

IMPACT OF MINIMALLY INVASIVE MITRAL VALVE SURGERY

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INTRODUCTION

Minimally invasive cardiac surgery has been introduced for the surgical treatment of isolated valvular heart disease. Interest among cardiac surgeons is growing as the potential benefits to the patient have become more reproducible. Ten years ago, surgeons began to recognize the advantages of performing smaller incisions compared to the traditional median sternotomy.¹ Our group at the Methodist DeBakey Heart & Vascular Center began our anatomic studies relating the cardiac valve position to the surface anatomy of the chest wall in 1998 as we launched our own efforts in this area.² Since that time, experience with large numbers of cases has shown minimally invasive mitral valve surgery to be reproducible, reliable, and much better tolerated by our patients.^{3,4} Recently, the Methodist DeBakey Heart & Vascular Center robotic mitral valve surgery program was successfully launched by Dr. Gerald Lawrie and his team with outstanding early results.

COMMON SURGICAL APPROACHES

Alternative approaches for aortic and mitral valve surgery were initially developed to avoid the increased morbidity and mortality of cardiac valve surgery in reoperative cardiac patients.⁵ It became apparent that these benefits could be extended to all cardiac valve procedures, and several minimally invasive techniques for isolated mitral valve surgery have been described within the last few years. The partial upper hemisternotomy and the minithoracotomy are the most common surgical approaches currently used.⁶

The upper hemisternotomy is done as an upside down J, with the bottom half of the sternum divided in the center with an extension into the right third or fourth interspace, allowing excellent exposure of the ascending aorta and aortic valve and easy conversion into a standard median sternotomy if needed. It does carry the disadvantage of disrupting the integrity of the chest wall, albeit to a lesser degree than full sternotomy.

The minithoracotomy is done in the right anterior lateral aspect of the thorax with a 2- to 3-inch incision in



Figure 1. Right minithoracotomy incision

the fourth or fifth intercostal space. This procedure is known to preserve the stability of the thoracic cage, produce superior cosmetic results,⁷ and allow excellent access to the left atrium and mitral valve. The addition of a thoracoscope allows visualization by the entire surgical team and improves communication among the surgeons, scrub nurses, and perfusionists (Figure 1).

The port access system (Port Access, Heartport, Inc.) is a sophisticated technique originally developed for endo-

scopic cardiac surgery.⁷ It aims for a smaller skin incision and employs a minithoracotomy using a special catheter system for balloon aortic occlusion and cardioplegia delivery. Cardiopulmonary bypass is established via the femoral vessels after general heparinization. Venous cannulas are inserted into the right femoral vein and advanced into the right atrium. A separate cannula may be placed into the right internal jugular vein. Arterial cannulation is done through the right femoral artery, forming a Y-shaped femoral endovascular bypass. Transesophageal echocardiography is an essential component to assess and monitor valvular anatomy and function before and after surgery. It is also helpful for positioning and monitoring the placement of cannulas and catheters. The endoscopic system is a critical component of robotic valve surgery.

• Robotic mitral valve surgery is done with a procedure set up similar to port access, but all access to the heart is by surgeon-controlled robotic arms inserted thru small ports.

The MICRO technique, as described by Chitwood and colleagues,⁸ uses the



Figure 2A. Healing partial upper sternotomy



Figure 2B. Healing right minithoracotomy

same thoracic access but also employs a thoracic aortic clamp and application of direct antegrade cardioplegia. We favor a hybrid technique with a combination of MICRO and port access approaches that offer direct control of the aortic occlusion.

BENEFITS OF PORT ACCESS SURGERY

With improved surgical equipment and advanced surgical techniques, port access surgery is likely to be more common in the future. For example, Grossi et al. compared the pore access approach with the traditional sternotomy and concluded that the pore access technique for isolated mitral valve surgery provided patients with significantly improved clinical outcomes in their immediate perioperative course.⁶ This approach has several advantages: It offers better exposure to the mitral valve in patients with a small left atrium; preservation of sternal integrity; better control of postoperative thoracic pain; a significantly shorter hospital stay; a decreased risk for transfusions due to less blood loss; early mobilization and rehabilitation; a notable reduced risk of deep sternal infection; and fewer septic complications.^{6,10}

The pore access technique also offers an excellent cosmetic result. Although it is clear, as surgeons our primary focus must be on providing the patient with the optimal surgical outcome.¹¹ It is, however, important to recognize that as patients become better informed about their options, we cannot ignore their desire for "less invasive" approaches. The right minithoracotomy used for mitral valve surgery produces a scar that almost completely disappears within the breast fold.¹²

While it is minimally invasive, the right minithoracotomy does have some potential disadvantages that include its limitation to isolated mitral valve surgery, the issue of successfully deairing the heart because of limited access to the ascending aorta/cardiac apex,

aortic dissection caused by flow or by cannula manipulation, increased costs, and longer cross-clamp times during the initial learning curve.¹³ To date, we have used this approach for mitral valve repair, left atrial Maze atrial fibrillation procedure, aortic septal defect closure, and to remove a left atrial myxoma with good results.

SUMMARY

In order for minimally invasive alternatives to become standard surgical procedures, they must neither compromise the quality of the procedure nor increase the operative morbidity and mortality of the conventional surgery.⁹ While the learning curve is steep, it is clear that the port access approach is reproducible and offers significant advantages over the standard median sternotomy and upper hemisternotomy. Both upper "J" hemisternotomy and right minithoracotomy provide excellent recovery from aortic valve replacement. Both upper "J" hemisternotomy and right minithoracotomy provide excellent cosmetic results (Figures 2A and 2B). Consistent outcomes can be expected in centers committed to developing this technique, and we believe this approach will likely become the new standard for isolated mitral valve pathology.

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