

Surgical management of patient with left ventricular aneurysm and ventricular tachycardia

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Abstract

The management of patients with dilated cardiomyopathy and large anterior ventricular aneurysm presenting with ventricular tachycardia is not well-described. We report the case of 45-year-old male 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 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. We also propose a methodology for the surgical management of patients with left ventricular aneurysm and intractable ventricular tachycardia focused on a discussion with the patient and the cardiac team about the options for treatment, including surgery or continuing pharmacological and electrical cardioversion therapy, choosing the surgical technique that would exclude the most diseased and akinetic myocardial segment, and being more liberal with the use of cryoablation.

Keywords

Left ventricular aneurysm, ventricular tachycardia, dilated cardiomyopathy

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Introduction

Dilated cardiomyopathy is a heterogeneous group of diseases altering the myocardium geometry and function. Dilated cardiomyopathy was traditionally treated medically and often resulted in end-stage patients being considered for heart transplantation as a definitive management.^{1,2} While there is an established role for surgical ventricular remodeling in patients with ischemic cardiomyopathy, earlier enthusiasm for such procedures in dilated cardiomyopathy has waned due to the high incidence of surgical failures.^{3–6} This could be the result of an outdated “one size fit all” approach in the surgical management of dilated cardiomyopathy, which has prompted several groups to initiate targeted surgical approaches, as we outline in this case report.^{7–9}

Case description

A 45-year-old male with a known history of dilated cardiomyopathy and left ventricular (LV) aneurysm presented with prolonged episodes of ventricular tachycardia (VT). The patient was initially diagnosed with idiopathic dilated cardiomyopathy

and LV apical aneurysm at the age of 20 and has struggled with recurrent episodes of non-sustained polymorphic VT since the age of 42 resulting in placement of an implantable cardioverter-defibrillator (ICD) for primary prevention. Cardiac imaging showed a large-sized calcified apical aneurysm on computed tomography (Figure 1(a)) and magnetic resonance imaging of the heart. His transthoracic echocardiogram on presentation redemonstrated a severely reduced LV systolic function (30%), LV end-diastolic diameter of 71 mm, end-systolic diameter of 59 mm, left ventricular end-diastolic volume of 332 mL, and distance from the apex to the mitral valve of 11.5 cm in diastole. The right ventricle was normal in size and function. His

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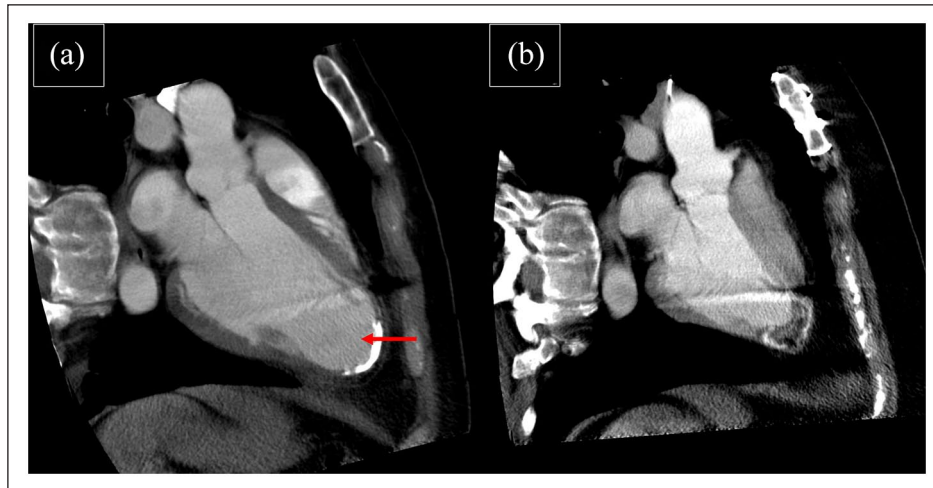


Figure 1. (a) Pre-operative computed tomography demonstrating a calcified left ventricle apical aneurysm (red arrow) in long axis, with a distance from the apex to the mitral valve of 11.5 cm in diastole. (b) Post-operative computed tomography of the heart showing the reconstructed left ventricle at 11 months following the Dor procedure, with a distance from the apex to the mitral valve of 9.0 cm in diastole.

coronary angiogram did not reveal any significant macrovascular coronary artery disease. The patient underwent unsuccessful attempts at epicardial and endocardial ablation of his VT 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 written informed consent was obtained, the patient was taken to the operating room for LV aneurysm resection and cryoablation.

