

Tchnetium-99m pertechnetate uptake in ectopic parathyroid adenoma

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A 37-year-old male with a persistent increased parathyroid hormone level, after subtotal thyroidectomy and parathyroidectomy, was referred for scintigraphic localization of a possible ectopic parathyroid adenoma. Tc-99m pertechnetate and Tc-99m MIBI scintigraphy were performed on separate days. There was marked uptake of both tracers in the mediastinum, which at surgery was confirmed to be an extrathyroidal parathyroid adenoma. Hypervascularity was suggested as a possible explanation for rare cases of pertechnetate avid parathyroid adenomas. And Tc-99m MIBI scintigraphy proved to be a successful imaging procedure for ectopic parathyroid tissue.

Key words: parathyroid adenoma, ectopic, Tc-99m pertechnetate

INTRODUCTION

PRIMARY HYPERPARATHYROIDISM is a common clinical disorder which is increasingly being recognized with the advent of routine biochemical screening.¹ Surgery is the treatment of choice with a success rate of 95%.² On the other hand, reexploratory surgery is technically more difficult and has a greater incidence of complications with a higher failure rate.³ The success rate for reoperation without preoperative localization is only about 62%.³

Nuclear scintigraphy is a well established technique for preoperative localization of parathyroid adenomas. Most imaging techniques rely on a dual tracer subtraction with Tl-201, I-123 and Tc-99m pertechnetate. More recently dual phase study with early and late imaging with Tc-99m MIBI is used. It is generally observed that the parathyroid adenoma shows hyperperfusion, but does not trap pertechnetate or iodine, permitting parathyroid adenoma to be differentiated from the thyroid on the subtraction image.

In this report a case of postsurgical hyperparathyroidism is presented. The localization technique in this case included ultrasound, magnetic resonance imaging and Tc-

99m MIBI scintigraphy. Tc-99m MIBI scintigraphy proved to be an excellent method for the detection of the aberrant tissue. Uptake of pertechnetate in the lesion was also seen, and this may be due to hypervascularity.

CASE PRESENTATION

A 37-year-old male with generalized bone pain was suspected of having primary hyperparathyroidism due to the high total calcium 12.9 mg/dl (9-11 mg/dl), parathyroid hormone (PTH) 219.1 ng/ml (10-65 ng/ml) and decreased inorganic phosphorus 1.7 mg/dl (4-6 mg/dl) in his blood tests. Ultrasonographic examination of the neck showed a hypoechoic nodule in the right lobe of the hyperplastic thyroid. The patient had right total and left subtotal thyroidectomy with parathyroid exploration. Histological examination revealed two nonneoplastic parathyroid glands.

A week after the neck surgery, control blood levels were as follows; PTH: 364.97 ng/ml, calcium: 13.8 mg/dl, phosphorus: 2.1 mg/dl, so he was referred for Tc-99m MIBI scintigraphy for localization of a possible ectopic parathyroid adenoma. Early (15 min p.i.) and delayed (3 hs p.i.) zoomed images of the anterior neck and thorax were performed following i.v. injection of 740 MBq Tc-99m MIBI (Cardio-SPECT, Hungary). Tc-99m MIBI was prepared according to the instructions of the manufacturer, with a chemical purity of 99.98%. Early accumulation of Tc-99m MIBI appeared in the left lobe of the

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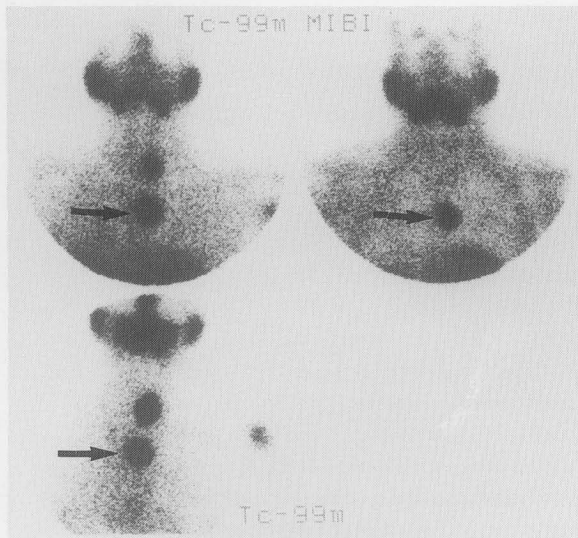


Fig. 1 (upper row) Following injection of 740 MBq Tc-99m MIBI, accumulation of radioactivity is seen in the left thyroid and mediastinum on the early image (left). Three hours later persistence of radioactivity is seen in the mediastinum (right). (lower row) After injection of Tc-99m pertechnetate, both the residual thyroid and the parathyroid adenoma show uptake of radioactivity.



Fig. 2 In the coronal slice of the MRI study the ectopic parathyroid adenoma is seen (arrow).

