

Interventional and Endovascular Tips and Tricks of the Trade

Interventional and Endovascular Tips and Tricks of the Trade

Edited by

S. Lowell Kahn, MD, MBA, FSIR

Assistant Professor of Interventional Radiology and Surgery
Tufts University School of Medicine
New England Endovascular Center
West Springfield, Massachusetts

Bulent Arslan, MD, FSIR

Associate Professor of Radiology
Director, Vascular & Interventional Radiology
Rush University Medical Center
Chicago, Illinois

Abdulrahman Masrani, MD

Radiology Resident
Mallinckrodt Institute of Radiology
Washington University in St. Louis
St. Louis, Missouri

OXFORD

UNIVERSITY PRESS

Oxford University Press is a department of the University of Oxford. It furthers the University's objective of excellence in research, scholarship, and education by publishing worldwide. Oxford is a registered trade mark of Oxford University Press in the UK and certain other countries.

Published in the United States of America by Oxford University Press
198 Madison Avenue, New York, NY 10016, United States of America.

© Oxford University Press 2018

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without the prior permission in writing of Oxford University Press, or as expressly permitted by law, by license, or under terms agreed with the appropriate reproduction rights organization. Inquiries concerning reproduction outside the scope of the above should be sent to the Rights Department, Oxford University Press, at the address above.

You must not circulate this work in any other form
and you must impose this same condition on any acquirer.

Library of Congress Cataloging-in-Publication Data

Names: Kahn, S. Lowell, editor. | Arslan, Bulent (Associate professor of radiology), editor. | Masrani, Abdulrahman, editor.

Title: Interventional and endovascular tips and tricks of the trade /
edited by S. Lowell Kahn, Bulent Arslan, Abdulrahman Masrani.

Description: Oxford ; New York : Oxford University Press, [2018] |
Includes bibliographical references and index.

Identifiers: LCCN 2016036932 (print) | LCCN 2016038173 (ebook) |

ISBN 9780199986071 (alk. paper) | ISBN 9780199986095 (e-book) | ISBN 9780199390885 (online)

Subjects: | MESH: Minimally Invasive Surgical Procedures—methods

Classification: LCC RD33.53 (print) | LCC RD33.53 (ebook) | NLM WO 505 | DDC 617/.057—dc23

LC record available at <https://lcn.loc.gov/2016036932>

This material is not intended to be, and should not be considered, a substitute for medical or other professional advice. Treatment for the conditions described in this material is highly dependent on the individual circumstances. And, while this material is designed to offer accurate information with respect to the subject matter covered and to be current as of the time it was written, research and knowledge about medical and health issues is constantly evolving and dose schedules for medications are being revised continually, with new side effects recognized and accounted for regularly. Readers must therefore always check the product information and clinical procedures with the most up-to-date published product information and data sheets provided by the manufacturers and the most recent codes of conduct and safety regulation. The publisher and the authors make no representations or warranties to readers, express or implied, as to the accuracy or completeness of this material. Without limiting the foregoing, the publisher and the authors make no representations or warranties as to the accuracy or efficacy of the drug dosages mentioned in the material. The authors and the publisher do not accept, and expressly disclaim, any responsibility for any liability, loss or risk that may be claimed or incurred as a consequence of the use and/or application of any of the contents of this material.

9 8 7 6 5 4 3 2 1

Printed by Sheridan Books, Inc., United States of America

Contents

Foreword [xiii](#)
Preface [xv](#)
Acknowledgments [xvii](#)
Contributors [xix](#)

Section I: Aortic Interventions [1](#)

1. Deployment Finesse of the Cook Zenith Stent Graft [3](#)
John Fritz Angle

2. Deployment Finesse of the Gore Excluder Stent Graft [8](#)
S. Lowell Kahn and Sergio Rojas

3. The Turret Technique for Contralateral Gate Access [14](#)
S. Lowell Kahn

4. Up-and-Over Snare Technique for the Difficult Contralateral Gate Access [16](#)
S. Lowell Kahn

5. Use of a Buddy Wire to Facilitate Contralateral Gate Catheterization During Endovascular Aortic Aneurysm Repair [18](#)
S. Lowell Kahn

6. Tips for Accurate Palmaz Stent Deployment [20](#)
S. Lowell Kahn

7. Managing Unilateral or Bilateral Common Iliac Artery Aneurysms with Preservation of the Hypogastric Artery [25](#)
S. Lowell Kahn

8. In Vivo Fenestration During Endovascular Aneurysm Repair [33](#)
Abdulrahman Masrani and Bulent Arslan

9. Reverse Deployment of the Gore Excluder Contralateral Iliac Limbs for Aortoiliac Interventions [36](#)
S. Lowell Kahn

10. Use of Two Bifurcated Stent Grafts for Creation of an Aorto-Uni-Iliac Endograft [40](#)
S. Lowell Kahn

11. Creation of a Flow-Modulating Stent Using Multilayered Wallstents for Aneurysm Exclusion [43](#)
S. Lowell Kahn

12. Obtaining True Lumen Access in Aortic Dissections with Iliac Extension [49](#)
Roshni A. Parikh and David M. Williams

