VASCULAR SURGERY AND ENDOVASCULAR THERAPY 9th EDITION

Anton N. Sidawy Bruce A. Perler

AbuRahma • Blankensteijn • Eidt • Forbes • Henke • Hoballah Killewich • LaMuraglia • Mills • Rockman • Upchurch • Weaver



Rutherford's Vascular Surgery and Endovascular Therapy

9TH EDITION

Anton N. Sidawy, MD, MPH

Professor and Lewis B. Saltz Chair Department of Surgery George Washington University Washington, District of Columbia

Bruce A. Perler, MD, MBA

Julius H. Jacobson, II, MD, Professor Vice Chair for Clinical Operations and Financial Affairs Department of Surgery The Johns Hopkins University School of Medicine Baltimore, Maryland Associate Executive Director for Vascular Surgery American Board of Surgery Philadelphia, Pennsylvania



ELSEVIER

Table of Contents

Instructions for online access

Cover image

Title Page

Copyright

Dedication

Associate Editors

Contributors

Preface

Video Contents

Volume 1

Common Abbreviations

Section 1 Basic Science

Chapter 1 Epidemiology and Research Methodology

Abstract

Epidemiology

Clinical Research Methods

Outcomes Analysis

Outcomes Translational Research

References

Chapter 2 Embryology and Developmental Anatomy

Abstract

Formation of Embryonic Blood Vessels

Development of the Descending (Thoracic and Abdominal) Aorta

Development of the Limbs

Development of the Venous System

References

Chapter 3 Vessel Wall Biology

Abstract

Arterial Wall Anatomy

Arterial Wall System

Hemodynamics and Vascular Wall Biology

Vein Wall Anatomy

Vein Wall System

Lymphatic Wall Anatomy

Lymphatic Wall System

References

Chapter 4 Atherosclerosis

Atherosclerotic Lesions

Theories of Pathogenesis

Atherosclerosis as a Chronic Inflammatory Disease

Localization of Atherosclerosis

Progression/Regression of Plaques

Thrombotic Complications of Atherosclerosis

Identification of Vulnerable Lesions

References

Chapter 5 Intimal Hyperplasia

Response of the Artery to Injury

Response of Vein to Injury

Healing Response of the Prosthetic Graft

Intimal Hyperplasia and Dialysis Access

Conclusion

References

Chapter 6 Ischemia-Reperfusion

Abstract

Pathophysiology of Ischemia-Reperfusion Injury

Clinical Manifestations of Ischemia-Reperfusion Injury

Future Directions in Ischemia-Reperfusion Injury

References

Chapter 7 Arteriogenesis and Angiogenesis

Neovascularization

Arteriogenesis

Angiogenesis

Role of Micrornas in Neovascularization

Clinical Trials

References

Chapter 8 Arterial Hemodynamics

Basic Concepts

Arterial Stenosis

References

Chapter 9 Venous Pathophysiology

Introduction

Basic Considerations

Thrombophlebitis

Conclusion

References

Chapter 10 Lymphatic Pathophysiology

Anatomy

Physiology

Molecular Lymphology

Pathophysiology

Clinical Overview

References

Section 2 Atherosclerotic Risk Factors

Chapter 11 Atherosclerotic Risk Factors

Abstract

Epidemiology

Biologic Effects of Smoking on the Vasculature

Nonvascular Clinical Effects

Vascular Clinical Effects

Smoking Cessation

References

Chapter 12 Atherosclerotic Risk Factors

Epidemiology

Classification of Diabetes

Diabetes and Vascular Disease

Pathophysiology of Vascular Disease in Diabetes

Vascular Evaluation of Patients With Diabetes

Treatment of Patients With Diabetes and Peripheral Artery Disease

	Summary and Future Directions	
	References	
Chapter 13 Atherosclerotic Risk Factors		
	Abstract	
	Historical Perspective	
	Physiology and Metabolism of Lipids	
	Pathophysiology of Atherosclerosis	
	Diagnosis of Atherogenic Lipid Disorders	
	Evolution of the Guidelines for Management and Therapeutic Goals for Lipoprotein Disorders	
	Clinical Trials of the Management of Dyslipidemia in Peripheral Arterial Disease	
	Nonpharmacologic Therapy for Dyslipidemia	
	Pharmacologic Therapy for Dyslipidemia	
	References	
Chapter 14 Atherosclerotic Risk Factors		
	Epidemiology	
	Diagnosis	
	Pathologic Mechanisms of Hypertension and Atherosclerosis	
	Management	
	References	

Chapter 15 Atherosclerosis Risk Factors

Abstract

	Familial Hypercholesterolemia
	Familial Hypertension
	Familial Diabetes
	Familial Obesity
	Genetics of Peripheral Artery Disease
	Influence of Nongenetic Factors
	Risk Assessment and Diagnosis
	Risk Management
	References
Chapter 16 Less Commonly Considered Causes of Atherosclero	
	Abstract
	The Atherosclerotic Lesion
	Hyperlipidemia
	Diet
	Infection
	Environmental Toxins
	Summary
	References
Cha	apter 17 International and Ethnic Trends in Vascular Disease
	Abstract
	International Trends
	Ethnic Trends
	References

