

Rare Imaging Findings of Concomitant Presence of Multiple Parathyroid Adenomas and Carcinoma in a Chronic Kidney Disease Patient with Tertiary Hyperparathyroidism Detected on ^{99m}Tc-Sestamibi Single-Photon-Emission Computed Tomography/Computed Tomography Scintigraphy

Abstract

Parathyroid carcinoma (PC) is a rare endocrine carcinoma. It is one of the rare causes for primary hyperparathyroidism. It is very uncommon in individuals with secondary or tertiary hyperparathyroidism. We report a rare case of 53-year-old male, a known case of chronic kidney disease on dialysis, who presented with fatigue and muscle cramps. Lab reports revealed elevated parathyroid hormone (PTH) and serum calcium levels. ^{99m}Tc-Sestamibi single-photon-emission computed tomography/computed tomography scintigraphy showed 4 foci of increased tracer uptake with retention, suggestive of parathyroid adenomas, including two ectopic foci in the mediastinum. At surgery, the enlarged bilateral superior, left inferior parathyroid gland, and two calcified left superior mediastinal lesions were removed. Histopathology revealed parathyroid adenomas in the right superior, left inferior, supernumerary ectopic left superior mediastinum lesion and PC in the left superior parathyroid lesion. Intraoperative serum PTH became normal, and the patient is asymptomatic now.

Keywords: ^{99m}Tc-sestamibi single-photon-emission computed tomography/computed tomography, parathyroid adenoma, parathyroid carcinoma, tertiary hyperparathyroidism

Introduction

Primary hyperparathyroidism (PHPT) is caused by autonomously functioning parathyroid adenoma. More than 85% of patients have single adenoma, <5% have two adenomas, <1% have four gland hyperplasia, and fewer than 1% of patients have parathyroid carcinoma (PC). Tertiary hyperparathyroidism (THPT) presents as hypercalcemia with increased parathyroid hormone (PTH) in chronic kidney disease (CKD) patients.^[1] Here, one or more glands become autonomous and no longer respond to serum PTH. ^{99m}Tc-Sestamibi single-photon-emission computed tomography/computed tomography (SPECT/CT) is used for localizing hyperfunctioning parathyroid glands before surgery, making possible minimally invasive surgery.^[2] It is very rare to have multiple parathyroid adenomas and PC in a patient with CKD and THPT.^[3]

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Case Report

We report a case of 53-year-old male patient, a known case of CKD on hemodialysis for the last 5 years, who presented with the complaints of fatigability, bone pain, and muscular cramps. Laboratory report showed elevated serum calcium of 12.5 mg/dl (normal value 8.5–10.5 md/dl) and PTH of 3360 ng/L (normal value 15–65 ng/L), suggestive of HPT. Ultrasound (USG) neck done was suggestive of two hypoechoic nodules in the left lobe of thyroid measuring 1.6 cm × 1.1 cm and 1.3 cm × 1.1 cm with peripheral vascularity and right lobe of thyroid was not visualized due to dialysis line and dressing. No evidence of cervical lymph nodes noted. The patient was referred for ^{99m}Tc-sestamibi Scintigraphy for localization of parathyroid adenoma. Dual-phase ^{99m}Tc-sestamibi planar images showed multiple foci of tracer retention

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Suneelkumar
Malipedda,
Koramadai
Karuppusamy
Kamaleshwaran,
Dhiwakar
Muthusamy¹,
Mangalakumar
Veerasamy²,
Arun Pandiyan
Soundararajan,
Arnold Vasumathi
Jayaraj

Departments of Nuclear
Medicine, PET/CT and
Radionuclide Therapy,
¹Head and Neck Surgery and
²Nephrology, Kovai Medical
Center and Hospital Limited,
Coimbatore, Tamil Nadu, India

Address for correspondence:
Dr. Koramadai Karuppusamy
Kamaleshwaran,
Department of Nuclear
Medicine, PET/CT and
Radionuclide Therapy, Kovai
Medical Center and Hospital
Limited, Coimbatore - 641 014,
Tamil Nadu, India.
E-mail: dr.kamaleshwar@gmail.
com

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in relation to superior and inferior lobes of the thyroid gland and ectopic focus in mediastinum [Figure 1a, early image, and b, delayed image]. SPECT/CT of the neck and mediastinum [Figure 2a-h] localized hypodense nodular lesions with increased tracer retention in the following locations, superior part of the right (a) and left lobes of thyroid gland (b), left inferior part,(c) and ectopic calcified lesions in the left upper paratracheal mediastinal location in thoracic inlet (d). CT component of the SPECT/CT did not show invasion of parathyroid nodules into adjacent structures.