The surgery was performed through a median sternotomy. After systemic heparinization, we 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, MN, 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 cm × 3 cm 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 two layers. We then placed BioGlue onto that area to reinforce hemostasis.

The patient was weaned off bypass with no difficulty and was transferred to the Intensive Care Unit in stable condition where he remained hemodynamically stable post-operatively, and was extubated on the first post-operative day. He was found to have no VT following his surgery with only occasional premature ventricular contractions (PVCs). He was discharged home on the sixth post-operative day. At 12-month follow-up, he was asymptomatic and his echocardiography and computed tomography images (Figure 1(b)) revealed significantly reduced LV diastolic dimensions and volumes. The LV ejection fraction rose to 55% from 25% pre-operatively. Interrogation of the patient's ICD showed PVCs, but no VT.

Discussion

Dilated cardiomyopathy is a heterogeneous group of direct myocardial dysfunction stemming from a wide range of pathologies. Dilated cardiomyopathy was traditionally treated medically and often culminated in heart transplant for patients at the end stage.^{1,2} As for surgical options, partial left ventriculectomy (PLV) was proposed and performed sporadically primarily by Batista et al.⁵ Due to the incorrect assumption that dilated cardiomyopathy was a homogeneous global LV disease and the adoption of surgical approaches that only exclude the lateral ventricular wall, PLV was associated with inconsistent results, and thus, LV reconstruction in this population of patients was abandoned all together.⁶ The poor outcomes from the PLV in dilated cardiomyopathy was believed to stem from the variability in myocardial distribution in this

non-homogeneous group of cardiomyopathy, and thus the risk of excluding healthy segments.^{8,9} Therefore, the outdated “one size fit all” approach with PLV was noted to be ineffective in the surgical management of dilated cardiomyopathy. This observation has prompted the initiation of targeted surgical approaches. 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 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.⁷ 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.⁴

In 2003, Mickleborough et al.³ published their experience of LV reconstruction in 108 patients with ischemic cardiomyopathy and pre-operative 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.³

In our report, we describe a successful surgical treatment of a patient who presented with a heavily calcified apical LV aneurysm secondary to dilated cardiomyopathy in conjunction with prolonged VT that has failed medical management and previous endocardial or epicardial ablation. The patient had an uneventful course with resolution of his VT and was discharge home on the sixth post-operative day with normalized left ventricular ejection fraction (LVEF) and freedom from any recurrent VT. The improvement in LV function following the procedure could be the result of restoring the “neck” of the contracting left ventricle, and thereby providing a more normal curvature of the chamber.⁹ Pharmacological management of the patient prior to and after surgery included an angiotensin-converting enzyme inhibitor (lisinopril 10 mg oral daily), beta-blocker (carvedilol 25 mg oral twice daily), and antiarrhythmics (sotalol 80 mg oral twice daily, as well as flecainide 100 mg oral twice daily). He was anticoagulated for his atrial fibrillation with apixaban 5 mg oral twice daily.

Conclusion

In summary, the approach that we followed in the management of this patient with dilated LV aneurysm and intractable VT is to: (1) discuss with the patient and the cardiac team about options for treatment, including surgery or continuing pharmacological and electrical cardioversion therapy, while also listing him for heart transplantation. In our case, the consensus was to attempt surgical management first, (2) choose the surgical technique that would exclude the most diseased and akinetic myocardial segment. In our case, we performed the endoventricular circular patch-plasty, also referred to as the Dor procedure, where we placed a stitch

that encircles the transitional zone between contractile myocardium and aneurysmal tissue and used a patch to re-establish ventricular wall continuity while excluding the LV apex, and (3) be more liberal with the use of cryoablation to ablate on the area of arrhythmia generation endo- and epicardially to achieve a transmural isolation to control the patient intractable VT.

Declaration of conflicting interests

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Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

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Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article

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