

Contents

List of Contributors *xiv*

- 1 Innominate & Carotid Artery Intervention in High-Risk Patients** *1*
Tyrone J. Collins
 Introduction *1*
 Innominate Interventions in High-Risk Patients *2*
 Catheter-based Therapy for An Innominate (Brachiocephalic) Stenosis *2*
 Carotid Artery Intervention in High-Risk Patients *5*
 Endovascular Treatment of A Carotid Stenosis *5*
 Catheter-based Therapy for Carotid Stenosis *6*
 Conclusions *10*
 References *13*
- 2 Subclavian Artery Intervention: Catheter-Based Therapy** *15*
Saadat Shariff, Isabella Alviz, Cornelia Rivera, Michelle Cortorreal, and Tyrone J. Collins
 Introduction *15*
 Endovascular Versus Open Surgical Revascularization *16*
 Endovascular Revascularization Techniques *16*
 Conclusion *18*
 References *19*
- 3 Vertebral Artery Intervention: Catheter-Based Therapy** *20*
Tamunoinemi Bob-Manuel and James S. Jenkins
 Introduction *20*
 Preprocedural Considerations *21*
 Step 1. Procedural Planning with Diagnostic Angiography *21*
 Step 2. Vertebral Artery Intervention (Percutaneous Transluminal Angioplasty) *24*
 Step 3. Vertebral Artery Intervention (Stenting) *25*

Management of Potential Complications	27
Postprocedural Care	28
References	29

4 Endovascular Repair of Thoracic Aortic Aneurysms: Catheter-Based Therapy 30

John Denesopolis, Patricia Yau, and Aksim G. Rivera

Introduction	30
Relevant Anatomy	31
Aortic Anatomy	31
Crawford Classification for TAA/TAAA	31
Landing Zones	31
Implication of Aortic Anatomy on Spinal Perfusion	32
Indications/Contraindications to Procedure	33
Indications	33
Asymptomatic TAA/TAAA	33
Blunt Aortic Injury (BAI)	33
Acute Aortic Syndromes	33
Contraindications/Caveats	34
Available Endografts	34
Preoperative Evaluation	40
Positioning and Intraoperative Monitoring Needs	41
Procedural Steps	42
Postoperative Course/Surveillance	46
Monitored Setting	46
Spinal Drain	46
Blood Pressure Control	47
Arm Ischemia Symptoms	47
CTA Surveillance/Endoleak Types	48
References	49

5 Endovascular Abdominal Aortic Aneurysm Repair (EVAR) 50

John Futchko, Katie MacCallum, and Aksim G. Rivera

Introduction	50
Patient Selection	50
Preoperative Imaging and Measurements	51
Graft Selection	52
Graft Sizing	52
Neck Length	53

Neck Diameter	53
Branch Vessels	54
Aortic Length Measurements	54
Step 1. Vascular Access	55
Percutaneous	55
Open	56
Iliac Disease and Conduits	56
Step 2. Imaging	57
Equipment	57
Neck Angulation	58
Renal Arteries	58
Step 3. Wires	58
Step 4. Delivery and Deployment	59
Main Body	59
Graft Orientation	59
Proximal Landing Zone	59
Contralateral Gate Cannulation	60
Limb Deployment	62
Completion Angiogram	62
Step 5. Troubleshooting	63
Endoleaks	63
Inadvertent Coverage of Renal Arteries	65
Iliac Artery Considerations	65
Conclusion	66
References	66

6 Severe Renal Artery Stenosis: How to Intervene 68

Mohammad Hashim Mustehsan, Cristina Sanina, and Jose D. Tafur

Introduction	68
Background and Clinical Significance	69
Epidemiology	69
Clinical Manifestations	69
Patient Selection: Who to Screen for RAS	70
RAS Assessment	70
Noninvasive RAS Assessment	70
Invasive RAS Assessment	72
Indications for Revascularization	72
Intervention	74
References	76

7 Mesenteric Ischemia: Chronic and Acute Management 78*David A. Hirschl*

Introduction 78

Chronic Mesenteric Ischemia 78

Step 1. Vascular Access and Sheath Selection 79

Step 2. Diagnostic Angiography 80

Step 3. Vessel Selection 81

Step 4. Selective Angiography 81

Step 5. Placement of a Working Wire 82

Step 6. Stent Placement 82

Step 7. Posttreatment Angiography 83

Step 8. Revision 83

Complications 84

Follow-Up and Outcomes 85

Acute Mesenteric Ischemia 85

Step 1. Arterial Vascular Access and Sheath Selection 87

Step 2. Selection of the SMA 87

Step 3. Aspiration Embolectomy 88

Step 4. Angiogram 89

Step 5. Thrombolysis 89

Step 6. Infusion and Follow-Up 91

Mesenteric Venous Thrombosis 91

Follow-Up and Outcomes 91

References 92

8 Aorto-Iliac Interventions 95*Michael S. Segal, Sameh Elrabie, and Rajesh K. Malik*

Introduction 95

Preoperative Workup 95

Noninvasive Studies 96

Computed Tomographic Angiography 96

Ultrasound Duplex 96

Magnetic Resonance Angiography 97

Invasive Imaging 97

Angiography 97

Classification of Lesion and Planning of Intervention 97

TransAtlantic InterSociety Consensus II Classification (TASC II) 97

Planning for the Intervention 97

Step 1. Patient Factors 97

Step 2. Vascular Access 98

Step 3. Crossing the Lesion 99

Step 4. Intervention	100
Step 5. Closure	102
Step 6. Complications	103
Rupture	103
Embolization	103
Access Complications	103
Cases	104
Case 1	104
Case 2	104
References	107