The patient underwent neck and mediastinal exploration with parathyroidectomy. At surgery, the enlarged bilateral superior and left inferior parathyroid glands were removed. Calcified adenoma like lesion from left superior mediastinum was removed along with thyrothymic tissue. The right inferior parathyroid was located in the thymus and was confirmed as hyperplastic parathyroid on frozen section (which was not visualized on sestamibi) and was autotransplanted in left brachioradialis muscle. Intraoperative calcium done showed 7.5 mg/dl and PTH was 5.27 ng/dl.

Pathological examination of the right superior, left inferior, and ectopic left superior mediastinum lesions was suggestive of parathyroid adenomas. Left superior lesion showed parathyroid with cells showing focal mild anisonucleosis, rare mitosis, broad trabeculae, foci with capsular invasion, and extracapsular vascular invasion, suggestive of PC. A final diagnosis of three parathyroid adenomas with one in ectopic location and left superior PC was made. The patient is on follow-up and asymptomatic now for HPT.

Discussion

Parathyroids are small lentiform glands that are normally located adjacent to the thyroid gland. Most people have two superior and two inferior parathyroid glands, however, there

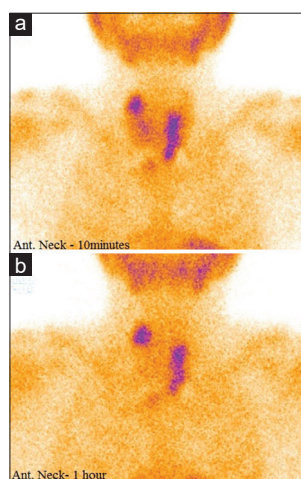


Figure 1: Dual-phase (early at 10 min [a], delayed at 1 h [b]) ^{99m}Tc-sestamibi planar images showed multiple foci of tracer retention in relation to the right superior, left superior, and left inferior lobes of the thyroid gland and ectopic focus in mediastinum

may be only three, or one or more supernumerary glands may be present. Variations in parathyroid gland locations are not only due to the glands' variable embryologic descent but also to the tendency of enlarged superior parathyroid glands to migrate posteriorly and inferiorly through fibroareolar tissue. Thus, localization of a parathyroid adenoma in three dimensions and differentiation of a superior parathyroid gland at the level of the inferior thyroid from an inferior parathyroid gland is important.^[4]

