Clinical Outcomes Associated With Robotic Repair of the Mitral Valve

In the current issue of Mayo Clinic Proceedings, Suri et al of Mayo Clinic in Rochester, MN, retrospectively report on their first 100 mitral valve repairs using robotic surgical techniques. This report is another important contribution to the field of less-invasive mitral valve surgery and adds to the understanding of different technologic platforms available for this procedure. The outcomes presented are impressive. There was no patient mortality. The last 25 patients were extubated in the operating room. Median hospital stay was 3 days. Only 15% of patients had any blood products. At 1 month after surgery, 82 patients had no mitral regurgitation (MR) or trivial MR, and 18 had mild MR. These outcomes are a testament to the expertise and commitment of the Mayo Clinic team of clinicians. Prior publications have shown similar results, indicating that the technique of robotic mitral valve repair is reproducible.

Robot-assisted mitral valve surgery is but one effort to improve mitral valve function while reducing perioperative morbidity and mortality compared with traditional open chest, open heart surgery. Competing with robotic-assisted mitral valve repair is the cutting edge technology of the mitral clip percutaneous procedure. The mitral clip is inserted through a delivery catheter from the right femoral vein and, via a transeptal approach, is positioned into the mitral valve under echocardiographic and fluoroscopic control. The clip grasps the free edge of the anterior and posterior leaflet at the site of regurgitation, creating a double-orifice mitral valve and decreasing significantly the amount of regurgitation. The percutaneous clip will most likely be combined with a percutaneous mitral annular band system that may be introduced into the clinical arena in the near future.

These developments need to be put in perspective with what is happening in Europe, where percutaneous valve therapies have a much larger penetration than in the United States and where robotic technology in cardiac surgery is far behind that of the United States as far as acceptance by surgeons.

In Europe, alternative, less-invasive procedures include mitral valve repair under direct vision through a right minithoracotomy and the total endoscopic approach through a 3- to 4-cm incision as performed by Casselman et al. These approaches have also been performed in the United States, particularly by New York University surgeons. These techniques compete with the robotic approach, and currently, there is no indication that the robotic technique is any better or worse than the others or that it is any more reproducible. Further study is required to determine which surgical approach is eventually superior and whether superiority of one technique over another is limited to specific subsets of patients.

Having personally seen surgical pioneers Dr Hugo Vanermen of Aalst, Belgium, and Dr Friedrich Mohr of Leipzig, Germany, perform a mitral valve repair via the total endoscopic approach or under direct visualization through a right minithoracotomy incision, respectively, I must say that both techniques appear to be equivalent and probably equally acceptable to patients.

A consensus statement of the International Society of Minimally Invasive Cardiac Surgery (ISMICS) 2010 on minimally invasive vs open mitral valve surgery concluded, on the basis of review of retrospective studies, that, in patients with mitral valve disease, minimally invasive surgery either robotically or through a right minithoracotomy may be an alternative to conventional mitral valve surgery, given the similar short- and long-term mortality and also the reduced sternum complications, transfusion requirements, and hospital stay. However, the risk of stroke was higher with minimally invasive surgery than with conventional approaches (2.1% vs 1.2%) as was the risk of aortic dissection, phrenic nerve palsy, and groin complications; additionally, cross clamp times and cardiopulmonary bypass time were increased. These data and conclusions were
obviously based on observation studies and not on randomized trials.

Our experience with the DaVinci robotic system (ie, the system also used by Suri et al) in the performance of minimally invasive mitral valve surgery continues to be positive and satisfying, encompassing more than 200 patients with 1 death and 2 permanent strokes. Yes, there is room for improvement in the robotic arena. There is still only one company in the world that makes the robotic system (Intuitive Surgical, Inc, Sunnyvale, CA) and thus no competition in the field. The price for the robotic system is arbitrarily too high and limits the number of units that any institution can have available. Improvements need to be made in the instrumentation. For example, a third robotic mitral retractor is needed to retract the posteromedial atrial fold and expose the posterior medial portion of the valve much more effectively than what is currently available. All these issues will ultimately be resolved, and I believe that the robotic approach will continue to provide an alternative to other minimally invasive techniques for mitral valve surgery.

Robotic-assisted mitral valve surgery may eventually become the standard of care in the United States. More work needs to be done to improve surgical outcomes and to reduce postoperative complications. Given that most of these patients with degenerative mitral valve disease are young, the eventual complication rate from this procedure should approach zero. I applaud Suri et al for their impressive results and for getting close to this goal of a zero complications rate.

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