Operative Techniques in Thoracic and Cardiovascular Surgery

# Repair Techniques for Ischemic Mitral Regurgitation

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Ischemic mitral regurgitation (IMR) is an insufficiency of the mitral valve (MV) secondary to myocardial ischemia and coronary artery disease and occurs in the absence of degenerative (structural) mitral valve disease. The underlying pathophysiologic mechanisms of IMR are often complex, resulting from structural changes involving left ventricular geometry, the mitral annulus, and the valvular/subvalvular apparatus. Moderate to severe IMR typically occurs due to several anatomic changes. These changes result in clinically significant valve incompetence due to the combined effects of decreased ventricular function and restricted motion of the valve itself due to tethering.

Recent estimates suggest that IMR occurs in nearly 20%-30% of patients following myocardial infarction.[1,2] IMR has a strong association with heart failure, and suboptimal medical management of heart failure further complicates the management of clinically significant IMR. In fact, moderate or severe mitral regurgitation (MR) may be associated with a 3-fold increase in the adjusted risk of heart failure and a 1.6-fold increase in risk-adjusted mortality at 5 years.[3] The presence of concomitant comorbid disease, including renal failure, chronic obstructive pulmonary disease, diabetes, and impaired left ventricular function,[4] further increases the risk of patient morbidity and mortality.

The surgical management of IMR has historically been associated with poor outcomes; however, recent series have demonstrated improvements in morbidity and mortality. Many contemporary series report mortality rates of <5% following surgical correction of IMR.[5-9] Current surgical options for IMR include myocardial revascularization alone with coronary artery bypass grafting (CABG), mitral valve replacement (MVR) with concomitant CABG, or MV repair with CABG. Among MV repair techniques, restrictive ring annuloplasty remains the most common and is our preferred initial approach to restoring the geometry and function of the affected MV. An alternative repair technique that we employ is the use of a posterior papillary muscle traction suture placed through the mitral annulus that is used to reduce the effects of cord tethering and a loss of MV leaflet coaptation. In our experience, we have found that the combined use of these techniques corrects the majority of clinically significant (2+ or greater) IMR.

Although outcomes and opinions remain mixed as to the efficacy of mitral replacement vs repair for IMR, increasing support for the performance of mitral repair over replacement has emerged in recent years. Mantovani and colleagues reported that both prosthetic MVR and MV repair offer very similar results for chronic IMR, demonstrating similar operative mortality and 5-year actuarial survival for both techniques.[10] Similarly, Magne and colleagues demonstrated lower operative mortality for MV repair compared to MVR (9.7% vs 17.4%, $P = 0.03$) with equivalent long-term survival.[11] In our own experience, we have demonstrated that mitral repair with concomitant CABG is associated with improved mortality and outcomes compared to MVR with CABG,[12] and that MV repair for IMR does not increase morbidity and mortality compared to MVR.[4] Our findings are in agreement with other series favoring the performance of MV repair for functional IMR. Although restrictive annuloplasty remains the most commonly performed repair technique,[13] it has been shown to be beneficial in both functional and chronic IMR.[14] Overall, improved survival, decreased valve-related morbidity, and improved left ventricular function have been previously established, and several series have reported lower hospital mortality with MV repair compared to MVR.[7,9,12,15-18]

Herein, we describe our surgical approach to the repair of the ischemic MV and subvalvular apparatus. Although we do not illustrate the performance of concomitant CABG in this article, myocardial revascularization remains critical to the long-term success of the surgical correction of IMR and should occur at the time of mitral repair. With respect to the performance of ring annuloplasty, we prefer the use of semi-rigid complete annuloplasty rings, and we have recently departed from the routine practice of significantly downsizing the annuloplasty ring by 2 sizes. We now favor downsizing the annuloplasty ring by 1 size to avoid tension.

