Pneumocystis Carinii Pneumonia Presenting as Focal Bibasilar Uptake on Gallium Scan During Aerosolized Pentamidine Prophylaxis

Rohit Katial, Wayne Honeycutt and Stephen G. Oswald

Department of Medicine; Nuclear Medicine Service, Department of Radiology, Dwight D. Eisenhower Army Medical Center, Fort Gordon, Georgia

Radionuclide imaging with gallium is commonly performed in the evaluation of patients with suspected *Pneumocystis carinii* pneumonia (PCP) and is known to be highly sensitive for detection of PCP. We present a patient with acquired immunodeficiency who developed PCP in the bases of both lungs while on aerosolized pentamidine prophylaxis. A gallium scan demonstrated focal uptake in the lung bases, a pattern generally not associated with PCP, and was extremely useful in guiding bronchoscopy. An aerosol ventilation scan performed after complete resolution of the clinical illness demonstrated prominent ventilatory defects in the lung bases corresponding to the regions of previous gallium uptake. We speculate that the underlying ventilatory abnormality may have contributed to poor drug delivery to the lung bases. *Pneumocystis carinii* pneumonia must be considered with any focal area of gallium accumulation in patients receiving aerosolized pentamidine.

Key Words: *Pneumocystis carinii* pneumonia; gallium scan; aerosolized pentamidine

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Pneumocystis carinii pneumonia (PCP) is a major cause of morbidity for patients infected with the human immunodeficiency virus (HIV). Radionuclide imaging with gallium is commonly performed in the evaluation of patients with suspected PCP. Much of the early literature demonstrated that the predominant pattern of gallium uptake in the patient with PCP was that of diffuse gallium lung activity of varying intensity (*1–6*). Gallium scanning was found to be extremely sensitive in the detection of PCP with sensitivities approaching 100% (*2,3,7*). The gallium scan may be positive when the chest x-ray is normal (*3–5*). A negative scan generally eliminates PCP from consideration (*8*).

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For correspondence or reprints contact: Stephen G. Oswald, 4140 Knollcrest Circle N., Martinez, GA 30907.

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To reduce the incidence of PCP, it is recommended that HIV patients with a CD4+ lymphocyte count of less than 200 cells/cubic ml receive prophylactic therapy. Inhalation of aerosolized pentamidine is commonly used for PCP prophylaxis. It has been well documented that the patterns of abnormal findings on chest x-ray and gallium scanning may change with the use of aerosolized pentamidine. Rather than the typical pattern of diffuse radiographic infiltrate or gallium uptake, upper lobe abnormalities become much more prominent (*9–13*). We present a patient who developed PCP in the bases of both lungs while on aerosolized pentamidine. Gallium scan was remarkable for focal lower lobe uptake, a pattern generally not associated with PCP. In this patient, gallium scanning was useful in directing the bronchoscopist in obtaining diagnostic material.

CASE REPORT

A 36-yr-old male with HIV presented with a dry hacking cough of two mo duration. He had fevers up to 38.3°C and night sweats. He denied any nasal discharge, shortness of breath, chest pain, nausea, vomiting, diarrhea, weight loss or history of prior opportunistic infection. His medications on admission included zidovudine (AZT) 500 mg per day and aerosolized pentamidine 300 mg per mo.

Physical examination revealed a blood pressure of 110/70 mm Hg, pulse of 88 beats per min, respiratory rate of 18 breaths per min and temperature of 37.5°C. He was a well-developed male in no acute distress. Skin, head, ear, eyes, nose, throat, neck, lung, cardiovascular, abdominal, neurologic, genital and rectal examinations were unremarkable.

Laboratory studies revealed a white blood count of 2.5 × 10^9/liter with an absolute lymphocyte count of 30 cells/cubic ml. Hemoglobin and hematocrit were 13.4 g/dL and 37%, respectively. The platelet count was 171,000. Serum electrolytes, liver associated enzymes, blood and respiratory cultures, fungal serology, and cerebrospinal fluid were unremarkable, except for a lactate dehydrogenase (LDH) of 258 IU/liter (normal: 100–250 IU/liter). Toxoplasma and cytomegalovirus immunoglobulin-M antibodies were negative as was a test for mycoplasma antibody. Fluorescent treponemal antibody was nonreactive. An arterial blood gas at rest on room air revealed a pH of 7.40, pCO_2 of 40 mm Hg, pO_2 of 93 mm Hg. The alveolar–arterial oxygen gradient ($P[A\text{-}a]O_2$) at rest was 7 (normal: less than or equal to 15). The

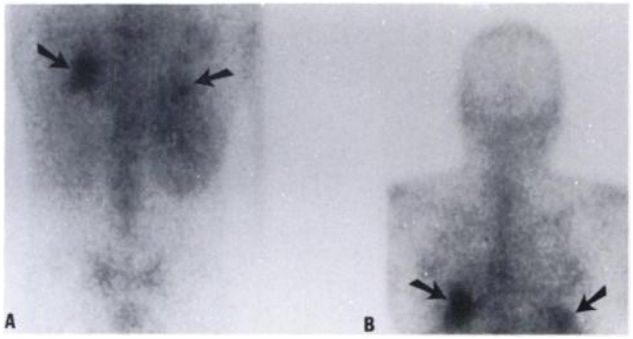

FIGURE 1. (A) Posterior view of lower chest and abdomen. (B) Posterior view of chest. Arrows indicate gallium accumulation in lung bases.

diffusing capacity of the lung (DL_{CO}) was 28 ml/min/mm Hg (83% of predicted). Chest roentgenogram (CXR) was normal.

