CASE REPORT

INCIDENTALLY DETECTED DIFFUSE LUNG UPTAKE ON TC-99M MIBI PARATHYROID SCAN DUE TO SMOKING-RELATED INTERSTITIAL LUNG DISEASE: FIRST CASE REPORT

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ABSTRACT

Diffuse lung uptake of Tc-99m MIBI is a rare condition on the parathyroid scan. A parathyroid scan was performed to localize parathyroid adenoma in a 42-year-old male with primary hyperparathyroidism. In dual-phase Tc-99m MIBI imaging, there was a focal persistent radiotracer uptake in the inferior aspect of the right thyroid lobe suggesting a parathyroid adenoma. In addition, unexpected diffusely increased MIBI uptake was noted in the lungs on both early and delayed images. The patient did not have a cardiac disorder and chest computed tomography (CT) was performed to investigate the underlying cause of diffuse MIBI uptake in the lungs. CT images showed ground-glass opacities (GGO) localized more prominently in the peripheral zones, pericardiac and peribronchovascular areas in both lungs. Mosaic attenuation and bronchiectasis were not present. The patient had a smoking history of 30 packs/year. The findings favoured smoking-related lung disease. Thus, the presence of diffuse MIBI lung uptake in our case was considered to be associated with smoking-related lung disease and probably desquamative interstitial pneumonia (DIP). This type of diffuse uptakes has been reported in cases with COVID-19 infection, HIV-associated lymphocytic interstitial pneumonitis, chemical pneumonitis, miliary tuberculosis, pulmonary interstitial fibrosis and end-stage restrictive heart failure in the literature. Determination of the underlying cause of diffuse MIBI lung uptake in scintigraphic studies is a fairly atypical condition. To the best of our knowledge, it is the first case report on this subject. Incidental MIBI lung uptake merits further evaluation.

Key Words: Tc-99m MIBI, parathyroid scan, diffuse lung uptake, desquamative interstitial pneumonia

Introduction

Primary hyperparathyroidism (PHPT) is typically caused by a solitary parathyroid adenoma, less frequently by multiple parathyroid gland disease and rarely by parathyroid carcinoma. Successful parathyroidectomy depends on preoperative exact localization and excision of all hyperfunctioning parathyroid glands. Dual-phase technetium-99m methoxy-isobutyl-isonitrile (Tc-99m MIBI) parathyroid scan is commonly used nuclear medicine technique along with ultrasound for localization of hyperfunctioning solitary or multiple parathyroid glands.[1] Although diffuse uptake in the lungs can be expected in patients with severe coronary artery disease and left ventricular failure on myocardial perfusion scintigraphy with Tc-99m MIBI.[2,3] Diffuse lung uptake in a Tc-99m parathyroid MIBI scan is not an expected situation and several cases are present in the literature. In addition, as far as known, there was no smoking-related ILD between reported cases who had unexpected or incidental diffuse lung uptake during scintigraphic studies with Tc-99m MIBI.[4-8] We

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present a case with PHPT demonstrating unexpected diffuse lung uptake of Tc-99m MIBI on parathyroid scan accompanied by clinical, radiological and scintigraphical findings. Herein, we described another pathology to the differential diagnosis of incidental diffuse MIBI lung uptake that could result from an underlying pulmonary pathology.

Case Report

A 42-year-old man with PHPT was referred to our nuclear medicine department for Tc-99m MIBI parathyroid scan. In his laboratory work-up, hypercalcemia (11.63 mg/dL; reference range 8.6-10.6 mg/dL), hypophosphatemia (2.1 mg/dL; reference range 2.5-4.5mg/dL) and elevated PTH level (210 pg/mL; reference range 15-65 pg/mL), as well as osteoporosis (T score of the lumbar spines: -2.8, T score of the left femur: -1.3 and T score of the right forearm: -4.9) were detected. Neck ultrasound examination showed mild heterogeneous echogenicity of the thyroid parenchyma, a hypoechoic nodule measuring 5x3 mm in the inferior pole of the right thyroid lobe and another 4x3 mm sized hypoechoic nodule at the the left lobe-isthmus junction.

Dual-phase Tc-99m MIBI parathyroid scan was performed for localization of parathyroid adenoma. At 15 minutes after 740 MBq (20 mCi) Tc-99m MIBI IV administration, early planar and SPECT images of the neck and upper-middle thorax were obtained. Delayed planar image was obtained at 2 hours after the injection. Early planar and SPECT images demonstrated physiological uptake of the radiopharmaceutical in the thyroid gland, and a little extension to downward of the inferior pole of the right thyroid lobe was also observed. Focal MIBI retention in the inferior aspect of the right thyroid lobe on delayed image was suggestive of a parathyroid adenoma. In addition, diffusely increased MIBI uptake was noted in bilateral lung fields on both early and delayed images (Fig.1).

