THE ERA OF CATHETER-BASED AND MINIMALLY INVASIVE CARDIAC SURGERY

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It's a great time to be a cardiac surgeon! Over the past decade, the field of cardiovascular surgery has seen major transformations in case mix, increasing volume trends, and continued improvement in overall surgical outcomes. This is due in large part to the advent of minimally invasive cardiac surgery (MICS), which has expanded the realm of open heart procedures to include a larger group of patients. Whether a valve procedure, atrial fibrillation ablation, coronary revascularization, hybrid aortic procedure, ventricular-assist device insertion, or cardiac tumor resection, MICS and catheter-based approaches can in many cases accomplish the job with quicker recovery times and improved clinical outcomes compared to traditional sternotomy procedures. However, our patients and referring physicians demand surgical innovation as well as reduced morbidity and recovery times, and these innovative procedures must be performed with the same high standards and durability that we have come to expect from traditional approaches. Therefore, it is important for cardiac surgeons to train in these MICS and catheter-based approaches to meet this patient demand and maintain their competitive advantage.

The annual Re-Evolution Summit, which I codirected with my partner Dr. Mahesh Ramchandani at the Houston Methodist DeBakey Heart & Vascular Center, allows surgeons to gain hands-on exposure to these novel techniques and learn from expert faculty. Such training in catheter-based and MICS procedures allows the surgeon to be a more effective member within a multidisciplinary heart team that puts the patient's needs ahead of any particular approach. In fact, one could argue that the cardiac surgeon trained in catheter-based approaches as well as traditional and MICS procedures would be the most objective judge when selecting the most appropriate procedure for a particular patient.

In this issue of the *Methodist DeBakey Cardiovascular Journal*, we provide our readers with an overview of current MICS and catheter-based approaches provided by experts from across North America. The first section focuses on minimally invasive techniques, beginning with a paper by Drs. Nathaniel Langer and Michael Argenziano titled "Minimally Invasive Cardiovascular Surgery: Incisions and Approaches." In this review, the authors discuss the most widely used methods for aortic valve, mitral valve, and coronary artery bypass procedures. Next, in their paper titled "Cannulation Strategies and Pitfalls in Minimally Invasive Cardiac Surgery," Dr. Mahesh Ramchandani and colleagues explore the many options for cannulation, cardiopulmonary bypass, and myocardial protection in MICS and how they may be applied in individual procedures. Drs. Marc Ruel and Maria Rodriguez, in their article titled "Minimally Invasive Multivessel Coronary Surgery and Hybrid Coronary Revascularization: Can We Routinely Achieve Less Invasive Coronary Surgery?," highlight two specific approaches that underscore the advantages of minimally invasive coronary surgery and can ultimately lead to increased use among cardiovascular surgeons without an excessive investment in training and infrastructure.

Our next set of articles discuss the use of minimally invasive techniques for mitral and aortic valve surgeries. "Mitral Valve Surgery: Current Minimally Invasive and Transcatheter Options" that I coauthored with Dr. James Gammie reviews current techniques for MICS mitral valve repair and replacement, upcoming catheter-based therapies for mitral valve diseases, and the feasibility of these approaches for treating patients with mitral regurgitation. In the area of aortic valve surgery, Dr. Lamelas and I present the article "Aortic Valve Surgery: Minimally Invasive Options," which weighs the benefits and risks of minimally invasive aortic valve surgery, describes operative techniques for both ministernotomy and anterior thoracotomy approaches, and discusses how these techniques compare to available standard and transcatheter aortic valve procedures. In their article "Advances in Transcatheter Aortic Valve Replacement," Drs. Michael Reardon and Neil Kleiman assess the evidence that led to the approval of transcatheter aortic valve replacement (TAVR) for extreme and high-risk patients with severe aortic stenosis and discuss recent advances as well as the current state of TAVR.

In our last section, Drs. Gorav Ailawadi and colleagues describe a new hybrid technique for treating atrial fibrillation that combines a thoracoscopic epicardial surgical approach with an endocardial catheter-based procedure, and they conclude with a review of the literature describing this unique treatment approach. Finally, in their review titled "Minimally Invasive Techniques for Total Aortic Arch Reconstruction," Dr. Hazim J. Safi and colleagues discuss the evolving use of endovascular techniques for aortic arch reconstruction in patients at high risk for open repair and evaluate the relevance of these approaches in an era of safe and durable open reconstructive surgery.

The paradigm of open cardiovascular surgery is shifting as surgeons continue to adopt minimally invasive techniques. With more and more patients desiring less invasive procedures and the advantages of decreased blood loss, shorter hospital length of stay, improved postoperative pain, and better cosmesis, it is becoming increasingly important for cardiovascular surgeons to be current on the most common minimally invasive and catheter-based techniques. We hope this issue provides a thorough overview of the current state of cardiovascular surgery and sets the stage for surgeons interested in pursuing these exciting new options.