13. The Endoconduit for Small Iliac Access [51](#)
Ripal T. Gandhi, Jonathan J. Iglesias, Constantino S. Peña, and James F. Benenati

14. Transcaval Aortic Catheterization for Transcatheter Aortic Valve Replacement and Thoracic Endovascular Aortic Repair Device Delivery [55](#)
Michael D. Dake

Section II: Peripheral Vascular Interventions [63](#)

15. Subintimal Arterial Recanalization Using the Bull’s-Eye Technique [65](#)
S. Lowell Kahn

16. Alternative Subintimal Entry and True Lumen Re-entry Techniques [71](#)
S. Lowell Kahn

17. Balloon Occlusion of Subintimal Tract to Assist Distal Luminal Re-entry During Subintimal Recanalization of Chronic Total Occlusions [83](#)
Abdel Aziz A. Jaffan

18. Extravascular Recanalization of Chronic Total Occlusions [86](#)
S. Lowell Kahn

19. Retrograde Femoral Access for Difficult Superficial Femoral Artery Occlusions [95](#)
Luke E. Sewall

20. The “Poor Man’s” Scoring Balloon [98](#)
S. Lowell Kahn

21. Balloon-Assisted Thrombin Injection for Pseudoaneurysms with Wide or Short Neck Morphology [101](#)
S. Lowell Kahn

22. Distal Occlusion Thrombectomy Technique [105](#)
S. Lowell Kahn

23. Techniques for Traversing Difficult Aortic Bifurcations and Aortobifemoral Grafts [107](#)
S. Lowell Kahn

24. Flip Techniques: Obtaining Antegrade and Retrograde Femoral Access Through a Single Access Site [115](#)
S. Lowell Kahn

25. Technical Pearls for Managing the Scarred Groin 122
S. Lowell Kahn

Section III: Visceral and Pelvic Vascular Interventions 127

26. Use of a Fogarty Occlusion Balloon During Splenic Artery Embolization to Prevent Distal Coil Migration 129
S. Lowell Kahn
27. Combined Endovascular and Surgical Retrograde Superior Mesenteric Artery Recanalization 132
Syed M. Peeran
28. Techniques for Treating Visceral Aneurysms and High-Flow Arteriovenous Malformations of the Renal and Visceral Vasculature 136
Nikhil Mehta and Bulent Arslan
29. Proximal Arterial Occlusion During Treatment of Pelvic High-Flow Arteriovenous Malformations 139
Roshni A. Parikh and David M. Williams

Section IV: Venous and Pulmonary Arterial Interventions 141

30. Reverse Deployment of the Gore Excluder Contralateral Iliac Limbs for Central Venous Occlusive Disease 143
S. Lowell Kahn
31. Branched Stent Graft Placement in the Vena Cava Using the Endologix AFX 147
S. Lowell Kahn
32. Needle Recanalization of Chronic Venous Total Occlusions 155
Adam N. Plotnik and Stephen Kee
33. Recanalization of Chronic Central Venous Occlusions: Techniques to Cross Difficult Venous Occlusions 160
Sreekumar Madassery and Bulent Arslan
34. Managing Chronic Iliac Venous Occlusions That Extend Below the Inguinal Ligament 164
Roshni A. Parikh and David M. Williams
35. Management of Acute Iliocaval Thrombosis 167
Jordan C. Tasse and Bulent Arslan
36. Management of Chronic Iliocaval Thrombosis 170
Osmanuddin Ahmed

37. Directional AngioJet Thrombectomy with Guide Catheter Helical Spin Technique 174
S. Lowell Kahn
38. Dual and Balloon-Assisted AngioJet Thrombectomy for Iliofemoral Deep Venous Thrombosis 179
Zubin Irani and Sara Zhao
39. Tips and Tricks of the AngioVac Device 184
David C. Stevens and Sabah Butty
40. Optimal Technique for Catheterizing the Pulmonary Arteries Without Dedicated Pulmonary Catheters 189
George Carberry and Michael Brunner

Section V: Venous Access and Dialysis Interventions 193

41. Minimally Invasive Repair of Azygos Catheter Migration 195
Mikin V. Patel and Steven Zangan
42. Endovascular Snaring Technique for Shortening of Central Venous Port Catheters in Children 197
Mahmoud Zahra and Ganesh Krishnamurthy
43. Placing a Jugular Port Without Direct Percutaneous Jugular Vein Access 203
Michael Rush, Cynthia Toot Ferguson, and S. Lowell Kahn
44. Transhepatic Snare Placement for Translumbar Inferior Vena Cava Access 209
Mikin V. Patel and Steven Zangan
45. Fibrin Sheath Removal Techniques 212
S. Lowell Kahn
46. Obtaining Hemostasis at Puncture Sites 218
Sreekumar Madassery
47. Elimination of Post-Procedural Bleeding After Placement of Tunneled Dialysis Catheters 221
Almas Syed, Robert Evans Heithaus, and Chet R. Rees
48. Balloon-Assisted Removal of the Trapped Catheter 224
S. Lowell Kahn
49. The Rapid Fistula Declot 229
Dean C. Preddie and Gregg A. Miller
50. Endovascular Options for Nonmaturing Fistulas due to Collateral Flow 232
Jayesh M. Soni
51. Percutaneous Creation of Jump Bypass in a Native Arteriovenous Hemodialysis Fistula 235
Peter Miller, Sabah Butty, and Thomas Casciani

