

I-123 IMP scintigraphy in two patients with primary pulmonary malignant lymphoma

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¹²³I-IMP lung scintigraphy was performed in two patients with primary malignant lymphoma, whose radiographic features were difficult to differentiate from inflammatory or atelectatic lesions. ¹²³I-IMP scans revealed a defect in the lesions on the delayed (24 hr) image, suggesting a tumorous lesion. ¹²³I-IMP scan may contribute to differential diagnosis of this rare tumorous entity from benign disorders having a different appearance.

Key words: ¹²³I-IMP, pulmonary malignant lymphoma, lung neoplasms

INTRODUCTION

N-isopropyl-p-[Iodine-123]iodoamphetamine (¹²³I-IMP) that was originally designed for brain scanning has been used in the assessment of various pulmonary diseases due to its high uptake by the lung.¹⁻¹³ A recognized characteristic features of this agent is its increasing accumulation in pneumonic or atelectatic lesions with time after its injection, while it does not accumulate in such lesions replacing normal lung tissue such as necrosis or malignant tumors.³⁻⁸ ¹²³I-IMP lung scanning has therefore been applied to the differentiation of lung cancer from its secondary changes, and from other noncancerous lung diseases exhibiting infiltrates on chest radiography.⁵⁻⁸

Primary pulmonary malignant lymphoma (PML) is a rare disorder which initially appears as a small peripheral nodule and progresses to form a mass-like consolidation with segmental or lobar distribution.^{13,14} Because other air space diseases caused by a wide variety of benign disorders can also occasionally show the same radiographic manifestations, PML is often misdiagnosed as a benign disease.¹⁴ However, it is postulated that ¹²³I-IMP lung scan may have the potential to differentiate it from other benign disorders. In this paper, we present two patients with PML and document the diagnostic potential of ¹²³I-IMP as a non-invasive method for its differential diagnosis from other benign disorders. To our knowledge, this is

the first report on ¹²³I-IMP scan performed in PML.

Method of ¹²³I-IMP Lung Scintigraphy

A dose of 111 MBq ¹²³I-IMP was injected intravenously, and plane static images were obtained 20 min (early scan) and 24 hr (delayed scan) later, with a medium energy multi-parallel hole collimator attached to a gamma camera (Toshiba, GCA 901-A). A 20% window centered on the 159 keV photo-peak was used for each view. In addition, SPECT was performed to assess the distribution of ¹²³I-IMP on the delayed scan with the same single head detector apparatus equipped with a slant hole collimator.

CASE REPORTS

Case 1

Six years ago, a 54-year-old female was referred to our hospital because of a persistent dry cough. Initial chest radiography showed a segmental consolidation in the middle lobe. On chest CT, the consolidation in the right S⁴ spreaded from the hilar region to the peripheral area. Bronchoscopy revealed a patent right middle lobe bronchus, and bronchial washing showed no malignancy. The shadow did not improve despite the administration of antibiotics. Thereafter, he was asymptomatic and was followed up for 6 years, with a presumed diagnosis of organizing pneumonia or middle lobe syndrome. The size of the consolidation showed a tendency to gradually increase, but at one time slight shrinkage was observed. The patient was readmitted for recurrent cough. At the time of admission, physical examination revealed no lymphadenopathy. Chest radiography showed more

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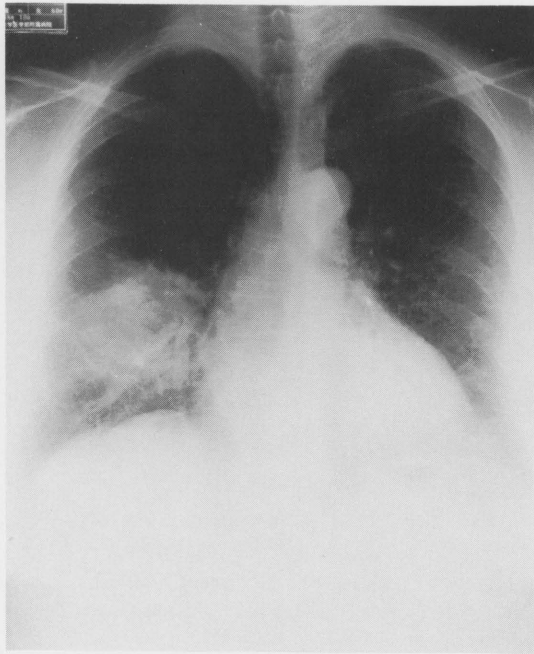


Fig. 1-A Posteroanterior chest radiography showing ill-defined lobar consolidation in the right middle lobe.

