DEVICE THERAPY

COMPLEX CASE STUDY

Externalized Permanent Pacemaker in a Pacemaker Dependent Patient with a Cardiac Device Infection

GURINDER S. GREWAL, MD, TERI M. KOZIK, PhD, MS, RN, CCRN and ROMANO ROCCUCCI, RN, BSN

Cardiac Research Department, St. Joseph’s Medical Center, Stockton, CA

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Introduction

As the incidence of cardiovascular implantable devices (permanent pacemakers (PPMs) and implantable cardioverter-defibrillators (ICDs)) has increased\(^1\),\(^2\) so have post-implantation associated bacterial infections\(^3\),\(^4\). Cardiovascular device infections (CDIs) pose an economic impact most often requiring a two-stage approach: explantation of all prosthetic material followed by reimplantation of a new device after an extended treatment of the infection has occurred\(^5\). In a study by Nery et al.,\(^6\) 24 infections occurred in 2,417 patients (1%) receiving any type of cardiac electronic implantable device. Further analysis of these infections showed that they were more likely to occur in patients who received a device replacement and/or received a more complex device (dual versus single chamber). Similar results were noted from The REPLACE Registry; data were collected on 1,744 patients who received a cardiac electronic device replacement and found that 22 patients (1.3%) developed an infection post procedure.\(^4\) The average cost of a CDI is approximately US$25,000–50,000.\(^3\) Even at a rate of approximately 1%, these CDIs can create a financial burden for our health-care system, so it becomes important to manage these patients safely while containing health-care costs.

Case report

Our patient was an 80-year-old gentleman with a history of coronary artery bypass surgery, prosthetic mitral valve replacement for hypertrophic cardiomyopathy, and severe mitral stenosis in June 1994. In December 2008, after surviving a cardiac arrest, he had a repeat mitral valve replacement and bypass surgery that required PPM implantation for symptomatic bradycardia. In May 2009, because of left ventricular dysfunction and dyssynchrony, his PPM was upgraded to an ICD/biventricular pacemaker that improved the patient’s left ventricular ejection fraction from 29.6% to 51.4%.

Three months later, the patient presented with redness and drainage from the ICD/biventricular implantation pocket site. Being pacemaker dependent and showing no signs or symptoms of a systemic infection, he was admitted to the hospital for intravenous antibiotics and wound care for 2 weeks followed by 2 weeks of outpatient treatment.

After a month, the wound had not healed; a lead was visible from an open area of the pocket incision site and it continued to drain. The device would need to be explanted, and because the patient was pacemaker dependent, he would need a temporary left ventricular pacemaker inserted while he had aggressive treatment for the infection; later a new permanent device would be reimplanted.

The patient would require a minimum of 4–6 weeks of aggressive treatment of the infection before another permanent device could be reimplanted. Because temporary pacemaker leads are most often associated with dislodgement, the cardiologist elected to insert an active-fixation long permanent pacemaker lead through a
sheath via the right internal jugular vein. The permanent lead was then connected to a new permanent pacemaker device that was no longer sterile for implantation (Figure 1). The pacemaker lead and external generator were then secured with sutures to the patient’s chest wall; a sterile dressing was applied creating a temporary pacemaker device utilizing permanent equipment. Permanent generators cannot be externally manipulated, so this approach was thought to be a safer option. Therefore, the patient was discharged home, and he had aggressive treatment for his infection as an outpatient.

On an outpatient basis, the patient’s infectious-disease physician treated him with intravenous vancomycin for the infection. Additionally, during this time the cardiologist saw the patient in his office every 1–2 weeks to assess pacemaker function and manage any cardiac symptoms. Since the patient could only be treated with a single chamber pacemaker during this treatment period, his left ventricular ejection fraction dropped dramatically; therefore, his furosemide was increased to prevent an exacerbation of congestive heart failure.

Nursing care was provided by a home health agency. The home health nurses assessed the dressing sites and administered the vancomycin for the infection, regularly communicating back to the infectious disease and cardiology physicians with any changes.

The patient tolerated his outpatient treatment and returned to the hospital approximately 8 weeks later to have a new permanent device implanted. The cardiologist inserted a temporary pacemaker via the right femoral vein. The PPM wire and external generator were then removed under fluoroscopy and a permanent device (biventricular/ICD) was reimplanted via a new right-sided pacemaker pocket utilizing the right subclavian vein. His femoral temporary device was then removed. The patient continues to see the cardiologist on a routine basis and has had no further problems with infection. His ejection fraction has subsequently increased to greater than 50%.

**Discussion**

Cardiac implantable devices have been shown to reduce morbidity and mortality in appropriate patient populations. Cardiac resynchronization therapy using biventricular pacing significantly improves ventricular hemodynamics, quality of life, and exercise capacity. However, these cardiac implantable devices can have negative outcomes such as CDIs.

The patient presented in August 2009 with a coagulase-negative staphylococcus pocket infection from his ICD/biventricular device. Staphylococcal species are the most common CDI agents, and coagulase-negative staphylococcus accounts for the majority of those cases. Once regarded as a harmless skin contaminant, coagulase-negative staphylococcus is now recognized for its increased persistence especially on foreign materials.

Once a pacemaker pocket infection is identified, it becomes imperative that all material from the device be explanted. Remnant remains have been associated with a 71.4% recurrence rate of infection. Therefore, it becomes important for eradication of the infection prior to any reimplantation. The patient was pacemaker dependent, making it difficult to manage his rhythm during treatment. Typically, patients with CDIs require in-hospital treatment for their infection, because they must have a temporary transvenous pacemaker in place until the patient no longer shows signs of infection and a new device can then be reimplanted. Conventional temporary pacing comprises placement of a transvenous temporary pacemaker lead via a sheath through an external central vein and attached to an external pacemaker generator that can be reprogrammed at anytime while in place. This type of pacing is frequently associated with complications such as infection, lead dislodgement with loss of capture, short battery life, and ventricular perforation. A conventional temporary pacing lead requires restricted mobility with close observation to prevent these complications, and for these safety reasons require a hospital stay. Utilizing a permanent active-fixation lead to enhance stability, as well as a permanent generator with an extended battery life, the patient could safely return home while being temporarily paced transvenously. Once treatment is complete, removal of permanent fixation leads poses more risk than removing conventional temporary leads; however, this is mostly associated with the length of time the lead is in place. Scar tissue can accumulate around the lead and lack of physician experience can affect the success of removal. The patient’s lead was removed after 8 weeks, posing minimal risk for scar tissue development.

Prolonged hospital stays have a financial impact and burden on patients and their families. Since the patient was treated for his infection for 8 weeks on an outpatient basis, a potential inpatient hospital cost of US$82,000 was prevented. The patient’s cardiologist used a modified approach in the treatment of a pacemaker pocket infection. In a study by Margey and colleagues, patients...
treated in the hospital for a CDI had a median length of stay of 28 days, from device extraction to reimplantation of a new device. Additionally, 10 consecutive patients were treated in a similar manner with an external pacing device and a bipolar active-fixation pacing lead, but these patients remained in the hospital on a non-monitored floor for a mean length of stay of 13.5 ± 10.5 days. Therefore, utilizing the same technique and treating the patient’s infection on an outpatient basis not only saved health-care costs by preventing a prolonged hospital stay, it improved patient satisfaction by permitting him to return home with his family and allowed a longer treatment regimen before reimplantation of a new device, reducing his chances of reinfection.

References