Because diffuse MIBI lung uptake is a well-known finding that can be seen in patients with severe coronary artery disease and severely impaired left ventricular function on Tc-99m MIBI myocardial perfusion scintigraphy, the patient s medical records were reviewed for a possible cardiac disorder. He had neither a cardiac disease, nor cardiac symptoms and complaints. He did not have COVID-19 positivity. The patient had a smoking history of 30 packs/year. Therefore, chest computed tomography (CT) was performed to investigate the underlying cause of the diffuse MIBI lung uptake. CT images showed ground-glass opacities (GGOs) localized more prominently in the peripheral zones, pericardiac and peribronchovascular areas in the bilateral lungs. the mosaic attenuation pattern or oligemia was not detected.

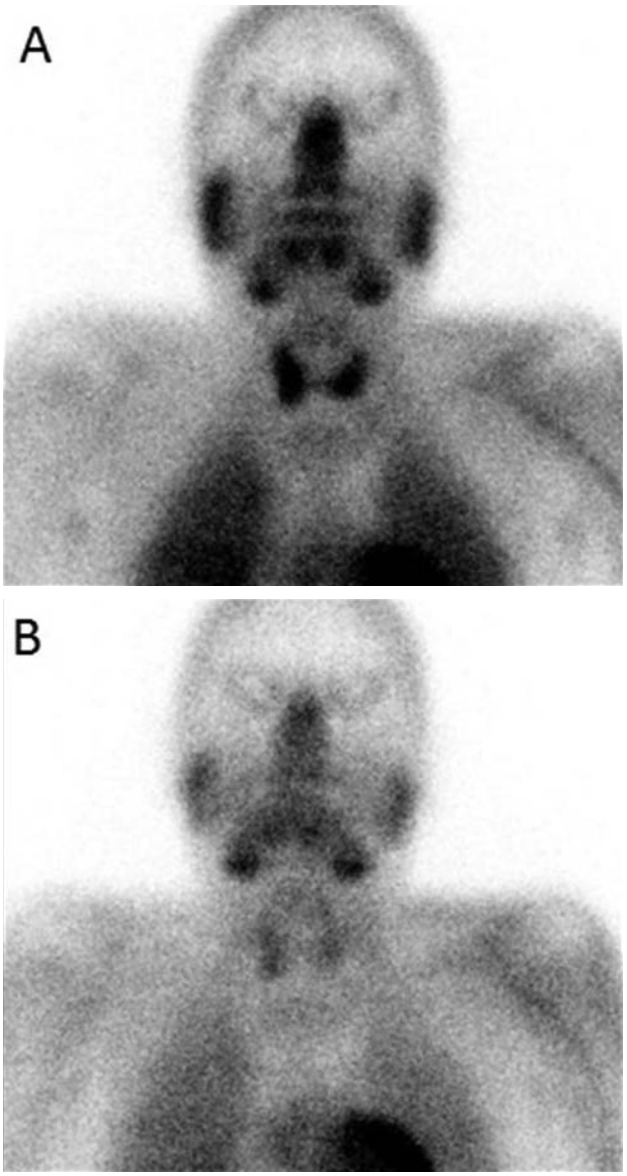

Figure 1: Early **(A)** and delayed **(B)** planar images of dual-phase Tc-99m MIBI parathyroid scan. On delayed image, focal activity retention suggesting parathyroid adenoma is observed in the inferior aspect of the right thyroid lobe, and unexpected diffuse MIBI lung uptake in both lungs is noted.

Vascular width in the normal areas was equal to that of GGO areas. GGOs were more prominent in the middle zones. Bilateral cardiophrenic and costophrenic angles were spared. The history of exposure to an offending antigen was not detected. The clinical and radiological findings were compatible with smoking-related ILD but pathologically, the diagnosis was not confirmed (Fig.2).

