

# A Potential Pitfall in Parathyroid Scintigraphy: Description of A Rare Case

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## Abstract

A 32 years old male patient after admission at our center was diagnosed as a primary hyperparathyroidism. Diagnostic imaging provided two different alternatives for the cause of the disease: an adenoma/carcinoma of the parathyroid gland or a hyper functioning thyroid node. The histology after surgical excision proved to be an adenoma of the parathyroid gland. This case report demonstrated this rare behavior for parathyroid scintigraphy in which parathyroid adenoma concentrates Tc<sup>99m</sup>-sestaMIBI in the early and late phase but also Tc<sup>99m</sup>-pertechnetate.

**Keywords:** Parathyroid; Scintigraphy

## Case Report

A 32 years old Caucasian male after admission at our centre was diagnosed as a primary hyperparathyroidism (PHPT). He worked as a teacher, weighted 75 kg and was 1.7 meters tall. The patient was non-smoking and declared of not drinking alcohol or using drugs. He reported to have been in general good condition except for a renal colic occurred seven months before. He presented with intense epigastralgia.

Blood analysis revealed severe hypercalcaemia (14.8 mg/dl) and elevated parathyroid hormone levels (665 pg/ml). Renal and thyroid functions were normal. Bone Mineral Density values were low (T score: lumbar spine = -2.39 SD, femur = -2.12 SD, forearm = -2.16 SD). No urinary lithiasis was documented. MEN syndrome was excluded. Patient was addressed to diagnostic imaging to eventually localize hyper functional parathyroid tissue.

## Diagnostic imaging

The patient was initially studied with ultrasonography (Fig. 1) that demonstrated a large node contiguous to the left thyroid lobe. The patient was addressed to our nuclear medicine protocol that consists of a thyroid scintigraphy followed by a parathyroid one. Thyroid scintigraphy using Tc<sup>99m</sup>-pertechnetate (Fig. 2) showed a large intense uptake of tracer in the left lower pole of the thyroid and parathyroid scintigraphy using Tc<sup>99m</sup>-sestaMIBI (Fig. 3) revealed an intense and persistent uptake on the tracer in the same region.

Usually, parathyroid adenoma shows an area of early and delay hyperconcentration of Tc<sup>99m</sup>-sestaMIBI, while it does not concentrate Tc<sup>99m</sup>-pertechnetate. Sometimes may show an uptake of Tc<sup>99m</sup>-sestaMIBI only in the early or only in the late images (Table 1). But, hardly ever, the parathyroid adenoma accumulates Tc<sup>99m</sup>-pertechnetate [2].

## Surgery

To correct for the severe PHPT, the patient underwent surgery with the thought that the large node could be either an adenoma/carcinoma of the parathyroid gland or a hyper functioning thyroid node.

During the surgical intervention the large node shown in imaging was situated in the posterior-inferior part of the thyroid left lobe (Fig. 4). The excised node was identified by the histological frozen section as pathological parathyroid tissue (ptotic superior adenoma) (Fig. 5).

The left inferior parathyroid, which was normal both in size and appearance (Fig. 6), was not excised also because PTH presented a remarkable drop during surgical procedure (from 484 pg/ml to 51 pg/ml).