Section 3 Clinical and Vascular Laboratory Evaluation

Chapter 18 Clinical Evaluation of the Arterial System

Abstract

Overview of the Clinical Evaluation

History in Patients With Arterial Disease

Physical Examination in Patients With Arterial Disease

The Ulcerated Leg

References

Chapter 19 Clinical Evaluation of the Venous and Lymphatic Systems

Introduction

Anatomic Considerations

The Clinical Evaluation

References

Chapter 20 Vascular Laboratory

Doppler Ultrasonography

Pressure Measurements

Plethysmography

Other Methods

References

Chapter 21 Vascular Laboratory

Instrumentation and Basic Concepts

Duplex Surveillance

References

Chapter 22 Vascular Laboratory

Ambulatory Venous Pressure

Plethysmography

Selective Use of Venous Physiologic Testing

References

Chapter 23 Vascular Laboratory

Abstract

Normal B-Mode Imaging Findings

Normal Flow Patterns in Veins

Diagnosis of Deep Vein Thrombosis

Calf Vein Thrombosis

Iliac Vein and Inferior Vena Cava

Diagnosis of Upper Extremity Deep Vein Thrombosis

Limited or Point-of-Care Ultrasound Examinations

Determination of Thrombus Age

Novel Ultrasound Techniques: Elastography

Determining the Duration of Therapy for Acute Deep Vein Thrombosis

Diagnosis of Recurrent Thrombosis

Superficial Veins

Evaluation for Chronic Venous Disease: Venous Insufficiency

Perforating Veins

References

Section 4 Vascular Imaging

Chapter 24 Radiation Safety

Abstract

Types of Radiation

Measurement

Biologic Effects of Radiation

Exposure and Recommended Limits

Principles of Radiation Protection

Radiation Safety: Diagnostic Procedures

Radiation Safety: Endovascular Procedures

Radiation and the Endovascular Surgeon

Radiation and Pregnancy

References

Chapter 25 Arteriography

Abstract

Equipment

Techniques

Clinical Applications

Limitations and Risks

Future Advances

References

Chapter 26 Venography

Basic Principles

Clinical Applications

Iliac Vein Assessment and Inferior Venacavography

Venography During Treatment of Iliocaval Stenosis

Diagnostic Venography of Pelvic Congestion Syndrome

Venography for Varicoceles

Renal Venography

Diagnostic Angiography of Mesenteric or Portal Venous Thrombosis

Diagnostic Venography of Budd-Chiari Syndrome

Upper Extremity Venography

Central Thoracic Venography

Pulmonary Arteriography

General Limitations and Risks of Venography

Future Advances

References

Chapter 27 Computed Tomography

Basic Principles

Clinical Application

Limitations and Risks

Common Artifacts

Special Pediatric Considerations Future Advances Acknowledgment References Chapter 28 Magnetic Resonance Imaging and Arteriography **Abstract Basic Principles** Clinical Applications of Magnetic Resonance Angiography Limitations and Risks **Recent Advances** References Chapter 29 Vascular PET/CT and SPECT/CT **Abstract Basic Principles Clinical Applications** Limitations and Risks **Future Advances** References Chapter 30 Intravascular Ultrasound Abstract Introduction **Basic Principles**

Clinical Applications

Limitations and Risks

Future Advances

References

Chapter 31 The Future of Imaging for Endovascular and Open Surgery

Background

X-Ray Imaging and Hybrid Operating Rooms

Endovascular Navigation and Catheter Robotics

The Future Hybrid Operating Suites

References

Section 5 Perioperative Care

Chapter 32 Preoperative Evaluation and Management

Abstract

General Preoperative Risk Assessment

Preoperative Medical Versus Interventional Therapy for Cardiac Disease

Ethical and Legal Concerns/Frailty Assessment

References

Chapter 33 Intraoperative Management

Anesthesia

Intraoperative Monitoring

Neurologic Monitoring Infection Control and Maintenance of Homeostasis Anticoagulation/Antiplatelet Therapy Control of Blood Loss/Transfusion **Transfusion Strategies** Venous Thromboembolic Prophylaxis Intraoperative Safety References Chapter 34 Postoperative Management Postoperative Triage Hemodynamics and Pressure Monitoring **Cardiovascular Complications Pulmonary Management** Bleeding **Fluids** Renal Failure General Issues References Chapter 35 Hospital Readmissions in Vascular Surgery **Abstract** Introduction History

Readmission in Vascular Patients

Interventions to Decrease Readmissions in Vascular Surgery

Limitations of 30-Day Readmissions

Conclusions

References

Section 6 Bleeding and Clotting

Chapter 36 Normal Coagulation

Abstract

Introduction

Procoagulant, Anticoagulant, and Fibrinolytic Proteins, Inhibitors, and Receptors

