

Contents

Foreword	xiii
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Ronald F. Martin

Preface	xv
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John A. Kern and Irving L. Kron

Cardiac Screening Before Noncardiac Surgery	747
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Freddie M. Williams and James D. Bergin

Cardiovascular complications are infrequent but can result in significant morbidity following noncardiac surgery, especially in patients with peripheral vascular disease or increased age. All patients require some level of preoperative screening to identify and minimize immediate and future risk, with a careful focus on known coronary artery disease or risks for coronary artery disease and functional capacity. The 2007 American College of Cardiology/American Heart Association Guidelines are clear that noninvasive and invasive testing should be limited to circumstances in which results will clearly affect patient management or in which testing would otherwise be indicated. β -Blocker therapy has become controversial in light of recent publications but should be continued in patients already on therapy, and started in patients with high cardiac risk undergoing intermediate- or high-risk surgery.

Noninvasive Imaging of the Heart and Coronary Arteries	763
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Amy M. West and Christopher M. Kramer

There are multiple imaging modalities currently available to noninvasively evaluate the heart and coronary arteries. Choosing the most appropriate modality depends on the pertinent clinical question and the underlying patient characteristics. This article provides an overview of the fields of echocardiography, myocardial perfusion imaging, cardiac computed tomography, and cardiac magnetic resonance imaging, with particular attention to specific clinical applications for cardiac surgery patients.

Cardiopulmonary Bypass/Extracorporeal Membrane Oxygenation/Left Heart Bypass: Indications, Techniques, and Complications	781
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Gorav Ailawadi and Richard K. Zacour

Cardiopulmonary bypass has revolutionized the ability to provide cardiorepiratory support and has advanced the field of cardiac surgery. This invention has given surgeons the ability to perform many procedures that were not possible previously. The concept and development of cardiopulmonary bypass has been pioneered by numerous legendary surgeons. Cardiopulmonary bypass, extracorporeal membrane oxygenation, and left heart bypass have revolutionized our ability to operate on

the heart, great vessels, and aorta in addition to providing means of short-term support for reversible causes of cardiac and/or respiratory failure. The success of these approaches is dependent upon excellent communication between the surgeon, perfusionist, and anesthesiologist as well as constant vigilance and troubleshooting by the caregivers.

Great Vessel and Cardiac Trauma

797

Chris C. Cook and Thomas G. Gleason

Thoracic great vessel and cardiac trauma are characterized by anatomic location and mechanism of injury: blunt or penetrating. Management strategies are also directed by the extent and mechanism of injury. Advances in imaging and catheter-based technologies have allowed easier and more accurate diagnosis and less-invasive treatments. Although the advantages of endovascular techniques are attractive, open surgical repair remains the definitive treatment for many of these thoracic injuries. Given the increasing sophistication of these technologies and the demonstrated usefulness of a disease-oriented approach toward patient management, trauma centers have adopted a multidisciplinary team model for management of multitrauma victims. In this review, the authors detail the diagnosis and management of blunt aortic, nonaortic great vessel, blunt cardiac, and penetrating cardiac injuries.

Surgical Treatment of Great Vessel Occlusive Disease

821

Margaret C. Tracci and Kenneth J. Cherry

Occlusive disease of the supra-aortic trunks remains a diagnostic and therapeutic challenge to the surgeon. Although most cases in Western series are attributable to atherosclerotic disease, other entities such as Takayasu arteritis and radiation arteritis account for a substantial subset of patients in whom choice of therapy and clinical response may be significantly affected by the peculiarities of the disease process involved. This article reviews the anatomy, causes, and diagnosis of occlusive disease of the supra-aortic trunks. The indications, techniques, and outcomes of reconstruction are also discussed.

Valve-Sparing Aortic Root Reconstruction

837

Robert L. Smith and Irving L. Kron

The aortic valve-sparing root reconstruction procedure remains an ideal concept, but it has not yet become an ideal operation. There is still great variation and evolution in techniques, which mirrors the increasing understanding of the aortic root's functional anatomy and the disease processes that affect it. These operations remain complex, and the surgeons who perform them well are often times best armed with an experienced eye for what looks right more than a mathematical model that can predetermine who will do well, with what repair type and with what percentage chance of long-term success. Because of this, it will likely still be a while before these operations are more routinely used by a broader group of surgeons, as compared with the very reproducible Bentall and De Bono repair.

Indications for the Treatment of Thoracic Aortic Aneurysms 845

John A. Elefteriades and Donald M. Botta, Jr

In an era of increasingly common and detailed imaging of the thorax, thoracic aortic aneurysms are being discovered in their precomplicated state with increasing frequency. At the same time, the list of potential treatments for thoracic aneurysms is beginning to expand. Deciding which treatment method to employ and which aneurysm to treat is often difficult. The risk of aneurysm complications must be balanced against the risks of the treatment. This work explores the behavior of thoracic aneurysms, the state-of-the-art in treatment, and a rational approach to the treatment decision is proposed.

