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A COMPANION TO **BRAUNWALD'S**
HEART DISEASE

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CARDIOVASCULAR INTERVENTION

A Companion to Braunwald's Heart Disease

Deepak L. Bhatt, MD, MPH, FACC, FAHA, FSCAI, FESC

Executive Director of Interventional Cardiovascular Programs
Brigham and Women's Hospital Heart and Vascular Center
Professor of Medicine
Harvard Medical School
Boston, Massachusetts

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This book is dedicated, with the deepest affection and gratitude ...
To my wife, Shanthala, and our sons, Vinayak, Arjun, Ram, and Raj, for their love and for their understanding of the many hours I devote to patients, to procedures, and to academic pursuits
To my parents, for initially setting me on the path of a scholar
To my teachers, for their knowledge, patience, wisdom, and guidance
To my patients, for teaching me what matters most about being a doctor

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List of Contributors

Alex Abou-Chebl, MD

Medical Director, Stroke, Baptist Health Louisville,
Louisville, Kentucky
Intracranial Intervention and Acute Stroke

Farhad Abtahian, MD, PhD

Cardiology Division, Massachusetts General Hospital,
Harvard Medical School, Boston, Massachusetts
Optical Coherence Tomography

Shikhar Agarwal, MD, MPH

Department of Cardiovascular Medicine, Section of
Interventional Cardiology, Heart and Vascular Institute,
Cleveland Clinic, Cleveland, Ohio
Hypertrophic Cardiomyopathy

Fernando Alfonso, MD

Director, Cardiac Department, Associate Professor of
Medicine, Hospital Universitario de La Princesa Madrid,
Madrid, Spain
Treatment of In-Stent Restenosis

Amjad T. AlMahameed, MD, MPH

Interventional Cardiologist and Endovascular Specialist,
Cape Cod Hospital, Hyannis, Massachusetts
Upper Extremity Intervention

Saif Anwaruddin, MD

Assistant Professor of Medicine, Perelman School of
Medicine at the University of Pennsylvania, Co-Director,
Transcatheter Valve Program, Hospital of the University
of Pennsylvania, Philadelphia, Pennsylvania
Transcatheter Mitral Valve Intervention

Usman Baber, MD

Assistant Professor of Medicine, The Icahn School of
Medicine at Mount Sinai, New York, New York
Contrast Selection

Subhash Banerjee, MD

Chief of Cardiology, VA North Texas Healthcare System,
Associate Professor, Internal Medicine, University of
Texas Southwestern Medical Center, Dallas, Texas
Bypass Graft Interventions

Sripal Bangalore, MD, MHA, FACC, FAHA, FSCAI

Director of Research, Cardiac Catheterization Laboratory,
Director, Cardiovascular Outcomes Group; Associate
Professor of Medicine, Division of Cardiology, New York
University School of Medicine, New York, New York
Vascular Access and Closure

Anthony A. Bavry, MD, MPH

Director, Cardiac Catheterization Laboratories, North
Florida/South Georgia Veterans Health System, Associate
Professor of Medicine, Division of Cardiovascular
Medicine, University of Florida, Gainesville, Florida
Management of Thrombotic Lesions

Stefan C. Bertog, MD

Cardiovascular Center Frankfurt, Frankfurt, Germany
Renal Denervation

Deepak L. Bhatt, MD, MPH, FACC, FAHA, FSCAI, FESC

Executive Director of Interventional Cardiovascular
Programs, Brigham and Women's Hospital Heart and
Vascular Center, Professor of Medicine, Harvard Medical
School, Boston, Massachusetts
Endomyocardial Biopsy

John A. Bittl, MD

Munroe Heart and Vascular Institute, Munroe Regional
Medical Center, Ocala, Florida
Hemodialysis Access Intervention

Emmanouil S. Brilakis, MD, PhD

Director, Cardiac Catheterization Laboratories, VA North
Texas Healthcare System, Associate Professor, Internal
Medicine, University of Texas Southwestern Medical
Center, Dallas, Texas
Bypass Graft Interventions

Robert A. Byrne, MB, BCh, PhD

Interventional Cardiologist, Deutsches Herzzentrum
München, Technische Universität München, Munich,
Germany
Treatment of In-Stent Restenosis

Robert Cecil, PhD

The Imaging Institute and The Heart and Vascular Institute,
Department of Radiology, Cleveland Clinic, Cleveland,
Ohio
Radiation Safety in the Cardiac Catheterization Laboratory