Connectivity and Dynamics of Blood Coagulation

Blood Coagulation Monitoring

Acknowledgment

References

Chapter 37 Coagulopathy and Hemorrhage

Abstract

Diagnosis and Preoperative Screening for Bleeding Disorders

Inherited Coagulopathies

Acquired Coagulopathies

Drug-Induced Coagulopathies

Hypothermia

Acidosis

Dilution

Treatment

Intraoperative Bleeding

Postoperative Bleeding

References

Chapter 38 Hypercoagulable States

Pathophysiology

Congenital Hypercoagulability

Acquired Hypercoagulability

Evaluation of the Patient With Suspected Thrombophilia

References

Chapter 39 Anticoagulant Drugs

Introduction

References

Chapter 40 Antiplatelet Agents

Introduction

Normal Platelet Function and Platelet Activation

Clinical Use of Antiplatelet Agents in Vascular Disease

References

Chapter 41 Thrombolytic Agents

Abstract

History

Thrombolytic Drug Administration

Thrombolytic Agents

Clinical Applications

References

Section 7 Complications

Chapter 42 Systemic Complications

Abstract

Epidemiology

The Pathophysiology of Perioperative Myocardial Infarction

Preoperative Cardiac Evaluation

Class I

Class III: No Benefit

Medical Prophylaxis

Treatment

References

Chapter 43 Respiratory Complications

Preoperative Risk Stratification

Perioperative Risk Reduction

Clinical Manifestations

Management Strategies

References

Chapter 44 Systemic Complications

Abstract

Renal Anatomy

Renal Function

Acute Kidney Injury After Vascular and Endovascular Procedures

Ischemic Injury to the Kidney

Altered Renal Function During Aortic Surgery

Acknowledgment

References

Chapter 45 Neurologic Complications

Structure of a Peripheral Nerve

Causes of Nerve Damage

Diagnostic Evaluation

General Principles of Treatment

Trauma

Specific Nerve Injuries

Spinal Cord and Lumbosacral Plexus Injury

Femoral Nerve Injury

Saphenous Nerve and Sural Nerve Injury

Tibial and Peroneal Nerve Injury

Other Nerves

References

Chapter 46 Graft Thrombosis

Abstract

Prevention: Intraoperative Graft Assessment

Graft Thrombosis: Pathogenesis

Graft Thrombosis: Therapeutic Approach

Acknowledgment

References

Chapter 47 Graft Infection

Abstract

Incidence

Classification

Pathogenesis

Diagnosis

Surgical Treatment and Outcomes

References

Chapter 48 Anastomotic Aneurysms

Incidence and Anatomic Location

Pathogenesis

Clinical Diagnosis

History and Physical Examination

Surgical Treatment

Outcomes

References

Chapter 49 Local Complications

Primary Aortoenteric Fistula

Secondary Aortoenteric Fistula

Clinical Presentation

Diagnosis

Treatment

Results and Conclusions

References

Chapter 50 Local Endovascular Complications and Their Management

Abstract:

Introduction

Groin Hematoma

Retroperitoneal Hematoma

Arteriovenous Fistula

Pseudoaneurysm

Axillary and Brachial Access Complications

Percutaneous Closure Device Complications

Bleeding Complications

Ischemic Complications

Procedure-Specific Complications

Other Complications of Endovascular Procedures

References

Chapter 51 Venous Complications

Abstract

Incidence of Venous Complications

Conclusions

References

Chapter 52 Local Complications

Abstract

Post-Bypass Edema

Lymphatic Fistula

Lymphocele

Chylous Ascites

Thoracic Duct Fistula

Chylothorax

References

Section 8 Technique

Chapter 53 Thoracic and Thoracoabdominal Vascular Exposure

Abstract

Exposure of the Ascending Aorta and Aortic Arch

Exposure of the Distal Aortic Arch and Descending Thoracic Aorta

Exposure of the Thoracoabdominal Aorta

Exposure of the Distal Descending Thoracic Aorta and Visceral Aorta

References

Chapter 54 Abdominal Vascular Exposures

Abstract

Anatomic Considerations

Exposure of Major Abdominal Veins

References

Chapter 55 Cerebrovascular Exposure

Abstract

General

Exposure of the Carotid Artery for Endarterectomy

Retrojugular Approach

Posterior Approach for Carotid Endarterectomy

Proximal Exposure for Carotid Endarterectomy

Reoperative Exposure for Carotid Stenosis

Exposure for Subclavian Carotid Interventions

Vertebral Artery Exposure

Exposure of the V2 Segment of the Vertebral Artery

Posterior Exposure of the Suboccipital Vertebral Artery (V4) Segment

Tips

Chapter 56 Lower Extremity Arterial Exposure

Abstract

Introduction

Femoral Artery Exposure

Popliteal Artery Exposure

Suprageniculate Popliteal

Midpopliteal

Infrageniculate Popliteal

Exposure of the Tibial and Peroneal Arteries

Exposure of the Arteries of the Foot

Exposure for Obturator Bypass

Exposure of the Lower Extremity Veins

Small Saphenous Vein

Femoral Vein of the Thigh

References

Chapter 57 Upper Extremity Vascular Exposure

Abstract

Introduction

Exposure of Arteries Within the Thorax

Exposure of Veins Within the Thorax

Exposure of Vessels Within the Thoracic Outlet

Exposure of the Arm Vessels

References

Chapter 58 Spinal Operative Exposure

Abstract

Clinical Presentation, Diagnostic Evaluation, and Risk Assessment

Surgical Treatment

Surgical Results and Complications

Postoperative Management and Follow-up

References

Chapter 59 Technique

Basic Principles

Basic Vascular Techniques

Thrombectomy and Thromboembolectomy

Endarterectomy

Arteriotomy Closure

Replacement and Bypass Procedures

References

Appendix e59.1

Appendix e59.2

Chapter 60 Endovascular Diagnostic Technique

Introduction

Vascular Access

Technique for Catheterization

Complications

Conclusion

References

Chapter 61 Endovascular Therapeutic Technique

Introduction **Balloon Angioplasty Stents** Atherectomy Devices (Debulking Technologies) Thromboembolectomy Intraluminal Devices to Cross Chronic Total Occlusions **Re-Entry Devices Embolization Devices and Agents** Vascular Closure Devices **Endovascular Therapeutic Techniques Stenting Hybrid Therapies Embolization** References Chapter 62 Laparoscopic and Robotic Aortic Surgery **Abstract** Introduction **Total Laparoscopic Aortic Surgery** Hand-Assisted Laparoscopic Aortic Surgery Totally Robotic Aortic and Robot-Assisted Procedures **Published Series**

Perioperative Outcomes

Summary

Conclusions

References

Section 9 Grafts and Devices

Chapter 63 Autogenous Grafts

Abstract

Histology

Anatomy

Vein Graft Preparation

Autogenous Vein Graft Configurations

Etiology of Vein Graft Failure

Prevention of Vein Graft Failure

References

Chapter 64 Prosthetic Grafts (Heparin-Bonded and Spiral Grafts)

