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Post-Pacemaker Pulsations

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PRESENTATION

Clinicians evaluating patients who have recently undergone medical procedures should have a high index of suspicion for procedure-related complications, even when the presenting symptoms are relatively mild. An 84-year-old man with a medical history of hypertension, coronary artery disease, and idiopathic hypothyroidism presented to our pacemaker clinic for a second opinion before heart surgery. His past surgical history included a 3-vessel coronary artery bypass-graft surgery and repair of an abdominal aortic aneurysm, both approximately 10 years previously, and recent implantation of a pacemaker. His current complaint was an intermittent, rhythmic "beating" and "raising up" of his left upper abdomen.

Approximately 2 weeks prior to his arrival at our clinic, he had been hospitalized in another institution after 1 day of lightheadedness, near-syncope, and fatigue on exertion. During his hospitalization, he had experienced episodes of atrial fibrillation and slow ventricular rate and was diagnosed with tachycardia-bradycardia syndrome. A pacemaker (St Jude Medical Victory XL DR 5816) was implanted with active-fixation leads in the right atrium (St Jude Medical 1782TC/46 cm) and right ventricle (St Jude Medical 1488TC/52 cm). His presenting symptoms had resolved, and he had been discharged the next day with amiodarone and warfarin added to his medical regimen.

That evening, as he was lying down to go to sleep, he had begun to feel abdominal pulsations, a sensation he had never before experienced. The symptoms occurred constantly when supine, and intermittently when seated or standing. At his routine follow-up appointment 1 week later, he was told that his pacemaker was functioning properly. After he described the abdominal pulsations, his cardiologist and the implanting surgeon had been contacted. They told him that the symptoms were not caused by the pacemaker and that he would "have to get used to it." His review of systems had been otherwise negative, without chest pain, dyspnea, or lightheadedness.

Due to continued concerns, he had discussed his situation with a family friend, who happened to be a physician. His friend raised the possibility of a device complication, so he had again contacted the implanting surgeon, who ordered a chest radiograph and scheduled him for "heart surgery" later that week. The patient's growing concerns about the direction of his care led him to seek our opinion.

ASSESSMENT

On physical examination, the patient had normal vital signs, a soft crescendo systolic murmur at the left sternum, and surgical scars on his chest and abdomen. An electrocardiogram revealed an atrial-paced and ventricular-sensed rhythm of 69 beats per minute. A pacemaker interrogation revealed stable atrial lead impedance, capture threshold, and P-wave amplitude. Despite the stable ventricular lead impedance, no ventricular capture was present at high output, and the R-wave amplitude was diminished (1.6-1.8 mV). (The R-wave amplitudes measured at implantation and at the 1-week pacemaker follow-up were unavailable.) Pacing at 2.5 V or higher at a pulse width of 0.6 ms led to reproduction of his abdominal signs and symptoms. A chest radiograph was ordered.

DIAGNOSIS

The chest radiograph revealed cardiac perforation as a result of migration of the right ventricular pacemaker lead (Figure 1). The distal end of the lead was noted to be outside the cardiac silhouette and overlapped with the cardiac fat pad.

Lead perforation is a relatively uncommon complication of pacemaker implantation, occurring in approximately 1% of patients.[1-3] Nevertheless, given the approximately 300,000 pacemakers and cardioverter-defibrillators implanted every year in the United States,[4] clinician familiarity with the clinical presentation and radiographic findings of lead perforations would save lives. Although most reported perfo-

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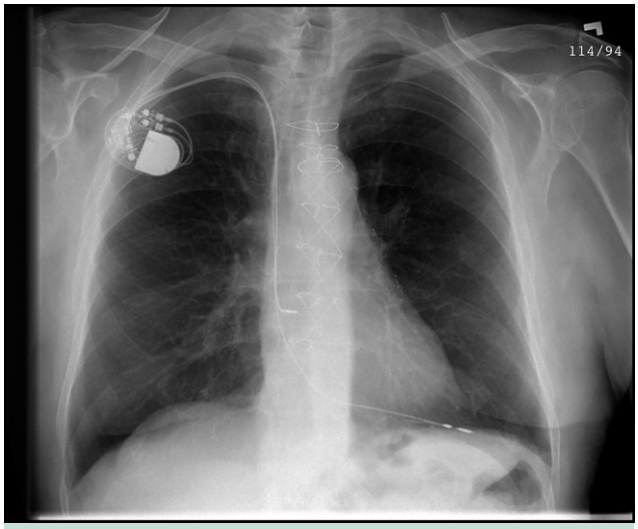

Figure 1 Chest radiograph taken while the patient was experiencing abdominal pulsations. Note that the tip of the right ventricular lead extends beyond the border of the cardiac silhouette and overlaps with the cardiac fat pad.

