Percutaneous Closure of Left Ventricular Pseudoaneurysm

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The risk of rupture of a left ventricular (LV) pseudoaneurysm ranges from 30% to 45% in the first year. Open surgical repair carries high mortality related to anatomic complexity and patient comorbidities. Percutaneous closure may offer a viable alternative to surgical intervention in this cohort. Herein, we describe 3 unique cases of transcatheter LV pseudoaneurysm closure.

Case Report

Case 1
A 90-year-old symptomatic man with a history of coronary artery bypass grafting underwent routine transthoracic echocardiography 4 months after a balloon aortic valvuloplasty. Imaging revealed an LV pseudoaneurysm in the inferolateral wall, measuring 13.5 cm², with a typical narrow (0.8-cm) neck (Fig 1A) confirmed by computed tomography (CT), and the patient was referred for transcatheter closure. The pseudoaneurysm was engaged with an 8F MPA guide catheter (Boston Scientific, Natick, MA) advanced retrograde through the femoral artery. After positioning, a 10-mm Amplatzer muscular ventricular septal defect occluder device (AGA Medical, Plymouth, MN) was delivered through the MPA guide across the neck of the pseudoaneurysm. Follow-up transthoracic echocardiography and CT showed residual flow into the pseudoaneurysm, with complete closure seen 3 months after the procedure (Fig 1B). At 9-month follow-up, the patient continued to do well.

Case 2
A 77-year-old man, with a history of 3-vessel coronary artery bypass grafting, resection of an ascending aortic aneurysm, an abdominal aortic aneurysm treated with surgical repair, and femoral-popliteal bypass, presented for ascending aortic aneurysm revision. An apical LV vent was placed during cardiopulmonary bypass. One week later, the patient presented with a pulsatile chest wall mass. A CT angiogram revealed an LV pseudoaneurysm at the previous apical venting site. The surgeon’s assessment of poor-quality tissue at the LV apex, extensive comorbidities, and recent surgical treatment placed the patient at prohibitively high surgical risk for open pseudoaneurysm repair. He was referred for percutaneous closure.

Because of severe peripheral artery disease, femoral venous and transseptal access to the left ventricle was used. Left ventriculography (Fig 2A) demonstrated a complex friable-appearing tunnel from the LV apex, extending into a 30-mm pseudoaneurysm. Given the size and complexity of the pseudoaneurysm, the defect was approached apically. Apical LV puncture using biplane fluoroscopy and a Chiba needle (22-gauge, 15-cm length; Cook Medical, Bloomington, IN) was used. The access site was predilated and a 12F sheath was placed. A 30-mm Amplatzer septal occluder (AGA Medical, Plymouth, MN) was deployed transapically, with the left atrial disk hammocked in the apex of the left ventricle and the right atrial disk filling the tunnel of the tract but remaining incompletely expanded (Fig 2B). After deployment, minimal residual flow was noted, which was seen by CT to be resolved 2 weeks later. The patient died of unrelated causes 3.5 years later, with follow-up echocardiography demonstrating successful closure.

Case 3
A 78-year-old man underwent mitral valve repair, tricuspid valve repair, and a CryoMaze procedure. Because of...
chest pain after the procedure, chest CT was performed, revealing a lateral LV pseudoaneurysm likely caused by a transmitral LV vent. Given his comorbidities and recent cardiac operation, percutaneous pseudoaneurysm closure was undertaken.

The pseudoaneurysm was engaged using an 8F MPA guide (Boston Scientific) advanced retrograde from the femoral artery. The pseudoaneurysmal neck measured 5 mm, and a 6-mm Amplatzer muscular ventricular septal defect occluder device (AGA Medical) was deployed across the neck. CT and LV angiography demonstrated no residual flow across the pseudoaneurysm. One day after the procedure, the patient experienced aphasia without radiographic evidence of ischemic stroke. He was discharged 7 days after transcatheter closure, with complete resolution of aphasia, consistent with a reversible ischemic neurologic deficit.

Comment

Untreated pseudoaneurysm has a 30% to 45% risk of rupture in the first year [1]. Spontaneous closure may occur in a minority of patients [3]. Because of multiple comorbidities, many of these patients have up to a 20% surgical mortality [4, 5]. Therefore transcatheter closure offers an attractive alternative to surgical intervention. Currently, no large series or randomized control trials exist to define therapy in this patient population.

Our cases demonstrate successful percutaneous closure of LV pseudoaneurysm in 3 patients at high operative risk. Case 1 highlights a unique method by which iatrogenic LV pseudoaneurysm can occur, ie, wire perforation during balloon aortic valvuloplasty. This complication is one that is expected to increase given the widespread adoption of transcatheter aortic valve implantation and the use of stiff wires placed in the left ventricle for deployment of these valves. Case 1 also demonstrates that successful transcatheter closure may occur late after closure device placement; complete closure followed a 3-month period of observation. Delayed closure, without long-term deleterious consequences, has been reported previously and highlights the importance of surveillance imaging [6]. The mechanism of delayed closure reflects delayed endothelialization or thrombus formation at the site of the closure device. Partial closure slows the entry velocity of blood into the pseudoaneurysm, facilitating spontaneous thrombus formation.

In addition to also highlighting the possibility of delayed closure, the second case demonstrates that complete deployment of both disks of a closure device is not necessary in a pseudoaneurysm tract. In fact given a long tract, incomplete expansion is an expected outcome that does not preclude procedural success.

The third case demonstrates LV pseudoaneurysm closure in a patient after a cardiac operation and highlights a cerebrovascular event as a potential complication of transcatheter closure. Although stroke as a result of thrombus formation has been reported in the literature as a complication of LV pseudoaneurysm, and transcatheter closure has been performed for the prevention of thromboembolic complications in patients with LV pseudoaneurysm [7], this is the first reported case, to our knowledge, of a cerebrovascular accident in the setting of transcatheter closure of an LV pseudoaneurysm. Whether the neurologic event occurred while crossing the aortic valve, engaging the pseudoaneurysm, or implanting the device is not clear. Regardless, transcatheter procedural technique dictates minimizing manipulation of the pseudoaneurysm to decrease the risk of rupture or potential thrombus mobilization.

Limitations

As a small case series, we cannot make definitive recommendations regarding the ideal management of LV pseudoaneurysm. Our cases do highlight that individualized management contingent on the anatomy and patient comorbidities is paramount. Further, the anatomic delineation obtained from contrast echocardiography and CT are vital in periprocedural planning.

In conclusion, transcatheter closure of LV pseudoaneurysm may be an attractive alternative to surgical intervention in high-risk patients.

References