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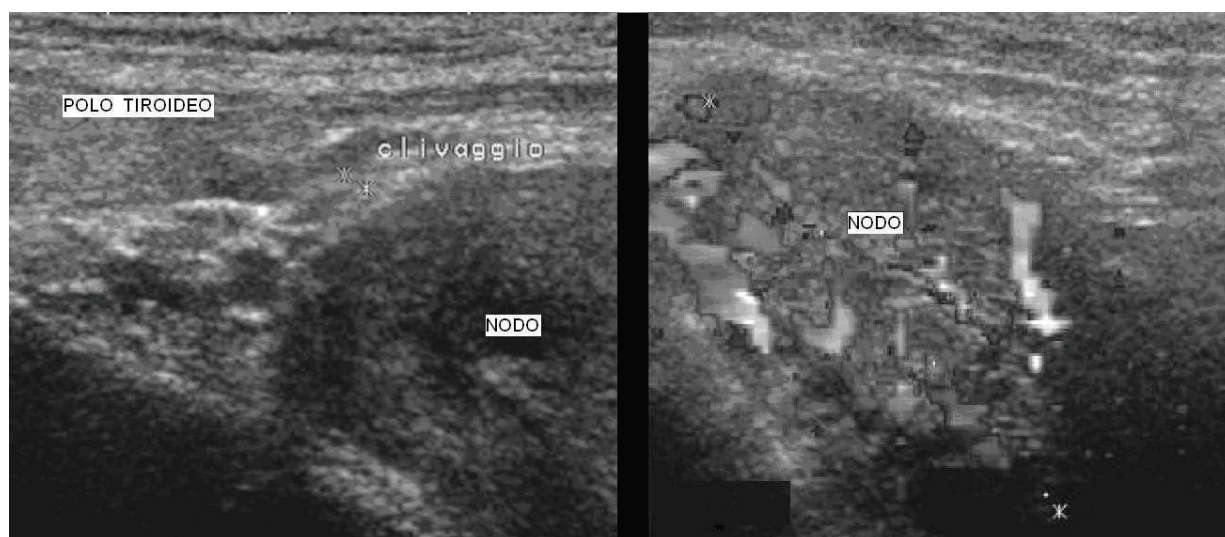
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**Figure 1.** Ultrasonography. Ultrasound scan showed a large solid (41 x 31 x 24 mm) hypo-echogen node contiguous to the left thyroid lobe. On the right picture we could observe the high intranodal vascularisation.

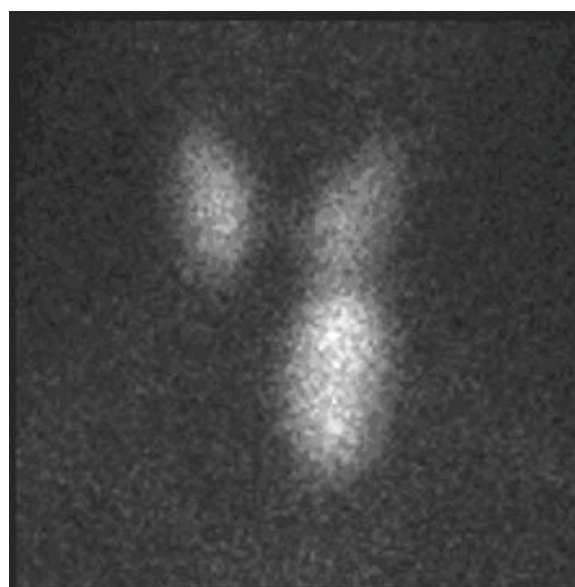
The final histological examination confirmed the diagnosis of adenoma of the parathyroid gland. The performed tissue was tested by immunohistochemical analysis with monoclonal antibodies for thyroglobuline and TTF-1 and resulted negative. The cellular proliferation evaluated by monoclonal antibody Ki-67 was less than 2-3%.

The patient was behaving well at eight months follow-up.

### Discussion

The new possibility offered by the minimally invasive parathyroid surgery greatly advantages by the possibility of localizing the adenoma with nuclear and ultrasound imaging. There is

