Does Minimally Invasive Cardiac Surgery Mean Small Incisions?

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Background

Objectives: Minimally invasive surgical techniques for mitral valve regurgitation are rapidly expanding. This case series reviews the careful application of three different approaches for three unique patients, and offers a redefined view of minimally invasive cardiac surgery.

Methods: A retrospective review of three recent cases of mitral valve regurgitation at our institution were reviewed in order to compare and contrast the preferred treatment approach based on various patient factors.

Results: Three patients underwent different procedures to address mitral valve regurgitation based on individually unique factors including religion, occupation, and recent cardiac history. Transcatheter Mitral Valve Clip Device, Beating Heart Mitral Valve Replacement, and Right Thoracotomy Mitral Valve Replacement were performed and discussed in relation to the indications. Each was treated using a customized approach that resulted in the minimization of mitral valve surgery's overall impact on their lives.

Conclusions: This series illustrates the importance of shared decision-making and surgical technique selection across a broad spectrum of patients. It provides an alternative perspective on the meaning of "minimally invasive" surgery and paves the way for future investigation on how to improve patient outcomes and satisfaction.

Case Description #1

Transcatheter MitraClip Application:

A 71 year old male with a history of nonischemic cardiomyopathy and heart failure with an ejection fraction of 10-15% was admitted to the hospital to undergo intervention for severe mitral valve regurgitation. The patient strongly wished to avoid surgery and had a 10% risk of mortality based on his STS score. He would have potentially been a surgical candidate, but when his religious preferences were discussed he became a prohibitively high risk due to his beliefs regarding transfusion as a Jehovah's Witness. Given his risks for pursuing mitral valve replacement, the patient elected to undergo a transcatheter MitraClip with the structural heart interventional cardiology team. He underwent the procedure successfully without complications and was discharged home on postoperative day 1. In the past, the patient would have been faced with the challenge of weighing his religious beliefs against the risks of surgery. Fortunately with modern techniques, a transcatheter approach was clearly the least invasive procedure that enabled him to maintain his religious practices while minimizing his risks.

Case Description #2

Beating Heart Mitral Valve Replacement via Median Sternotomy:

The second case in this series was that of a 50 year old African-American male who initially presented to the hospital with an acute anterior myocardial infarction. He was admitted and endured a prolonged course due to a variety of comorbidities including ESRD, COPD, HTN, DM, atrial fibrillation, and ischemic cardiomyopathy. He remained inpatient and underwent treatment for worsening shortness of breath, pneumonia, and GI bleed with increasing oxygen requirements, need for steroids, and challenges with anticoagulation. Despite treatment, the patient's pulmonary infiltrates failed to resolve and a TTE showed Type IIIb mitral regurgitation. The patient's clinical course and history of poor compliance demonstrated that he would not be an appropriate candidate for outpatient medical optimization followed by MitraClip. His heart failure regimen was optimized while inpatient and he required erythropoietin therapy. His STS risk score indicated that he had a 20-30% risk of mortality, stroke, bleeding, infection, or need for pacemaker. Given the patient's extensive coronary artery disease with an occluded right coronary artery, it was determined that the patient would benefit most from a bioprosthetic mitral valve replacement using a warm beating heart cardioprotective strategy. Although this would involve an incision of traditional size, the individualized selection of operative technique minimized the specific risks of coronary perfusion in his surgery. In addition, a MAZE procedure and exclusion of the left atrial appendage was performed given the patient's history of atrial fibrillation and anticoagulation risks. He recovered gradually as expected and was preparing for inpatient rehab after approximately three weeks of inpatient management. Unfortunately, the patient suddenly passed away during a session of hemodialysis on postoperative day 19 after becoming hypotensive and bradycardic. The patient had been ambulatory and on DVT prophylaxis but the suspected cause of his decline remains pulmonary embolism pending further investigation.

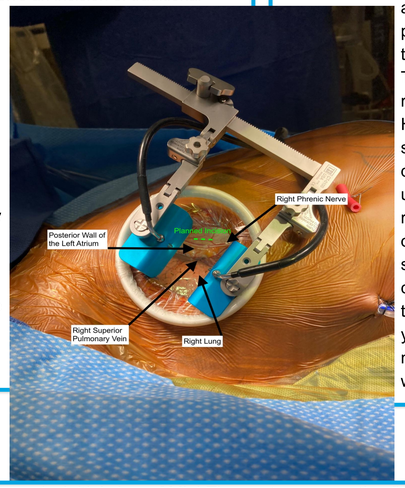


Figure 1 - Initial view of Mini-Thoracotomy operative field

Case Description #3

Mitral Valve Replacement via Right Anterolateral Mini Thoracotomy:

The case of a 29 year old African-American male with severe mitral regurgitation is the third example in our series. He initially presented to the hospital for evaluation after several weeks of gradually increasing congestion, fatigue, and fevers, culminating in altered mental status that prompted his mother to bring him to the emergency department. He was found to have streptococcus pneumoniae in his blood and CSF cultures with numerous minute foci of infarctions in the brain, concerning for septic emboli from a cardiac source. Transthoracic echocardiogram revealed a thickened posterior mitral valve leaflet with a large vegetation and moderate eccentric mitral valve regurgitation. The patient's urine drug screening was negative and he had no history of IV drug abuse. His septicemia was ultimately attributed to pansinusitis seen on imaging of his head. After treatment with antibiotics the patient's clinical and neurologic status improved dramatically and repeat cultures became negative. Cardiothoracic surgery was consulted for management of the mitral valve regurgitation and vegetation. The patient and his family were counselled on the risks of surgery and mechanical versus bioprosthetic valve replacement, as the thickened leaflet and vegetation would likely preclude the possibility of native valve repair. Notably, the patient reported that he works in construction and performs heavy manual labor. Therefore, it was decided to pursue bioprosthetic mitral valve replacement via a right mini-thoracotomy approach (Figure 1). His STS risk score indicated a risk of mortality, renal failure, or stroke of approximately 1%. He recovered expediently and was discharged home on postoperative day #4 for outpatient follow up. The decision to perform a mitral valve replacement using a right mini-thoracotomy rather than a median sternotomy was not only beneficial for metrics such as a shortened length of ICU stay (Sunderman), but also because the patient works in construction. A median sternotomy would have been devastating to the young man's livelihood and his ability to provide for his two young children. Thus, the mini-thoracotomy approach was minimally invasive not only from a surgical standpoint, but also with respect to his career and lifestyle.

Conclusions

The continued development and advancement of minimally invasive surgical techniques within mitral valve surgery is a promising and exciting chapter in the history of cardiac surgery. However, it is essential that surgeons never lose sight of the overall effects that cardiac surgery has on patients. Minimizing incisions offers clear benefits, but it is our belief that minimally invasive surgery can alternatively be viewed as an effort to reduce impact on the lives of patients. Through the lens of shared-decision making, application of these new techniques can be uniquely tailored to each patient and their goals for surgery. Whether patients require large incisions, small incisions, or simply a needlestick, our primary goal remains applicable to every aspect of a patient's life: "Primum non nocere". Discussions regarding surgical outcomes can thus be framed in this light, and patients can develop an understanding of how surgery will change their lives. This further enables them to make meaningful decisions about their surgical care and provides for improved patient satisfaction. This concept of minimally invasive surgery gives surgeons an opportunity to improve patient outcomes, not only within mitral valve surgery, but across the entire spectrum of surgery.

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