52. Using a Glidewire Cheater and Flow Switch to Temporarily Secure Purse-String Sutures **240**
Adam N. Plotnik and Stephen Kee

Section VI: Filter Placement and Retrieval **243**

53. Deploying a Straight Conical Filter **245**
S. Lowell Kahn
54. Removing the Angled Inferior Vena Cava Filter with an Embedded Hook: The "Hangman" Technique **250**
Adam N. Plotnik and Stephen Kee
55. Femoral Flip Technique for Removal of the G2 Filter **254**
Adam N. Plotnik and Stephen Kee
56. Femoral Retrieval of Conical Filters **257**
Mikin V. Patel and Steven Zangan
57. Laser Sheath Assisted Filter Removal **259**
Mohammad Arabi

Section VII: Miscellaneous Catheterization, Wire, and Embolization Techniques **263**

58. Transradial Access Technique **265**
Kyle Sanders, Craig Miller, Ricardo Yamada, and Marcelo Guimaraes
59. Slow and Steady Method for Advancing Devices Through Tight or Tortuous Anatomy **270**
Robert Evans Heithaus, Almas Syed, and Chet R. Rees
60. End of the Road: Bailout Techniques for the Short Wire **272**
S. Lowell Kahn
61. Balloon Anchor Techniques for Sheath, Guide Catheter, and Stent Advancement and to Facilitate Chronic Total Occlusion Traversal **275**
S. Lowell Kahn
62. Catheter Modification Techniques for Venous Sampling **281**
S. Lowell Kahn
63. Techniques for Forming Large Reverse Curve Catheters **285**
S. Lowell Kahn
64. Clearing the Clogged Microcatheter During Particulate Embolization **289**
Roshni A. Parikh and David M. Williams
65. The Anchor and Scaffold Techniques for Precise Coil Embolization **291**
S. Lowell Kahn

66. Selective Retrograde Thoracic Duct Embolization **295**
Abdulrahman Masrani and Bulent Arslan

Section VIII: Interventional Oncology and Biopsies **297**

67. Water Seal Technique for Lung Biopsy **299**
Kazim Narsinh and Thomas Kinney
68. Extreme Thoracic Biopsies **302**
William Derry and Scott Genshaft
69. Balloon Occlusion Technique During Y90 Radioembolization **307**
Armeen Mahvash and Ravi Murthy
70. Suprahepatic Catheter Placement for Hydrodissection **310**
Alessandro Gasparetto and John Fritz Angle
71. Percutaneous Thermal Ablation: Hydrodissection and Balloon Displacement to Protect Adjacent Non-Target Critical Structures **314**
Farrah J. Wolf and Jason Iannuccilli
72. Taming Cryoablation for Lung Tumors **318**
Anshuman Bansal and Fereidoun Abtin
73. Bland Lipiodol-Assisted Thermal Ablation of Renal Cell Carcinoma **326**
S. Lowell Kahn

Section IX: Hepatobiliary Interventions **329**

74. Optimal Imaging Techniques of the Portal Vasculature During TIPS Creation: Use of the CO₂ Portogram **331**
Hector Ferral
75. Use of Prolapsing Guidewire to Secure Portal Venous Access During the TIPS Procedure **333**
Thomas Kinney and Kazim Narsinh
76. Advancing the TIPS Sheath Through a Difficult Cirrhotic Liver: Pay It Forward Off the Balloon **335**
Adam N. Plotnik and Stephen Kee
77. The Gun-Site and Percutaneous Portocaval Techniques for the Challenging TIPS **338**
S. Lowell Kahn
78. Deployment of Direct Intrahepatic Portocaval Shunt (DIPS) from a Femoral Access **345**
Abdulrahman Masrani and Bulent Arslan

