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Case Report

Reporting the First Subcutaneous ICD Placed in the Immediate Postorthotopic Heart Transplant Period for Acute Cellular Rejection-Associated Cardiac Arrest and Investigating the Role of Secondary Prevention ICDs in This Population

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Orthotopic heart transplantation (OHT) has made incredible strides and currently boasts excellent outcomes for patients with end-stage heart disease. Despite the impressive improvement in mortality with OHT, there remains a 10% incidence of sudden cardiac arrest (SCA).[1] The authors are reporting a case of a 54-year-old man with ischemic cardiomyopathy, left ventricular ejection fraction (LVEF) (10%), and status post-left ventricular assist device insertion 1 year prior, who underwent OHT. The initial postoperative course was uneventful; however, on post-operative day (POD) 5, the patient developed nonsustained ventricular tachycardia (VT), which progressed to refractory VT arrest. The cause of the arrest was found to be cellular rejection that required escalating immunosuppressive therapy. The resuscitation of the patient was challenging and ultimately required initiation of central venoarterial (VA) extracorporeal membrane oxygenator (ECMO). Following treatment for rejection, the patient was weaned from ECMO. He subsequently received a subcutaneous implantable cardioverter-defibrillator (S-ICD, Boston Scientific, Marlborough, MA) as secondary prevention. To the authors' knowledge, this was the first case report in which an S-ICD was implanted in a patient post-OHT who suffered SCA.

More than 5,000 heart transplants are performed in the United States every year, with a 5-year survival rate of 69% and a median survival of 11 years. It is clear that advances over recent decades in surgical techniques and postoperative care, namely immunosuppression, have translated into significant clinical stability and excellent cardiopulmonary functional status for these patients.[2–5] Despite the impressive survival statistics, these patients remain a clinically challenging population, as they are susceptible to numerous complications that may present with a significant burden of morbidity and mortality. Perioperative physicians have a critical role in all phases of care for the OHT patient. This care is extended from the operating room to cardiac catheterization and electrophysiology laboratories and it was the authors' goal to highlight the unique challenges that SCA presented within this patient population as well as the rationale for placing an S-ICD in this patient.

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The patient was a 54-year-old male with ischemic cardiomyopathy who was treated with a drug-eluting stent to his left anterior descending artery 5 years earlier. Other comorbidities included atrial fibrillation, diabetes mellitus, and chronic kidney disease. His LVEF deteriorated to 10% and he developed New York Heart Association class IV symptoms. Consequently, a HeartMate II (Thoratec, Corp., Pleasanton, CA) left ventricular assist device and a primary prevention ICD were implanted 1 year prior to OHT. He underwent an apparently uncomplicated transplantation, with an ischemic time of 217 minutes, and was weaned successfully from cardiopulmonary bypass without mechanical support. Post–cardiopulmonary bypass, the echocardiogram showed an LVEF of 40% with septal hypokinesis. Patient was extubated on POD 1 and remained on inotropic support consisting of milrinone, 0.25 μg/kg/min, on POD 3.

As per institutional practice, the patient received mycophenolate mofetil preoperatively, pulse-dose steroids intraoperatively, and tacrolimus postoperatively, a maintenance immunosuppressive regimen without induction therapy.

The patient was first noted to have an episode of hemodynamically stable supraventricular tachycardia on POD 4, which responded to carotid massage. On POD 5, his telemetry showed nonsustained VT. For suspicion of acute rejection, he was given pulse-dose methylprednisolone (500 mg IV BID) and antithymoglobulin, a regimen that is consistent with recommendations from the International Society for Heart and Lung Transplant's (ISHLT) 30th official report.[3] Later that same day, the patient had an endomyocardial biopsy and a right-heart catheterization, which showed a cardiac index of 1.73 L/minute/m^2 and a PCWP of 23 mmHg while on milrinone, 0.25 μg/kg/minute.

On POD 6, the patient was noted to be in VT on telemetry and he was found unresponsive on the floor. Advanced cardiac life support protocol was initiated but he progressed to refractory VT, and the ECMO team was emergently called. The cardiac surgeon attempted femoral arterial and venous cannulation, but had to proceed to emergent sternotomy for central VA ECMO. The total resuscitation time was 40 minutes, with chest compressions being interrupted during chest opening. Subsequently, in the operating room, ECMO cannulae were changed for peripheral access.

Endomyocardial biopsy from the day before arrest showed ISHLT grade-1R cellular rejection. This finding provided histopathologic evidence to support the diagnosis of cellular rejection-induced allograft failure, for which the patient was continued on antithymoglobulin and methylprednisolone as well as his maintenance tacrolimus and mycophenolate mofetil.

Nine hours after the arrest, the first neurologic examination was documented, and he was noted to move all extremities voluntarily and follow simple commands. On POD 7, the patient had a left-heart catheterization, which showed no coronary allograft vasculopathy (CAV). He was relisted as status 1a possible retransplant given acute graft failure and refractory VT on multiple antiarrhythmic medications and requiring VA ECMO.

ECMO was weaned on POD 12 with intra-aortic balloon pump assistance (which subsequently was removed on POD 14), and the patient was transitioned to amiodarone as his only antiarrhythmic on POD 10. After a multidisciplinary discussion, an ICD was deemed necessary and S-ICD was chosen over a transvenous (TV) ICD because of a decreased risk of endovascular infection and fewer lead-related complications. On POD 33, the patient received the first S-ICD (Boston Scientific Emblem S-ICD; Model 209) placed for secondary prevention of cellular rejection-associated SCA. It was implanted uneventfully. Prescreening prior to the procedure and intraoperative testing demonstrated typical normal sensing and defibrillator capabilities of the S-ICD in this patient. During follow-up, the patient continued to demonstrate normal function of the device.

Serial endomyocardial biopsies were done throughout his hospital stay, which all showed grade-1R rejection, until POD 41 which showed ISHLT grade-0 rejection. Throughout his admission, he had no further episodes of ventricular arrhythmias and he remained in normal sinus rhythm. He was successfully discharged on POD 42 without neurologic defects, and as of POD 210, his S-ICD had not detected any clinically significant arrhythmia.

Discussion

Arrhythmias

Arrhythmias in the OHT patient are often multifactorial in etiology due to the denervation of the transplanted heart, use of immunosuppression, myocyte necrosis, and infiltration secondary to graft rejection and vasculopathy.[6] Between 5% and 30% of OHT patients will develop atrial fibrillation or atrial flutter and other SVTs, which may have adverse consequences for these patients' functional status in some cases.[7] The incidence of SCA death in OHT patients ranges from 8% to 38% in multiple studies, and sustained VT and ventricular fibrillation are the most likely etiology for a significant portion of sudden and unexplained deaths in OHT patients. When stratified by the type of arrhythmia, those OHT patients who did have documented VT (nonsustained and sustained), such as this study's patient, notably had the worst prognosis, with an all-cause mortality of 89% at 83 months.[8]

SCA in the OHT Patient

As OHT recipients are living longer, more attention is being paid to sudden cardiac death and its prevention. In a single-center retrospective chart review of 628 OHT patients with a mean follow-up of 76 months post-transplant, sudden cardiac death caused 35% of deaths in this study's population.[10] The terminal rhythms documented were most commonly asystole (34%), pulseless electrical activity (20%), and ventricular fibrillation (10%).

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