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MINIMALLY INVASIVE
CARDIAC SURGERY

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The purpose of *Minimally Invasive Cardiac Surgery* is to introduce the reader to the exciting developments in the field of “minimally invasive” or “minimal access” cardiac surgery. All the chapters have been written by investigators actively involved in their respective fields. We are appreciative of the concerted effort made by our collaborators to provide us with the most up-to-date material possible, thus making the book both timely and useful for those working in this rapidly evolving field. More than highlighting specific experiences and surgical procedures, we hope this text will outline an optimal approach to a rapidly developing new field of cardiac surgery, one that will substantially benefit future investigators and practitioners, as well as their patients.

*Minimally Invasive Cardiac Surgery* is organized into three major sections. The first part, Physiology of Injury, consists of a basic science review of the pathophysiological mechanisms underlying cardiopulmonary bypass and endothelial injury. To understand the benefits of avoiding cardiopulmonary bypass, Dr. Ron H. Speekenbrink and his colleagues examine the effect of extracorporeal circulation on the stimulation of coagulation pathways, the generation of interleukins and cytokines, the expression of adhesion molecules, and the regulation of vascular tone by the endothelium. Potential approaches to the attenuation of these effects are also discussed.

Vascular endothelium has emerged as a crucial player in the genesis of the diverse biological events that occur during the perioperative course of patients undergoing cardiac surgery. Indeed, surgical manipulation, shear stress, vasospasm, and ischemia/reperfusion injury are just a few of the important mediators of endothelial cell injury. This topic is reviewed in detail by Drs. Talia Spanier and Ann Marie Schmidt, prominent researchers in the field of vascular biology.

The second theme, Less Invasive Approaches to Coronary Bypass Grafting, is the most extensive section in the book, owing to the burgeoning interest in less invasive approaches to myocardial revascularization. Dr. LeRoy Rabbani and associates present the interventional cardiologist’s perspective on minimally invasive approaches to coronary revascularization. A comprehensive review of the data derived from the randomized trials comparing angioplasty and stent therapy with surgical revascularization is presented and the benefits, disadvantages, and indications for each therapy are discussed.

Optimal visualization, careful and meticulous harvest of the internal mammary artery, and reduction of cardiac motion are the three key factors underlying the success of beating heart coronary bypass grafting through limited incisions. In the following three chapters, renowned authors discuss these topics. Dr. Michael J. Mack dissects the elements that presently comprise videoscopic systems in his chapter on visualization techniques. A glimpse into the state-of-the-art in videoscopic surgery, including the use of head-mounted displays and “virtual” surgery, is presented.

Controversy persists on the vessel length and incision necessary to achieve an optimal internal mammary artery conduit. Based on the various techniques of less invasive
revascularization currently practiced, Dr. Patrick Nataf presents an overview of the different approaches to the harvest of the internal thoracic artery. Particular attention is focused on the advantages of the thoracoscopic approach.

A factor critical to the success of beating heart bypass grafting is immobilization of the surgical field. Dr. M. Clive Robinson from the University of Kentucky has pioneered the use of pharmacological techniques to achieve myocardial wall stabilization. In the chapter entitled “Myocardial Stabilization Techniques During Off-Pump Coronary Grafting,” the author presents the rationale and clinical experience with adenosine-induced transient asystole for the creation of coronary anastomosis and reviews the different mechanical stabilizers that are currently available to achieve optimal surgical conditions for beating heart surgery.

The ensuing two chapters encompass the clinical experience of pioneering groups of investigators who have advanced our knowledge of beating heart coronary grafting through their extensive clinical experience. Drs. Antonio M. Calafiore and Valavanur A. Subramanian are largely responsible for the introduction and dissemination of coronary grafting on the beating heart through limited incisions in Europe and the United States, respectively.

Port-access coronary bypass grafting, a major alternative to off-pump revascularization, was in part developed by the New York University group who discuss in detail the technique and excellent results that can be obtained. Unlike off-pump techniques, the port-access method relies on the conventional use of cardiopulmonary bypass and myocardial protection, achieved through endovascular access and tiny incisions.

The final five chapters of this section deal with aspects peripherally related to less invasive bypass grafting. Dr. Nader Moazami discusses the different systems available for endoscopic saphenous vein harvest and reviews the clinical experience in the literature. Though the hand-sewn technique remains the preferred method for creation of a vascular anastomosis, many investigators in the field believe that broader applicability of beating heart bypass grafting is contingent upon the development of facilitated methods for creation of coronary anastomosis. Dr. Paul M. N. Werker, from the Hospital of Utrecht, presents a comprehensive historical perspective on alternative methods of anastomosis, including the use of mechanical devices, laser welding, glues, and automated staplers.

The use of miniature axial flow pumps instead of cardiopulmonary bypass to unload the left ventricle and to reduce ventricular motion while maintaining coronary and systemic perfusion is currently being investigated. Dr. Robert K. Jarvik who pioneered and developed one such device collaborates with Dr. Joseph J. DeRose to describe the current state of the art in cardiac support using these innovative pumps.

Increasingly, the success of innovative ideas hinges on the cost-effectiveness associated with their application. To this effect, Dr. Gerald M. Lemole and colleagues examine the economic impact associated with the use of off-pump coronary grafting procedures at one institution, and dissect the New York State Database to identify the predictors for length of stay. In the last chapter in this section our group reviews the generally neglected yet very important quality-of-life issues that are associated with the use of less invasive cardiac procedures.
The third and final section in this book addresses growing areas of less invasive cardiac surgery, including valvular and congenital heart operations. Drs. W. Randall Chitwood and Steven R. Gundry, pioneers in the less invasive revolution describe their extensive experiences with “mini” approaches to mitral and aortic valve pathology. Finally, Dr. Gregory P. Fontana delineates the advances made in both extracardiac and intracardiac repairs via less invasive approaches and hints at the roadblocks that must be overcome and the advances that are likely to take place to achieve less invasive correction of complex congenital cardiac repairs.

_Mehmet C. Oz, MD_
_Daniel J. Goldstein, MD_
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