Georgios Christodoulidis, MD

The Icahn School of Medicine at Mount Sinai, New York,
New York
Contrast Selection

Antonio Colombo, MD

Chief Director, Interventional Cardiology Unit, San Raffaele
Scientific Institute, Interventional Cardiology Unit,
EMO-GVM Centro Cuore Columbus, Milan, Italy
Bifurcations

Darshan Doshi, MD

Herbert and Sandi Feinberg Interventional Cardiology and
Heart Valve Center, Columbia University Medical Center/
New York-Presbyterian Hospital, and Cardiovascular
Research Foundation, New York, New York
Aortic Valvuloplasty and Transcatheter Aortic Valve Replacement

Todd Drexel, MD

University of Minnesota, Minneapolis, Minnesota
Renal Denervation

**David P. Faxon, MD**

Vice Chair of Medicine for Clinical Strategic Planning,
Division of Cardiology, Brigham and Women's Hospital;
Senior Lecturer, Harvard Medical School, Boston,
Massachusetts

*Guidelines and Appropriateness Criteria for Interventional
Cardiology*

Sameer Gafoor, MD

Cardiovascular Center Frankfurt, Frankfurt, Germany

Renal Denervation

Philippe Généreux, MD

Cardiovascular Research Foundation; New York-
Presbyterian Hospital/Columbia University Medical
Center, New York, New York; Associate Professor, Hôpital
du Sacré-Coeur de Montréal, Université de Montréal,
Montréal, Canada

*Percutaneous Coronary Intervention for Unprotected Left Main
Disease*

Sachin S. Goel, MD

Interventional Cardiology, Prairie Heart Institute at
St John's Hospital, Springfield, Illinois

*Patient Foramen Ovale, Atrial Septal Defect, Left Atrial
Appendage, and Ventricular Septal Defect Closure*

William A. Gray, MD

Associate Professor of Medicine, Columbia University,
New York, New York

Carotid and Vertebral Intervention

Howard C. Herrmann, MD

Professor of Medicine, Perelman School of Medicine at the
University of Pennsylvania; Director, Interventional
Cardiology Program and Cardiac Catheterization Labs,
Hospital of the University of Pennsylvania, Philadelphia,
Pennsylvania

Transcatheter Mitral Valve Intervention

Frederick A. Heupler, Jr., MD

Director, Diagnostic Catheterization Laboratory, Robert and
Suzanne Tomsich Department of Cardiovascular
Medicine, Cleveland Clinic, Cleveland, Ohio

Radiation Safety in the Cardiac Catheterization Laboratory

Ilona Hofmann, MD

Cardiovascular Center Frankfurt, Frankfurt, Germany

Renal Denervation

Dani Id, MD

Cardiovascular Center Frankfurt, Frankfurt, Germany

Renal Denervation

Ik-Kyung Jang, MD, PhD

Professor of Medicine, Massachusetts General Hospital,
Harvard Medical School, Boston, Massachusetts

Optical Coherence Tomography

Hani Jneid, MD, FACC, FAHA, FSCAI

Assistant Professor of Medicine, Director of Interventional
Cardiology Research, Baylor College of Medicine;
Director of Interventional Cardiology, The Michael E.
DeBakey VA Medical Center, Houston, Texas

Pharmacotherapy in the Modern Interventional Suite

Michael Joner, MD

Deutsches Herzzentrum München, Technische Universität
München, Munich, Germany; CEO, Cardiovascular
Pathology, CVPath Institute, Gaithersburg, Maryland

Treatment of In-Stent Restenosis

Marwan F. Jumean, MD

Interventional Cardiology and Advanced Heart Failure,
The Cardiovascular Center, Tufts Medical Center, Boston,
Massachusetts

Interventions for Advanced Heart Failure

David E. Kandzari, MD

Chief Scientific Officer and Director, Interventional
Cardiology, Piedmont Heart Institute, Atlanta, Georgia

*Chronic Total Coronary Occlusions: Rationale, Technique, and
Clinical Outcomes*

Samir R. Kapadia, MD

Director, Sones Catheterization Laboratory, Department of
Cardiovascular Medicine; Director, Interventional
Cardiology Fellowship, The Cleveland Clinic Foundation,
Cleveland, Ohio

*Radiation Safety in the Cardiac Catheterization Laboratory and
Patient Foramen Ovale, Atrial Septal Defect, Left Atrial
Appendage, and Ventricular Septal Defect Closure*

