parenchyma. However, few reports have appeared of mediastinal emphysema associated with hypersensitivity pneumonitis. In hypersensitivity pneumonitis such as farmer's lung or summer-type hypersensitivity pneumonitis, common symptoms are chronic cough, dyspnea, and fever, but mediastinal emphysema is a very rare complication.

In both acute and chronic stages of farmer's lung, obstructive bronchiolar lesions (obstructive bronchiolitis) are common pathologic features. In our patient, the open lung biopsy specimens demonstrated obstruction or narrowing of respiratory bronchioles resulting from development of numerous epithelioid cell granulomas in the peribronchial area and overdistention or disruption of the surrounding alveoli. In children, bronchiolitis-caused viral infection is considered to be an etiologic factor of mediastinal emphysema.  

On the basis of these pathologic conditions, we postulate that in this patient, obstructive bronchiolitis associated with granulomatous alveolitis assumed an important role in the development of mediastinal emphysema in addition to the coughing spasm, ie, rupture of alveoli resulted from increased intra-alveolar pressure probably occurring as a result of check valve bronchiolar obstruction secondary to bronchiolitis. From this pathologic perspective, it would seem that the occurrence of mediastinal emphysema associated with hypersensitivity pneumonitis is not so rare.

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Use of Indium 111-Labeled White Blood Cell Scan in the Diagnosis of Cytomegalovirus Pneumonia in a Renal Transplant Recipient with a Normal Chest Roentgenogram*

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Opportunistic infections are common in patients after renal transplantation. This report describes a case of cytomegalovirus pneumonia in a renal transplant recipient with a normal chest roentgenogram and normal arterial oxygenation. An abnormal 111In-white blood cell scan led to the discovery of a pulmonary source of his recurrent fevers.

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| BAL = bronchoalveolar lavage; CMV = cytomegalovirus; HSV = herpes simplex virus; 111In-WBC scan = indium 111-labeled white blood cell scan |

Cytomegalovirus (CMV) infections are a major cause of morbidity and mortality in patients after renal transplantation. The average incidence of infection from multiple studies is approximately 71 percent. In one study, 20 percent of 59 hospitalized patients died as a direct result of CMV disease. Cytomegalovirus is the most common cause of pneumonia in renal transplant recipients, usually occurring one to four months after transplantation. Patients typically present with fever, dyspnea, hypoxemia, and an abnormal chest roentgenogram most often showing interstitial or alveolar infiltrates, although cavities and nodules have also been described. Lobar consolidation is rare, although this has been reported in two cardiac transplant patients from whom CMV was the only pathogen recovered. A definitive diagnosis of CMV pneumonitis is made by culture of the virus from bronchial washings or bronchoalveolar lavage (BAL) fluid in association with identification of cytopathic cells in washings or BAL fluid or the typical pathologic changes in tissue specimens.

Although there have been reports of CMV pneumonia occurring in renal transplant recipients with normal chest roentgenogram, histologic confirmation is generally absent. In one such reference, the diagnosis was based on a fourfold rise in antibodies against CMV early and late antigens by enzyme-linked immunosorbent assay in conjunction with a decrease in Krogh's coefficient on pulmonary function testing.

We describe a case of biopsy specimen-confirmed CMV pneumonia in a renal transplant recipient with a normal chest roentgenogram. The diagnosis was initially suspected because of an abnormal indium 111-labeled white blood cell scan (111In-WBC scan).

CASE REPORT

A 33-year-old man with end-stage renal disease due to chronic pyelonephritis underwent bilateral nephrectomy and living related donor renal transplantation in 1975. Four episodes of rejection

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Diagnosis

I subsequently led to graft failure and on August 15, 1989, a second living related donor transplantation was performed. At that time he was CMV seronegative, while the donor was seropositive. After transplantation, he received acyclovir 800 mg four times a day and CMV immune globulin weekly.

He presented with fever on September 9, 1989, but had no pulmonary symptoms, normal findings on chest examination, and a normal chest roentgenogram. His buffy coat and urine cultures were positive for CMV. Ganciclovir was administered for ten days and the fevers resolved.