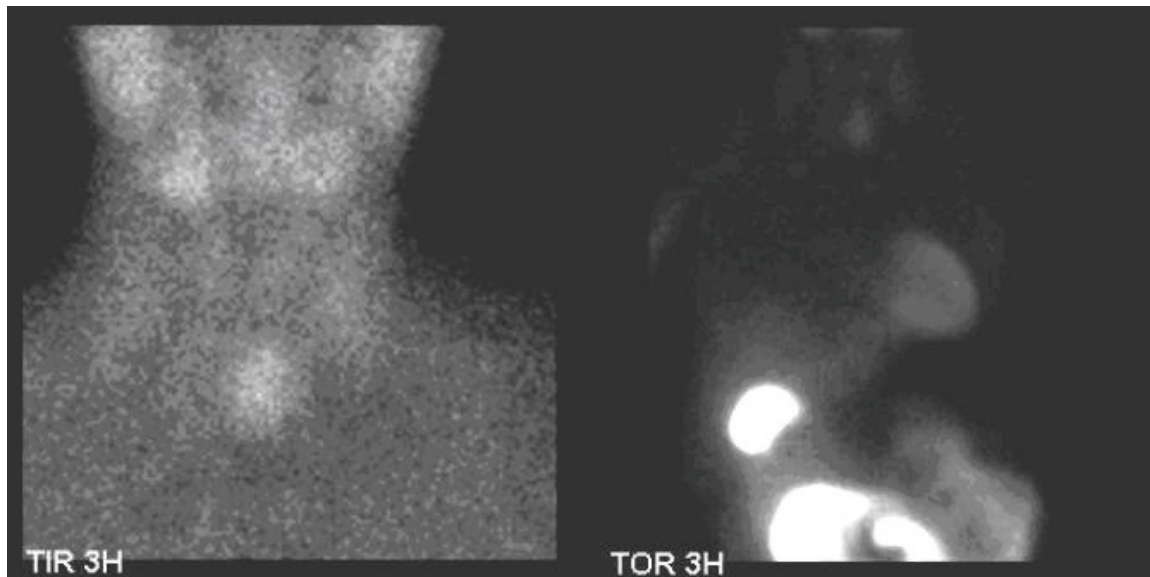
general consensus that the  $Tc^{99m}$ -sestaMIBI is the best way to localize preoperatively the hyper secreting parathyroid tissue. A meta-analysis of the sensitivity and specificity of this



**Figure 2.** Thyroid scintigraphy.  $Tc^{99m}$ -pertechnetate, that mimics iodine, is rapidly concentrated in the thyroid but conversely to iodine is quickly released from the thyroid with a half life of about one hour. While  $Tc^{99m}$ -pertechnetate accumulates in the healthy thyroid it usually does not accumulate in the parathyroid [1]. The thyroid study was obtained 15 minutes after the administration of 74 MBq of  $Tc^{99m}$ -pertechnetate. All the images were obtained with a Millennium VG gamma camera (GE Healthcare, Wisconsin, USA) using a LEHR collimator. Thyroid scintigraphy using  $Tc^{99m}$ -pertechnetate showed a large intense uptake of tracer in the left lower pole of the thyroid.

**Table 1.** Different Patterns of Radiopharmaceuticals Uptake

Pattern	Uptake in Parathyroid Adenoma		
	$Tc^{99m}$ -SestaMIBI		$Tc^{99m}$ -pertechnetate
	Early	Late	
1 (usual)	Yes	Yes	No
2 (not frequent)	Yes	No	No
3 (not frequent)	No	Yes	No
4 (hardly ever)	Yes	Yes	Yes

