Candida Endocarditis*
A Treatable Form of Pacemaker Infection

Fungal endocarditis is a rare complication of permanent pacemaker implantation. In all reports we have identified, this infection has been fatal, diagnosed postmortem. We present a patient in whom early echocardiographic diagnosis resulted in curative surgical and antimicrobial therapy. Fungal endocarditis is an unusual, but treatable complication of permanent pacemakers. (Chest 1993; 103:283-84)

Endocarditis is an uncommon complication of pacemaker placement. This problem is reported in only 1 percent to 7 percent of patients, and is usually caused by staphylococcal infection.1-4 Pacemaker endocarditis due to fungi is distinctively rare. We have identified reports of only four such cases,5-4 and all were diagnosed postmortem. We present a patient in whom fungal pacemaker endocarditis was identified antemortem. Early diagnosis was facilitated by echocardiography and led to curative surgical and medical treatment.

CASE REPORT
A 56-year-old man was referred with fever, nonproductive cough, dyspnea, and pleurisy of five weeks' duration. He had undergone uncomplicated placement of a dual chamber (DDD) pacemaker five years earlier for second degree Mobitz II heart block, but otherwise was generally well. An initial chest roentgenogram was clear and he was given a course of erythromycin. He returned with persistent symptoms and wheezing and was placed on a regimen of cefaclor and a tapering dose of prednisone. Ten days prior to referral, he developed worsening fever, chills, and cough. Laboratory findings included a white blood cell count of 13,500/cc, PaO2 of 66 mm Hg, and an unremarkable chest roentgenogram. The patient was hospitalized and treated with empiric broad-spectrum antibiotics. A 99Tc MAA perfusion lung scan showed absent perfusion of the left lung, suggesting massive pulmonary embolism, and he was heparinized. Follow-up chest roentgenogram showed left lower lobe consolidation.

On transfer to our medical center, the patient had a low-grade fever with diminished breath sounds and left basal crackles. Laboratory studies showed a white blood cell count of 16,000/cc with no left shift. Chest roentgenogram demonstrated infiltrates in the left upper and lower lobes. Heparin therapy was continued, but a lower extremity Doppler failed to demonstrate deep vein thrombosis. Pulmonary arteriography was performed (Fig 1). This study demonstrated subtotal occlusion at the origin of the left pulmonary artery, suggesting an obstructive mass rather than pulmonary embolism. Fiberoptic bronchoscopy showed no endobronchial lesion.

The patient's condition deteriorated with worsening hypoxemia. A two-dimensional echocardiogram revealed multiple large right atrial masses prolapsing into the right ventricle and with possible adherence to the right atrial wall and pacemaker wire. Blood cultures from the referring hospital were then reported to be growing Candida albicans, and amphotericin B therapy was initiated. The following day the patient underwent right atriotomy and pulmonary arteriotomy with removal of the pacemaker leads. Intraoperative transesophageal echocardiography (Fig 2) confirmed preoperative findings, and surgery demonstrated several friable soft-tissue masses encasing the atrial pacer wire (Fig 3). Although the tricuspid valve appeared uninvolved, a large fungus ball

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FIGURE 1. Pulmonary angiogram revealing complete occlusion of the left pulmonary artery with normal right pulmonary artery.

FIGURE 2. Intraoperative transesophageal echocardiogram showing right atrial masses prolapsing into the right ventricle. RA = right atrium; RV = right ventricle; M = mass.
Candida cultures continued surrounding syndrome several following autopsy. Infection was included in fungal infections, otherwise postoperatively. Right kidney, ischemic lead. 67

In fungal infection of a pacemaker wire, a 71-year-old diabetic who presented with a septic syndrome nine months after implantation and died. Autopsy demonstrated a 2-cm vegetation involving the pacemaker wire, with disseminated candidiasis involving the myocardium, kidney, and lung. The species of Candida was not identified. There have been two reports of Aspergillus infection of a pacemaker lead. One of these patients presented with fever following surgery for a toe deformity, but otherwise had no predisposing illness. The other patient was an elderly diabetic who became symptomatic after a second pacemaker was implanted, with the original apparatus left in place. Pacemaker infection due to *Parellidium boydii* was also reported in a 62-year-old woman with mixed connective tissue disease who had received long-term corticosteroid therapy. She presented with dyspnea and chest pain and was found to have a pulmonary infiltrate and pleural effusion. Shortly before her death, an echocardiogram demonstrated abnormal right ventricular echoes that corresponded to a large tricuspid valve vegetation found at autopsy.

Common features of these previously reported cases have included advanced patient age, prolonged intervals between pacemaker placement and onset of illness, and the presence of large fungal vegetations encasing the pacemaker lead at autopsy. Symptoms were protean, and likely contributed to delayed diagnosis. Moreover, three of the four patients had chronic underlying illnesses predisposing to infection. Our patient is unique in several aspects. His younger age, the identification of *C albicans* as the causative organism, and the role of echocardiography in his diagnosis are especially noteworthy. Although he was treated with a brief course of corticosteroid therapy after the onset of his symptoms, their effect on the pathogenesis of his infection is unclear. Most importantly, the diagnosis was made antemortem, allowing definitive surgical treatment and survival.

A review of 46 pacemaker infections at the Mayo Clinic showed that nearly half occurred more than six months following implantation and that two thirds followed multiple pacemaker procedures. Twenty-five patients had chronic predispositions to infection. The most common causal organism isolated was *Staphylococcus epidermidis*. Importantly, none of these patients had fungal infection, and all required removal of the pacemaker. Our patient illustrates that fungal infection of a pacemaker wire is not inevitably fatal. Because the syndrome can mimic other conditions, a high index of suspicion is necessary. Our patient's clinical presentation of acute pulmonary embolism was consistent with the anatomic extent of his disease, and echocardiography proved invaluable in our decision making. As with other foreign body infections, removal of the device followed by appropriate antimicrobial drugs was essential treatment.

**REFERENCES**