
Clearer Visualization of Ectopic Parathyroid Gland with ^{99m}Tc MIBI as Compared to ^{201}Tl

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Abstract

A 63-year-old man with a long history of hemodialysis developed secondary hyperparathyroidism. Ultrasonography, CT and ^{201}Tl - ^{99m}Tc subtraction scintigraphy demonstrated an adenoma in the left upper pole of the thyroid gland, but failed to detect hyperplasia in the right upper and lower poles and an ectopic parathyroid gland in the left superior mediastinum. But, ^{99m}Tc -methoxyisobutylisonitrile (MIBI) scintigraphy more clearly delineated a parathyroid hyperplasia in the right lower pole and an ectopic parathyroid in the left superior mediastinum than conventional ^{201}Tl - ^{99m}Tc subtraction scintigraphy. ^{99m}Tc -MIBI scintigraphy is useful in detecting parathyroid glands, especially ectopic ones.

Introduction

When the glomerular filtration rate drops to below 50% of normal in chronic renal failure, secondary hyperparathyroidism may develop. If conservative treatment with suppressive doses of

active vitamin D analogs fails, total or subtotal parathyroidectomy in combination with autotransplantation of one gland is the procedure of choice. Because not all glands can be removed during the first surgery, symptoms of hyperparathyroidism may persist or return. Several imaging modalities may be helpful to localize the parathyroid glands^{2)~5)}: ultrasound, CT, scintigraphy and, more recently, MRI. But, in fact the preoperative localization of abnormal parathyroid tissues in patients with hyperparathyroidism before surgical neck exploration has been a difficult diagnostic problem with ectopic parathyroid glands. Scintigraphy has played a major role in detecting ectopic parathyroid glands compared with other diagnostic modalities. ^{99m}Tc -MIBI, like ^{201}Tl , has recently been introduced as a myocardial perfusion agent and is now also showing very promising results in parathyroid scintigraphy^{2~5)}.

We report here an ectopic parathyroid gland which could be clearly detected with ^{99m}Tc -MIBI versus ^{201}Tl scintigraphy in a patient with secondary hyperparathyroidism.

Key words: secondary hyperparathyroidism, ectopic parathyroid gland, ^{99m}Tc -MIBI, ^{201}Tl - ^{99m}Tc subtraction scintigraphy.

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Case report

A 63-year-old man with a long history of hemodialysis due to chronic renal failure developed secondary hyperparathyroidism. Results of the parathyroid function tests were : PTH-C : 26.6 ng/ml (0.20~1.00), PTH-IN : 851 pg/ml (10~60), HS-PTH : 74,700 pg/ml (150~500), C-PTHrP : 504 pmol/l (13.8~55.3), Ca : 12.0 mg/dl (8.2~10.5). Ultrasonography and CT demonstrated only a parathyroid adenoma in the left upper pole of the thyroid gland. The patient underwent scintigraphy for the purpose of detecting other parathyroid glands and ectopic parathyroid glands preoperatively. Subtract scintigraphy was performed with $^{201}\text{TlCl}$ and $^{99\text{m}}\text{Tc}$ pertechnetate. Five minutes after intravenous injection of 74 MBq (2 mCi) ^{201}Tl chloride, an image of the thyroid region was taken. After a 5-minute acquisition of the thallium image, without changing the position of the patient, 74 MBq (2 mCi) $^{99\text{m}}\text{Tc}$ sodium pertechnetate was intravenously injected and acquisition was initiated 15 minutes later. These data were recorded for 5 minutes in the same mode as used for ^{201}Tl chloride.

The final image was obtained by computer subtraction of the $^{99\text{m}}\text{Tc}$ image from the ^{201}Tl image. ^{201}Tl scintigraphy shows a focal area of increased uptake in the left upper pole of the thyroid gland (arrow) (Fig. 1 A). $^{99\text{m}}\text{Tc}$ scintigraphy shows a focal area of decreased uptake in the left upper pole (arrow) (Fig. 1 B).