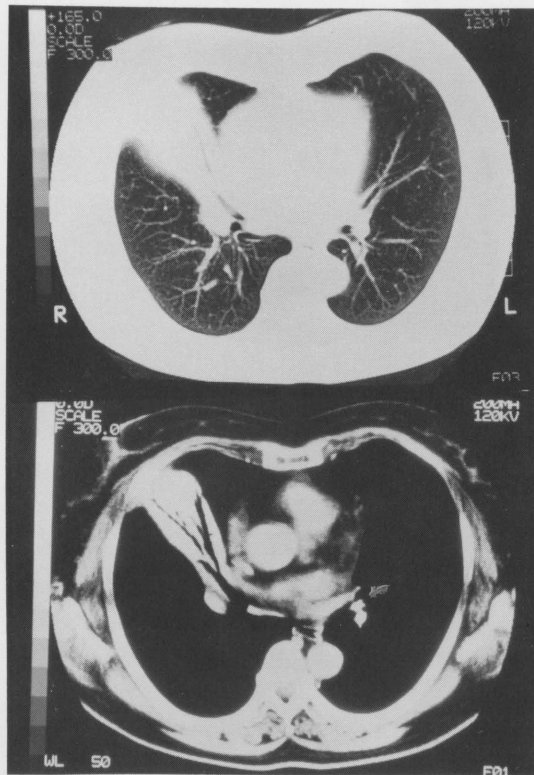


Fig. 1-B Chest enhanced CT revealing the consolidation is homogeneously enhanced except for the air bronchograms.

extensive lobar consolidation occupying the entire middle lobe (Fig. 1-A). On the chest CT, patent bronchi could be seen extending to the periphery within the lobar consolidation (Fig. 1-B). ^{67}Ga scan showed an intense



Fig. 1-C ^{123}I -IMP SPECT obtained 24 hr after injection showing a defective uptake corresponding to the lesion (►).

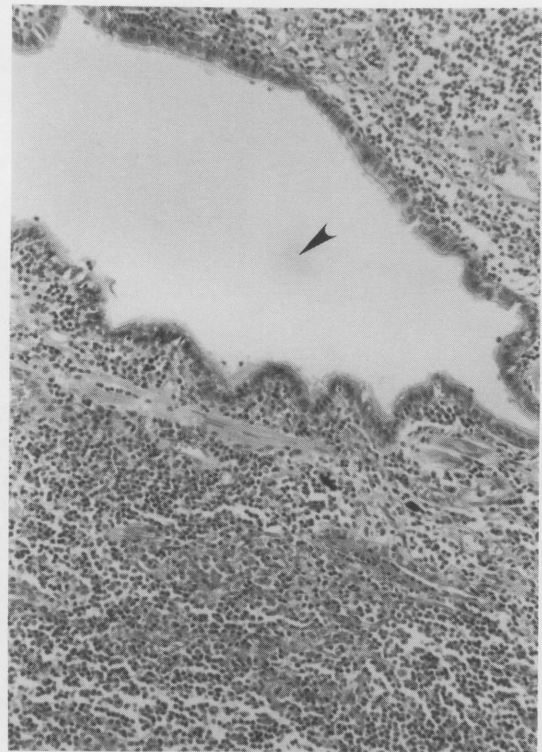


Fig. 1-D A low power photomicrograph of the resected lung showing diffuse lymphoma cellular infiltrate that obscures normal lung architecture. However, the lumen of the proximal bronchi is patent (►).