Abstract

Introduction

Basic Principles

Clinical Applications

Limitations and Risks

Future Advances

References

Chapter 65 Biologic Grafts

Abstract

Graft Properties

Clinical Use in Peripheral Vascular Surgery

Clinical Outcomes

References

Chapter 66 Bioengineered Vascular Grafts

Abstract

Basic Principles

Clinical Experience

Limitations and Risks

Future Advances

References

Chapter 67 Nonaortic Stents and Stent Grafts

Abstract

Historical Background

Stent-Vessel Interaction

Stent Types and Characteristics

Selection of Stent

Failure Modes

New Developments

Future Developments

References

Chapter 68 Novel and Evolving Aortic Endovascular Devices Introduction **Thoracic Aorta Abdominal Aorta Future Directions** Conclusion References **Section 10 Abdominal Aortic And Iliac Aneurysms** Chapter 69 Arterial Aneurysms Abstract **General Considerations Historical Perspective Aneurysm Classification** Multiple Aneurysms References Chapter 70 Aortoiliac Aneurysms History **Definitions**

Epidemiology

Diagnosis

Pathophysiology

Screening and Surveillance Recommendations

Medical Therapy

Indications for Intervention

Future Directions

References

Chapter 71 Abdominal Aortic Aneurysms

Indication for Open Repair

Preoperative Assessment and Planning

Operative Technique

Transperitoneal Repair

Retroperitoneal Repair

Anatomic Considerations

Intraoperative Management

Postoperative Complications

Outcomes

Special Circumstances

References

Chapter 72 Aortoiliac Aneurysms

Abstract

Graft Types

Randomized Trials of Endovascular Aneurysm Repair Versus Open Repair

Endovascular Aneurysm Repair Compared With Medical Management

Endovascular Aneurysm Repair in Ruptured Abdominal Aortic Aneurysms

Comparison of Different Stent Grafts

Complications of Endovascular Aneurysm Repair

Follow-Up

Endovascular Repair of the Juxtarenal Aorta

Endovascular Repair of Common Iliac and Internal Iliac Artery Aneurysms

Cost of Endovascular Aneurysm Repair

References

Chapter 73 Endovascular Aneurysm Repair Techniques

Abstract

Characteristics of Abdominal Aortic Stent Grafts

Anesthesia, Access, and Imaging

Evar Deployment

EVAR Troubleshooting

Selected Key References

Chapter 74 Ruptured Aortoiliac Aneurysms and Their Management

Terminology and History

Epidemiology

Pathophysiology of Aortic Rupture

Clinical Features

Initial Management Strategies

Operative Strategies: Endovascular Repair

Operative Strategies: Open Surgical Repair

Complications of Ruptured Abdominal Aortic Aneurysm Repair

Outcomes of Ruptured Abdominal Aortic Aneurysm Repair

Quality of Life

References

Chapter 75 Isolated Iliac Artery Aneurysms and Their Management

Introduction

Pathogenesis

Natural History

Presentation

Diagnosis

Management

Conclusions

References

Section 11 Thoracic and Thoracoabdominal Aortic Aneurysms and Dissections

Chapter 76 Thoracic and Thoracoabdominal Aortic Aneurysms

Introduction

The Thoracic Aorta: Anatomy and Epidemiology of TAA and TAAA

Pathogenesis

Etiology

Anatomic Classification

Clinical Findings Diagnostic Evaluation Medical Therapy Selection of Treatment **Preoperative Evaluation** Other Pathologies Associated With the Thoracic Aorta References Chapter 77 Thoracic and Thoracoabdominal Aneurysms **Abstract Pathology** Degenerative Inheritable Trauma, Mycotic, Vasculitis **Anatomic Classification Indications for Surgical Treatment Patient Evaluation Imaging Informed Consent Surgical Repair** Anesthesia **Patient Positioning**

Surgical Exposure

Aneurysm Repair

Impact of Endovascular Treatment Postoperative Care **Outcomes** Spinal Cord Ischemia **Pulmonary Complications** Mortality **Renal Function** Effect of Surgical Technique on Morbidity Long-Term Survival and Quality of Life References Chapter 78 Thoracic and Thoracoabdominal Aneurysms Abstract Approved Devices for Thoracic Endovascular Aortic Repair PlanningThoracic Endovascular Aortic Repair for Thoracic Aneurysms Hybrid Endovascular Repair for Thoracoabdominal Aneurysms Investigational Devices for Thoracoabdominal Aortic Aneurysms **Investigational Devices for Aortic Arch** References Chapter 79 Thoracic and Thoracoabdominal Aneurysms Abstract Introduction **Indications**

Devices

Technique

Complications

Neuroprotective Strategies

Imaging Surveillance

Outcomes

Ruptured Descending Thoracic Aortic Aneurysm

Connective Tissue Disorders

Methods for Failure to Rescue

References

Chapter 80 Fenestrated and Branched Endograft Treatment of Juxtarenal, Paravisceral, Thoracoabdominal, and Aortic Arch Aneurysms

