



**Nuclear Medicine Case Report**

## Ectopic Submandibular Parathyroid Adenoma by Tc-99m Sestamibi SPECT/CT Localization

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### ABSTRACT

We present a 74-year-old woman with primary hyperparathyroidism, with elevated parathyroid hormone and calcium. Tc-99m-methoxyisobutyl isonitrile (sestamibi) planar imaging showed a focus of uptake over the inferior aspect of the right submandibular gland that was localized on the single-photon emission computed tomography with CT.

**Keywords:** Ectopic parathyroid adenoma, Tc-99m, Sestamibi, Primary hyperparathyroidism, SPECT/CT

### INTRODUCTION

Localization of parathyroid adenomas before surgery requires a multimodality approach to aid operative planning. Ectopic parathyroid adenomas are rare and are reported to account for 5–10% of cases of primary hyperparathyroidism (PHPT),<sup>[1]</sup> which is often a diagnostic challenge for localization.

### CASE REPORT

A 74-year-old woman with a diagnosis of PHPT was sent to nuclear medicine with persistently raised serum calcium and parathyroid hormone (PTH) levels. The calcium was elevated to 2.7 mmol/L (2.15–2.55). The ionized calcium was elevated to 1.54 mmol/L (1.13–1.32). The PTH measures 9.03 pmol/L (1.6–6.9).

20 mCi Tc-99m sestamibi planar imaging [Figure 1] showed a solitary focus of uptake over right submandibular gland. The location for uptake in the right submandibular gland is uncommon for a parathyroid adenoma. Differential washout of tracer is seen from the immediate to the 3 h image with a clearer delineation of the lesion on delayed imaging. Single-photon emission computed tomography with CT (SPECT/CT) [Figure 2] demonstrated increased uptake over the inferior aspect of the right submandibular gland, suggestive of a parathyroid adenoma.

### DISCUSSION

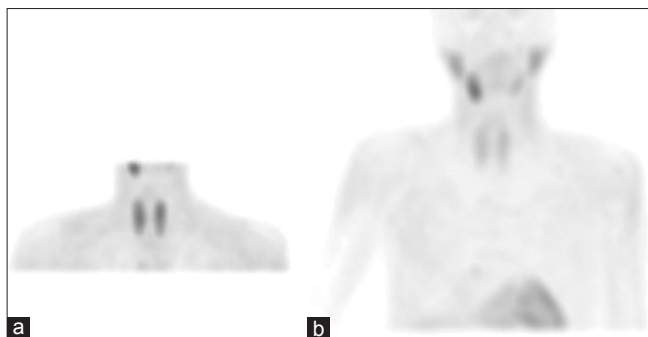
Ectopic parathyroid adenomas are rare and are reported to account for 5–10% of cases of PHPT.<sup>[1]</sup> Pre-operative localization of hyperfunctioning parathyroid tissue is an essential

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component if minimally invasive surgery is scheduled. Parathyroid localization has improved with numerous imaging techniques, including sestamibi scintigraphy, ultrasonography, and four-dimensional CT.<sup>[2]</sup>

Parathyroid scintigraphy using 99 mTc-MIBI has been proven to be greatly effective for the diagnosis of adenomas,

