

Ring appearance on Tc-99m MIBI thoracic SPECTs and increased uptake on Tc-99m HMDP thoracic SPECTs in a pulmonary mass of small cell carcinoma

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Tc-99m MIBI is taken up avidly by viable tumor tissue and does not accumulate in the necrotic carcinoma. We present a patient who underwent Tc-99m MIBI and Tc-99m HMDP thoracic SPECTs: a large area of increased MIBI uptake with central photopenia (ring appearance) in the right upper lung localizes bone imaging agent and does not localize multiple areas of intense uptake in the metastatic hilar mediastinum lymph nodes. Rapid growth of tumor cells in the lung leading to central necrosis/ischemia accounts for bone imaging agent localization in the tumor, as well as the ring-appearance of lung mass on Tc-99m MIBI imaging. These findings may reflect less viability of the lung tumor as compared with intense MIBI uptake in hilar/mediastinal lymph node uptake without bone agent localization.

Key words: small cell carcinoma of the lung, Tc-99m MIBI SPECT, Tc-99m HMDP SPECT, photopenia, bone agent extraosseous localization

CASE REPORT

A 56-YR-OLD MAN (SW4997) complained of cough with hemoptysis for three weeks; he had three episodes of bronchitis and as a result lost 9.1 kgs of body weight over the previous year. He smoked three packs of cigarettes a day for 27 years. Physical exam revealed diffuse inspiratory and expiratory wheeze in both lungs. Chest radiograph showed a mass lesion in the right lung. CTs of the chest showed a large mass lesion in the right upper lung with several enlarged mediastinal lymph node (Fig. 1). Tc-99m HMDP planar bone images showed no focal area of increased uptake to suggest bone metastasis, but did display a suspicious area of increased uptake in the right upper lung. SPECTs of the thorax showed a large focal area of increased uptake in the right upper lung posteriorly (Fig. 2). Tc-99m MIBI thoracic SPECTs performed seven days later showed ring appearance of the tumor mass in the right upper lung and areas of intense uptake in the hilar/mediastinal lymph nodes (Fig. 3). A bronchial wash

and biopsy confirmed small cell carcinoma of the lung. The patient was undergoing chemotherapy.

DISCUSSION

Tc-99m MIBI has been introduced to use myocardial perfusion imaging,¹ and noncardiac applications of the agent have successfully localized primary and secondary malignant lesions of the lung, breasts, thyroid, parathyroid, brain, bone and liver.²⁻¹¹

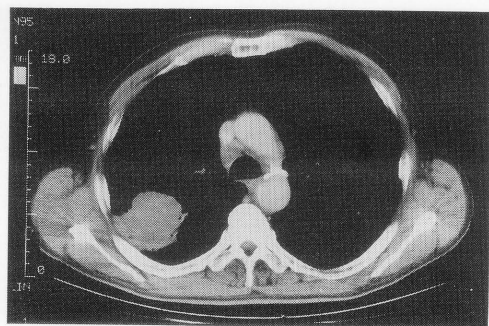
Tc-99m MIBI can be used as a sensitive indicator of myocardial cell viability¹¹ because MIBI does not accumulate at all in the necrotic or irreversible in the ischemic myocardial tissue.^{1,13-16}

Likewise, absence of MIBI uptake in bronchogenic carcinoma may be due to tumor necrosis.^{2,16,17} Tumor necrosis of lung cancer on MIBI images showed focal uptake with a central hypoactive focus that paralleled tumor necrosis seen on CT.¹⁸

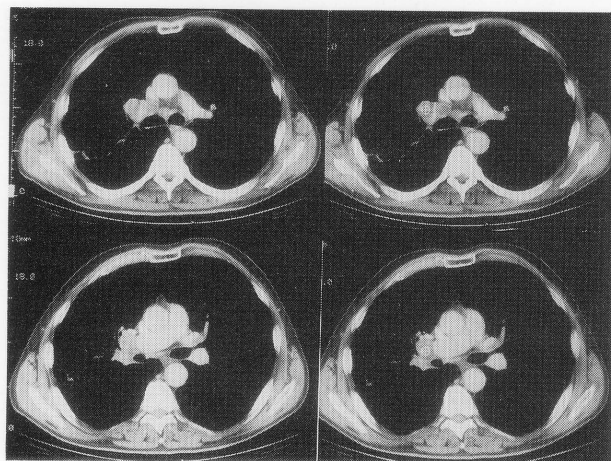
Tc-99m MIBI is avidly taken up by viable tumor tissue and effectively imaged in detection of hilar/mediastinal lymph node metastases.¹⁸ MIBI uptake reflects viable tumor tissue by differentiating viable residual/recurrent disease from post therapy necrosis.¹⁷ As a consequence,

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A



B

Fig. 1 A: CT of the thorax shows a large mass lesion in the posterior aspect of the right upper lung at the level of the aortic arch. B: CTs of thorax show several enlarged mediastinal lymph nodes.