Abstract

History of Fenestrated and Branched Endovascular Aortic Aneurysm Repair

Definitions

Overview of Current Devices Based on Aneurysm Location and Extent

Case Planning and Sizing

Patient Selection and Preoperative Evaluation

Operative Technique

Outcomes of Fenestrated and Branched Repair

Surveillance Recommendations After Fenestrated and Branched Repair

Practice and Regulatory Issues

References

Chapter 81 Aortic Dissection

Classification

Epidemiology

Pathologic Anatomy of Acute Aortic Dissection

Pathogenesis of Malperfusion Syndromes

Clinical Presentation

Diagnostic Evaluation

Treatment of Type B Dissection

Natural History and Follow-Up

References

Chapter 82 Penetrating Aortic Ulcers

Abstract

Introduction

Pathophysiology

Incidence

Clinical Presentation

Other Aortic Pathologies Associated With Penetrating Aortic Ulcer

Diagnostic Imaging

Treatment

Operative Repair

Endovascular Repair

Complications Associated With Repair

Summary

References

Section 12 Peripheral and Splanchnic Aneurysms

Chapter 83 Lower Extremity Aneurysms

Femoral Artery Aneurysms

Persistent Sciatic Artery Aneurysm

Popliteal Artery Aneurysms

Conclusion

Tibial Artery and Pedal Artery Aneurysms

References

Chapter 84 Upper Extremity Aneurysms

Abstract

Arch Vessel Aneurysms

Aneurysm of Aberrant Subclavian Artery and Kommerell Diverticulum

Axillary Artery Aneurysms

Brachial Artery Aneurysms

References

Chapter 85 Splanchnic Artery Aneurysms

Abstract

Incidence and Etiology

General Treatment Principles

Surgical and Endovascular Techniques

Specific Splanchnic Aneurysms

Other Rare Splanchnic Aneurysms

References

Section 13 Cerebrovascular Diseases

Chapter 86 Cerebrovascular Disease

Abstract

Background

Stroke—Background/Introduction

Stroke—Prevalence/Incidence

Declining Prevalence/Incidence of Stroke

Ischemic Stroke—Epidemiology

Ischemic Stroke—Natural History

Transient Ischemic Attack—Background/Introduction

Transient Ischemic Attack—Prevalence

Transient Ischemic Attack—Natural History

Extracranial Carotid Artery Atherosclerosis—Background

Extracranial Carotid Artery Atherosclerosis—Epidemiology

Extracranial Carotid Artery Atherosclerosis—Natural History

Additional Topics

References

Chapter 87 Cerebrovascular Disease

Abstract

Mechanism of Stroke in Carotid Atherosclerosis

Stable Versus Unstable Carotid Plaques

Histomorphology of the Unstable Carotid Plaque

Biomechanics of the Unstable Carotid Plaque

Noninvasive Identification of the Unstable Carotid Plaque

Two-Dimensional B-Mode Imaging

Ultrasonographic Virtual Histology

Three-Dimensional Ultrasonography

Contrast Enhanced Ultrasonography

Plaque Strain Measurement

Intravascular Ultrasound

Magnetic Resonance Imaging for Histomorphology

Combined Magnetic Resonance Imaging and Ultrasonography for Biomechanics

Summary

References

Chapter 88 Cerebrovascular Disease

Duplex Ultrasound

Magnetic Resonance Imaging/Magnetic Resonance Angiography

Positron Emission Tomography-Computed Tomography (See Chapter 29)

Computed Tomography Angiography

Digital Subtraction Angiography

Transcranial Doppler

References

Chapter 89 Cerebrovascular Disease

Introduction

Treatment Options When Carotid Bifurcation Stenosis Is Identified

Best Medical Therapy

Estimating the Stroke Risk in A Particular Clinical Scenario

Patient-Specific Factors That Influence the Choice of Therapy

Evidence-Based Selection of Therapy

Societal Guidelines Regarding Carotid Revascularization and Stroke Prevention

Selecting the Appropriate Therapy for the Appropriate Patient

References

Chapter 90 Nonatherosclerotic Carotid Artery Disease and Its Management

Abstract

Carotid Stenosis After Radiotherapy

Recurrent Carotid Stenosis

References

Chapter 91 Carotid Endarterectomy

Abstract

Epidemiology

Indications for Carotid Endarterectomy

Preoperative Imaging

Perioperative Medical Management

Operative Technique

Exposure for High Lesions

Cerebral Protection and Monitoring

Arteriotomy Closure

Completion Studies

Perioperative Stroke Management

Surgical Results

Complications

Special Considerations

References

Chapter 92 Cerebrovascular Disease

Abstract

Background

Landmark Clinical Trials

Current Guidelines

Patient Selection

Anatomic Considerations

Preoperative Considerations

Technique

Perioperative Medications

Complications

Postoperative Surveillance

Long-Term Outcomes Conclusions References Chapter 93 Cerebrovascular Disease **Abstract Carotid Artery Dissection** References Chapter 94 Carotid Artery Aneurysms **Abstract** Definition **Historical Review Epidemiology** Pathogenesis **Clinical Findings Diagnostic Evaluation Natural History** Treatment **Treatment Outcome Medical Management Special Considerations** References

Chapter 95 Carotid Body Tumors

Abstract Introduction **Epidemiology and Etiology** Anatomy and Physiology **Pathology Clinical Presentation** Diagnosis **Treatment Preoperative Preparation** Surgical Technique Positioning and Exposure Resection of Tumor **Postoperative Care** Results Conclusions Selected Key References Chapter 96 Unusual Carotid Artery Conditions **Abstract** Background Carotid Sinus Syndrome/Carotid Sinus Hypersensitivity Moyamoya Disease

Carotid Artery Kinks and Coils

Intracranial Vascular Stenosis

Intracranial Aneurysm With Extracranial Carotid Stenosis **Cerebral Vasculitis Lacunar Infarcts** References Chapter 97 Vertebral Artery Dissection and Other Conditions **Abstract** Pathogenesis and Anatomy **Disease Distribution** Patient Selection for Vertebral Artery Reconstruction Vertebral Artery Reconstructive Procedures **Operative Results Endovascular Therapy** Conclusion References Chapter 98 Brachiocephalic Artery Disease and Its Surgical **Treatment Abstract** Introduction **Anatomic Variants** Indications for Intervention in Occlusive Disease Other Indications for Intervention **Diagnostic Evaluation** Revascularization

