
## Introduction

The most common cause of asymptomatic hypercalcemia is primary hyperparathyroidism(1) and most common cause of primary hyperparathyroidism is parathyroid adenoma. Parathyroidectomy is effective in such clinical settings. Parathyroid scintigraphy is a useful imaging modality in the pre-surgical localization of the parathyroid adenoma(2-5). However, the finding of coexisting thyroid disorder with hyperparathyroidism is not uncommon (6, 7). According to a few published reports in 2.0 to 11.4% of patients operated for hyperparathyroidism, a non-medullary thyroid cancer has also been incidentally detected (6, 8-11). Although it is well-known that hyperparathyroidism may be associated with medullary thyroid cancer in a setting of multiple endocrine neoplasia (MEN) syndrome(12, 13), co-existence of hyperparathyroidism with non-medullary thyroid cancer has often been under-appreciated before parathyroidectomy. In this investigation, we tried to evaluate the role and value of dual tracer parathyroid scintigraphy in the detection of thyroid cancer as an incidental finding prior to neck exploration.

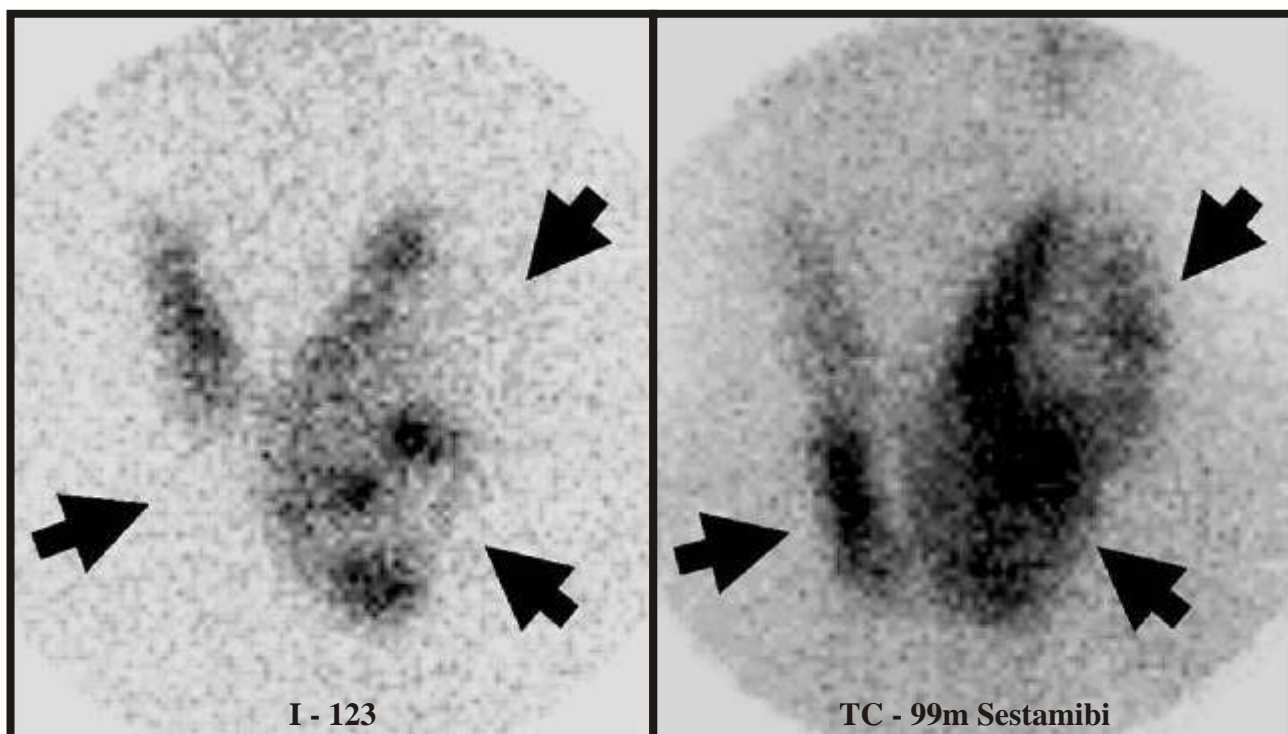
## Material and Methods

The records of two hundred ninety-seven patients (aged 26-81 years old) who had undergone parathyroid surgery were retrospectively reviewed. All patients had pre-surgical Iodine-123 and Tc-99m Sestamibi dual-tracer imaging for hyperparathyroidism, and in all cases results of histopathological examinations were available for verification of final diagnosis.

Dual tracer parathyroid imaging was performed as per the recommended standard protocol (5). At first a thyroid scan was obtained 90 minutes after oral administration of 0.2 mCi of I-123. This was followed by scanning of the neck and chest after intravenous injection of 15 mCi of Tc-99m Sestamibi. The Iodine-123 thyroid and Tc-99m Sestamibi neck scans were then interpreted for any thyroid or parathyroid abnormality. The scintigraphic findings were subsequently correlated with the final diagnosis arrived at by histo-pathological examinations.