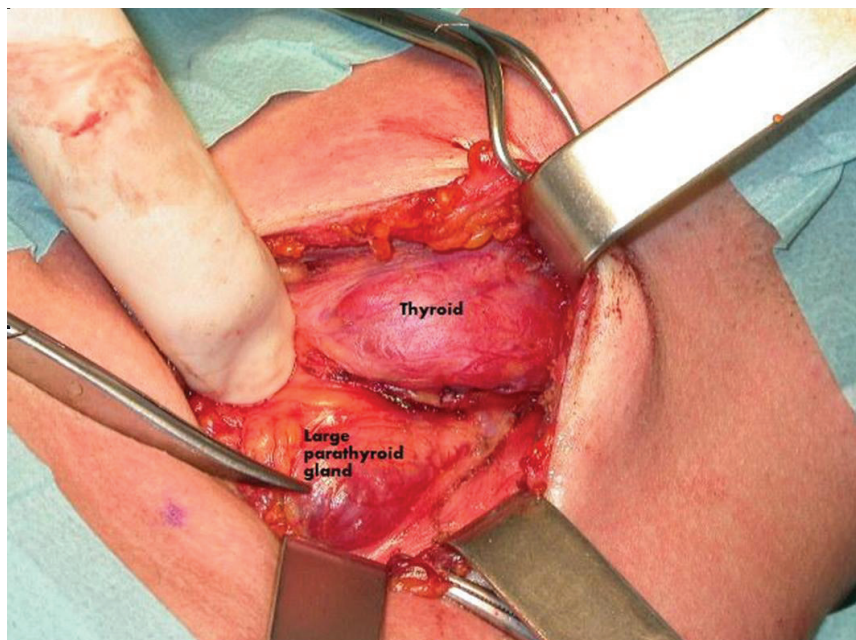


**Figure 3.** Parathyroid scintigraphy. SestaMIBI is a monovalent lipophilic cation that diffuses passively across cell membranes, concentrates in mitochondria and accumulates in adenomatous parathyroid tissue because of increased blood supply, higher metabolic activity and the absence of glycoprotein on the cell membrane [2]. Parathyroid scintigraphy was performed immediately after thyroid scintigraphy and the patient was given 740 MBq of  $Tc^{99m}$ -sestaMIBI followed by 600 mg of sodium perchlorate for thyroid blocking. Additional anterior images of the neck were acquired 20 minutes and 3 hours after, followed then by a late chest image. All the images were obtained with a Millennium VG gamma camera (GE Healthcare, Wisconsin, USA) using a LEHR collimator. Parathyroid scintigraphy using sestaMIBI showed an intense and persistent uptake on the tracer in the left lower left pole of the thyroid. No other focus of uptake was found in the chest image.

technique in 6,331 cases gave values of 90.7% and 98.8%, respectively [4]. The sensitivity of  $Tc^{99m}$ -sestaMIBI is limited in patients affected by parathyroid multiglandular disease

and multinodular goiter.

As we demonstrated in this case, the parathyroid adenoma could present an intense uptake of pertechnetate, that



**Figure 4.** Surgical procedure. During surgery a large parathyroid gland was identified near the left thyroid lobe.



**Figure 5.** Excised parathyroid gland. The large (45 x 30 x 25 mm) superior left parathyroid gland was excised and afterwards diagnosed as an adenoma.

is very unusual. Particularly in patients with multinodular goiter, the focal uptake of Tc<sup>99m</sup>-perthecnetate and Tc<sup>99m</sup>-sestaMIBI could be therefore attributed to a hyper functioning thyroid node rather than, as we demonstrated to be the case, a parathyroid adenoma.

### Consent

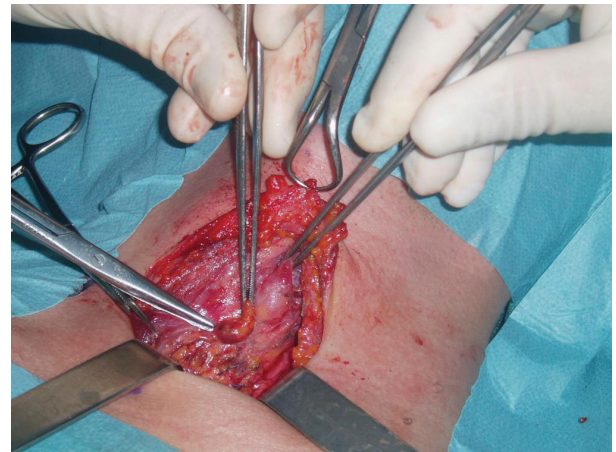
Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

### Competing Interests

The authors declare that they have no competing interests.

### Authors' Contributions

AF and FA performed ecography and scintigraphy. IE per-



**Figure 6.** Normal parathyroid gland. The lower left parathyroid gland was grossly normal and therefore was not excised also because PHT decreased abruptly during surgical intervention.

formed the surgical procedure. GB admitted and follows up the patient. GF performed the histopathology. AF and SC wrote and reviewed the manuscript. All authors read and approved the final manuscript.

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