Severe Mitral Regurgitation After Left Ventricular Pseudoaneurysm Repair

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LEFT VENTRICULAR (LV) PSEUDOANEURYSMS are rare entities that develop when a free wall rupture is contained by the pericardium or adhesions, with the most common cause being transmural myocardial infarction.[1–8] Other conditions also can lead to pseudoaneurysm formation and include LV trauma, prior LV surgery, LV foreign body infection, myocarditis, and LV posterior wall rupture complicating mitral valve replacement.[1–8] Left ventricular pseudoaneurysms have been associated with the development of significant mitral regurgitation (MR), necessitating mitral valve replacement.[9] Because most pseudoaneurysms occur in the basal aspect of the LV, they can distort the geometry of the mitral valve (MV) apparatus and cause MR. Repair of a basal pseudoaneurysm with a patch can decrease MR by improving the geometry of the LV and MV apparatus.[1,9]

The occurrence of moderate-to-severe MR after LV pseudoaneurysm surgical repair poses a significant challenge to the cardiac surgeon and anesthesiologist. Changes in the LV geometry after primary pseudoaneurysm repair can further distort the MV apparatus and cause MR.[1] Likewise, LV systolic dysfunction from poor myocardial protection and iatrogenic injury to the subvalvular MV apparatus (chordae and papillary muscles) may result in significant MR after cardiopulmonary bypass (CPB). This imposes tough decisions as to whether CPB should be reinstituted to either repair or replace the MV. Unfortunately, concomitant LV pseudoaneurysm repair and MV replacement have been associated with higher rates of mortality.[2] Accordingly, the mechanism of the MR should be meticulously investigated via echocardiography before proceeding with MV surgery.

Transesophageal echocardiography (TEE) remains the best imaging modality in this setting and can help delineate the etiology of the MR after pseudoaneurysm repair. The comprehensive data provided by TEE, such as the mechanism and severity of MR, integrity of the MV apparatus, distortion of LV geometry, and abnormalities of LV wall motion, are invaluable to the decision-making process and help guide surgical strategy.

The authors present a case of successful intraoperative management of severe MR in an elderly patient after a basal LV pseudoaneurysm repair.

CASE REPORT

A 73-year-old female with a history of hypertension, diabetes, coronary artery disease (status post 4-vessel coronary artery bypass graft surgery in 2007), and myocardial infarction presented to an outside hospital with unstable angina, nausea, and diaphoresis. She was diagnosed with a non-ST-segment elevation myocardial infarction (troponin level, 13.58 ng/mL; normal, <0.11 ng/mL) and was taken for emergency angiography of the native coronary arteries and the bypass grafts. The angiogram demonstrated complete occlusion of the native circumflex artery and the saphenous vein bypass graft to the second obtuse marginal (OM) branch vessel. Percutaneous coronary intervention of the proximal circumflex and proximal OM2 bypass grafts was not possible because of the presence of angiographic features suggestive of severe chronic total occlusion. The left internal mammary to left anterior descending artery pedicle graft was patent as were the saphenous vein bypass grafts to the right coronary artery and the OM1 branch vessel. Furthermore, the ascending aorta was discovered to be severely aneurysmal. To decrease the risk of contrast-induced nephropathy in this elderly patient, the decision was made to defer contrast left ventriculography and to assess cardiac function echocardiographically. The outside hospital transferred the patient to the authors' facility for ascending aorta replacement and possible revascularization of the OM2 bypass graft. Unfortunately, an echocardiogram was not performed before the transfer occurred.

Upon admission to the authors' institution, multidetector computed tomographic angiography was performed to anatomically characterize the ascending aortic aneurysm. The results revealed that the ascending aorta was aneurysmal, with a maximal dimension of 6.5×6.5 cm (Fig 1). In addition, a focal contained LV pseudoaneurysm was incidentally discovered, which was adjacent to the basal inferolateral and anterolateral walls (Figs 1–4). The pseudoaneurysm capsule measured 3.7×1.6 cm, and its neck measured 1.4 cm. A transthoracic echocardiogram was obtained and revealed severe LV systolic dysfunction with a 25% ejection fraction (EF), mild central functional MR, and a large ascending aortic aneurysm. It also demonstrated a pseudoaneurysm of the basal inferolateral and anterolateral LV walls with systolic and diastolic

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1053-0770/2602-0033$36.00/0
http://dx.doi.org/10.1053/j.jvca.2015.07.014
Key words: coronary artery bypass graft surgery, echocardiography, ischemic mitral regurgitation, left ventricular pseudoaneurysm, mitral valve apparatus, myocardial protection strategies, papillary muscle

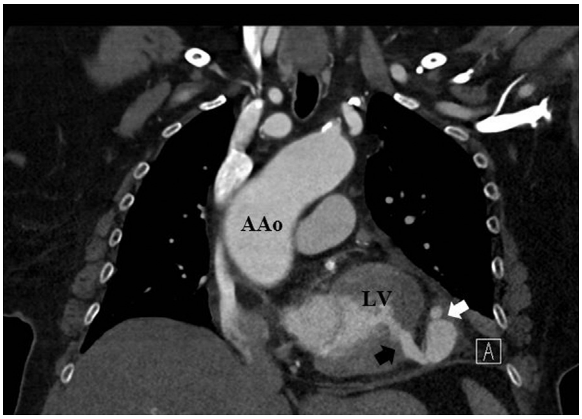

Fig 1. Coronal chest computed tomography angiogram showing the 6.5 × 6.5 cm ascending aortic aneurysm, left ventricle, left ventricular pseudoaneurysm, and the communication between the left ventricle and the pseudoaneurysm (*white arrow*, left ventricular pseudoaneurysm; *black arrow*, pseudoaneurysm neck). AAo, ascending aortic aneurysm; LV, left ventricle.