Navin K. Kapur, MD, FACC, FSCAI

Assistant Professor of Medicine, Director, Acute Circulatory
Support Program, Director, Interventional Research
Laboratories, Investigator, Molecular Cardiology
Research Institute, The Cardiovascular Center, Tufts
Medical Center, Boston, Massachusetts

Interventions for Advanced Heart Failure

Adnan Kastrati, MD

Professor of Cardiology, Director, Catheterization
Laboratory, Deutsches Herzzentrum München,
Technische Universität München, Munich, Germany

Treatment of In-Stent Restenosis

Morton J. Kern, MD, FSCAI, FAHA, FACC

Professor of Medicine, University California Irvine, Orange,
California; Chief of Medicine, Veterans Administration
Long Beach Health Care System, Long Beach, California

Fractional Flow Reserve

Scott Kinlay, MBBS, PhD, FAHA, FACC, FSCAI, FSVM, FRACP, FCSANZ

Director, Cardiac Catheterization Laboratory and Vascular
Medicine, VA Boston Healthcare System, West Roxbury,
Massachusetts; Co-Director, Interventional Cardiology
and Vascular Diagnostic & Interventional Clinical and
Research Fellowship Program, VA Boston Healthcare
System and Brigham and Women's Hospital, Associate
Professor in Medicine, Harvard Medical School, Adjunct
Associate Professor in Medicine, Boston University
Medical School, Boston, Massachusetts

Intervention for Lower Extremity Arterial Disease

Susheel K. Kodali, MD

Herbert and Sandi Feinberg Interventional Cardiology and
Heart Valve Center, Columbia University Medical Center/
New York-Presbyterian Hospital, and Cardiovascular
Research Foundation, New York, New York

Aortic Valvuloplasty and Transcatheter Aortic Valve Replacement



Amar Krishnaswamy, MD, FACC

Associate Director, Interventional Cardiology Fellowship Program; Associate Director, General Cardiology Fellowship Program; Interventional Cardiology, Cleveland Clinic, Cleveland, Ohio

Calcified Lesions

Azeem Latib, MD

Interventional Cardiology Unit, San Raffaele Scientific Institute, Interventional Cardiology Unit, EMO-GVM Centro Cuore Columbus, Milan, Italy

Bifurcations

Martin B. Leon, MD

Professor of Medicine, Herbert and Sandi Feinberg Interventional Cardiology and Heart Valve Center, Columbia University Medical Center/New York-Presbyterian Hospital, and Cardiovascular Research Foundation, New York, New York

Aortic Valvuloplasty and Transcatheter Aortic Valve Replacement

Ronan Margey, MB, FACC, FESC

Consultant Interventional Cardiologist, Special Interest in Vascular and Structural Heart Disease Intervention, Mater Private Hospital Group, Cork and Dublin, Ireland

Pericardiocentesis and Pericardial Intervention

Roxana Mehran, MD

Professor of Medicine (Cardiology) and Health Evidence Policy, Director of Interventional Cardiovascular Research and Clinical Trials, The Zena and Michael A. Wiener Cardiovascular Institute, The Icahn School of Medicine at Mount Sinai, New York, New York

Contrast Selection

Aravinda Nanjundappa, MD, FACC, FSCAI, RVT

Professor of Medicine and Surgery, Director of TAVR program, West Virginia University, Charleston, West Virginia

Endovascular Management of Aortic and Thoracic Aneurysms

Brian P. O'Neill, MD

Division of Cardiology, Temple Heart and Vascular Institute, Temple University, Philadelphia, Pennsylvania

Hemodynamic Support During High-Risk PCI

William W. O'Neill, MD, FACC, FSCAI

Division of Cardiology, Henry Ford Hospital, Detroit, Michigan

Hemodynamic Support During High-Risk PCI

Igor F. Palacios, MD, FACC, FSCAI, FAHA

Director, Structural Heart Disease and Interventional Cardiology, Massachusetts General Hospital, Boston, Massachusetts

Pericardiocentesis and Pericardial Intervention

Lourdes R. Prieto, MD

Director, Pediatric Cardiac Catheterization Laboratory, Department of Pediatric Cardiology, Cleveland Clinic Children's Hospital, Cleveland, Ohio

Patient Foramen Ovale, Atrial Septal Defect, Left Atrial Appendage, and Ventricular Septal Defect Closure

Markus Reinartz, MD

Cardiovascular Center Frankfurt, Frankfurt, Germany

Renal Denervation

John F. Rhodes, Jr., MD

Director of Cardiology, The Heart Program, Miami Children's Hospital, Miami, Florida

