Quality of mitral valve repair: Median sternotomy versus port-access approach

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Objectives: We sought to compare early and late clinical and echocardiographic outcomes of patients undergoing minimally invasive mitral valve repair by means of the port-access and median sternotomy approaches.

Methods: Between 2000 and 2009, 503 patients had mitral valve repair, of whom 143 underwent surgical intervention for isolated posterior leaflet pathology: 61 through port access and 82 through median sternotomy. The port-access group had better preoperative New York Heart Association functional class ($P = .007$) and a higher rate of elective cases (97% vs 87%, $P = .037$). Other preoperative characteristics were similar between the groups, including mitral valve pathology and repair techniques.

Results: Operative, bypass, and clamp times were significantly longer in the port-access group. Mean hospital stay was 5.3 ± 2.5 days in the port-access group versus 5.7 ± 2.5 days in the median sternotomy group ($P = .4$). Early postoperative echocardiographic analysis showed that most patients in both groups had none or trivial mitral regurgitation and none of the patients had greater than grade 2 mitral regurgitation. Follow-up extended for up to 100 months (mean, 34 ± 24 months). New York Heart Association class improved in both groups ($P = .394$). Freedom from reoperation was 97% and 95% in the port-access and median sternotomy groups, respectively. Late echocardiographic analysis revealed that 82% (49/60) in the port-access group and 91% (73/80) in the median sternotomy group were free from moderate or severe mitral regurgitation ($P = .11$).

Conclusions: In isolated posterior mitral valve pathology, quality of mitral valve repair with the port-access approach can compare with that with the conventional median sternotomy approach. (J Thorac Cardiovasc Surg 2010;140:86-90)

A better understanding of the structure, function, and pathology of the mitral valve (MV) has led to improved surgical results of MV repair, with early mortality reduced to less than 1%, excellent long-term durability, and patient survival.[1-5]

Efforts to minimize surgical trauma, hasten patient recovery, improve cosmetics, and increase patient satisfaction continue to motivate minimally invasive procedures. Although several approaches have been advocated for MV surgery,[6-11] some have expressed concern that minimally invasive techniques might lead to inferior results, particularly regarding MV repair. Such concerns are based on the fact that operative space is limited and ''operator to MV'' distance is extended during a minimally invasive approach. Smaller incisions are more attractive to patients, but the quality of MV repair must not be compromised by the motivation to develop and market new techniques in response to patient expectations.

Several studies have documented excellent clinical outcomes for minimally invasive approaches, and a systematic review of the literature with a meta-analysis of all important series has recently been published.[12] Although this review described some studies on the incidence of long-term freedom from reoperation, none of the studies demonstrated the long-term effects on the quality of MV repair, including full echocardiographic follow-up of the repaired MV compared with results of the conventional median sternotomy (MS) approach. One study[13] has reported excellent early and 1-year echocardiographic results of MV repair for the minimally invasive approach. However, this study was limited by a 1-year follow-up without comparison with an MS group.

In this study we analyzed and compared data for both early and late clinical and echocardiographic outcomes of patients undergoing minimally invasive MV repair through the port-access (PA) and MS approaches.

MATERIALS AND METHODS

This is a retrospective nonrandomized review of a prospective follow-up of all patients who underwent primary isolated MV repair for isolated posterior leaflet pathology through either a video-assisted right minithoracotomy (PA approach) or full MS (MS approach).

Patients

Between June 2000 and March 2009, 503 patients underwent MV repair in our department. Throughout that time, a total of 169 PA minimally invasive procedures were performed (eg, MV replacement, MV repair, tricuspid

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Abbreviations and Acronyms
MR = mitral regurgitation
MS = median sternotomy
MV = mitral valve
NYHA = New York Heart Association
PA = port access

valve surgery, atrial septal defect closure, and myxoma excision). The study comprised all consecutive patients who had undergone isolated repair of the posterior MV leaflet. Patients with other valve pathologies or previous cardiac surgeries or those who had undergone concomitant procedures (eg, coronary artery bypass grafts, other valves, and the maze procedure) were excluded. Based on these criteria, 143 patients were included in the study, 61 of whom underwent surgical intervention through the PA approach and 82 through the conventional MS approach. The PA group had better preoperative New York Heart Association (NYHA) functional class ($P = .007$) and a higher rate of elective cases (97% vs 87%, $P = .037$). Other preoperative characteristics were similar between the groups (Table 1). Patient selection for the MS or PA approach was based on patient and surgeon preference.

Surgical Techniques

MS. Patients in the MS group underwent surgical intervention through a standard MS incision with conventional cardiopulmonary bypass with ascending aortic and bicaval cannulation. Intermittent cold blood cardioplegia was administrated through the aortic root and coronary sinus. A traditional left atrial incision, parallel to the interatrial sulcus, was used to access the MV. The incision was started from the superior vena cava and extended inferiorly to the mitral annulus. The most common valve repair procedure was triangular resection and primary closure of the resected portion of the posterior leaflet with 2 continuous layers of 4–0 Prolene sutures (Ethicon, Inc, Somerville, NJ). In the past, we used artificial chords for posterior repair only in cases of fibroelastic deficiency. Recently, we have also been using them for myxomatous posterior pathology.