He was readmitted to the hospital on November 7, 1989 with recurrent fevers, chills, and headaches. He appeared acutely ill although his findings from his physical examination were unrevealing. The day after admission, his temperature rose to 39.6°C. His white blood cell count was 8,300/cu mm with 75 percent polymorphonuclear leukocytes, 21 percent lymphocytes, and 4 percent monocytes. Arterial blood gas obtained on room air revealed a pH of 7.51, Pco2 of 21 mm Hg, and Po2 of 96 mm Hg. Chest roentgenogram on the day of hospital admission was again normal (Fig 1). Despite an extensive search for the source of fever, none was identified. Chest roentgenogram one day later remained normal. On November 10, 1989 an 111-In-WBC scan was performed that revealed diffuse uptake in both lungs (Fig 2). On November 13, 1989, fiberoptic bronchoscopy was performed. Bronchial washings and BAL from the right middle lobe were positive for CMV by both early antigen expression and conventional cultures. Transbronchial biopsy specimens from the left lower lobe revealed numerous large, basophilic intranuclear and cytoplasmic inclusions diagnostic of CMV (Fig 3). Subsequently, the washings (but not the BAL or tissue) were also positive for herpes simplex virus (HSV) and a light growth of Aspergillus fumigatus. For the reasons discussed below, these were not believed to be pathogens. The patient was treated with ganciclovir intravenously and his condition improved immediately. He remained afebrile and felt well while completing 21 days of treatment. Chest roentgenograms obtained immediately after bronchoscopy and again on November 17, 1989 showed mild infiltrates in the areas where BAL and biopsies were performed. However, the next roentgenogram which was obtained on January 8, 1990, was interpreted as normal.

**DISCUSSION**

Locating the source of fever in an immunocompromised patient can be a difficult task. Our patient had no pulmonary symptoms and the only clue to a pulmonary process was a minimally abnormal alveolar-arterial gradient for oxygen. However, this represents a nonspecific finding and without other evidence, it is unlikely a pulmonary process would have been pursued further.

Nuclear medicine studies have proved useful in locating sources of fever in other immunocompromised patients. For example, it is well known that gallium 67-citrate scans are frequently positive in patients with AIDS and *Pneumocystis carinii* pneumonia at a time when the chest roentgenogram is normal.9 Gallium scanning has also been used to help diagnose CMV pneumonia in a renal transplant recipient with a normal chest roentgenogram.10 Gallium scans have been reported to be positive in several AIDS patients with CMV pneumonitis; however, in one such patient with biopsy specimen-proven CMV pneumonitis and an abnormal chest roentgenogram, the gallium scan was negative.11

The 111-In-WBC scan is also useful in determining the
location of focal infectious processes. As opposed to gallium, accumulation in normal bowel does not significantly affect imaging of the abdomen and pelvis. It can also identify extra-abdominal sites of infection as well; in one study, three patients had pneumonitis detected prior to the appearance of an abnormal chest roentgenogram.

The 111In-WBC scanning is performed by obtaining a leukocyte-rich fraction of blood and labeling it with 111In oxine. The lipophilic chelating agent oxine carries the 111In across the membranes of cells to be labeled. The oxine then diffuses out of the cell while the 111In binds to intracellular proteins.

The use of this scan in the diagnosis of rejection and CMV infection in renal transplant recipients has been described once previously. Abnormal lung uptake was observed in 13 of 14 patients with CMV infection in that study. One of these 13 patients with disseminated CMV infection had an abnormal 111In-WBC scan and a normal chest roentgenogram. However, in contrast to our patient, he developed bilateral infiltrates soon thereafter.

This case demonstrates the usefulness of the 111In-WBC scan in the diagnosis of CMV pneumonia in a renal transplant recipient with a normal chest roentgenogram. Such patients have infectious pneumonitis due to a variety of organisms, including Aspergillus and HSV. Cytomegalovirus may suppress T-cell immunity and cause neutropenia, and on this basis, may predispose to superinfections with Aspergillus. However, this patient was never neutropenic and had no tissue evidence for Aspergillus infection. Given his immediate improvement with ganciclovir and in the absence of treatment for Aspergillus, we believe it is virtually impossible that the isolated Aspergillus was a pathogen. Likewise, although HSV infection is common in renal transplant recipients, primary HSV pneumonia is rare. There was no tissue evidence for HSV pneumonitis, and it grew only from the washings, not the BAL. We believe the HSV culture resulted from upper airway contamination.

The mortality of CMV pneumonia in renal transplant recipients remains significant. Treatment with ganciclovir has been reported to be effective in this setting. Because of this, early diagnosis may be important.

To our knowledge, this is only the second report of use of the 111In-WBC scan to help diagnose CMV pneumonia in a renal transplant recipient. In contrast to prior studies, our case stresses that these patients may never develop infiltrates related to their CMV.

Because the majority of the information regarding 111In-WBC scans is contained in the radiology and nuclear medicine literature, we believe it is worthwhile reiterating for pulmonologists and general internists that, in the proper clinical setting, a normal chest roentgenogram should not deter the clinician from searching for a pulmonary source of fevers in a renal transplant recipient. The 111In-WBC scan has proved useful in guiding physicians to a definitive diagnostic procedure in such cases.

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Potentially Fatal Asthma and Syncope* A New Variant of Munchausen’s Syndrome in Sports Medicine

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