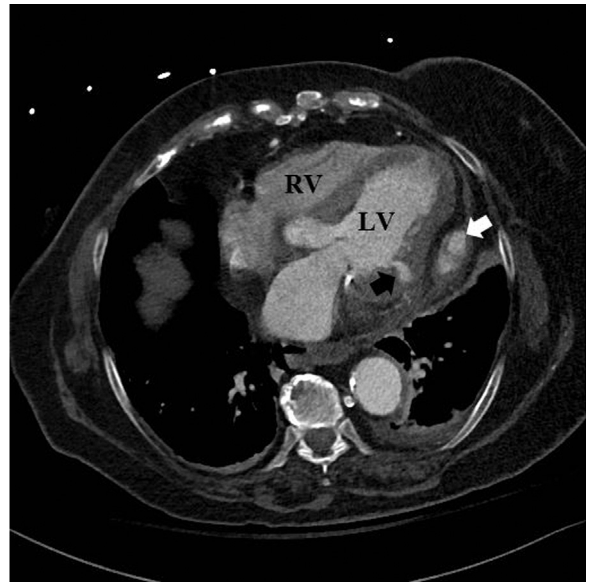

Fig 3. Axial computed tomography angiogram showing the basal location of the LV pseudoaneurysm neck (*white arrow*, LV pseudoaneurysm; *black arrow*, neck of the pseudoaneurysm). LV, left ventricle; RV, right ventricle.

flow, as demonstrated by a color flow Doppler analysis (Videos 1-3). Regional wall motion analysis showed akinetic wall motion in the basal and mid-portions of the inferolateral and anterolateral walls. The remaining LV walls were hypokinetic.

The patient was taken to the operating room for emergency repeat median sternotomy and ascending aorta replacement and LV pseudoaneurysm repair. After placement of a left radial intra-arterial catheter, general anesthesia was induced, followed by intubation and placement of a right internal jugular pulmonary arterial catheter. Intraoperative TEE (X7-2t transducer; Philips Healthcare, Andover, MA) examination demonstrated a mildly dilated LV with moderate systolic dysfunction (35% ejection fraction) and stage II diastolic dysfunction (pseudonormalized mitral inflow pattern). There was mild functional MR, secondary to symmetric tethering of both MV leaflets, resulting from lateral and apical displacement of the papillary muscles (Figs 5–7 and Videos 4-9). The diagnosis of symmetric chronic ischemic MR was supported by the echocardiographic quantitative measurements described by Dudzinski et al.[10] The measurements for the patient in the case presented here included a tenting height of 9.5 mm, an anterior mitral leaflet tethering angle (α) of 44°, a posterior mitral leaflet tethering angle (β) of 48°, a β:α ratio of 1.1, and a tenting area of 1.76 cm^2. The mitral annulus was not dilated and measured 25 mm. Identification of the LV pseudoaneurysm in the midesophageal views was made difficult by the presence of significant posterior mitral annular calcification (Videos 5-7). Likewise, examination from the multiple transgastric

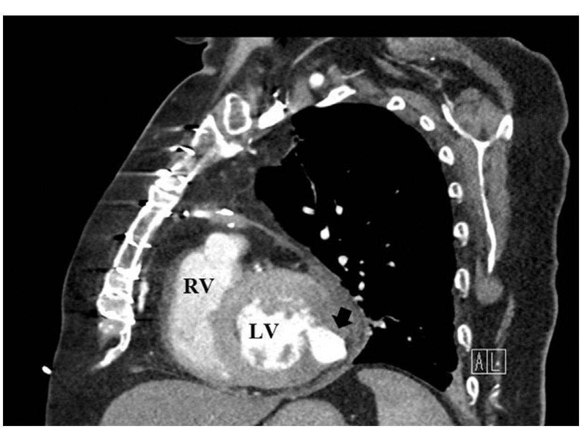

Fig 2. Sagittal computed tomography angiogram of the chest showing the LV pseudoaneurysm measuring 3.7 × 1.6 cm (*black arrow*, LV pseudoaneurysm). LV, left ventricle; RV, right ventricle.

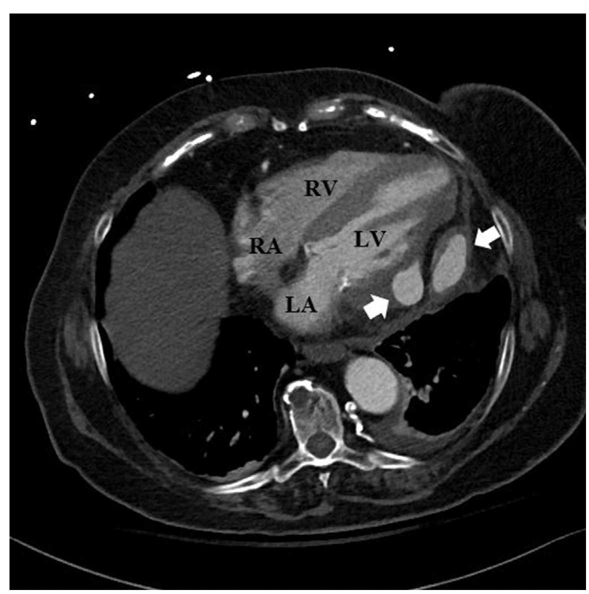

Fig 4. Axial computed tomography angiogram showing the LV pseudoaneurysm contained by pericardium and adhesions (*white arrows*, LV pseudoaneurysm). LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle.