Surgical Management of Patient with Left Ventricular Aneurysm and Ventricular Tachycardia

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Abstract

The management of patients with dilated non-ischemic cardiomyopathy with a large anterior ventricular aneurysm presenting with ventricular tachycardia is not well described. We report a 45-year-old gentleman who presented with recurrent episodes of prolonged polymorphic ventricular tachycardia and previously failed medical management and endocardial and epicardial transcatheter ablation. We performed a Dor procedure to exclude the apical left ventricular aneurysm in conjunction with cryoablation to terminate his ventricular tachycardia. This surgical approach was found to be successful with conversion of the patient into normal sinus rhythm and restoration of the patient's left ventricular morphology and function.

CLINICAL SUMMARY

A 45-year-old male with a known history of non-ischemic cardiomyopathy (NICM) presented with prolonged episodes of ventricular tachycardia (VT). The patient was initially diagnosed with NICM at the age of 2 and has struggled with recurrent episodes of non-sustained polymorphic ventricular tachycardia since the age of 42 resulting in placement of an implantable cardioverter-defibrillator (ICD) for secondary prevention. The patient was also found to have a large sized calcified apical aneurysm on computed tomography (Figure 1A) and magnetic resonance imaging of the heart. His echocardiogram on presentation revealed a severe decrease in his left ventricular (LV) systolic function. His coronary angiogram did not reveal any significant coronary artery disease. The patient underwent attempts at epicardial and endocardial ablation of his VT but those were of no avail and failure was attributed to adhesions from his heavily calcific apical LV aneurysm. Nonetheless, the area suspect of arrhythmia generation was marked by electrophysiology team. The patient's other past medical history includes hypertension, dyslipidemia, and atrial fibrillation. He is also an active smoker. The options for treatment were discussed with the patient and the cardiac team, including surgery or continuing pharmacological and electrical cardioversion therapy, while also listing him for heart transplantation. The cardiac team and the patient agreed that surgery should be attempted given the multiple failed non-operative management efforts. After informed consent was obtained, the patient was taken to the operating room for left ventricular aneurysm resection and cryoablation.

The surgery was performed through a median sternotomy. After systemic heparinization, we routinely cannulated his distal ascending aorta and the right atrium. The patient was placed on cardiopulmonary bypass and maintained warm. An LV vent was then engaged in the right superior pulmonary vein. We then cross-clamped the aorta and arrested the heart using antegrade cardioplegia with warm induction followed by cold intermittent cardioplegia. We then exposed the LV apex and found a heavily calcified aneurysm. The aneurysm which was adhered to the pericardium, was carefully mobilized. We opened the

aneurysm sac and enucleated the calcified cap in order to get suture needles through the tissue. We did not resect the fibrous tissue to facilitate closure and hemostasis. We used cryoablation (Cardioblate CryoFlex surgical ablation Probe, Medtronic, Minneapolis, USA) to ablate both the endocardium and epicardium at the junction between the normal myocardium and fibrous tissue to ensure a transmural isolation. A Fontan suture was placed around the neck of the LV aneurysm and was tied around a 150 ml normal saline filled balloon which was stationed in the LV cavity. We then used a triangular bovine pericardial patch measuring 2.5 x 3cm to close the aneurysm neck and used felt from each side of the aneurysm to close the tissues of the apex over the patch in 2 layers. We then placed BioGlue onto that area to reinforce hemostasis. The patient was weaned off bypass with no difficulty. The surgery was completed with no complications and the patient was transferred to the Intensive Care Unit in stable condition.

The patient remained hemodynamically stable postoperatively, and was extubated on the first post-operative day. He was found to have no ventricular tachycardia following his surgery with only occasional premature ventricular contractions (PVC). He was deemed safe to be transferred to the floor by our electrophysiology colleagues. He mobilized himself very quickly and was discharged home on the 6^{th} post-operative day. At 2-months follow-up, the patient was still doing well from a clinical standpoint with CCS class 0 and NYHA class II symptoms. At 12-month follow-up, his echocardiography and computed tomography images (Figure 1B) revealed significantly reduced LV diastolic dimensions and volumes. The LV ejection fraction rose to 55% from 25% preoperatively. Interrogation of the patient's ICD showed PVCs, but no ventricular tachycardia.

COMMENT

Non-ischemic cardiomyopathy (NICM) is a heterogenous group of direct myocardial dysfunction stemming from a wide range of pathologies. Dilated NICM was traditionally treated medically and often culminated in heart transplant for patients at the end stage (1). As for surgical options, partial left ventriculectomy (PLV) was proposed and performed sporadically primarily by Dr. Batista. Due to lack of accurate diagnosis techniques such as the contemporary intraoperative echocardiographic studies to identify the predominant region of myocardial involvement, PLV was associated with inconsistent results and thus left ventricular reconstruction in this population of patients was abandoned all together (2). The poor outcomes from the PLV in dilated NICM was believed to stem from the variability in myocardial distribution in this non-homogenous group of cardiomyopathy and thus the risk of excluding healthy segments (3). Therefore, the outdated "one size fit all" approach with PLV was noted to be ineffective in the surgical management of dilated NICM. This observation has prompted the initiation of targeted surgical approaches that only exclude the most affected regions. In fact, PLV remains an option reserved for lateral wall involvement. However, when septal damage is the most culprit area, a technique developed by Dr. Torrent-Guasp, termed Septal Anterior Ventricular Exclusion (SAVE) was developed to exclude the septum with the insertion of an oblique patch between the apex and high septum, just below the aortic valve with subsequent closure of the excluded wall over the patch (4). This technique acts in a fashion similar to the more circular patch used to exclude the apical wall in the Dor procedure that has been heavily used in the treatment of ischemic cardiomyopathy to reconstruct the LV (5).

In 2003, Mickleborough et al. published their experience of LV reconstruction in 108 patients with ischemic cardiomyopathy and preoperative VT which were treated with direct visual endocardial excision and peripheral cryoablation. The post-operative freedom from VT or sudden death was found to be 99%, 97%, and 94% at 1, 5, and 10 years, respectively. This study however only focused on patients who developed aneurysmal changes to their left ventricle following myocardial infarction.

In this report, we describe a successful surgical treatment of a patient who presented with a heavily calcified apical left ventricular aneurysm secondary to non-ischemic cardiomyopathy in conjunction with prolonged VT that has failed medical management and was unamenable to previous endocardial or epicardial ablation. We believed that performing a Dor procedure would exclude the LV apex that was the most diseased and akinetic myocardial segment. We also opted to use CryoFlex Probe to ablate on the area of arrhythmia generation endo- and epicardially to achieve a transmural isolation to control the patient intractable VT. The patient had an uneventful course with resolution of his ventricular tachycardia and was discharge home

on the 6thpost-operative day with normalized LVEF and freedom from any recurrent VT.

FIGURES:

Figure 1A: Preoperative computed tomography of the heart demonstrating a calcified left ventricle apical aneurysm (red arrow) in long axis, with a distance from the apex to the mitral valve of 11.5 cm in diastole.

Figure 1B: Postoperative computed tomography of the heart showing the reconstructed left ventricle at 11 months following the Dor Procedure, with a distance from the apex to the mitral valve of 9.0 cm in diastole.

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