rations occur soon after pacemaker implantation, they can occur weeks or months later.[5,6] Risk factors for perforation include temporary pacemaker usage, use of helical screw-in leads, and oral steroid use within 7 days of the implant.[3]

Patients with lead perforation typically complain of pleuritic chest pain, a result of pericarditis. The development of a pericardial effusion and cardiac tamponade may lead to dyspnea, hypotension, and loss of consciousness.[7] Diaphragmatic pacing might occur even in the absence of cardiac perforation, so it should be screened for at the time of implant. The right atrial lead can cause right diaphragmatic stimulation via stimulation of the right phrenic nerve, whereas the right ventricular lead might cause left diaphragmatic stimulation via stimulation of either the left phrenic nerve or left hemidiaphragm.[8] In patients who develop new symptoms of diaphragmatic pacing, there should be a high index of suspicion for lead perforation. There have been rare reports of stimulation of the left chest wall from cardiac perforation and lead migration.[9]

In patients presenting with a possible lead perforation, a pacemaker interrogation and chest radiograph are essential for the initial evaluation. Increased capture threshold or inability to capture and decreased sensing of the affected lead are often present, but it is not uncommon for these parameters to be normal. On chest radiographs, the lead tip might be seen outside of the cardiac silhouette, the cardiac silhouette might be enlarged from a pericardial effusion, or a pneumothorax and/or pleural effusion can be present if the lead tip has migrated to the lung. Chest radiographs may also aid in the diagnosis of other complications associated with pacemaker implantation in the absence of lead perforation. These include pneumothorax, lead malposition, lead dislodgement, lead fracture, loose connection between the lead and pacemaker connector block, and excessive manipulation of the device by the patient (twiddler's syndrome).[10] Lead insulation failure and micro-displacement of the lead tip may be associated with pacing failure without being obvious on a standard chest radiograph.

An echocardiogram can be helpful to evaluate for lead position and the presence and size of a pericardial effusion. In the presence of a pericardial effusion, echocardiography may evaluate for physiology consistent with cardiac tamponade. In equivocal cases, computed tomography (CT) scanning can be a useful adjunctive modality.[11] Importantly, in asymptomatic individuals, CT may detect incidental lead perforations that do not alter the pacemaker lead parameters.[12] Although the long-term significance of this finding is not well studied, a conservative approach consisting of patient counseling regarding symptoms of perforation and close monitoring for changes in lead parameters is reasonable.

MANAGEMENT

The majority of patients diagnosed with cardiac perforation from a pacemaker lead have a good outcome. Cardiac surgery is typically not required, and the majority of cases can be managed with pericardiocentesis as needed and repositioning of the lead in the electrophysiology laboratory.[3,7] Surgical back-up is prudent and may be required for reaccumulation of a pericardial effusion resulting from persistent bleeding.[8] Leads that have been in place for several months might require extraction under visual guidance with transesophageal echocardiography and fluoroscopy.[6] Despite the relatively good outcomes overall, suspected lead perforations should be evaluated and treated in an urgent manner, as fatalities have been reported.[13,14]

In our patient, an echocardiogram did not reveal a pericardial effusion. The pacemaker lead was repositioned in

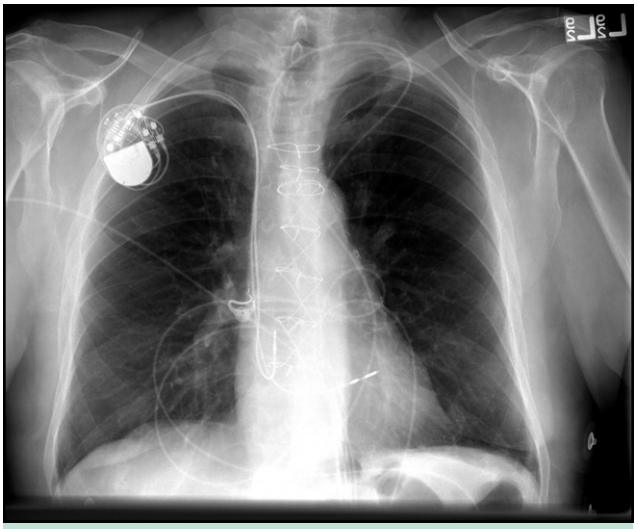

Figure 2 Chest radiograph taken the morning after the right ventricular lead was repositioned showing satisfactory tip position at the right ventricular septum.

the electrophysiology laboratory on the day of presentation. A chest radiograph performed on the following day (Figure 2) revealed a satisfactory lead tip position on the right ventricular septum. The patient cancelled his scheduled "heart surgery" and was uneventfully discharged.

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