79. Transmesenteric Method of TIPS Placement Using Portal Access via Mini-Laparotomy **348**
Sam McCabe, Christopher Harnain, and Grigory Rozenblit
80. Recanalization of Occluded TIPS Using a Transhepatic Percutaneous Technique **351**
Saher S. Sabri
81. Adjustable Small-Diameter TIPS **354**
Zubin Irani and Sara Zhao
82. Use of a Coda Balloon to Assist Left Renal Vein Sheath Delivery During Balloon-Occluded Retrograde Transvenous Obliteration **357**
S. Lowell Kahn
83. Use of Contrast-Fortified Surgilube for Biliary Drainage in the Setting of Active Leakage **361**
S. Lowell Kahn
84. Percutaneous Placement of a Temporary Large-Bore Biliary Endoprosthesis **365**
Sam McCabe, Christopher Harnain, and Grigory Rozenblit
85. Method of Increasing Luminal Scaffolding for Biliary Strictures **368**
S. Lowell Kahn
86. Use of a Fogarty Balloon Catheter to Create Backwall Support and Facilitate Intrahepatic Bile Duct Access During Antegrade Stone Extraction **372**
George Carberry and Orhan Ozkan
87. Portal Vein Tract Embolization After Percutaneous Transhepatic Biliary Interventions **375**
Kazim Narsinh, Steven C. Rose, and Thomas Kinney
88. Use of an Elongated Radiopaque Gelatin Sponge Plug for Tract Occlusion After Hepatic Interventions **380**
Sam McCabe, Christopher Harnain, and Grigory Rozenblit

Section X: Gastroenterology and Genitourinary Interventions **383**

89. The Air Technique to Determine Appropriate Posterior Calyx for Puncture **385**
Kazim Narsinh and Thomas Kinney
90. Permanent Ureteral Occlusion **388**
Almamoon I. Justaniah

91. Exchange of Retrograde Occluded Nephroureteral Catheter Through Ileal Conduits Without Losing Access **391**
Jayesh M. Soni
92. Use of a Mushroom-Retained Gastrostomy Tube for Stenting Benign Esophageal Stricture **394**
Sam McCabe, Christopher Harnain, and Grigory Rozenblit
93. Balloon-Assisted, Fluoroscopically Guided Percutaneous Gastrostomy Tube Placement **397**
Joseph Farnam, Jason Iannuccilli, and Gregory Soares

Section XI: Drainage Procedures **401**

94. Maximizing Visualization of the Needle During Ultrasound Procedures **403**
Ki Jinn Chin
95. Method for Optimal Tract Anesthesia During Biopsies, Drainage Catheter Placement, Nephrostomies, and Percutaneous Transhepatic Cholangiography **410**
Robert Evans Heithaus, Almas Syed, and Chet R. Rees
96. Tract-o-gram to Reduce the Risk of Non-Target Catheterization During Placement of a Drainage Tube **413**
Almas Syed, Robert Evans Heithaus, and Chet R. Rees
97. Advancing the Difficult Drainage Catheter **418**
Robert Evans Heithaus, Almas Syed, and Chet R. Rees
98. Creation of a Steerable Coaxial Needle System for Indirect Line-of-Site Computed Tomography-Guided Procedures **421**
S. Lowell Kahn
99. Drainage of the Multiloculated Collection **424**
Mikin V. Patel and Steven Zangan
100. Transurethral Retrograde Approach to Pelvic Abscess Drainage in Post-cystectomy Patients **427**
George Carberry and Orhan Ozkan
101. Creation of an Additional Side Hole as a Method to Exchange Obstructed Percutaneous Drainage Catheters **430**
Jessica M. Ho and Michael D. Katz

102. Use of a Peel-Away Sheath as a Method to Exchange a Clogged Drainage Tube	434
<i>Harsha R. Jonna and Michael D. Katz</i>	

Section XII: Imaging and Pharmacology Techniques

437

103. Optimizing Carbon Dioxide Peripheral Arteriography	439
<i>Mikin V. Patel and Steven Zangan</i>	

104. Local Administration of Fresh Frozen Plasma and Platelets in the Critically Ill Patient	442
<i>Salim E. Abboud, Dean A. Nakamoto, and John R. Haaga</i>	
105. Reducing Operator Exposure Using Suspended Radiation Protection System	445
<i>Almas Syed, Robert Evans Heithaus, and Chet R. Rees</i>	

