was noted to be 560 ms. The magnet rate is set at 89.7 per minute or 660 ms.

**Discussion**

For years, after clinical use of cardiac pacemakers, it was thought that radiation for therapeutic purposes did not have any effect on the function of implanted cardiac pacemakers. In 1969, Hildner et al1 subjected two separate units to direct irradiation from a cobalt-60 teletherapy source. A ventricular demand type pacemaker was given a total dose of 10,000 rads, and a P-wave synchronous pacemaker was given a total of 46,000 rads. Each pacemaker was irradiated separately at a dose rate of 300 rads per minute and checked for performance. At no time during the irradiation of either pacemaker was there any detectable change in the output-pulse characteristics. Since they did not see any ill effect from the radiation exposure to the pacemaker, they proceeded with radiating a patient with presumptive carcinoma of the right upper lobe bronchus. The patient was given 3,500 rads over a period of three weeks. No changes in the patient's pacemaker function were noted during or immediately after therapy.

In 1972, Eipper and Laumenberg,4 concluded that radiation therapy presented no danger to patients with pacemakers. In 1975, Walz et al5 reached the same conclusion. However, in 1978, Marbach et al6 showed that the effect of radiation therapy on pacemaker function could be severe, so they advised against radiation with betatrons. Adamac et al,7 in their own study, observed only mild changes in the first series containing the demand pacemakers. However, the programmable pacemakers, in the second series, for the most part showed complete sudden failure after varying doses of irradiation. These failures lasted from 1 to 24 hours. They concluded that direct radiation of a programmable pacemaker at therapeutic levels should be avoided.

Katzenberg et al8 stated that newer multiple programmable units which employ complimentary metal oxide semiconductors (CMOS) for their integrated circuits may be more sensitive to ionizing radiation than bipolar semiconductors, the circuitry of older pacemakers. Reasoning for utilizing CMOS is that they consume less power and are highly reliable. They reported the first case of pacemaker malfunction due to exposure of the generator to radiation therapy. This malfunction occurred at cumulative dosages of 3,000 to 3,600 rads to treat breast carcinoma.

**Conclusion**

Studies show that there is no deleterious effect from diagnostic x-ray-ray exposures on the pacemakers, but radiation for therapeutic purpose could cause permanent malfunction of the pulse generator containing CMOS device. The mode of failure cannot be predicted.7 Precautions should be undertaken with the proper shielding, or possibly moving the pacemaker generators to a new location using lead extenders. If these precautions cannot be carried out, since the dose is cumulative, the pacemaker performance should be monitored throughout the course of radiation therapy.

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**Cytomegalovirus Infection with Idiopathic Pulmonary Fibrosis**

**Diagnosis Suggested by Bronchoalveolar Lavage**

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Bronchoalveolar lavage was used to provide important diagnostic information for a patient found to have idiopathic pulmonary fibrosis and concomitant cytomegalovirus infection. The use of this procedure may not only provide useful information regarding the underlying disease, but may also suggest alternative diagnostic possibilities.

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Idiopathic pulmonary fibrosis (IPF) is a progressive fibrotic disorder of unknown etiology which is characterized by the presence of polymorphonuclear leukocytes in the alveolar structures. Bronchoalveolar lavage has been utilized as an investigative tool by which to assess and quantify changes in the inflammatory cell traffic within the lower respiratory tract in a variety of interstitial lung diseases including IPF. The proposed utility of this procedure has been primarily in the assessment of disease activity, with only rarely the opportunity to provide diagnostic information.

The cytomegalovirus (CMV) is frequently an opportunistic agent in the immunosuppressed host and may have various clinical presentations including a prolonged febrile illness, diffuse pneumonitis, and/or hepatitis. The diagnosis of a CMV infection relies on the appropriate clinical picture with rising specific serum antibody titers, characteristic histologic features, and/or positive culture. Its occurrence in nonimmunosuppressed subjects is less common and usually presents as an "infectious mononucleosis-like" syndrome.

