

Tc-99m sestamibi scanning in the preoperative localization of mediastinal parathyroid adenomas

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We report on two patients with mediastinal parathyroid adenomas who underwent preoperative Tc-99m sestamibi scintigraphy. Excellent physical characteristics of technetium and slow washout of Tc-99m sestamibi made possible clear delineation of mediastinal parathyroid adenomas by Tc-99m sestamibi imaging.

Key words: ectopic parathyroid adenoma, Tc-99m sestamibi, hyperparathyroidism

INTRODUCTION

ALTHOUGH INITIAL SURGERY for primary hyperparathyroidism without preoperative localization is successful in 90-95% of patients,¹ there is great interest in seeking a reliable non-invasive localization procedure to reduce operation and anesthesia time and increase the success rate. Tl-201/Tc-99m subtraction scanning, high-resolution ultrasonography, computed tomography and magnetic resonance imaging have been attempted, but because of the relatively low sensitivity and low specificity in comparison with the surgical success rate, the uses of these studies are controversial or not even indicated prior to initial surgery.¹⁻⁴ Understandably, there is continuing interest in an accurate localization procedure. In 1989, Coakley et al. reported the use of Tc-99m sestamibi.⁵ Subsequent studies show Tc-99m sestamibi is a promising agent for parathyroid imaging.⁶⁻⁹

Here we report two cases in whom preoperative Tc-99m sestamibi scans clearly demonstrated mediastinal parathyroid adenomas. Tc-99m sestamibi images were acquired immediately after intravenous injection of 740 MBq of Tc-99m sestamibi with a preset-time mode of 2 minutes each frame for twenty minutes. We used a large field-of-view scintillation camera with a low energy, high resolution, parallel hole collimator covering the neck and the upper thorax. A delayed image was obtained at about

2 hours after the injection of the radiotracer.

CASE REPORT

The first patient was a 70-year-old male complaining of nausea and vomiting. Because of increased serum calcium (13.3 mg/dl) and C-terminal parathyroid hormone (2.0 ng/ml), hyperparathyroidism was suspected. Neck MRI and sonography were negative. Tc-99m sestamibi scanning was performed three days later and showed a hot area over the mediastinum in a delayed image (Fig. 1). The operators excised a 2 cm diameter parathyroid adenoma from the anterior mediastinum.

The second patient was a 60-year-old female who was admitted due to a mediastinal mass seen on a chest X-ray and computed tomography (Fig. 2). The serum calcium (14.6 mg/dl) and intact parathyroid hormone (136 pg/ml) of this patient were increased. A delayed Tc-99m sestamibi SPECT image showed a focal hot area corresponding to the lesion revealed on CT (Fig. 3). A 4 × 4 × 3 cm parathyroid adenoma was removed from the location demonstrated by the imaging procedures. After surgery, the above two patients were restored to the euparathyroid status.

DISCUSSION

At present, the most frequent causes of failed initial parathyroidectomy are ectopic parathyroid glands and incomplete excision of hyperplastic glands.^{10,11} Considering that 13% to 20% of parathyroids are ectopically located,^{2,12} preoperative localization of these lesions would

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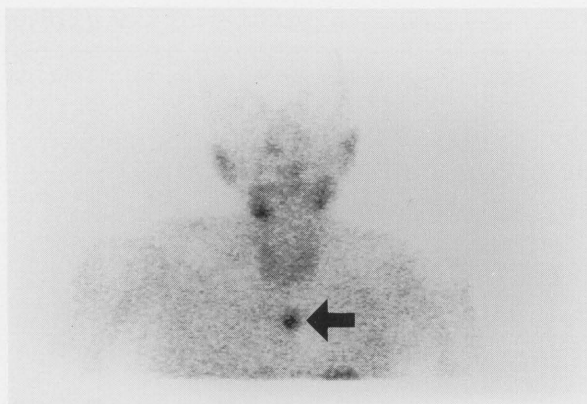


Fig. 1 Case 1. Delayed planar Tc-99m sestamibi image shows focal increased radioactivity in the upper mediastinum (arrow).