Index	449
-------	-----

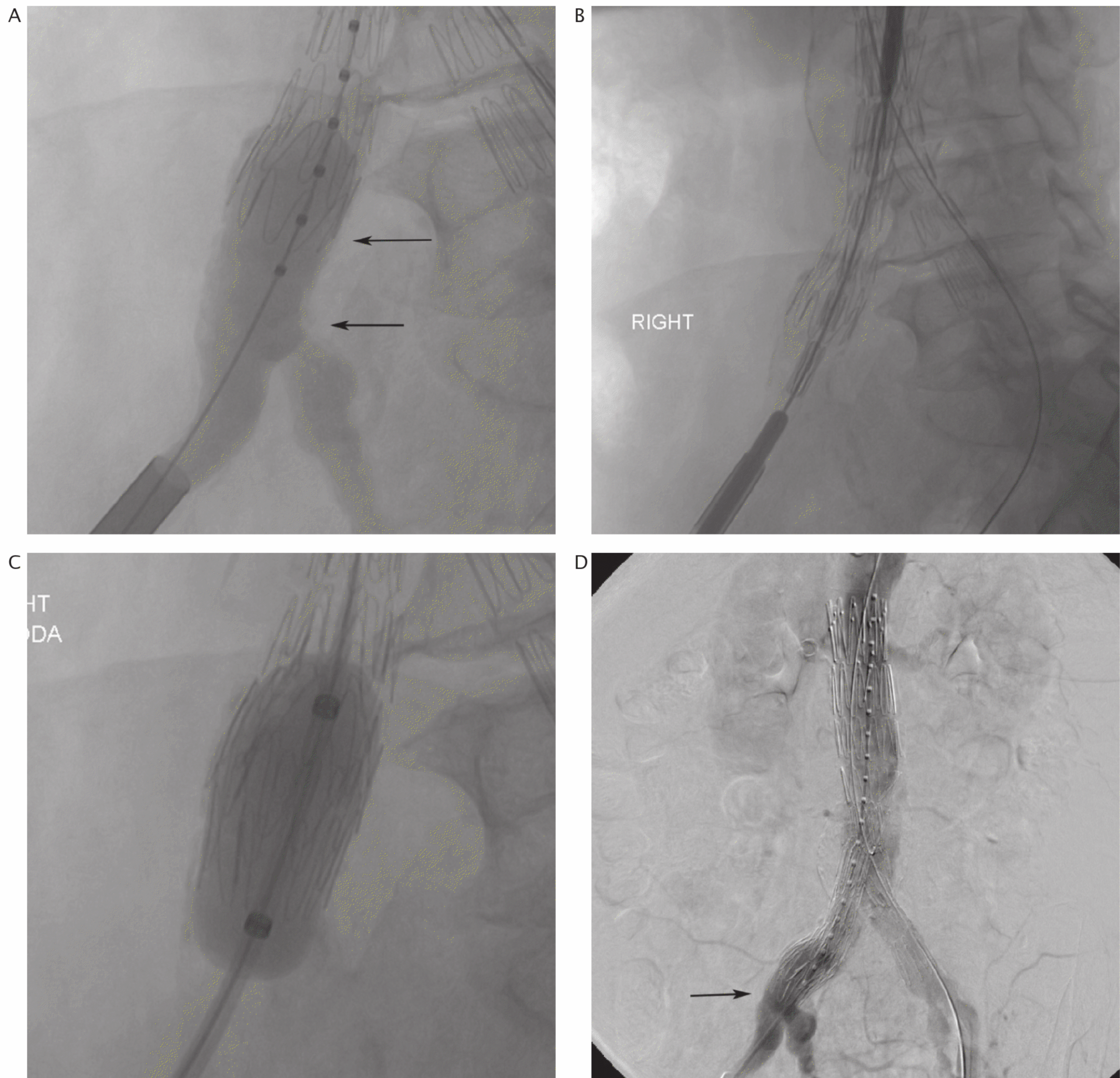


Figure 1.4 (A) Although there is a seal, it is best to cover the entire right common iliac artery aneurysm with an iliac extension (arrows). (B) Extension being inserted (Zenith). (C) A conformable balloon (Coda, Cook Medical Inc.) molds the limb to the iliac artery. Avoid dilating the native artery distal to the limb. (D) The limb now extends to the internal iliac artery (arrow), and there is no endoleak.

References and Suggested Readings

1. Sobocinski J, Briffa F, Holt PJ, et al. Evaluation of the Zenith low-profile abdominal aortic aneurysm stent graft. *J Vasc Surg.* 2015;62(4):841–847.
2. Stanley BM, Semmens JB, Mai Q, et al. Evaluation of patient selection guidelines for endoluminal AAA repair with the Zenith stent-graft: The Australasian experience. *J Endovasc Ther.* 2001;8(5):457–464.
3. Byrne J, Mehta M, Dominguez I, et al. Does Palmaz XL stent deployment for type 1 endoleak during elective or emergency endovascular aneurysm repair predict poor outcome? A multivariate analysis of 1470 patients. *Ann Vasc Surg.* 2013;27(4):401–411.
4. Jordan WD Jr, Mehta M, Varnagy D, et al. Results of the ANCHOR prospective, multicenter registry of EndoAnchors for type Ia endoleaks and endograft migration in patients with challenging anatomy. *J Vasc Surg.* 2014;60(4):885–892.e2.
5. Katada Y, Kondo S, Kondo T, Yamabe T. Endovascular treatment for type Ia major endoleak after endovascular aneurysm repair. *J Vasc Surg.* 2014;59(5):1430–1431.
6. Demanget N, Latil P, Orgeas L, et al. Finite element analysis of the mechanical performances of 8 marketed aortic stent-grafts. *J Endovasc Ther.* 2013;20(4):523–535.