^{201}Tl - $^{99\text{m}}\text{Tc}$ subtraction scintigraphy shows an area of intense uptake in the left upper pole (arrow) (Fig. 1 C). Two days later, thirty minutes after the administration of 740 MBq (20 mCi) $^{99\text{m}}\text{Tc}$ -MIBI, acquisition was started using the same settings used in the $^{99\text{m}}\text{Tc}$ image. $^{99\text{m}}\text{Tc}$ -MIBI scintigraphy shows a focal area of increased uptake in the left upper pole (arrow) and a focal area of increased uptake in the right lower pole (small arrowhead), and a focal area of increased uptake in the intrathoracic region (big arrowhead) (Fig. 1 D).

Pathological examination revealed an adenoma in the left upper pole, hyperplasia in the right upper and lower poles and an ectopic parathyroid gland in the left superior mediastinum.

Discussion

When primary hyperparathyroidism (PHP) or secondary hyperparathyroidism (SHP) is diagnosed, all enlarged parathyroid glands must be removed for treatment during the first surgery. The benefit of preoperative imaging in hyperparathyroidism has yet to be established. In the majority of patients, an experienced surgeon will be able to remove all parathyroid glands. This statement appears true when there are no supernumerary or ectopic glands. Because symptoms persist or recur when all glands cannot be located and removed, imaging procedures may be useful before performing the first or second operations. As a complicating factor, approximately 20% of parathyroid glands are found in ectopic locations, and inferior parathyroid glands are the most frequently found in the mediastinum^{6)~8)}. A number of studies have been performed to evaluate the usefulness of ultrasound, CT and MRI in detecting such glands²⁾⁷⁾⁸⁾. Ultrasound can be repeatedly performed because it does not use radiation, and is superior in detecting parathyroid glands adjacent to thyroid glands, but is inferior to detect ectopic parathyroid glands in the mediastinum. CT clearly reveals the anatomical position of parathyroid glands, and facilitates the detection of parathyroid glands because the use of contrast media makes the CT values of parathyroid glands changeable, and is superior with regard to the detection of ectopic parathyroid glands in the mediastinum, although the use of contrast media must be limited in the presence of chronic renal failure. Scintigraphy is superior to detect ectopic parathyroid glands, but is inferior to detect small lesions.

It is necessary to detect only one parathyroid gland in many cases of PHP because one is enlarged and the others are atrophic. But it is neces-

