Editorial

Minimally invasive valve surgery: trends for the future

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In the last 3 years a new wave of interest in less invasive cardiac surgery has arisen almost as a ‘tsunami’. A new wave of technology has covered the entire globe. The potential benefits of minimally invasive heart surgery include less intensive care stay requirements, less patient discomfort, earlier hospital discharge, more rapid recovery, and less cost. Critics of minimally invasive valve surgery have stressed operative adequacy and safety, as well as the continued need for a pump/oxygenator. Moreover, valve exposure through small thoracic incisions less than 6 cm is new and presents a challenge, even to experienced surgeons, evoking concerns related to myocardial protection and operative quality. Despite these questions, minimally invasive valve surgery continues to improve through technological advances and new skill acquisition by surgeons.

Minimally invasive valve surgery has been used recently with great success. Cosgrove [1,2] and Cohn [3–5] have repaired and replaced both mitral and aortic valves using either a small right parasternal incision, a mini-sternotomy or a trans-sternal incision. Their operative mortality was 1–2% for aortic valve operations and 0–1% for mitral procedures. The experience from these two groups alone has subtended well over 600 patients to date. Other minimally invasive techniques for valve operations include the mid to lower hemi-sternotomy (Carpentier) and mini-thoracotomy (Chitwood, Colvin, Mohr, Vanermin) [6–8].

Video-assistance or ‘secondary vision’ may offer advantages over direct vision through tiny incisions. However, acquisition of video-dexterity will become the next challenge for the ‘new wave’ minimally invasive cardiac surgeons. This becomes an even greater challenge to those who plan complex repairs using these techniques. In January of 1996 Kaneko [9] reported videoscopic examination of the mitral valve during a commissurotomy done via a sternotomy. One month later, Carpentier successfully performed the first video-assisted mitral valve repair through a mini-thoracotomy using cold ventricular fibrillation. Thereafter, port-access mitral replacements were done in Malaysia by the Stanford team using a new intra-luminal aortic balloon (Heartport) and peripheral cardiopulmonary bypass. Subsequently, Colvin of New York University and Mohr of the University of Leipzig have shown minimally invasive mitral repairs possible using similar intra-luminal aortic occlusive technology. Mohr has used three-dimensional video-assistance in most of his over 100 patients. The Heartport Registry showed that by January of 1997 412 patients worldwide had undergone a minimally invasive mitral operation using port-access methods. Of these 57% were repairs and 43% were replacements. The overall operative mortality was 3.2% but rose to 5.6% after 30 days. A stroke rate of 2.2% existed with 5.3% of patients requiring re-exploration for bleeding. The average cross-clamp time was 100 min with the mean incision length at 8.4 cm. Most of these operations were done using direct visualization.

In May of 1996 our group at East Carolina University performed the first video-assisted minimally invasive mitral valve operation in North America. As of October 1998, we had performed 72 mitral repair/replacement operations successfully at our center and five in Europe using the mini-thoracotomy, transthoracic aortic occlusion with a specially designed clamp, and video-assistance, which was the mainstay of the operative method. Repairs were done in nearly 65% of patients; however, these were more difficult than replacements by video-assistance. Operative results have been excellent with a 1.4% mortality and few perioperative complications. Our oldest patient was 82 years. Perfusion and cardiac arrest times were long initially; however, patients were discharged significantly earlier (4 vs 8 days) and with less post-operative pain. It is clear to us that patients recover faster than with conventional stenotomies. Operative times and length of stay have fallen progressively since the early cases. In addition, transfusion requirements and hospital costs have been significantly less when compared with a cohort of conventional mitral surgery patients. Recently, we have employed the Vista three-dimensional camera system to perform 10 totally videoscopic mitral operations. Our group was also the first in the country to use the Aesop 3000 voice activated robotically controlled camera to endoscopically repair a mitral valve and have performed 15 mitral operations using this system. Clearly, robotic manipulation has a place in the new
era of cardiac surgery, as typified by totally robotic mitral operations performed in Europe by Carpentier [10] and Mohr [11] in late May (1998) using the Intuitive System. The author was present for several of these operations in Leipzig and saw that intracardiac suturing and tissue reconstruction can be done totally robotically. These systems work on the concept of telepresence surgery, where the surgeon no longer manipulates the tissue directly but through robotic manipulators controlled electronically by the surgeon.

Thus, our ‘micro-mitral method’ should have promise for the future as it is safe and employs modifications of conventional cardiac surgical technology. This method represents sort of a ‘half-way house’ to a totally endoscopic mitral operation [12–15]. Surgeons can learn video-dexterity and how to operate using a totally new concept as a bridge to the future which may be heavily influenced by electronic and robotic manipulation. Technical familiarity and cost benefits are important for surgeons first experiencing the challenging nuances of operating through tiny incisions. We believe that this simple aortic occlusion approach, used with the ‘micro-mitral’ operation, can be compounded with other devices to provide a safe and relatively simple minimally invasive mitral operation. The operative mortality is similar to conventional operations, and we have seen far less complications with faster recovery. As found earlier by general surgeons, the acquisition of intracavitary video-dexterity takes experience, and we recommend gaining familiarity during open sternotomy cases. Newer three-dimensional visioning devices may help immensely in operating through even smaller incisions. We believe that various forms of developing robotic devices will lead us to true ‘tele-micro-access’ for both valve and coronary surgery. Hopefully, our techniques can be expanded to both aortic valve and coronary operations. A new era has arrived for cardiac surgeons. Our patients will benefit from these new operations if we proceed cautiously, question our results, and maintain databases that can help us critically review our progress. It is imperative that the cardiovascular health care team understands the benefits and deficiencies of rapidly developing technology in cardiology and cardiac surgery. The new century in cardiac care will bring us surprises still never dreamed.

References