Acknowledgments

References

Chapter 99 Brachiocephalic Artery Disease and Its Endovascular Management

Procedure Planning

Imaging Studies

Options for Endovascular Therapy

Perioperative Medical Management

Results

References

Volume 2

Section 14 Acute Limb Ischemia

Chapter 100 Acute Limb Ischemia

Etiology and Pathology

Clinical Presentation

Clinical Assessment

Classification of Acute Limb Ischemia

Diagnosis

Investigation

Initial Management

Treatment

Prognosis

Upper Limb Ischemia
References

Chapter 101 Acute Ischemia

Abstract

Initial Management

Treatment Selection

Endovascular Treatment

Surgical Revascularization

Special Considerations

Upper Limb Ischemia

References

Chapter 102 Compartment Syndrome and Its Management

Abstract

Introduction

Pathogenesis of Compartment Syndrome

Clinical Etiologies

Clinical Presentation

Adjunctive Measures

Fasciotomy

Technique of Fasciotomy

Fasciotomy Wound Management

Outcomes

Chronic Exertional Compartment Syndrome

References

Chapter 103 Atheromatous Embolization and Its Management

Incidence

Pathogenesis

Risk Factors

Clinical Features

Diagnosis

Differential Diagnosis

Treatment

Summary

References

Section 15 Lower Extremity Chronic Arterial Disease

Chapter 104 Lower Extremity Arterial Occlusive Disease

Abstract

Epidemiology of Peripheral Arterial Disease

Anatomic Distribution of Disease and Clinical Correlations

Clinical Syndromes of Peripheral Arterial Disease, Staging and Natural History

References

Chapter 105 Lower Extremity Arterial Disease

Abstract

Medical Management

Decision Making for Revascularization

Treatment Guidelines According to Presentation

Risk Prediction Models

Angiogenesis for Peripheral Arterial Disease

References

Chapter 106 Aortoiliac Disease

Abstract

Pathology and Clinical Presentation

Diagnosis

Indications for Surgical Intervention

Surgical Treatment

Results

Isolated Profundaplasty

References

Chapter 107 Aortoiliac Disease

Femorofemoral Bypass

Axillofemoral Bypass

Obturator Bypass

Summary

References

Chapter 108 Aortoiliac Disease

Abstract Background **Indications** Contraindications Relevant Anatomy: Trans-Atlantic Inter-Society Consensus Classification Patient Evaluation and Operative Planning Technique Results Complications **Postoperative Management** References Chapter 109 Infrainguinal Disease **Abstract Indications Preoperative Assessment Preoperative Imaging Operative Planning Operative Exposures Choice of Conduit Bypass Technique Intraoperative Completion Studies**

Results

Postoperative Management

Complications

Graft Surveillance

Treatment of Graft and Anastomotic Stenoses

Acknowledgment

References

Chapter 110 Infrainguinal Disease

Abstract

Introduction

Intermittent Claudication

Chronic Limb Threatening Ischemia

Factors Affecting Outcomes

Inflow Considerations

Outflow Considerations

Conclusions

References

Chapter 111 Lower Extremity Amputations

Abstract

Epidemiology

Indications for Amputation

Primary Amputation Versus Revascularization

Perioperative Evaluation

Amputation Level Selection

Rehabilitation Considerations

Functional Outcome

References

Chapter 112 Lower Extremity Amputations

Abstract

General Principles

Amputation Types

Midfoot and Hindfoot Amputations

Transtibial (Below-Knee) Amputation

Through-Knee Amputation

Transfemoral (Above-Knee) Amputation

Hip Disarticulation

Principles of Postoperative Care

Long-Term Survival

Functional Outcome

Reamputation

Complications

References

Section 16 Diabetic Foot and Its Management

Chapter 113 General Considerations of Diabetic Foot Ulcers

Abstract

Introduction

Epidemiology

Pathophysiology **Presentation and Diagnosis** Management Soft Tissue Surgery for the Diabetic Foot **Amputation** Peripheral Arterial Disease and the Diabetic Foot Surgical Bypass in the Diabetic Patient Multidisciplinary Limb Preservation Programs References Chapter 114 Diabetic Foot Abnormalities and Their Management **Abstract** Introduction **Peripheral Neuropathy Biomechanics** Ischemia Infection The Diabetic Foot Ulcer **Charcot Neuroarthropathy Other Important Considerations** Conclusions References