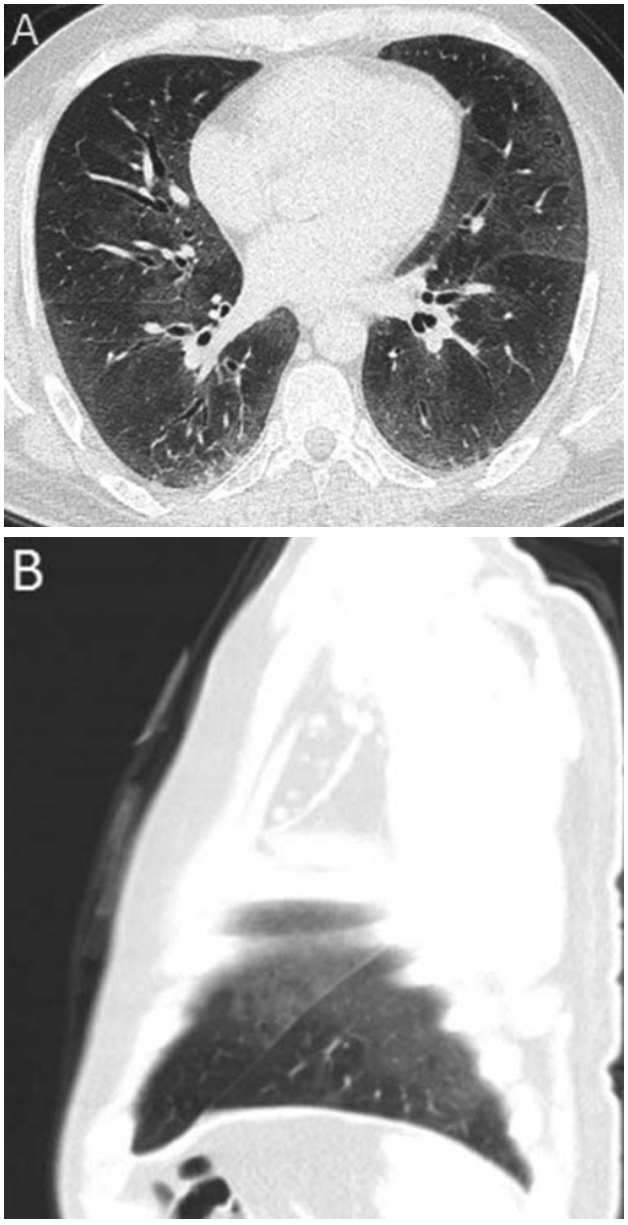

Figure 2: A) Bilateral peripheral, pericardiac and peribronchovascular patchy distribution of GGO areas were observed on axial CT image at the inferior pulmonary vein level. **B)** Sagittal CT slice shows that costophrenic and cardiophrenic angles are spared.

Discussion

Besides findings of parathyroid adenoma on parathyroid scan, unexpected diffusely increased MIBI uptake in bilateral lung fields was observed in our case. Similar unexpected diffuse lung uptake of Tc-99m MIBI on parathyroid scan has been reported in a patient with end-stage restrictive heart failure and this situation changed his management.[4] Diffuse MIBI lung uptake has also been reported in cases with COVID-19 infection, HIV-associated lymphocytic interstitial pneumonitis, chemical pneumonitis, pulmonary interstitial fibrosis due to sarcoidosis.[5-8] In addition to these case reports, some patients with miliary tuberculosis and pulmonary interstitial fibrosis due to systemic sclerosis demonstrated diffuse MIBI lung uptakes in two studies.[9,10] In another study, all patients with interstitial lung disease which is characterized by inflammation and fibrosis had diffuse MIBI lung uptake.[11]

Unexpected diffuse lung uptake of Tc-99m MIBI in our case was considered to be associated with smoking-related ILD when evaluated together with chest CT findings and clinical presentation. Other possible diagnoses such as non-specific interstitial pneumonia (NSIP), hypersensitivity pneumonia (HSP), COVID-19 were clinically and radiologically excluded.

In our case, cellular type NSIP was in the differential diagnosis due to the presence of GGO areas. However, the GGO distribution was located both centrally and peripherally. In addition, spared costophrenic angles were atypical for NSIP. No bronchiectasis was detected. There was no finding in favour of reticulation in the pattern. Therefore, the radiological appearance was not compatible with NSIP.[12]

HSP, formerly known as extrinsic allergic alveolitis,is a rare immune system disorder that affects the lungs. The main mechanism of the disease is inflammation of the alveoli and bronchioles resulting from hypersensitivity to inhaled organic dust and molds. Allergen inhalation triggers a process of inflammation in the lung that progresses to fibrosis.[13] There was no allergen exposure in our patient. Although spared costophrenic angles and the presence of GGO conformed to non-fibrotic type HSP according to the new classification, radiological findings were not compatible with HSP due to the absence of centrilobular nodules

and the absence of mosaic attenuation. HSP was excluded clinically and radiologically.[14]

COVID-19 is characterized by GGO and consolidation involving the peripheral, basal, and posterior lung regions. It is in the differential diagnosis in our patient due to the presence of diffuse GGO. However, there was no clinical or laboratory evidence in favour of an infective process in our patient.[15,16]

Smoking related ILD was considered as a diagnosis of exclusion in the patient. However, it could not be proven pathologically. In this group, there are two different disease groups as desquamative interstitial pneumonia (DIPand (respiratory bronchiolitis) RB-ILD. These two interstitial lung diseases are histopathologically close to each other and are related to smoking. As in our patient, the patients have a long-term smoking history. RB-ILD presents with centrilobular nodules accompanying GGO areas with upper lobe involvement. Mosaic attenuation is another common finding. In advanced stages, honeycomb lung disease may accompany. As can be seen, the findings are distributed in a very wide range.

DIP predominantly affects the male gender. The average age group is 50. The main pattern of DIP is GGO. Basal and peripheral appearance is typical. The diagnosis of our patient is more compatible with DIP.[17,18]

Tc-99m MIBI is a lipophilic cathionic complex and localized at intramitochondrial anionic proteins in the cells.[17] Diffuse lung uptake of Tc-99m MIBI in our case was most likely secondary to extensive inflammatory parenchymal response. The extensive inflammatory cells infiltration in GGO areas may explain the diffuse lung uptake of MIBI.

Conclusion

Diffuse MIBI lung uptake is a rare finding on Tc-99m MIBI parathyroid scan. In our case unexpected diffuse lung uptake of Tc-99m MIBI was found to be associated with smoking related ILD.To determine underlying cause of MIBI lung uptakes in scintigraphic studies is very rare. As far as we know, it is the first case report in this subject.

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