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## Operative Technique

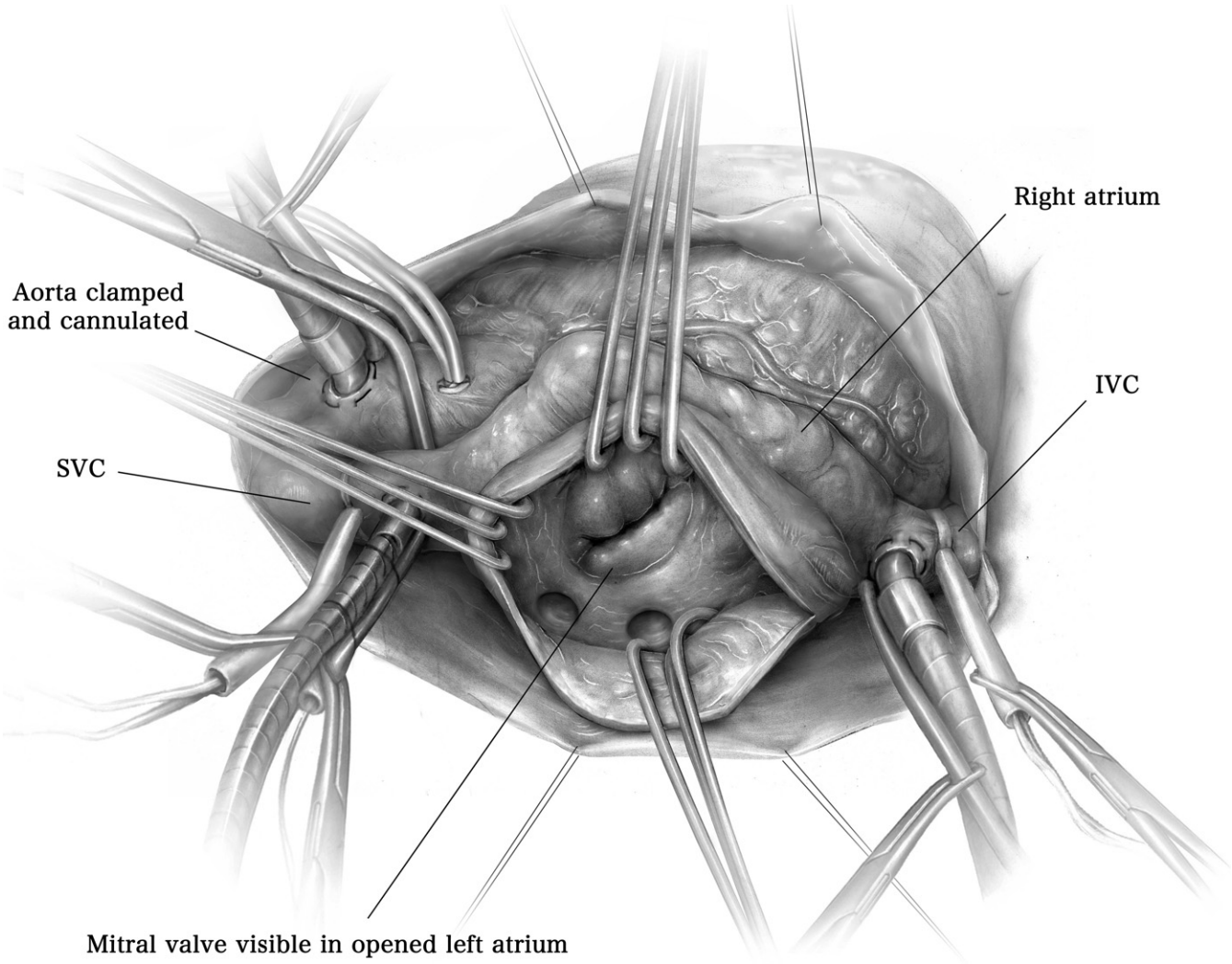


**Figure 1** After standard preoperative preparation, including arterial and central venous monitoring, intraoperative transesophageal echocardiography is performed to carefully assess the mechanism of MR. It is our practice to routinely repair ≥2 + MR. CABG harvesting is performed as most patients require concomitant myocardial revascularization. Our preference is to perform endoscopic harvesting for all saphenous vein grafts. Harvesting of the left internal thoracic artery is performed in the usual surgical fashion following full median sternotomy. After pericardotomy, cardiopulmonary bypass is established using standard aortic and bicaval cannulation with vacuum-assisted venous drainage and a combination of both antegrade and retrograde cardioplegia. Distal coronary anastomoses are then performed. Antegrade cardioplegia down the grafts is then performed every 15 minutes to ensure myocardial protection. Next, traction is placed on the umbilical tape passed around the inferior vena cava, elevating the right side of the heart and facilitating surgical access to the left atrium and mitral valve. A left atriotomy is then performed beginning at the junction of the left atrium and right superior pulmonary vein, which is extended from under the superior vena cava to the inferior vena cava, exposing the entire mitral valve. We then utilize a Cosgrove self-retaining mitral retractor, and the operating table is rotated to the left away from the surgeon. IVC = inferior vena cava; SVC = superior vena cava.