Chapter 115 Wound Care

Abstract

Normal Wound Healing

Mechanisms of Abnormal Wound Healing in Chronic Wounds

Etiology of Ulceration

Clinical Presentation and Initial Evaluation

Properties and Categories of Wound Dressings

Venous Leg Ulcers

Diabetic Foot Ulcers

Ulcers Associated With Arterial Insufficiency

Specialized Techniques

References

Chapter 116 Podiatric Care

Abstract

The Specialty of Podiatry

Diabetes-Related Amputations

Summary

References

Section 17 Upper Extremity Arterial Disease

Chapter 117 Upper Extremity Arterial Disease

Abstract

Introduction

Epidemiology

Etiology and Pathogenesis

Summary

References

Chapter 118 Upper Extremity Arterial Disease

Abstract

Clinical Findings

Treatment

Surgical Treatment

Alternative Therapy

Trauma

References

Chapter 119 Upper Extremity Arterial Disease

Epidemiology

General Operative Considerations

Specific Amputations

Postoperative Management and Complications

Long-Term Outcomes

References

Section 18 Thoracic Outlet Syndrome

Chapter 120 Thoracic Outlet Syndrome

Introduction

Relevant Anatomy

Venous Thoracic Outlet Syndrome
Arterial Thoracic Outlet Syndrome

References

Chapter 121 Thoracic Outlet Syndrome

Anatomy

Etiology

Clinical Findings

Conservative Management

Surgical Treatment

Surgical Complications

Results of Surgery

References

Chapter 122 Thoracic Outlet Syndrome

Pathophysiology

Epidemiology

Clinical Presentation

Diagnostic Evaluation

Differential Diagnosis

Treatment

References

Chapter 123 Thoracic Outlet Syndrome

Abstract

Epidemiology and Etiology

Clinical Presentation

Diagnostic Evaluation

Treatment

References

Chapter 124 Thoracic Outlet Syndrome

Indications

Preoperative Planning

Surgical Techniques

Postoperative Care and Rehabilitation

Pitfalls and Complications

References

Section 19 Renovascular Disease

Chapter 125 Renovascular Disease

Historical Perspective

Pathogenesis of Renovascular Disease

Epidemiology

Clinical Presentation

Treatment of Renovascular Hypertension

References

Chapter 126 Renovascular Disease

Indications for Surgical Repair

Management Options

Direct Surgical Techniques

Indirect Surgical Techniques

Intraoperative Assessment

Results of Open Operative Management

References

Chapter 127 Renovascular Disease

Indications and Contraindications

Results

Description of Technique

Complications

References

Chapter 128 Renovascular Disease

Abstract

Renal Artery Aneurysms

Renal Arteriovenous Malformations and Fistulae

References

Chapter 129 Renovascular Disease

Pathophysiology

Clinical Presentation

Diagnostic Evaluation

Renal Artery Embolism

Renal Artery Thrombosis

Renovascular Trauma

Renal Vein Thrombosis

References

Chapter 130 Renovascular and Aortic Developmental Disorders

Abstract

Developmental Abdominal Aortic Coarctation and Hypoplasia

Developmental Renal and Splanchnic Arterial Stenoses

Clinical Manifestations

Diagnostic Evaluation

Medical Management

Surgical Treatment

Endovascular Treatment

References

Section 20 Mesenteric Vascular Disease

Chapter 131 Mesenteric Arterial Disease

Abstract

Anatomy of the Visceral Arteries

Physiology of Splanchnic Blood Flow

Epidemiology

Pathophysiology

Clinical Presentation

Diagnostic Evaluation

Treatment of Acute and Chronic Mesenteric Ischemia

Treatment of Nonocclusive Mesenteric Ischemia

Treatment of Mesenteric Venous Thrombosis

References

Chapter 132 Chronic Mesenteric Arterial Disease

Background

Pathophysiology

Etiology

Natural History

Diagnostic Evaluation

Clinical Presentation

Diagnostic Imaging

Treatment Strategies

Preprocedure Evaluation

Endovascular Revascularization

Open Revascularization

Results

References

Chapter 133 Acute Mesenteric Arterial Disease

Abstract

Incidence and Risk Factors

Pathophysiologic Classification Final Common Pathway of Bowel Ischemia **Diagnostic Evaluation Treatment Other Considerations** References Chapter 134 Mesenteric Arterial Dissection **Abstract** Incidence **Etiology Clinical Presentation Diagnosis Classification System** Treatment **Other Considerations** Surveillance Remodeling **Summary** References Chapter 135 Median Arcuate Ligament Syndrome Introduction **Diagnosis** Radiologic Studies

Management

Conclusion

References

Chapter 136 Mesenteric Vascular Disease

Abstract

Epidemiology

Pathogenesis

Natural History

Pathology and Manifestations

Diagnosis

Treatment and Results

References

Section 21 Nonatherosclerotic Arterial Diseases

Chapter 137 Vasculitis and Other Uncommon Arteriopathies

Vasculitis Presentation

Large-Vessel Vasculitis

Medium-Sized Vessel Vasculitis

Small-Vessel Vasculitis

Vasculitis Secondary to Connective Tissue Diseases

Vasculitis Mimics

References

Chapter 138 Thromboangiitis Obliterans (Buerger Disease) **Abstract** Introduction **Epidemiology Clinical Presentation** Diagnosis **Treatment** Acknowledgments References Chapter 139 Takayasu Disease **Abstract** Introduction **Epidemiology** Pathogenesis **Clinical Presentation Diagnostic Evaluation** Classification **Medical Treatment** Refractory Therapy Indications for and Results of Revascularization Procedures **Special Considerations Prognosis**

References

Chapter 140 Aneurysms Caused by Connective Tissue Abnormalities

Abstract

Marfan Syndrome

Vascular-Type Ehlers-Danlos Syndrome

Loeys-Dietz Syndrome

Familial Thoracic Aortic Aneurysm and Dissection

References

Chapter 141 Raynaud Phenomenon

Epidemiology

Normal Arterial Flow to the Hand

Regulation of Blood Flow in the Digits

Pathogenesis

Clinical Findings

Diagnosis

Treatment

References

Chapter 142 Fibromuscular Dysplasia

Abstract

Introduction

Pathogenesis of Fibromuscular Dysplasia

Renal Artery Fibromuscular Dysplasia

Natural History

Clinical Presentation

Diagnostic Evaluation

Treatment Selection

Medical Treatment

Endovascular Treatment in Adults

Surgical Management

Fibromuscular Dysplasia and Aneurysm

Pediatric Renal Artery Stenosis and Arterial Dysplasia

Extracranial Cerebrovascular Fibromuscular Dysplasia

Fibromuscular Dysplasia in Other Arterial Beds

References

Chapter 143 Nonatheromatous Popliteal Artery Disease

Introduction

Popliteal Artery Entrapment Syndrome

Adventitial Cystic Disease

References

Chapter 144 Infected Arterial Aneurysms

History and Epidemiology

Pathogenesis and Etiology

Microorganisms

Diagnosis

Management

Aorta

Femoral Artery

Popliteal Artery

Carotid Artery

Upper Extremity Arteries

Visceral Arteries

References

Section 22 Acute Venous Thromboembolic Disease

Chapter 145 Acute Deep Venous Thrombosis

Abstract

Epidemiology

Natural History

References

Chapter 146 Venous Thromboembolic Disease

Abstract

Rationale for Risk Stratification and Prophylaxis

Methods of Prophylaxis

Specific Surgical Groups

Evidence-Based Guidelines Versus Real Clinical Practice

Summary of Recommendations for Venous Thromboembolism Prophylaxis in Surgical Patients