This report describes a subject with untreated IPF who was subsequently shown to have a concomitant CMV pneumonitis. The diagnosis was suggested by the finding of highly atypical lymphocytes from bronchoalveolar lavage, and these findings influenced the need to pursue an open lung biopsy. The patient's pulmonary disease spontaneously improved without therapeutic intervention. The use of bronchoalveolar lavage in the assessment of interstitial lung disease may not only provide useful information regarding the underlying disorder, but may suggest alternative diagnostic considerations in the evaluation of these patients.

**CASE REPORT**

A 67-year-old white man was in good health six months prior to admission when he noted a mild upper respiratory infection resulting in a chronic cough productive of clear sputum. Progressive dyspnea on exertion and orthopnea occurred three prior to admission. The past medical history included a 50-pack-year history of smoking, and a history of pneumonia as a child and young adult. The patient had received no previous corticosteroid or immunosuppressive therapy. The initial physical examination revealed diffuse "Velcro"-type rales bilaterally at the bases. There was no clubbing nor evidence of congestive heart failure. The chest x-ray film revealed extensive interstitial pulmonary infiltrates in the bases of both lungs. Pulmonary function tests noted a markedly restricted pattern with a total lung capacity at 55 percent predicted with preservation of normal flows. The inequality of ventilation as measured by the slope of phase 3 was markedly abnormal at 7.0 percent N/V (normal 1.4). An exercise DCO was depressed at 10 ml/min/mm Hg (normal 22 to 37).

Flexible fiberoptic bronchoscopy was performed with transbronchoscopic lung biopsy which revealed only benign intact bronchial tissues. Bronchoalveolar lavage was obtained from the right middle lobe using five 20-ml aliquots of normal saline solution with a return of 45 ml. The cellular findings from bronchoalveolar lavage

![Figure 1](http://journal.publications.chestnet.org/pdfaccess.ashx?url=data/journals/chest/21379/)

(Fig 1) are noted in Table 1. Such a marked increase in both the absolute number and percentage of lymphocytes is very atypical for IPF in our series (IPF n = 35); macrophages, 73 ± 2 percent, lymphocytes, 9 ± 2 percent, neutrophils, 11 ± 2 percent, eosinophils 6 ± 1 percent) as well as in the series of others. The lymphocytes were bizarre in appearance and were myeloperoxidase-negative. An open lung biopsy was pursued which revealed moderate chronic interstitial fibrosis with moderate pneumonitis consisting of lymphocytes, plasma cells, and polymorphonuclear leukocytes with slight desquamation. Two open lung biopsy specimens were submitted for culture, and both grew cytomegalovirus. All smears and cultures for tuberculosis, Mycoplasma, Chlamydia, Legionnaires, Pneumocystis carinii, bacteria (aerobic and anaerobic), fungi, and other viruses

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<th>Table 1—Cellular Findings from Bronchoalveolar Lavage</th>
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<td><strong>Cell No.</strong>&lt;br&gt;(× 10⁶)</td>
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<tr>
<td><strong>Macrophages</strong></td>
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<td><strong>Normals</strong>&lt;br&gt;(n = 7)</td>
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<td><strong>Patient</strong></td>
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were all negative. A retrospective review of the open lung biopsy revealed a single intranuclear inclusion body.

The patient received no therapy and returned three months later for a follow-up evaluation. At that time, the patient was subjectively improved with less dyspnea and cough. The chest x-ray film had markedly improved in the three-month period, and the pulmonary function tests revealed an increase in the total lung capacity from 55 to 65 percent predicted, a decrease in the slope of phase 3 from 7.0 to within the normal range of 1.2% N/L. The Dco remained unchanged. The cytomegalovirus titer was 1:160. The patient was felt to have idiopathic pulmonary fibrosis with the concurrent and now resolving CMV pneumonitis.

Discussion

This report describes the unusual concurrence of a cytomegalovirus pneumonitis in an apparently nonimmunosuppressed subject with IPF. Whereas the conventional evaluation of this subject, including an open lung biopsy, suggested only the diagnosis of IPF, the findings from bronchoalveolar lavage, the positive CMV culture from the open lung biopsy, the positive CMV titer, and the improving clinical course without therapeutic intervention all suggested a concomitant and resolving infection with CMV.

The clinical features of IPF, often become manifest after a viral-like prodrome.1 However, efforts to detect a viral etiology have largely been disappointing, perhaps because the provocative agent is not a virus or possibly because the viral agent only triggers an immune response which initiates the lung injury; by the time the clinical manifestations of pulmonary fibrosis are present, the viral infection has abated. There is no evidence from this isolated case report to indicate that some cases of IPF may represent an immune response to CMV infection. However, the unusual concurrence of these disorders does suggest that perhaps a subset of patients with IPF may have either an immune deficiency which predisposes to opportunistic infection or rather a viral agent in isolated cases may be etiologically linked to the pathogenesis of the disorder.

Bronchoalveolar lavage has been proposed as a useful means to assess the clinical activity of patients with IPF. This report suggests bronchoalveolar lavage may also indicate alternative diagnostic possibilities in the assessment of subjects with this disorder. As investigative tools such as bronchoalveolar lavage are more widely adapted to the clinical practice of pulmonary medicine, it is likely that “idiopathic” diseases such as IPF will be recognized as not representing a homogeneous disease process in all patients; rather, it is a disease with variations in the clinical course and presentation due to specific exacerbating and remitting factors. Bronchoalveolar lavage may assist in the detection of these factors, and may permit a more rational therapeutic approach in the treatment of subjects with this disorder.

References

Pulmonary Embolectomy in the Neonate

Ricardo J. Moreno-Cabral, M.D., F.C.C.P.,* and James A. Breitweiser, M.AJ, M.CT

Pulmonary embolectomy under cardiopulmonary bypass was performed on a six-day-old infant. The clinical presentation suggested cyanotic congenital heart disease secondary to pulmonary stenosis or atresia with intact ventricular septum. At operation, a large blood clot was found completely occluding a normal pulmonary valve. The use of prostaglandin E, facilitated cardiac catheterization and emergency surgery.

Emergency pulmonary embolectomy has been applied in adults with massive pulmonary embolism. This is a report of a six-day-old cyanotic infant who underwent pulmonary embolectomy under cardiopulmonary bypass.

Case Report

The patient, a newborn male, suffered severe intrapartum and birth asphyxia. The umbilical cord had a true knot; the Apgar scores were 2, 4 and 5 at 1, 5 and 10 minutes. His initial heart rate was less than 10 beats per minute and he required immediate endotracheal intubation. Arterial blood gas levels while the patient was on the ventilator with 100 percent FiO2 showed a pH of 7.12, PaO2 25, PaCO2 46; base excess of −15 with 30 percent saturation. Physical examination showed a cyanotic newborn with a palpable precordial thrill and a grade 4/6 tricuspid regurgitant murmur. A chest x-ray film revealed decreased pulmonary vascularity.

The electrocardiogram suggested right-sided strain, atrial and ventricular enlargement. Results of a 2D echocardiogram were considered normal. The clinical impression was tricuspid regurgitation and persistent fetal circulation.

The child was treated with intravenous tolazoline (Priscoline), but this was later discontinued because of hypotension. He then required therapy with dopamine up to 15 μg/kg/min and epinephrine 0.25 μg/kg/min. His course was further complicated by thrombocytopenia, anuria, rising BUN and creatinine. His condition subsequently stabilized with less inotropic support, but he required continued ventilation and high oxygen concentrations. Because of lack of improvement, cardiac catheterization was undertaken at five days of age. A prostaglandin E, infusion was started prior to cardiac catheterization. Catheterization data are shown in Table 1. Cine

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