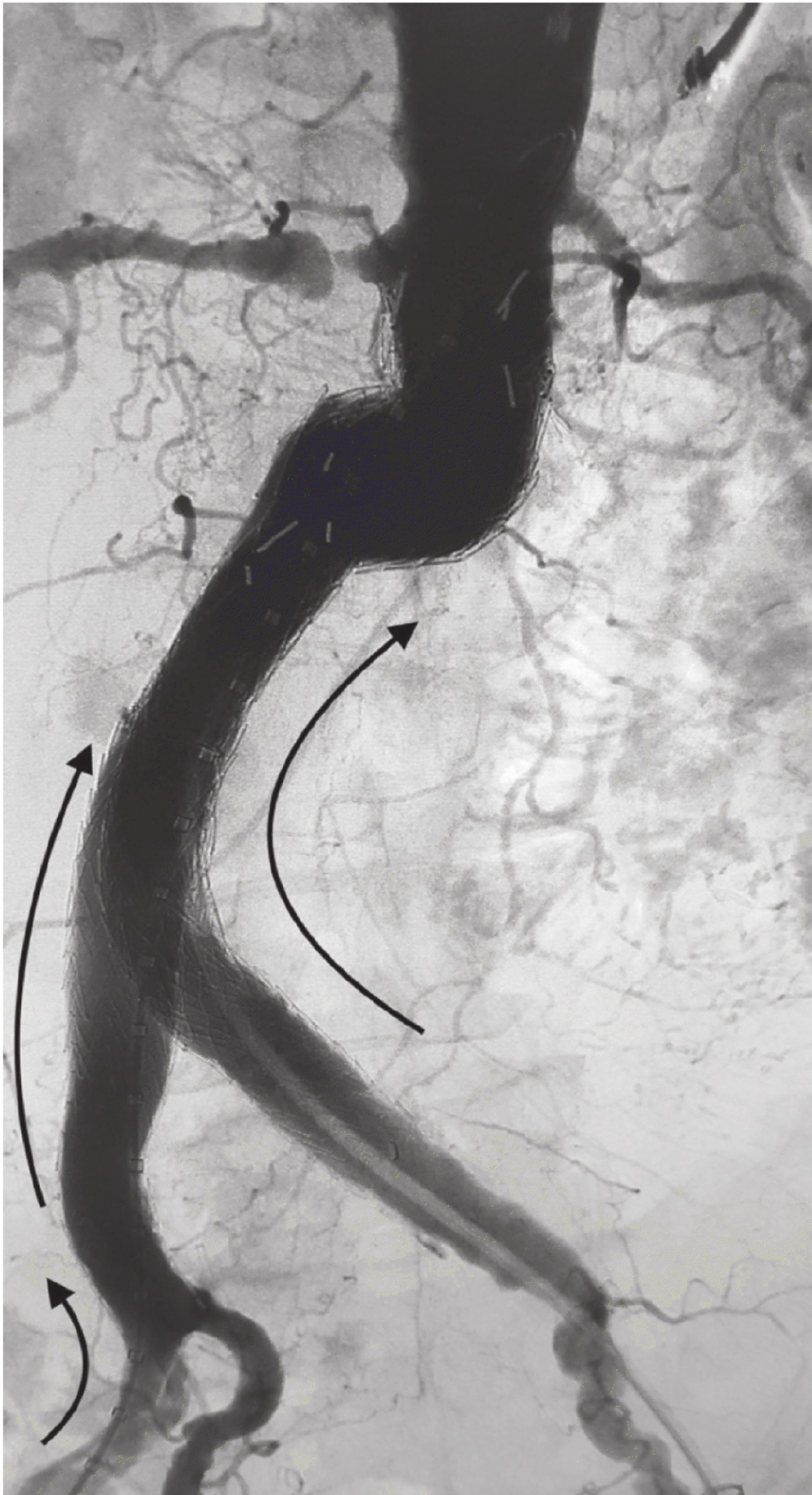


Figure 2.3 C-curve technique. Coronal DSA aortogram shows a tortuous aorta. The summation of the angles (arrows) of the tortuous aorta shows the right side to have more of an “S” configuration, whereas the left side has more of a “C” configuration. Based on the angles, a more accurate deployment was obtained by placing the main body from the left side access.

References and Suggested Readings

1. Katsargyris A, Oikonomou K, Bracale UM, Verhoeven EL. Unexpected complication with the new C3 excluder: Cause and treatment. *Cardiovasc Intervent Radiol*. 2013;36(2):536–539.
2. Maudet A, Daoudal A, Cardon A, et al. Endovascular treatment of infrarenal aneurysms: Comparison of the results of 2nd and