The repair was completed with annuloplasty by using a flexible posterior band in 41 (50%) of 82 patients, a complete semirigid ring in 33 (40%) of 82 patients, and other types of annuloplasty in 8 (10%) of 82 patients.

PA. For the PA approach, patients were placed in a supine position with slight elevation of the right hemithorax and intubated with a double-lumen endotracheal tube. External defibrillator patches were placed on the thoracic cage, and a 17F or 19F cannula was inserted through the right jugular vein into the superior vena cava. A 6- to 8-cm skin incision was made in the right inframammary groove to create a small anterolateral ''working port.'' A soft tissue retractor (Heartport; Edwards Lifesciences, Irvine, Calif) was placed in the incision.

After switching to single left lung ventilation, 3 thoracic ports were created. The first port (5 mm), for video assistance with an endoscopic camera, was located in the fourth intercostal space at the level of the anterior axillary line. The second port (5 mm), for placing the left atrial retractor rod, was located parasternally in the fourth intercostal space. The third port was made below the incision for placing a left ventricular vent.

After general heparinization, arterial and venous cannulas were inserted by using the Seldinger technique in the right groin through a 2- to 3-cm-long incision covered by the natural skin folds of the groin. Arterial and venous cannulas were introduced over a guidewire under transesophageal echocardiographic control, and an EndoClamp balloon (Ethicon, Inc) was positioned at the ascending aorta just above the sinotubular junction. The cardiopulmonary bypass protocol included a membrane oxygenator, roller pump, and assisted venous return. The patient was cooled to a body temperature of 28°C to 30°C. After aortic occlusion, antegrade cold blood cardioplegia was delivered through the balloon tip and repeated every 30 minutes. Aortic crossclamping was done with an EndoClamp balloon in 43 cases and a transthoracic Chitwood clamp (Scanlan International, St. Paul, Minn) in 18 cases.

Traditional left atrial incision parallel to the interatrial sulcus was used to approach the MV, and the left atrial retractor was placed through the parasternal incision at the fourth intercostal space. As in the MS group, the most common repair in the PA group was triangular resection and primary closure of the resected portion of the posterior leaflet with a Prolene 4–0 suture. In the past, we used artificial chords for posterior repair only in cases of fibroelastic deficiency. Recently, we have also been using them for myxomatous posterior pathology. The repair was completed with annuloplasty by using a flexible posterior band in 33 (54%) of 61 patients, a complete semirigid ring in 23 (38%) of 61 patients, and other types of annuloplasty in 5 (8%) of 61 patients. In the early stage of the PA group, the Alfieri edge-to-edge technique was used as part of the repair in 6 patients. In 4 patients it was chosen by the surgeon as part of the repair technique and in 2 patients as a bailout procedure to minimize operative time when the intraoperative echocardiographic result was unsatisfactory.

Follow-up

Demographic, echocardiographic, and surgical data were collected from our prospectively collected database, whereas mortality data were retrieved from the official national database. All patients were contacted for clinical follow-up. Late follow-up echocardiographic data were obtained from the institutional echocardiographic laboratory database or from ambulatory medical services.

Data Analysis

The data for this review were derived from the database of the cardiac surgery department and have the approval of the institutional review board. Complications were reported according to the ''Guidelines for reporting mortality and morbidity after cardiac valve interventions.''[14] Mitral regurgitation (MR) grade was classified according to Society of Thoracic Surgeons guidelines (http://www.sts.org/file/CoreDef241Book.pdf): grade 0, no MR; grade 1, trivial MR; grade 2, mild MR; grade 3, moderate MR; and grade 4, severe MR.

All statistical analyses were performed with SPSS software (SPSS 16.0 for Windows; SPSS, Inc, Chicago, Ill). Group statistics were expressed as means ± 1 SD. Continuous variables were compared by using Student's t test, and categorical variables were compared by using the χ^2 test. Predictors for increased operative risks were determined by means of multivariate analysis. Survival information for the 2 groups was compared by using Kaplan–Meier curves with the log-rank test.

RESULTS

Early Results

Surgical information is summarized in Table 2. MV repair techniques were similar between the groups, except for the use of the Alfieri edge-to-edge technique, which was more common in the early stage of the PA group (6 patients). There was no conversion from minithoracotomy to MS in the PA group. Mean operative, cardiopulmonary, and aortic clamp times were significantly longer in the PA group compared with those in the MS group ($P < .001$, Table 2).

No operative or in-hospital mortality occurred in either group. Freedom from major hospital morbidity (including stroke, transmural myocardial infarction, re-exploration for bleeding or tamponade, renal failure, respiratory failure, sepsis, and deep wound infection) was similar between the groups (PA group, 85%; MS group, 92%; $P = .233$; Table 3).