

Case Report

Use of the Abiomed BVS 5000 Ventricular Assist Device for Myocardial Support Following Left Ventricular Aneurysmectomy: Case Report

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ABSTRACT

Left ventricular aneurysms (LVA) are most commonly the result of a large transmural myocardial infarction, usually in the distribution of an occluded left anterior descending coronary artery. We investigated a case at Allegheny University Hospitals, Hahnemann Division, Philadelphia, PA, involving the use of the Abiomed BVS 5000 ventricular assist device (VAD) for LVA repair. The patient was successfully weaned from cardiopulmonary bypass using the Abiomed BVS Left Ventricular Assist Device (LVAD). The LVAD was successfully removed on the fourth postoperative day. In summary, we report the successful support of the myocardium with the Abiomed BVS 5000 Ventricular Assist Device after left ventricular aneurysmectomy. We favor mechanical over high dose inotropic support of the myocardium with a VAD in postcardiotomy patients with severe ventricular dysfunction.

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INTRODUCTION

Left ventricular aneurysms (LVA) are most commonly the result of a large transmural myocardial infarction, usually in the distribution of an occluded left anterior descending coronary artery. The sequelae of this disorder are left ventricular (LV) dysfunction with congestive heart failure, mural thromboses and emboli, and ventricular arrhythmias. Operative treatment is required for one or more of these indications. A variety of techniques have evolved since Beck buttressed an LVA with strips of fascia lata in 1944 (1), Bailey plicated an LVA in 1955 (2), and Cooley excised an LVA with cardiopulmonary bypass (CPB) in 1958 (3). We report the successful outcome of LVA repair with myocardial support utilizing the Abiomed BVS 5000 ventricular assist device (VAD).

CASE REPORT

A sixty-five year old female presented to Allegheny University Hospitals, Hahnemann Division, Philadelphia, PA, on July 29, 1996, with congestive heart failure (CHF). The patient had a history of a prior myocardial infarction (MI), chronic obstructive pulmonary disease, peripheral vascular disease, diabetes mellitus requiring insulin, hypertension, and bilateral femoral-popliteal bypasses. There was cardiomegaly with severe LV dysfunction with moderate mitral and tricuspid regurgitation on echocardiography. The septum was dyskinetic, the inferolateral walls were hypokinetic, and there was a large anterior LVA. Right ventricular function was preserved. The ejection fraction was less than 30%. There was total occlusion of the proximal left anterior descending (LAD) and right coronary (RCA) arteries, and 90% occlusion of the proximal left circumflex (LCX) coronary artery. The pulmonary artery pressures were 32/12 mmHg and the pulmonary capillary wedge pressure 12 mmHg. Because of the presence and severity of her comorbid conditions, she was not considered a cardiac transplant candidate. Intense medical management failed to improve the patient's symptoms of CHF. The patient was offered coronary revascularization and LVA resection with myocardial support utilizing the Abiomed BVS 5000 VAD. An intra-aortic balloon pump (IABP) was not a consideration because of her severe obstructive ilio-femoral arterial disease.

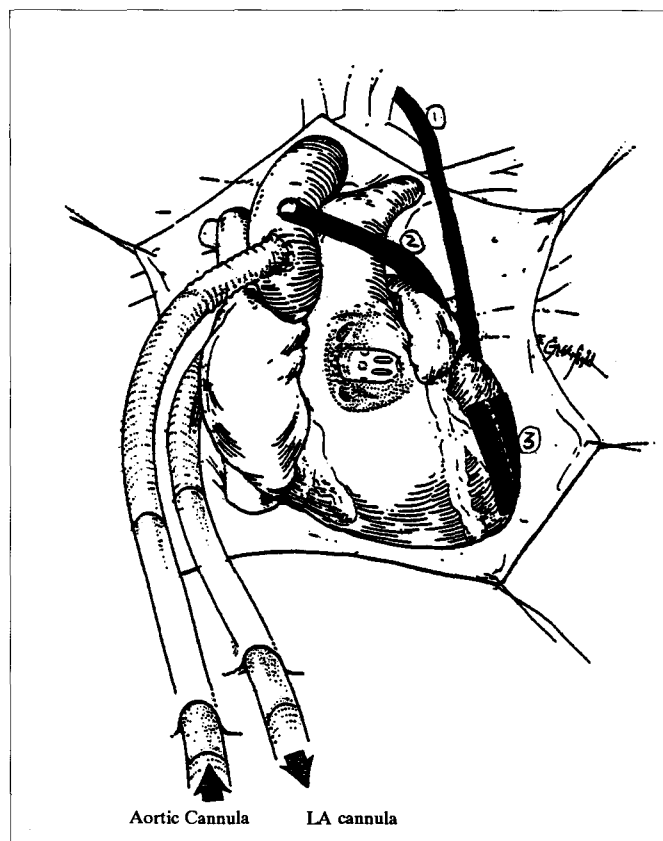
On August 7, 1996, the patient was taken to the operating room. Cardiopulmonary bypass was conducted using standard aortic and right atrial cannulation techniques, utilizing a 24 French straight arterial and 36/34 French two-stage venous cannula, respectively. Moderate hypothermia (26°C) with cold antegrade/retrograde blood-crystalloid cardioplegia was employed (15 ml/kg). Coronary artery bypass grafting (CABG) to the major