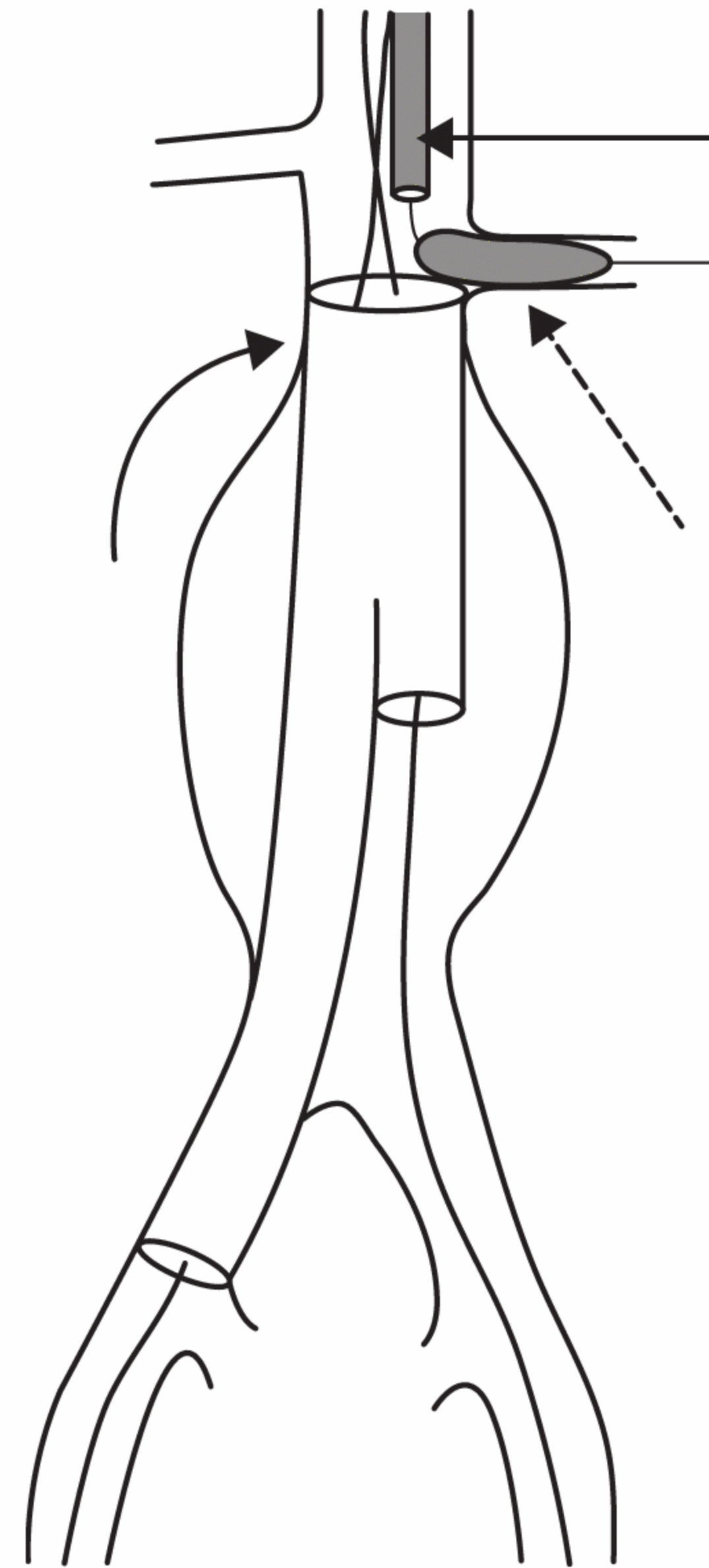


Figure 2.4 Renal buddy wire technique. Schematic demonstrates advancement of a sheath (solid arrow) from a left brachial approach with the tip lying just above the lower left renal artery. A balloon (dashed arrow) is placed into the left renal artery and extends a short distance into the aorta. The balloon protects the left renal artery while the C3 Excluder (curved arrow) is positioned immediately adjacent to the left renal artery to maximize seal in a short, reverse taper neck.

3rd generation stentgrafts. *Ann Vasc Surg*. 2016;May 9 [Epub ahead of print].

3. Katsargyris A, Mufty H, Wojs R, Utech G, Verhoeven EL. Single-centre experience with the Gore C3 Excluder stent-graft in 200 consecutive patients. *J Cardiovasc Surg*. 2016;57(4):485–490.
4. Verhoeven EL, Katsargyris A, Bachoo P, et al.; GREAT European C3 Module Investigators. Real-world performance of the new C3 Gore Excluder stent-graft: 1-year results from the European C3 module of the Global Registry for Endovascular Aortic Treatment (GREAT). *Eur J Vasc Endovasc Surg*. 2014;48(2):131–137.
5. Katsargyris A, Botos B, Oikonomou K, Pedraza de Leistl M, Ritter W, Verhoeven EL. The new C3 Gore Excluder stent-graft: Single-center experience with 100 patients. *Eur J Vasc Endovasc Surg*. 2014;47(4):342–348.
6. Krajcer Z. The Gore Excluder AAA endoprosthesis with C3 delivery system: Results in high-volume centers. *J Cardiovasc Surg*. 2014;55(1):41–49.