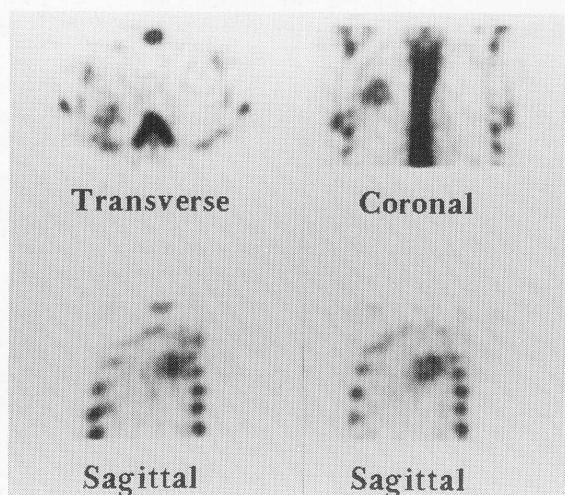
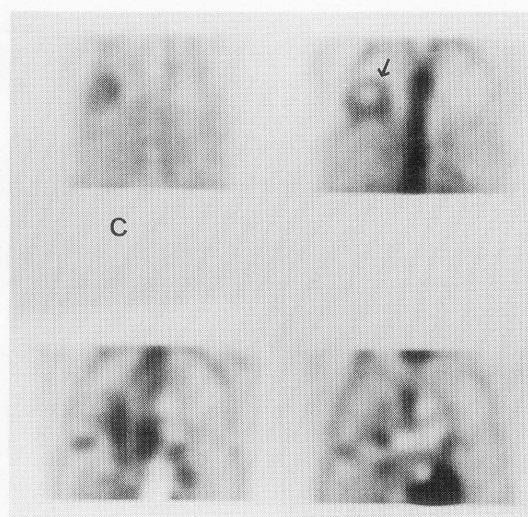


Fig. 2 Tc-99m HMDP bone SPECTs of the thorax show a large focal area of increased uptake in the right upper lung, posteriorly.

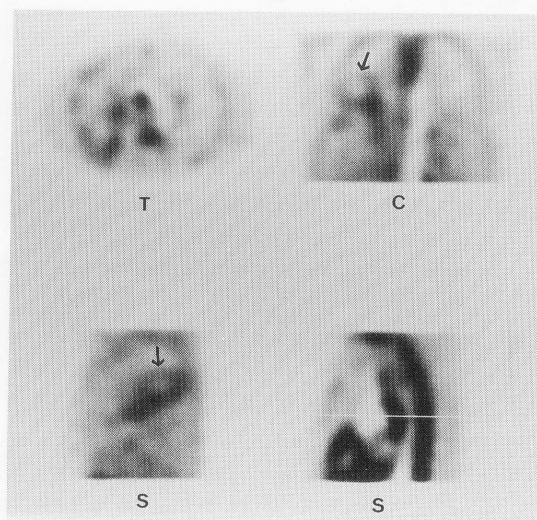
MIBI has been proposed to be a valuable clinical tool in the follow-up of patients with lung cancer.

Our patient's ring-appearance of the right upper lung tumor on MIBI images reflects tumor irreversible ischemia/



C

A



T

C

S

S

B

Fig. 3 A: Tc-99m MIBI thoracic SPECTs (coronal, C, section) show increased uptake area with central photon deficiency (arrow) in the right upper lung, posteriorly. B: Tc-99m MIBI thoracic SPECTs in transaxial (T), coronal (C), sagittal (S) sections show a large ring-appearance of mass lesion and areas of intense uptake in the mediastinal areas including ring-like appearance (arrows).

undergoing tumor necrosis. Tumor necrosis shown on concurrent CT of the thorax was mild, however, the necrosis may not have been severe enough to appear. Scintigraphies were more sensitive, however, in demonstrating earlier pathophysiologic processes of ischemia adjacent to necrosis, and depicted central photopenia of Tc-99m MIBI tumor uptake (ring appearance) (Fig. 3) and bone agent localization (Fig. 2).

Bone scintigraphy using Tc-99m HMDP has been widely used for the detection of bone metastasis and extra-osseous localization of bone imaging agent has been observed¹⁸⁻²⁷ in various malignant tumors. Bone imaging agent localization in our patient's lung tumor is similar to bone agent localization in massive/multiple

metastases of the liver from colon cancer.²⁸ It has been proposed that tissue necrosis/irreversible ischemia is related to bone agent localization, since massive hepatic necrosis has been reported diffuse uptake of bone agent.²⁹

Intensity of uptake MIBI depends on blood perfusion and tumor viability. The intensity of our patient's mediastinal lymph node uptake has been shown to be much higher than that of the original tumor mass in the lung. These findings represent that lung tumor undergoing necrosis/necrotic change and that viability of mediastinal metastatic lymph nodes appear to be high. Intensity of MIBI uptake of tumor may indicate tumor viability.

In conclusion, ring-appearance of lung mass on MIBI imaging associated with bone imaging agent localization may reflect the tumor ischemia/undergoing necrosis. Whether the viability of tumor with ring-appearance on MIBI imaging and bone agent localization is less than the tumor without ring appearance and localization should be further investigated.

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