A gallium scan was obtained 72 hr after the intravenous administration of 5 mCi (185 MBq) of ^{67}Ga citrate. Images were acquired on a large field-of-view gamma camera (Sophy DSX, Sopha Medical, Columbia, MD) using a medium energy collimator. Each image was obtained for 1000K counts or 10 min, whichever came first. An area of moderately intense focal uptake was seen in the base of the left lung with a second much less intense region noted in the base of the right lung (Fig. 1). A lateral view confirmed the increased activity to be in the region of the posterior segments of both lower lobes (Fig. 2). The patient underwent bronchoscopy and a bronchoalveolar lavage (BAL) was performed in the posterior segments of the right and left lower lobes. The BAL was negative for acid fast bacillus, fungus and bacteria. However, the methenamine silver stain was positive for *pneumocystis carinii* bilaterally. The patient was begun on intravenous pentamidine and clinically improved.

A repeat gallium scan 2 mo later (not shown) demonstrated normal lung activity with no evidence of residual increase gallium accumulation in the posterior bases. At that time a ventilation lung scan performed with aerosolized technetium diethlyenetriaminepentacetic acid (DTPA) revealed ventilatory defects in the base of each lung corresponding to the regions of previous gallium accumulation (Fig. 3).

DISCUSSION

Pneumocystis carinii pneumonia in the HIV population is commonly suggested by the clinical presentation of dyspnea, fever and nonproductive cough. The typical abnormalities seen on diagnostic evaluation include diffuse infiltrates on CXR, diffuse lung uptake on gallium scan, hypoxemia on the arterial blood gas determination, reduced DL_{CO}, and increased $P(A\text{-}a)O_2$. Our patient's clinical presentation was suggestive of PCP despite a normal CXR, DL_{CO}, and arterial pO_2. A gallium scan was obtained in an effort to document an inflammatory process. Focal accumulation of gallium was seen in the posterior base of each lung, a pattern not typically seen with PCP. This study proved extremely useful in guiding bronchoscopy to the abnormal region of the lung facilitating a definitive diagnosis.

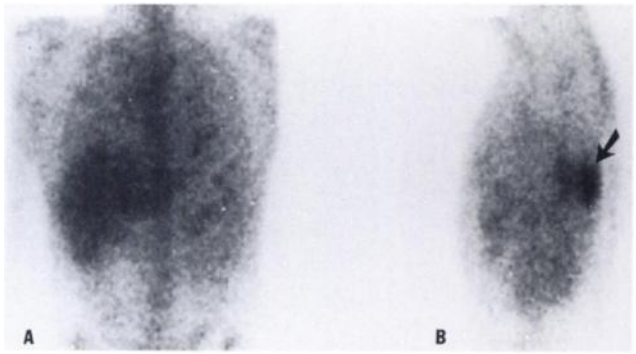

FIGURE 2. (A) Anterior view of chest. (B) Left lateral view of chest. Arrows indicated gallium accumulation in lung base.

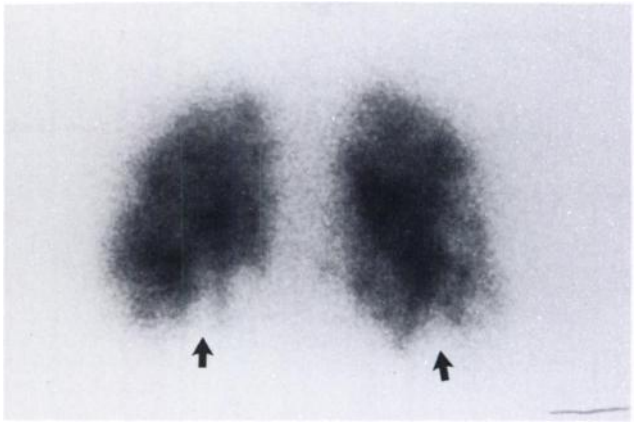

FIGURE 3. Posterior view of ventilation scan. Arrows indicate ventilatory defects in lung bases corresponding to regions of previous gallium accumulation.

Diffuse homogenous uptake in the lungs is the most common finding on gallium scanning in patients with PCP, although diffuse heterogenous and focal uptake may also be found (*8*). With the use of aerosolized pentamidine there have been reports of atypical presentations of PCP including apical lung disease, pneumothoraces and extra-pulmonary infections without lung involvement (*9–14,16,17*). It has been suggested that these atypical presentations are due to poor drug delivery to the apices of the lungs (*10,13*), but others have speculated that additional factors may be important (*15*). The ventilation study with aerosolized ^{99}Tc-DTPA demonstrated prominent ventilatory defects in the posterior base of each lung corresponding to the areas that had accumulated gallium at the time of the patient's acute illness. At the time of the ventilation study the patient was clinically well and no residual gallium uptake could be seen. This implies that the acute infection itself was not responsible for the ventilatory defects. The cause of the ventilatory abnormalities is unknown, although more subtle ventilatory abnormalities may be seen in other areas of the lung (Fig. 3). It is our speculation that the focal occurrence of PCP in the basilar segments was related to reduced delivery of aerosolized pentamidine to these areas.

Although focal uptake of gallium in the base of the lung resulting from PCP has been previously reported (*10*), it is

not a widely recognized pattern. When performing gallium imaging in patients who have been using aerosolized pentamidine, focal infection with PCP is likely. Infection with PCP must be considered with any focal gallium accumulation in these patients.

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