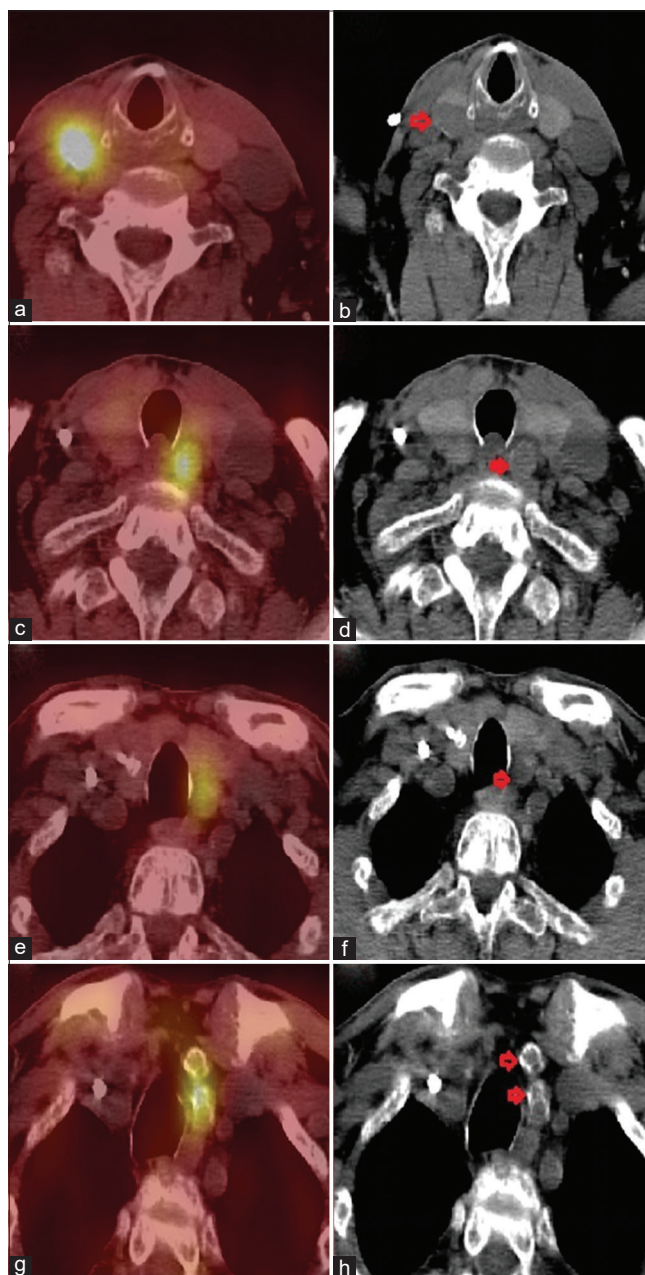


Figure 2: Single-photon-emission computed tomography/computed tomography fused and computed tomography images of the neck and mediastinum (a-h) localized hypodense nodular lesions with increased tracer retention in the following locations: right superior (a and b, adenoma) and left superior (c and d, adenoma), left inferior (e and f, carcinoma) and calcified lesion in the left upper paratracheal location in the thoracic inlet (g and h, adenoma)

PC is a rare malignancy, and it accounts for <1% of all cases of PHPT. The diagnosis becomes particularly challenging when there is no palpable neck mass. Palpable neck mass was seen in only 30%–76% of patients of PC, while <5% of patients with adenomas had a palpable mass in the neck.^[5] Our patient did not have a palpable neck mass. The diagnosis of malignancy was based on a strong clinical suspicion, with elevated serum calcium (>14 mg/dl) level and highly elevated levels of serum PTH (>5 times the normal levels). PC may be associated with familial HPT, in patients of HPT jaw tumor syndrome or in patients with CKD. Our patient had high level of PTH, serum calcium and CKD, suggestive of THPT.^[6]

PC may be associated with hyperplasia of other parathyroid glands in TPHT. However, it was rarely associated with adenoma of the other normal and ectopic supernumerary parathyroid glands. The occurrence of PC in a case of TPHT is very rare. Berland *et al.* reported the first case of PC developing in a patient on hemodialysis.^[7] Only 17 cases of PC in THPT in English literature were reported as mentioned by Khan *et al.*^[8] Compared to different parathyroid imaging methods, ^{99m}Tc-sestamibi scintigraphy for preoperative localization was found to be superior than other imaging modalities. A meta-analysis of the medical literature reported that the overall sensitivity of dual-phase ^{99m}Tc-sestamibi scintigraphy in comparison with high-resolution ultrasonography was 88% versus 78% for single adenomas, 30% versus 16% for double adenomas, and 44% versus 35% for multiple-gland hyperplasia.^[9]

However, the role of a sestamibi scan in diagnosing PC in secondary or tertiary HPT is as yet not clear. Sestamibi can be used as an indicator of proliferative parathyroid gland activity. PC can be assumed to have higher proliferative activity than parathyroid hyperplasia. Therefore, when a lesion of PC coexists with other lesions of parathyroid hyperplasia, an increased uptake in the sestamibi scan is suggestive of PC.^[10] In our patient, there is concomitant occurrence of multiple adenomas and PC associated with TPHT, which is a very rare presentation.

Conclusion

PC is a rare cancer, and occurs rarely in patients with THPT and CKD. In a patient with highly elevated serum PTH, associated PC, which is a rare presentation, should be suspected. ^{99m}Tc SPECT/CT sestamibi scintigraphy is a very useful one-stop shop investigation for parathyroid adenoma or carcinoma which will give the exact anatomical location of adenoma with its CT component and help surgeons

to locate and remove all lesions. Our case represents a very rare occurrence of multiple parathyroid adenomas in normally located parathyroid and ectopic location along with PC visualized in ^{99m}Tc-Sestamibi scintigraphy.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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