uptake, and $^{99\text{m}}\text{Tc}$ -MAA scan showed a defect, corresponding to the lesion. Both the early and delayed planar ^{123}I -IMP scan images and a SPECT image obtained 24 hrs after the injection showed a defect in ^{123}I -IMP uptake within the lesion (Fig. 1-C). Because the gradually progressive consolidation and ^{123}I -IMP scan were suggestive of a tumorous lesion, bronchoscopy was reperformed, and the biopsy suggested malignant lymphoma. Right thoracotomy was performed and a mass-like consolidation occupying the entire middle lobe was found. Micro-

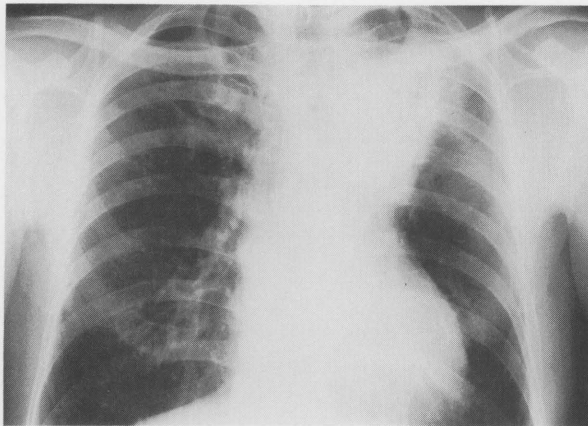


Fig. 2-A Posteroanterior chest radiography showing massive consolidation adjacent to the aortic arch in the left upper lobe and segmental consolidation in the right upper lobe.

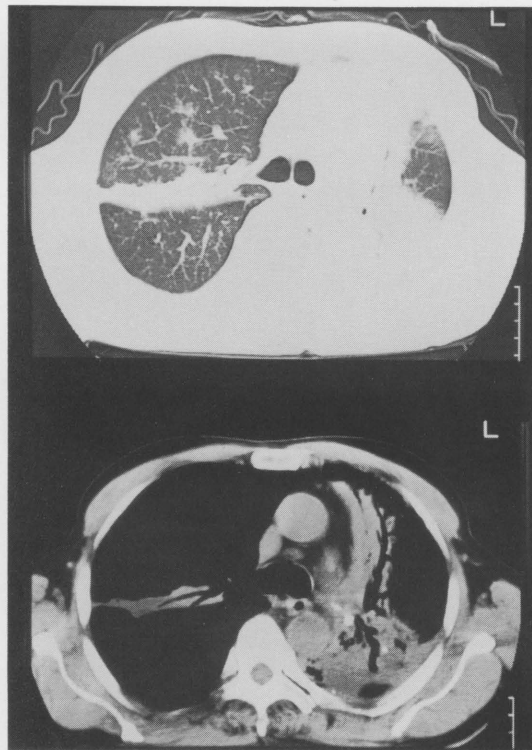


Fig. 2-B Chest CT showing mass-like consolidation with shaggy borders and air bronchograms in the left upper lobe. Also, ill-defined segmental consolidation was seen in the right upper lobe.

scopically, the normal lung parenchyma was effaced by a monotonous sheet of small round lymphocytes (Fig. 1-D), and mono-clonal antibody studies were consistent with non-Hodgkin's diffuse B-cell type lymphoma.

Case 2

Three years ago, a 68-year-old man was referred to our hospital because of a slight cough and sputum. Initial chest radiography showed a massive consolidation in the

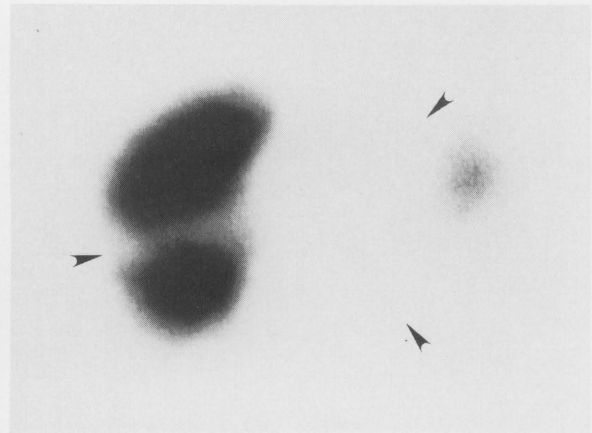


Fig. 2-C ^{123}I -IMP SPECT obtained 24 hr after injection showed a defect corresponding to the consolidations of bilateral lobe (►).