References

Chapter 147 Acute Lower Extremity Deep Venous Thrombosis

Clinical Assessment

Diagnostic Tests

Diagnostic Strategies

Medical Treatment of Acute Lower Extremity Deep Venous Thrombosis

References

Chapter 148 Acute Lower Extremity Deep Venous Thrombosis

Abstract

Postthrombotic Syndrome

Rationale for Thrombus Removal

Randomized Trials of Catheter-Directed Thrombolysis

Strategies for Thrombus Removal

Choosing the Appropriate Treatment Option

Published Guidelines

References

Chapter 149 Acute Upper Extremity and Catheter-Related Venous Thrombosis

Abstract

Introduction

Clinical Findings

Diagnostic Strategies

Risk Factors and Prevention

Treatment

Conclusion References Chapter 150 Superficial Thrombophlebitis and Its Management **Epidemiology and Pathogenesis Clinical Presentation** Diagnosis **Treatment** References Chapter 151 Pulmonary Embolism **Abstract** Introduction **Clinical Presentation** Diagnosis **Risk Stratification Treatment Prognosis** References Chapter 152 Vena Cava Interruption **Abstract**

Filter Design

Clinical Indications

Inferior Vena Cava Filters

Superior Vena Cava Filters

References

Chapter 153 Compartment Syndrome and Venous Gangrene

Introduction

Phlegmasia Cerulea Dolens

Venous Gangrene

Heparin-Induced Thrombocytopenia

Cancer-Associated Disseminated Intravascular Coagulation With Venous Limb Gangrene

Disseminated Intravascular Coagulation

Symmetric Peripheral Gangrene (Purpura Fulminans)

Fasciotomy for Venous Disease

Fasciotomy for Acute Venous Thrombosis (Phlegmasia Cerulea Dolens)

References

Section 23 Chronic Venous Disorders

Chapter 154 Varicose Veins

Abstract

Decision Making

Surgical Techniques

Results

Multimodality and Individualized Care

Patient Management and Reimbursement Considerations

Chapter 155 Varicose Veins

Abstract

Background

References

Relevant Anatomy

Diagnostic Evaluation

Treatment Selection

References

Chapter 156 Chronic Venous Disorders

Abstract

Introduction

Postphlebitic (Thrombotic) Syndrome: Etiology and Epidemiology

Postphlebitic (Thrombotic) Syndrome: Cellular and Molecular Mechanisms

Postphlebitic (Thrombotic) Syndrome: Natural History and Pathophysiology

Postphlebitic (Thrombotic) Syndrome: Clinical Summary Points of Natural History, Epidemiology, and Pathophysiology

References

Chapter 157 Chronic Venous Disorders

Abstract

Treatment of Chronic Venous Disorders

Conclusion

References

Chapter 158 Chronic Venous Insufficiency

Abstract

Pathophysiology

Anatomy

Diagnostic Evaluation

Indications for Interruption

Operative Planning Options

Open Surgery

Percutaneous Ablation of Perforating Veins

References

Chapter 159 Chronic Venous Insufficiency

Pathogenesis

Diagnostic Evaluation

Treatment Selection

Surgical Treatment

Venous Valve Substitutes (Neovalve)

References

Chapter 160 Iliocaval Venous Obstruction

Abstract

Surgical Treatment of Iliocaval Venous Obstruction

Etiology

	Preoperative Evaluation
	Indications for Surgical Treatment
	Grafts in the Venous System
	Surgical Procedures
	Summary
	Pelvic Congestion Syndrome
	Incidence
	Anatomy of the Pelvic Venous System
	Pathophysiology
	Clinical Findings
	Diagnosis
	Treatment
	References
Chapter 161 Iliocaval Venous Obstruction	
	Abstract
	Introduction
	Pathology
	Indications and Patient Selection for Iliocaval Venous Stenting
	Diagnosis
	Treatment
	Outcomes
	References

Section 24 Miscellaneous Venous Conditions

Chapter 162 Superior Vena Cava Occlusion and Management	
Abstract	
Etiology	
Clinical Presentation	
Diagnostic Evaluation	
Initial Treatments	
Indications for Interventional Treatment	
Endovenous Treatment	
Surgical Treatment	
Results	
Conclusions	
References	
Chapter 163 Congenital Occlusion/Absence of Inferior Vena Cava	
Abstract	
Association With Deep Venous Thrombosis	
Embryogenesis	
Presentation	
Management	
Summary	
References	

Chapter 164 Portal Hypertension

Abstract Introduction Pathophysiology Classification **Clinical Presentation Complications of Portal Hypertension Diagnosis** Nonsurgical Treatment of Portal Hypertension and Its Complications Surgical Treatment of Portal Hypertension References Chapter 165 Nutcracker Syndrome **Abstract** Introduction Background Diagnosis Management Summary References Chapter 166 Venous Aneurysms and Their Management **Abstract** Introduction **Lower Extremity Venous Aneurysms Abdominal Venous Aneurysms**