- with wide or short neck morphology, balloon-assisted thrombin injection for, 102–103, 103*f*
- Pulmonary arteriovenous malformation (PAVM) embolization, coil deployment, 285
- Pulmonary artery catheterization, without dedicated pulmonary catheters, 185–186, 186*f*
- Purse-string sutures, glidewire cheater and flow switch for, 234–235, 240
- Radial artery anatomic variance, tortuosity, and loops, 259
- Radioembolization, Y90, balloon occlusion technique for, 301–302, 307
- Radiofrequency ablation, 312
 - heat injuries, adjacent organs, 304
 - of renal cell carcinoma, 320
 - transarterial embolization before, 320
 - suprahepatic catheter placement for, 304–306, 310, 306*f*–307*f*
- Rapid fistula declot, 223–225
- Rebound technique, retrograde to antegrade femoral access through single site, 115–116, 117–118, 119*f*
- Recanalization techniques, for chronic central venous occlusions, difficult crossings, 158–159, 160*f*–161*f*
- Re-entry devices, true lumen, 69
- Re-entry techniques, true lumen, 73–82
 - applications, 74–75
 - catheter-based, shortcomings, 74
 - challenges, 75–76
 - potential pitfalls/complications, 76
 - procedure steps, 76–78, 79*f*–82*f*
 - SAFARI technique, 74, 87
- Renal buddy wire technique, 7–10, 11*f*
- Renal cell carcinoma
 - bland lipiodol-assisted thermal ablation, 320–321, 314
 - radiofrequency ablation, 320
 - transarterial embolization before, 320
- Renal vein, left, Coda balloon for sheath delivery in balloon-occluded retrograde transvenous obliteration, 351–353, 353*f*
- Retrograde femoral access
 - for difficult superficial femoral artery occlusions, 96–97, 97–98*f*
 - ultrasound-guided, applications, 96
- Retrograde nephroureteral catheter
 - occluded, exchange through ileal conduits, without losing access, 385, 386*f*–387*f*
 - uses, 385
- Retrograde superior mesenteric artery recanalization, combined endovascular and surgical, 130–131, 133
- Retrograde to antegrade femoral access, though single site (flip technique), 116–120. *See also* Flip techniques ...
- Retrograde wire technique 74–79
- Reverse curve catheters
 - forming large, technique, 279–281, 281*f*–282*f*
 - uses and types, 279
- Reverse deployment, of Gore Excluder contralateral iliac limbs
 - for aortoiliac interventions, 38–39
 - for central venous occlusive disease, 141–143, 143–144
- Reverse Outback® LTD® technique, 75–77
- SAFARI technique, 69, 74, 87
 - true lumen re-entry, 84
- Scaffold techniques, for precise coil embolization, 285–286, 287*f*
- Scoring balloon, 99
 - “poor man’s,” 99–100, 99*f*
- Selective retrograde thoracic duct embolization, 289, 290*f*
- Sheath advancement
 - balloon anchor techniques for chronic total occlusion, 269–271, 271*f*–273*f*
 - into small, diseased or angled branch vessel, 269
- Short wire advancement techniques, 266–268
- Side branch technique, 279–281, 281*f*
- Side hole creation, for obstructed percutaneous drainage catheter exchange, 424–425, 425*f*–427*f*
- Slow and steady method, advancing devices through tight or tortuous anatomy, 264, 270
- Small-diameter TIPS, adjustable, 348–349, 349*f*–350*f*, 355*t*
- Smaller veins, catheterization
 - catheter modification techniques, 275–276, 276*f*–277*f*
 - diagnostic, 275
- Small iliac access, endoconduit for, 52*t*, 53–55, 55*f*–56*f*
- Snared wire technique, 108–113
- Splenic artery embolization to prevent distal coil migration, Fogarty occlusion balloon for, 127–128, 359*f*
- Standard and buddy wire balloon anchor technique, 269–271, 271*f*–273*f*
- Static forces of friction, overcoming, 264
- Steerable coaxial needle system, for indirect line-of-site CT-guided procedures, 415–416, 417*f*
- Stent
 - advantages, 359
 - bare metal, 146, 359
 - covered metal, 146
 - self-expanding, 146
- Stent advancement
 - balloon anchor techniques for chronic total occlusion, 269–271, 271*f*–273*f*
 - into small, diseased or angled branch vessel, 269
- Stent grafts
 - aortic, modular two- and three-piece, contralateral gate catheterization, 13, 15
 - for aorto-uni-iliac endograft, two bifurcated, 42–43, 44*f*
 - branched, vena cava placement via Endologix AFX, 145–149, 149–150
 - for central venous occlusive disease, 141
 - Cook Zenith, abdominal endograft deployment, 3–4, 4*f*–6*f*
 - Gore Excluder
 - C 3, 7
 - deployment, 7–10, 10*f*–11*f*
 - Viatorr, 348–349
- Straight conical filter, deploying, 239–241, 241*f*–242*f*
- Subintimal artery
 - flossing with antegrade–retrograde intervention, 69, 74
 - recanalization, bull’s eye technique, 69–71, 71*f*–72*f*
- Subintimal entry, alternative techniques, 73–82
 - applications, 74–75
 - challenges, 75–76
 - devices, 74
 - overview, 73–74
 - potential pitfalls/complications, 76
 - procedure steps, 76–78, 79*f*–82*f*
 - SAFARI technique, 74