9 Femoropopliteal Arterial Interventions in the Claudicant 108

Sahil A. Parikh, Joseph J. Ingrassia, and Matthew T. Finn

Introduction	108
Patient Evaluation and Indications for Treatment of Femoropopliteal Arterial Pathology	108
Indications for Revascularization Femoropopliteal Claudication	109
Vascular Imaging in Endovascular Treatment	109
Contrast Angiography	109
CO ₂ Angiography	110
Steps to CO ₂ Angiography	110
Extravascular and Intravascular Ultrasound	110
Steps to IVUS Use	111
Vascular Access and Lesion Crossing Techniques	113
Steps for Crossover “Up and Over” technique	113
Radial	114
Tibio-Pedal Approach	115
Antegrade Femoral Access	115
Working Wire Size and Changing Between Systems	116
Lesion Preparation	117
Plain Old Balloon Angioplasty	117
Focal Force Balloons for Optimal Lumen Gain	120
Drug-Coated Balloons	120
Atherectomy	121
Laser	121
Excimer Laser Use Steps	122
Rotational Atherectomy	123
Rotational Atherectomy Steps	124
Directional Atherectomy	124
Orbital Atherectomy	126
Embolic Protection	127

	Troubleshooting Embolic Protection Devices	130
	Troubleshooting a “Full” Filter	130
	Distal Embolization or “No Reflow”	130
	Stenting for Femoropopliteal Disease	131
	Bare-Metal Stents	131
	Drug-Eluting Stents (DES)	131
	Alternative Stent Technologies	132
	Covered Stents	132
	Tacks	132
	Final Efficacy Assessment	132
	Conclusions	132
	Acknowledgments	133
	References	133
10	Tibial Interventions in Patients with Critical Limb-Threatening Ischemia	138
	<i>Raman Sharma, Roberto Cerrud-Rodriguez, and Prakash Krishnan</i>	
	Introduction	138
	Indications and Goals of Endovascular Revascularization	138
	Considerations for Access Site	139
	Single Versus Multitibial Artery Revascularization	140
	Antegrade Tibial Artery Intervention	141
	Retrograde Access for Retrograde Lesion Crossing and Wire Externalization with Antegrade Revascularization	143
	TAMI Retrograde Revascularization	144
	Reentry and Externalization Devices	146
	Deep Venous Arterialization (DVA)	146
	References	147
11	Acute Limb Ischemia: Endovascular Approach	151
	<i>Shunsuke Aoi and Amit M. Kakkar</i>	
	Introduction	151
	Procedure Planning, Equipment, and Considerations	151
	References	161
12	Pedal Reconstruction	162
	<i>Ehrin Armstrong and Rory Brinker</i>	
	Introduction	162
	Pedal Arch Reconstruction	162
	Indications for Pedal Revascularization	166

Technical Considerations	166
Access	166
Lesion Crossing	167
CTO Lesion Subtype	167
Special Considerations of the Pedal Intervention	167
Troubleshooting	169
Summary	169
References	173

13 Endovascular Management of Access Site Complications 175

Manaf Assafin, Robert Pyo, Pedro Cox-Alomar, and Miguel Alvarez-Villela

Introduction	175
Complications Related to Common Femoral Artery Access	176
Access Site Bleeding	176
Crossover Technique	179
Balloon Tamponade, Endovascular Coiling, and Covered Stent Placement	179
Femoral Pseudoaneurysms	180
Ultrasound-Guided Compression Repair	182
Ultrasound-Guided Thrombin Injection	183
Covered Stent Placement	184
Other Techniques	184
Arteriovenous Fistulas	185
Vascular Closure Device Related Complications	186
Radial Artery Related Complications	187
Radial Artery Spasm	188
Radial Artery Occlusion	189
Bleeding Complications	190
References	191

14 Acute Deep Vein Thrombosis 196

Vishal Kapur and Sagar Goyal

Introduction	196
Treatment Strategy	197
Initial and Long-Term Treatment of VTE	200
Oral Anticoagulants	200
Thrombolysis	200
Vena Cava Filters	201
Compression Stockings	202
Cancer-Associated VTE	202
Isolated Distal DVT	202

Extended Treatment	202
Unprovoked VTE	202
Oral Anticoagulants	203
Conclusion	203
References	204

15 Lower-Extremity Venous Stenting 207

Asma Khaliq, Sandrine Labrune, and Cristina Sanina

Introduction	207
Follow-Up	213
References	214

16 Intervention for Pulmonary Embolism 215

Seth I. Sokol, Wissam A. Jaber, and Yosef Golowa

Introduction	215
Pulmonary Angiography	215
Vascular Access	215
Injection and X-Ray Detector Positioning	216
Catheter-Directed Thrombolysis	216
EKOS™ Catheter-Directed Thrombolysis	216
Preparation of System	217
Access	218
Mechanical Disruption	220
Catheter Fragmentation of Clot	220
Large Catheter Aspiration	220
FlowTrier™	220
Access	221
Penumbra	225
AngioVac	227
Patient Selection and Central Venous Access	227
AngioVac Circuit Setup and Thrombus Aspiration	229
AngioVac for Pulmonary Embolus	231
AngioVac for Clot-in-Transit	232
AngioVac for Right Heart Vegetation	232
Patient Selection and Approach	232
Technique	233
References	234

17 Catheter-Based Therapy for Varicose Veins 236

Juan Terre and Nelson Chavarria

Introduction	236
Thermal Techniques	236

Radiofrequency (RF) Ablation	237
Follow-Up	239
Endovenous Laser Ablation (EVLA)	239
Nonthermal Techniques	240
Mechanico-Chemical Ablation (MOCA)	241
Limitations	242
Summary	243
References	243
Index	245