left upper lobe and a small consolidation in the right upper lobe. Although antituberculous therapy was initially administered on the suspicion of tuberculosis, these shadows did not improve. During the 3-year follow-up period, chest radiography did not show significant progression of these lesions. The patient again complained of increased cough and sputum and was admitted for further examination. At the time of admission, physical examination revealed no lymphadenopathy. Chest radiography and CT showed consolidations with air bronchograms in both upper lung fields (Figs. 2-A,B). ^{67}Ga scan showed intense uptake in the lesions, but no extrathoracic abnormal accumulation was found. $^{99\text{m}}\text{Tc}$ -MAA scanning revealed defects corresponding to these consolidations. Both early and delayed planar ^{123}I -IMP scans showed defective uptake in these consolidations, as well as a $^{99\text{m}}\text{Tc}$ -MAA perfusion scan, and ^{123}I -IMP SPECT performed 24 hr after the injection also demonstrated a defect in ^{123}I -IMP uptake within these lesions (Fig. 2-C). Because the ^{123}I -IMP scan pattern was suggestive of a tumorous lesion, bronchoscopy was performed and biopsy results revealed that the normal lung parenchyma was effaced by a homogeneous sheet of small round lymphocytes in both lesions. Subsequent monoclonal antibody studies were consistent with non-Hodgkin diffuse B-cell type lymphoma. After a 6-month follow-up period, no other extrathoracic lesions were found and a diagnosis of PML was made.

DISCUSSION

More than 90% of ^{123}I -IMP is rapidly localized within the lung after IV injection.¹⁻³ Microautoradiography has revealed the specific location to be the endothelium of the microvasculature of the lung,¹ and other investigations have revealed that it is captured by the so-called amine receptors.^{1,15} The characteristic features and kinetics of ^{123}I -IMP in malignant tumors are that it is not accumulated

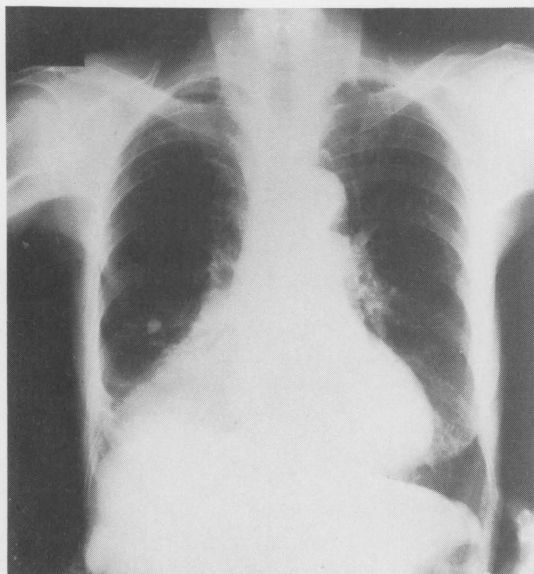


Fig. 3-A Posteroanterior chest radiography showing atelectasis of right middle lobe in a patient with right middle lobe syndrome due to obstructive inflammatory changes of the orifice of middle lobe bronchus.

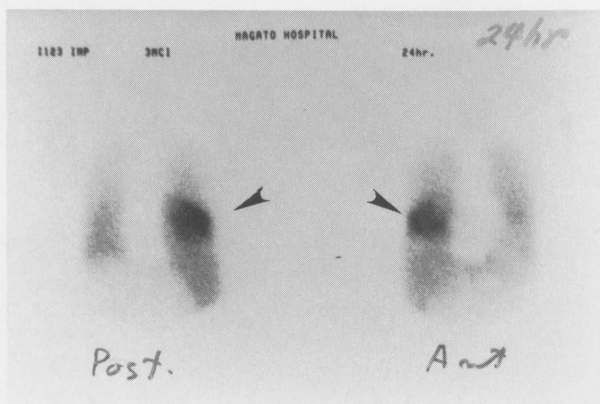


Fig. 3-B Anterior and posterior images of ^{123}I -IMP scan obtained 24 hr after injection showing intense uptake corresponding to the lesion (►).