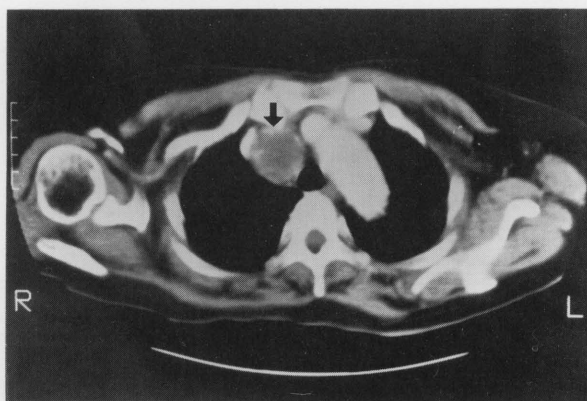


Fig. 2 Case 2. Contrast-enhanced CT demonstrates a nodular lesion (arrow) located between the superior vena cava and aortic arch.

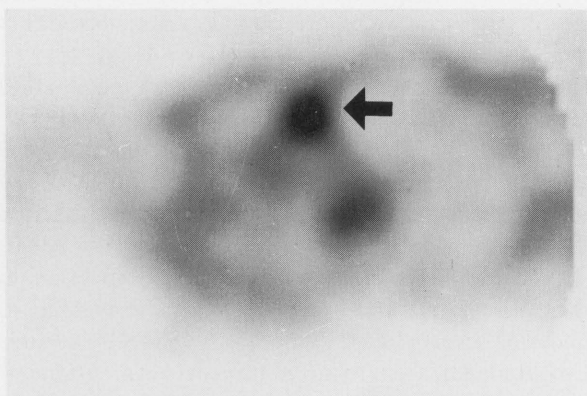


Fig. 3 Case 2. Delayed Tc-99m sestamibi SPECT image in the transverse plane shows a focal hot area (arrow) corresponding to the lesion demonstrated on CT.

be very helpful for surgeons.

Both thyroid and parathyroid tissue can uptake Tc-99m sestamibi, but the washout of Tc-99m sestamibi from parathyroid tissue is slower than from thyroid tissue. Parathyroid imaging can be obtained by Tc-99m sestamibi/I-123 subtraction scanning or double-phase Tc-99m

sestamibi scanning. These two methods have been shown to be more sensitive than Tl-201/Tc-99m subtraction scanning in detecting normotopic parathyroid adenoma.^{7,8} We performed double-phase Tc-99m sestamibi scan in our patients. The early phase imaging can offer anatomical reference and the late phase imaging will depict focal accumulation of Tc-99m sestamibi in parathyroid lesion.⁷ In detecting ectopic parathyroid adenoma, because the washout of Tc-99m sestamibi from parathyroid tissue is slow, there would be adequate time to get the necessary images.

Moisa et al. reported their experience in the localization of ectopic parathyroid lesions with Tl-201. They found that Tl-201 scintigraphy was superior to other imaging methods. The sensitivity of Tl-201 scintigraphy, ultrasonography, computed tomography and magnetic resonance imaging in detecting ectopic parathyroid lesions was 72%, 15%, 42% and 69%, respectively,¹³ but the Tc-99m sestamibi scan may have higher sensitivity than the Tl-201 scan.

Tc-99m sestamibi scanning has some advantages over conventional Tl-201 scanning. First, technetium has superior physical characteristics (a shorter half-life and higher photon energy). The energy of Tl-201 is lower than ideal. Therefore, the ability of Tl-201 to detect mediastinal parathyroid glands may be limited by low resolution and attenuation of the emitted photon by the sternum.¹⁴ In addition, Tc-99m sestamibi in parathyroids remains relatively constant following peak uptake while Tl-201 steadily declines.⁶ We can composedly perform a late phase planar or SPECT image, as required, with Tc-99m sestamibi to detect normotopic and ectopic parathyroid lesions. By means of SPECT, we will have greater contrast resolution and spatial localization of the parathyroid lesions. Finally, in rare cases of impaired thallium uptake of parathyroid adenoma, Tc-99m sestamibi scan may be useful in depicting the lesion.¹⁵

In the present cases, Tc-99m sestamibi imaging clearly delineated mediastinal parathyroid lesions. Because the time available for acquiring parathyroid images is long, we will have sufficient time to evaluate both normotopic and dystopic parathyroid glands by means of planar or, if necessary, SPECT images.

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