Approach to the Treatment of Aortic Dissection 869

Marc R. Moon

Acute aortic dissection is a fatal disease if early diagnosis and institution of appropriate therapy are delayed. Unfortunately, the presentation of a dissection can be diabolical, leading to an initial misdiagnosis in more than 25% of patients. For type A dissections, surgical repair is essential because mortality rates approach 50% at 48 hours with expectant therapy alone. For type B dissections, medical management is successful in most patients, although a subset with complications or early dilation may benefit from newer endovascular techniques. The goal of this review is to summarize the diagnostic algorithm, initial therapeutic options, and long-term management regimen that offer patients with an acute aortic dissection the best chance for short-term and long-term survival. There is an emphasis on the specific practical approach that is applied at Washington University to patients who present with an aortic dissection.

Endovascular Repair of the Thoracic Aorta 895

Joshua D. Adams, Lleowell M. Garcia, and John A. Kern

The use of endovascular stent grafts for treatment of the descending thoracic aorta is reviewed. Currently, 3 devices have been approved by the US Food and Drug Administration for the treatment of descending thoracic aneurysms, and multiple studies are ongoing to investigate the efficacy of endovascular treatment in such pathologies as traumatic aortic injury and Stanford type B dissection. Outcomes are highly dependent on good case planning and patient selection and will likely continue to improve as newer-generation devices and delivery systems are designed and made available.

Off-Pump Versus On-Pump Coronary Artery Bypass Grafting 913

Michael E. Halkos and John D. Puskas

Off-pump coronary artery bypass is a safe and effective method of coronary revascularization that avoids the use of cardiopulmonary bypass. Randomized trials, typically enrolling low-risk patients, have shown comparable mortality and reduced morbidity between off-pump and on-pump coronary artery bypass. Larger retrospective analyses suggest improved mortality and a lower incidence of adverse events in patients undergoing off-pump coronary artery bypass. This article reviews the available literature comparing outcomes of patients undergoing on- and off-pump coronary artery bypass surgery.

Minimally Invasive Valve Surgery

923

Y. Joseph Woo

Traditional cardiac valve replacement surgery is being rapidly supplanted by innovative, minimally invasive approaches toward the repair of these valves. Patients are experiencing benefits ranging from less bleeding and pain to faster recovery and greater satisfaction. These operations are proving to be safe, highly effective, and durable, and their use will likely continue to increase and become even more widely applicable.

Transcatheter Cardiac Valve Interventions

951

William T. Brinkman and Michael J. Mack

Currently aortic valve replacement is performed for patients with severe aortic stenosis and symptoms or objective pathophysiologic consequences such as left ventricular dysfunction. For transcatheter mitral valve interventions, the complex pathophysiology of mitral regurgitation with varying causes along with challenging imaging and delivery issues has led to slower than anticipated clinical introduction. Transcatheter pulmonary valve intervention was primarily designed to treat the difficult problem of right ventricular to pulmonary artery conduit stenosis in the congenital population. These techniques are reviewed in this article.

Surgical Treatments for Advanced Heart Failure

967

Mani A. Daneshmand and Carmelo A. Milano

Patients with heart failure represent a significantly ill cohort, and the survival of the most advanced heart failure patients is dismal with medical management alone. This cohort of advanced heart-failure patients benefits from several surgical treatments. Although several techniques for surgical ventricular restoration in the setting of left ventricular aneurysms have been described, the broader application of these techniques to patients with ischemic cardiomyopathy has occurred during the last decade. This review focuses on left ventricular aneurysm (LVA) repair and surgical ventricular restoration, ventricular assist devices, and cardiac allograft transplantation for the treatment of advanced heart failure. Indications for these procedures are addressed, as well as intraoperative technical features and postoperative management strategies.

The Surgical Treatment of Atrial Fibrillation

1001

Anson M. Lee, Spencer J. Melby, and Ralph J. Damiano, Jr

Atrial fibrillation is a complex disease affecting a significant portion of the general population. Although medical therapy is the mainstay of treatment, intervention plays an important role in selected patients. The Cox-Maze procedure is the gold standard for the surgical treatment of atrial fibrillation and has more than 90% success in eliminating atrial fibrillation. Ablation technologies have played a key role in simplifying this technically demanding procedure and making it available to more patients. A myriad of new

lesion sets and approaches were introduced over the last decade which has made the operative treatment of atrial fibrillation less invasive and more confusing.

Congenital Heart Disease Surgery in the Adult **1021**

Bret A. Mettler and Benjamin B. Peeler

As a result of improved treatment of congenital heart disease (CHD) over the last half century, the number of patients reaching adulthood continues to grow. With increased success a challenging group of adults with unique anatomy and physiology, in addition to the usual effects of aging, has been created. All of these patients present unique and fascinating challenges, and their best care requires bridging pediatric and adult medical and surgical care. This review is a discussion of some of the more common surgical issues that arise in this evolving group of patients.

Index **1033**