**Figure 1.** A 64-year-old man with hypocalcaemia and increased parathyroid hormone levels in the blood underwent dual tracer (I-123 on the left and Tc-99m Sestamibi on the right) Thyroid-Parathyroid scintigraphy before parathyroidectomy. The Iodine-123 scan revealed a large hypo-functioning nodule (arrow) in the right lobe of the thyroid. In the delayed Sestamibi scan, there is persistent radiotracer uptake (arrow) corresponding to the hypofunctioning nodule on the I-123 scan. Additionally diffusely increased tracer uptake is also noted in the left lobe. Surgery and histopathological examination revealed parathyroid adenoma on the left side and papillary carcinoma of thyroid on the right side.



**Figure 2.** Dual tracer (I-123 on the left and Tc-99m Sestamibi on the right) Thyroid-Parathyroid imaging in a patient of hyperparathyroidism. The Iodine-123 scan revealed multiple cold nodules in the thyroid involving both lobes (Arrows). The delayed Sestamibi scan demonstrated persistent sestamibi activity (arrows) in the regions corresponding to hypofunctional nodules on iodine-123 scan. Surgery and histopathology revealed hypercellular parathyroid glands without adenoma. Additionally, follicular thyroid cancer was diagnosed in the left lobe and isthmus nodules; and papillary thyroid cancer in the right lobe lower pole thyroid nodule

## Results

In addition to the primary findings of parathyroid pathology, 9 out of the 297 patients, who were reviewed, revealed additional thyroid pathologies. Scintigraphic studies in these patients revealed concomitant focally decreased I-123 uptake and persistent focal Tc-99m Sestamibi uptake in the dual tracer study (Figures 1,2). Histopathological examinations of such lesions revealed thyroid cancer in 7 out of 9 patients, while two patients had benign thyroid adenomas. Incidentally, none of these patients were suspected of having thyroid cancer at the time of doing dual tracer parathyroid scintigraphy.

## Discussion

Several methods have been employed for parathyroid scintigraphy for the detection of possible parathyroid adenomas. The earlier approach was a dual tracer technique using Thallium-201/Tc-99m pertechnetate. In recent years, this method has been replaced by dual phase Tc-99m sestamibi imaging (14). However, controversy still remains with regard to the superiority of dual phase Sestmibi imaging alone over another dual tracer technique using I-123 and Tc-99m Sestamibi (2,4,15).

Sestamibi is known to accumulate in a variety of malignant cells (16). Incidental detection of non-parathyroid tumors during Tc-99m sestamibi parathyroid scintigraphy has been previously reported (17, 18). There are also several case reports of incidental detection of thyroid cancer during Tc-99m Sestamibi parathyroid scintigraphy (19, 20). Our investigation has examined this issue in a larger patient population. It is well-known that hypofunctional thyroid nodule has significant risk of being malignant (21, 22). Since Sestamibi can accumulate in the thyroid cancer, we feel that a persistent accumulation of Sestamibi in a hypofunctioning thyroid nodule can further increase the likelihood of the lesion being malignant.

The level of Sestamibi concentration in the primary thyroid cancer and benign thyroid nodules is still controversial and a topic of debate. Several investigators have reported that both benign thyroid adenoma and thyroid cancers may show significant sestamibi concentration, and therefore cannot be reliably used to distinguish these two conditions (23, 24). However, there are reports, which have emphasized that benign adenomas of the thyroid accumulate much less Sestamibi activity than the malignant lesions (25-27). It has been reported that intense Sestamibi concentration increases the probability of thyroid cancer, while reduced activity drastically decreases the probability of malignancy (26). It has also been reported that if cold nodule on a Tc-99m pertechnetate or I-123/131 scan shows increased uptake on Tc-99m Sestamibi scan, the probability of the nodule being malignant increases by 7-8 times (27). In our patient population, 77.8% (7 of 9) lesions with persistent sestamibi and decreased I-123 activity were

proven to be malignant. Therefore, our results support the view that persistent sestamibi activity in a cold thyroid nodule is associated with a high likelihood of malignancy. The early diagnosis of thyroid cancer in patients with hyperparathyroidism is crucial in the management of these patients. Early awareness of the concurrent thyroid cancer before parathyroidectomy would enable surgeons to remove both parathyroid adenoma and thyroid cancer with one single neck exploration and therefore avoid the cost and risks associated with the second neck exploration.

## Conclusion

Although I-123 /Tc-99m Sestamibi dual tracer scintigraphy has been designed for better imaging of parathyroid gland pathology, its ability in detecting thyroid abnormalities should not be overlooked.

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