CLINICAL VIGNETTE

Cardiovascular Implantable Electronic Devices in End of Life Care

Maristela Garcia, MD and Jonathan Wanagat, MD, PhD

Division of Geriatrics, Department of Medicine, David Geffen School of Medicine at UCLA

Case Report

An 81-year-old man was admitted from home with two days of severe back pain. Past medical history was significant for coronary artery disease status post multiple coronary artery bypass grafts, ischemic cardiomyopathy, symptomatic high-degree atrioventricular block with dual-chamber pacemaker/automatic implantable cardioverter defibrillator (AICD), transitional urothelial carcinoma of the bladder and transfusion-dependent myelodysplastic syndrome. On admission, he was treated empirically for possible osteomyelitis, but four days after admission developed sepsis, and cardiopulmonary arrest requiring intubation and ICU care. He was extubated one week later with signs and symptoms of anoxic brain injury, hypoactive delirium, worsening acute kidney injury (AKI) and vasopressor dependence. The patient was >99% ventricularly paced according to pacemaker interrogation. He did not have a living will or other advanced care directive. At the time of extubation, the family changed his code status to Do Not Resuscitate (DNR) and a week later the family decided to transition to comfort care. The night before transition to comfort care, his AICD and pacemaker were deactivated, he became bradycardic, and died two hours later.

Discussion

Cardiovascular Implantable Electronic Devices (CIEDs) such as Implantable Cardioverter Defibrillators (ICDs), pacemakers, Cardiac Resynchronization Therapy (CRT), and Ventricular Assist Devices (VADs) are used increasingly as their indications expand. In the United States, more than 100,000 ICDs are implanted annually, with Medicare beneficiaries accounting for 2/3 of the recipients[1]. All users of these devices will die eventually. However, plans for what to do with these devices in end of life care are often inadequate. Clinicians vary in their comfort and experience with these devices. A survey at an academic tertiary center in Boston showed that clinicians were consistently less comfortable discussing deactivation of these devices compared to other life-sustaining therapies such as mechanical ventilators, dialysis and feeding tubes[2].

Deactivation of devices in end of life care has both ethical and legal considerations. Device deactivation is not considered equivalent to physician-assisted suicide or euthanasia for two reasons. First, the intent of the clinician discontinuing the device is not to do harm. Second, the cause of death is the underlying disease[3]. The duty to do no harm is particularly important in end of life settings where devices such as the ICD may cause painful shocks, nausea, vomiting, and involuntary defecation and urination[4,5]. Nearly 20% of ICD patients receive these shocks in the last few weeks of their lives[6]. When device deactivation conflicts with the personal values of an individual clinician, the clinician is not compelled to participate in the deactivation procedure, but is obligated to involve a willing colleague if the patient or legal surrogate makes the request for deactivation[3].

The Heart Rhythm Society, in collaboration with representatives from the American Geriatrics Society, American Academy of Hospice and Palliative Medicine, and other major organizations, released a consensus statement in 2010 to guide clinicians regarding the process of device deactivation. The statement outlined the basic steps and documentation required after a decision to deactivate the device. These include: 1) confirm that the patient (or legal surrogate) has requested device deactivation; 2) establish the decisional making capacity of the patient, or identify the appropriate surrogate; 3) confirm that the alternative therapies (if applicable) and the consequences of deactivation have been discussed; 4) specify the device therapies to be deactivated; 5) notify the family, if appropriate[3].

Death may or may not immediately follow device deactivation, and it is essential that the patient's and family's expectations be addressed beforehand. For example, with ICDs, patients and families may expect that death instantly follows the deactivation procedure. In reality, a retrospective study of

outcomes following ICD deactivation showed a median survival of three days; 20% died within one day, and 4% were alive after a year[7]. Among patients who are thought to be pacemaker-dependent to maintain adequate cardiac output, demise may be quick as in this patient, however, not in all cases. The degree of pacemaker dependence varies and most patients are not completely "pacemaker-dependent". With regards to deactivation of bradycardia therapies (i.e., pacemakers and ICDs with pacemaker functions), 53% died within a day and 94 % died within a month[7]. Worsening of heart failure may occur after pacemaker discontinuation, and deactivation plans should include orders for symptom management. With CRTs, there is some concern that deactivation may worsen heart failure symptoms. Some feel that in NYHA Class 4 patients facing imminent death, continuation of CRT may be prolonging the dying process[4]. Deactivation of destination VAD therapies may result in death within minutes[8]. It is important to recognize that some devices deliver combined therapies (e.g. ICD with pacing function). Depending on the goals of care and the clinical context, deactivation discussions may involve separate decisions for defibrillator and pacing functions.

Most devices are deactivated by Industry-Employed Allied Professionals ([IEAPs], sometimes referred to as field representatives or technicians) in end of life settings, although the guidelines recommend the presence of a clinician (e.g., a physician or nurse) at the time of deactivation[3,9]. These allied professionals require physician orders for deactivation, which should include the specific therapies to be discontinued, particularly if the device delivers multiple functions. Like clinicians, some IEAPs may experience moral distress and refuse to perform the actual deactivation procedure[10]. If so, the IEAP can be requested to provide technical guidance for deactivation while the clinician performs the actual deactivation, or the IEAP can assist in locating a qualified professional to carry out the request[3]. If the device manufacturer is unknown, an option is to contact the three major manufacturers to determine if the patient is enrolled in their database: Boston Scientific, (800) CARDIAC; Medtronic, (800) MEDTRON; and St Jude Medical, (800) 722-3774[11]. If there is an urgent need to discontinue distressing shocks in a dying patient at home and a device technician is not immediately available, a doughnut magnet placed over the device may be helpful until the technician arrives. If magnets are not available, household items with magnetic function such as home telephone receivers, ceramic clip magnets, and ear buds for cell phones have temporarily deactivated the shock function of some devices[11].

Device deactivation is a consideration in end of life care planning for all patients with CIEDs. The clinician's familiarity with the process of device deactivation at the end of life can help ensure that patients with implantable devices who reach the end of their lives will transition to a dignified, peaceful death, without the burden of technologies that have outlasted their usefulness.

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Submitted on April 17, 2014