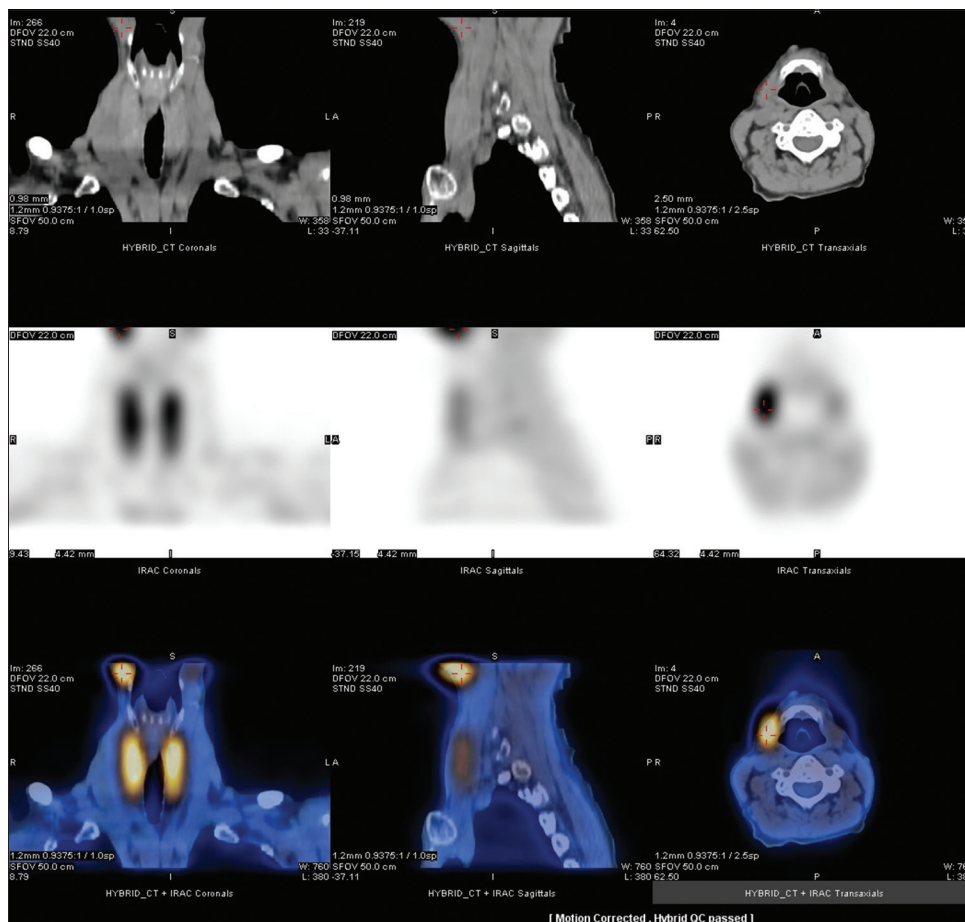


**Figure 1:** A 74-year-old woman with primary hyperparathyroidism. Anterior static sestamibi images performed at 20 min (a) and 3 h (b) show a focal lesion over the inferior aspect of the right submandibular gland.

however, despite the relatively high accuracy of planar parathyroid imaging, intrathyroidal adenomas with low 99 mTc-MIBI uptake and ectopic adenomas may be overlooked. Another limitation for planar 99 mTc-MIBI scintigraphy is a nodular goiter because thyroid nodules are frequently 99 mTc-MIBI avid and can cause false-positive scintigraphic results.

SPECT/CT fusion imaging is increasing used, due to the three-dimensional information, it provides and the improved sensitivity for the detection and localization of hyperfunctioning parathyroid lesions.<sup>[2]</sup> SPECT/CT can further enhance localization by providing better resolution of surrounding structures and has the added benefit of a more precise localization of ectopic and mediastinal parathyroid lesions.<sup>[2]</sup>

We routinely do SPECT/CT imaging at 20 min post-tracer injection for more accurate anatomical localization the lesion. If it is posteriorly located, we can confirm a parathyroid lesion, however, if it is located anteriorly, it may be due to an intrathyroidal parathyroid lesion or a false-positive finding of a thyroid nodule. In this instance, Tc-99m



**Figure 2:** A 74-year-old woman with primary hyperparathyroidism. SPECT/CT in tomographic, CT, and fused images in the axial, sagittal, and coronal plane shows a focal increased uptake over the right submandibular gland.

perchnetate thyroid imaging will be helpful in deciding if a lesion is due to an intrathyroidal lesion versus a thyroid nodule. If the lesion is in an ectopic location, more accurate anatomical localization is obtained. SPECT/CT is more reproducible as compared to ultrasound, which is operator dependent.

The single isotope, dual-phase technique is simple and easy to perform.<sup>[1,3]</sup> It requires a single injection of sestamibi followed by early and delayed imaging. It takes advantage of the differential washout rates of sestamibi from the thyroid and the parathyroid glands. On delayed images, parathyroid lesions are easily visualized. This principle is based on the observation that sestamibi washes out more rapidly from the thyroid than from abnormal parathyroid tissue, where it is retained for a longer period of time. The retention in parathyroid lesions is assumed to be related to the presence of oxyphil cells, which are rich in mitochondria, and is the site of intracellular sestamibi sequestration.<sup>[4]</sup>

## CONCLUSION

Localization of parathyroid adenomas before surgery requires a multimodality approach to aid operative planning. This is particularly important in cases of ectopic parathyroid adenomas, in which the surgical approach has to be modified. The hybrid SPECT-CT imaging used in our patient has helped not only in diagnosis with confidence but also provided good information regarding location and anatomical details for operation.

## Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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