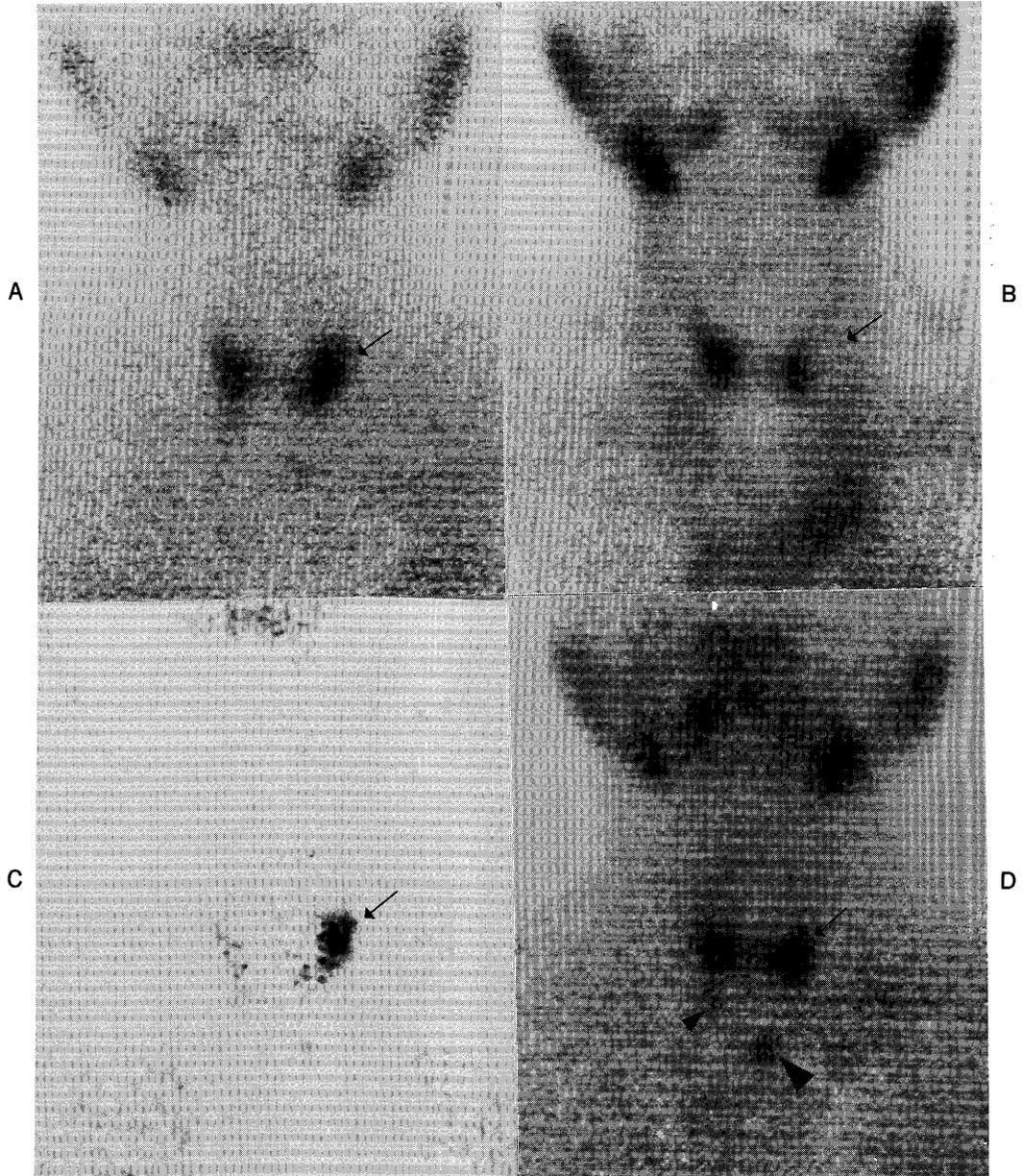


Fig. 1 Planar anterior views of the neck. (A) ^{201}Tl scintigraphy shows a focal area of increased uptake in the left upper pole of the thyroid gland (arrow). (B) $^{99\text{m}}\text{Tc}$ scintigraphy shows a focal area of decreased uptake in the left upper pole (arrow). (C) ^{201}Tl - $^{99\text{m}}\text{Tc}$ subtraction scintigraphy shows an area of intense uptake in the left upper pole (arrow). (D) $^{99\text{m}}\text{Tc}$ -MIBI scintigraphy shows a focal area of increased uptake in the left upper pole (arrow) and a focal area of increased uptake in the right lower pole (small arrow head), and a focal area of increased uptake in the intrathoracic region (big arrow head). Histologic examinations revealed a parathyroid adenoma in the left upper pole (arrow), hyperplasia of the parathyroid in the right lower pole (small arrow head) and an ectopic intrathoracic parathyroid (big arrow head).

sary to detect four or more parathyroid glands and ectopic parathyroid glands in the neck and mediastinum because all four parathyroid glands are enlarged in many cases of SHP. So, scintigraphy is good for detecting ectopic parathyroid glands or more than four parathyroid glands, especially in the case of SHP. Since the introduction of ^{99m}Tc -MIBI as a parathyroid imaging agent in 1989, many investigators have reported that ^{99m}Tc -MIBI scintigraphy is superior to conventional ^{201}Tl - ^{99m}Tc subtraction scintigraphy in detecting abnormal parathyroid glands¹⁾⁻⁵⁾. But, only a few investigators have reported that ^{99m}Tc -MIBI scintigraphy is very useful in localizing ectopic parathyroid glands in patients with persistent or recurrent hyperparathyroidism after previous operation⁶⁾⁻⁸⁾. ^{99m}Tc -MIBI scintigraphy is more suitable for detecting deep lesions like ectopic parathyroid glands in the mediastinum than conventional ^{201}Tl - ^{99m}Tc subtraction scintigraphy.

Our present case illustrates the successful use of ^{99m}Tc -MIBI in detecting and localizing not only parathyroid adenoma and hyperplasias in normal sites but also an ectopic parathyroid gland in the mediastinum before the first surgical neck exploration. But in this case, ^{99m}Tc -MIBI scintigraphy failed to detect hyperplasia in the right lower pole of the thyroid because it was small.

It is concluded that ^{99m}Tc -MIBI is a very useful radiotracer for parathyroid scintigraphy, especially in detecting ectopic parathyroid glands.

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