intratumorally in either early or delayed images. On the contrary, in benign lesions such as inflammation and atelectasis, ^{123}I -IMP accumulation in the lesion was seen on later images (3–24 hr after injection), although early images show a defect or reduced uptake very similar to that observed on $^{99\text{m}}\text{Tc}$ -MAA perfusion scans.^{2–8} Among those we have seen, ^{123}I -IMP scan in a case of right middle lobe syndrome is shown in Figure 3. In this case, ^{123}I -IMP scan obtained 24 hr after injection showed intense uptake within the lesion, although $^{99\text{m}}\text{Tc}$ -MAA scan showed a defect corresponding to the lesion. This finding is in contrast with the present two cases showing a defect in the lesion.

PML is a rare disorder, and the patients are often asymptomatic.^{13,16–19} On chest radiography, most of the

lesions show only slow progression over a period of several years, and progress to form mass-like consolidations and rarely involve a segment or entire lobe.^{13,14} These consolidations often have a characteristic features which is a tendency to have air bronchograms, as seen in our cases.^{14,20} However, similar radiographic manifestations can be caused by a wide variety of benign disorders.^{13,14,20} For the early diagnosis of PML, the condition must be initially differentiated from benign disorders. However, the diagnostic difficulty of differentiation of PML from other inflammatory lesions despite transbronchial biopsy by bronchoscopy has been reported.^{15,21–23}

In the present cases, ^{123}I -IMP scan did not show abnormal uptake within the lesions in either early or delayed images, indicating that these consolidations were tumorous or malignant lesions and not benign disorders such as inflammation or atelectasis. The ^{123}I -IMP scan therefore contributed to accurate diagnosis.

As the major cause of the absence of ^{123}I -IMP uptake within tumorous lesions, it is speculated that normal endothelial cells are replaced or destroyed by tumor cells and the receptor density within the tumorous lesion is reduced.^{3,7} In Case 1, the resected specimen revealed that the normal lung parenchyma was replaced by lymphoma cells in the lesion, but the structure of relatively large bronchi remained patent (Fig. 1-D).

On the other hand, regarding the reasons why ^{123}I -IMP uptake is seen in areas where little $^{99\text{m}}\text{Tc}$ -MAA is found, showing abnormal accumulation within benign lesions such as atelectatic or inflammatory disorders in the later images after injection, it is speculated that non-particulate ^{123}I -IMP can reach more peripheral microvasculature than the large $^{99\text{m}}\text{Tc}$ -MAA microspheres, and that ^{123}I -IMP is captured by so-called amine receptors on the surface of endothelial cells remaining in these lesions. Although ^{123}I -IMP accumulation is initially decreased due to reduced circulation carrying this agent, and these lesions are depicted as defects in the early image, the subsequent slow wash-in and slower wash-out of this agent in these lesions compared to the normal lung cause abnormal accumulation in the later images.^{2,3}

^{67}Ga scan shows an intense uptake in PML lesions, as seen in our cases. Although this agent may contribute to the detection of metastatic lesions and to determining the clinical stage, it cannot differentiate malignant from other benign lesions because of its nonspecific accumulation in various inflammatory lesions.

When PML is confined to the lung parenchyma without extension into the mediastinum or chest wall, 5-year survival rates of 80–90% have been obtained when complete resection is achieved,^{13,16,18,21} suggesting the importance of early diagnosis. If ^{123}I -IMP scan had been performed initially in our cases, it would have contributed to the earlier detection of this malignant disorder. This scan may be helpful also in management as a method of re-examination or a further diagnostic procedure, when broncho-

scopic biopsy fails to diagnose malignancy.

In conclusion, we evaluated ^{123}I -IMP scintigraphy in two cases of PML and demonstrated that this rare malignant entity showed no accumulation of ^{123}I -IMP, as in the case of other tumorous lesions. In patients in whom radiographic features are difficult to differentiate from other benign conditions, as in the present cases, ^{123}I -IMP scan may be performed first as a non-invasive method to differentiate from benign lesions.

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