marginal branch of the LCX and to a ramus intermedius vessel was performed. The LAD, RCA, and posterior descending arteries were not bypassable. A large anterior LVA was resected, mural thrombus was removed, and primary reconstruction of the LV with Teflon strips was performed. The patient could not be weaned from CPB with high dose inotropic agents. We elected to insert the Abiomed BVS 5000 VAD^a. Left atrial (36 French) and aortic conduits (46 French/14 mm) were connected to the external pneumatically driven pump (Figure 1). The left atrial cannula was inserted into the body of the left atria and secured with snares. The aortic cannula was anastomosed end-to-side to the lateral aspect of the ascending aorta with 3-0 polypropylene suture. Activation of the device permitted successful discontinuation of CPB with minimal inotropic support. The cross-clamp time was 112 minutes and total CPB time was 215 minutes.

Postoperatively, the patient was clinically and hemodynamically stable. The flow rates on the VAD were maintained at maximal output (an automatic setting based on a fixed stroke

a Abiomed Cardiovascular, Inc., Danvers, MA

Figure 1: Diagram of VAD cannulas in relation to bypass grafts and LVA repair



- (1) LIMA → ramus intermedius
- (2) SVG → major marginal branch of left circumflex
- (3) LVA repair with buttressed Teflon strips

volume of 70-80 ml) ranging between 4.5 to 5.5 L/min depending upon preload and afterload conditions. Anticoagulation was maintained with a heparin infusion to achieve an anticoagulation time (ACT) of approximately 200 seconds (or a partial thromboplastin time approximately twice the control). Bedside weaning on the third postoperative day showed satisfactory hemodynamics at flow rates of 2 L/min.

On the fourth postoperative day, the LVAD was successfully removed. Postoperative complications included line sepsis, renal failure, and respiratory failure requiring tracheostomy. Over the course of several weeks, her condition improved. On the forty-first postoperative day she was discharged with a normal white blood count and creatinine to a skilled nursing facility.

DISCUSSION

The results of LVA surgery have been extensively studied (4). Hospital mortality after repair of LVA, with or without concomitant CABG, is about 5% (5). The overall time-related survival of patients undergoing resection of LVASs is 90%, 85%, 75% and 65% at 30 days, 1, 3, and 5 years, respectively (4). These results are superior to the 61% one year mortality of patients with an LVA after an anterior MI, and the 80% mortality associated with the development of a detectable aneurysm within forty-eight hours of a myocardial infarction (6). In patients with LVA, hospital, early, and late survival is worse for patients with CHF alone compared to angina alone (27% versus 8%) (4). Our solution to this problem was unique because we employed an LVAD to support the myocardial function following LVA resection. In other circumstances, an IABP would have been tried prior to LVAD placement. However, with the severity of peripheral vascular disease, IABP insertion was not an option. Others have reported success in postcardiotomy shock (7), particularly in the setting of coronary revascularization with inability to wean from CPB. The advantages of the Abiomed BVS 5000 include ease of insertion, simplicity of maintenance, and effectiveness of performance. The inotropic requirements following VAD insertion are dramatically reduced. The excellent results of the VAD have led us to hypothesize that a VAD would be beneficial in other conditions in which myocardial dysfunction prevented successful surgical outcome. Mechanical support for decompression of the LV in repair of ischemic cardiac rupture in two cases (8, 9) and for LV disruption during a mitral valve operation in one case (7) has been reported. Similarly, we used the Abiomed BVS 5000 VAD in a case of post-infarction ventricular septal defect for intraventricular decompression. In summary, we report the successful support of the myocardium with the Abiomed BVS 5000 Ventricular Assist Device following left ventricular aneurysmectomy. We favor mechanical over high dose inotropic support of the myocardium with a VAD in postcardiotomy patients with severe ventricular dysfunction.

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