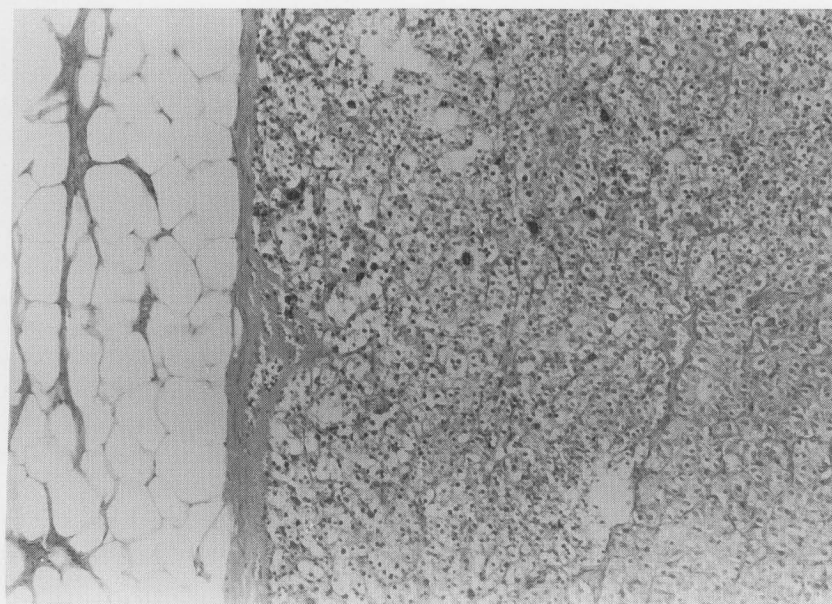


Fig. 3 Beneath the thin fibrous capsule, neoplastic tissue was seen. Tumor composed of the uniform cells and capillaries ($\times 230$).

thyroid gland and anterior mediastinum with marked retention up to 3 hours in the mediastinum (Figure 1). A repeat scan with Tc-99m pertechnetate with 370 MBq was done on a subsequent day. Tracer uptake was seen in the left thyroid lobe and in the mediastinum. The MRI study was performed consecutively during that course which confirmed the radionuclide studies (Figure 2). The mediastinum was explored at surgery and a parathyroid

adenoma was found in the posterior region of the manubrium sterni and excised. Microscopic evaluation of the mass revealed a tumoral mass which was surrounded by a thin fibromuscular capsule, arranged in a solid pattern. Neoplastic cells, mainly composed of chief cells, showed no sign of pleomorphism. The tumoral tissue was highly vascular and surrounded by tumoral nests (Figure 3).

A controlled blood test two weeks after the surgery revealed calcium: 6.2 mg/dl, phosphorus: 3.0 mg/dl and PTH: 8 ng/ml. The patient's post-operative course was unremarkable.

DISCUSSION

Most currently employed localizing anatomic procedures provide suboptimal results to detect multiglandular parathyroid glands as well as intrathyroidal or mediastinal glands⁴ as they depend on the size and localization of the lesion⁵ which severely limit their efficacy for identifying small or ectopic adenomas prior to reexploration.⁶⁻⁹ Localization with scintigraphic procedures is more valuable in patients undergoing reexploration where the normal anatomy is destroyed, as it depends on the metabolism not the size of the aberrant parathyroid tissue.⁶ Ectopic adenomas occur in 6-10% of cases, in locations such as the thymus, thyroid, pericardium or behind the esophagus. The reported incidence of ectopic hyperplastic parathyroid glands ranges from 7% to 47%.¹⁰

Among the several radioisotopic techniques available for parathyroid imaging, recently, Tc-99m MIBI is the agent of choice for the preoperative localization of parathyroid pathology for its favorable uptake and washout characteristics with a sensitivity of 88% to 100%.¹¹⁻¹⁴ Tc-99m MIBI imaging has been found to accurately guide the operative approach and expedite the surgical procedure in patients undergoing reexploration for recurrent or persistent hyperparathyroidism.

There are only a few reports in which a parathyroid adenoma had shown significant uptake of Tc-99m pertechnetate.^{15,16} The mechanism of Tc-99m pertechnetate localization in the parathyroid remains uncertain. Hypervascularity is the most cited explanation since there is no known cellular mechanism by which parathyroid tissue should actively trap iodine or its analogues. The presence of a thick capsule was observed in the previously reported cases and in our case as well.

We conclude that Tc-99m MIBI scintigraphy is likely to become the preferred parathyroid localization method. Given its superior imaging characteristics and other merits, it deserves strong consideration as the procedure of choice for preoperatively localizing aberrant parathyroid gland(s) in patients requiring reexploration for recurrent or persistent hyperparathyroidism. Tc-99m MIBI imaging may also play a role in the preoperative evaluation before initial surgery, especially in patients that are poor surgical candidates and in whom reexploration carries an

unacceptably high risk of morbidity and mortality.

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