Congenital Heart Disease

Nicolas W. Shamma, MD, MS, EJD, FACC, FSCAI

Adjunct Clinical Associate Professor of Medicine University of Iowa Hospitals and Clinics; Founder and Research Director, Midwest Cardiovascular Research Foundation; Section Editor, *Advances in Vein Therapies*, *Journal of Invasive Cardiology*; Consultant and Interventional Cardiologist Cardiovascular Medicine, PC, Genesis Heart Institute, Davenport, Iowa

Management of Chronic Venous Insufficiency

Nicholas Shkumat

Department of Radiology, Cleveland Clinic, Cleveland, Ohio

Radiation Safety in the Cardiac Catheterization Laboratory

Horst Sievert, MD, PhD

Cardiovascular Center Frankfurt, Frankfurt, Germany

Renal Denervation

Akhilesh K. Sista, MD

Assistant Professor of Radiology, Weill Cornell Medical College, New York, New York

Interventional Management of Lower Extremity Deep Vein Thrombosis and Pulmonary Embolism

Gregg W. Stone, MD

Professor of Medicine, Columbia University, Director of Cardiovascular Research and Education, Center for Interventional Vascular Therapy, New York Presbyterian Hospital/Columbia University Medical Center; Co-Director of Medical Research and Education, The Cardiovascular Research Foundation, New York, New York

Percutaneous Coronary Intervention for Unprotected Left Main Disease

E. Murat Tuzcu, MD

Professor of Medicine, Vice Chair for Clinical Operations, Department of Cardiovascular Medicine, Section of Interventional Cardiology, Heart and Vascular Institute, Cleveland Clinic, Cleveland, Ohio

Hypertrophic Cardiomyopathy

Laura Vaskelyte, MD

Cardiovascular Center Frankfurt, Frankfurt, Germany

Renal Denervation

Suresh Vedantham, MD

Professor of Radiology and Surgery, Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, Missouri

Interventional Management of Lower Extremity Deep Vein Thrombosis and Pulmonary Embolism

**Christopher J. White, MD**

Professor and Chairman of Medicine, Department of Cardiovascular Diseases, Ochsner Clinical School of the University of Queensland, Ochsner Medical Institutions, New Orleans, Louisiana

Renal Artery Intervention: Catheter-Based Therapy for Renal Artery Stenosis and Mesenteric Artery Intervention: Catheter-Based Therapy for Chronic Mesenteric Ischemia

Patrick L. Whitlow, MD, FACC, FAHA

Department of Cardiovascular Medicine, Cleveland Clinic, Cleveland, Ohio

Calcified Lesions

David O. Williams, MD

Professor of Medicine, Harvard Medical School; Senior Physician, Cardiovascular Division, Brigham and Women's Hospital, Boston, Massachusetts

The Birth of Interventional Cardiology

Kevin Wunderle, MS

Department of Radiology, Cleveland Clinic, Cleveland, Ohio

Radiation Safety in the Cardiac Catheterization Laboratory

James B. Young, MD

Professor of Medicine and Executive Dean, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University; George and Linda Kaufman Chair, Kaufman Center for Heart Failure, Heart and Vascular Institute, Cleveland Clinic Foundation, Cleveland, Ohio

Endomyocardial Biopsy

Khaled M. Ziada, MD, FACC, FSCAI

Professor of Medicine, Gill Foundation Professor of Interventional Cardiology, Division of Cardiovascular Medicine, Director, Cardiac Catheterization Laboratories, Director, Cardiovascular Interventional Fellowship Program, Gill Heart Institute—University of Kentucky, Lexington, Kentucky

Intravascular Ultrasound Imaging

Foreword

Cardiac catheterization was developed during the first half of the twentieth century, and together with electrocardiography became one of the two cornerstones of modern cardiology. Appropriately, the credit for applying this technique to patients and to employ it for assessment of cardiac function and to cardiac diagnosis was rewarded by the Nobel Prize in Medicine or Physiology to Forssmann, Cournand, and Richards in 1956. Cardiac catheterization made possible selective angiography, including, of course, coronary arteriography. These invasive techniques allowed measurement of intracardiac pressures and flows and visualization of the cardiac chambers, valves, great vessels, and coronary arteries. Simultaneously, cardiac surgery, especially open heart surgery, made great advances. These two separate approaches to cardiac patients—precise diagnosis in the cardiac catheterization laboratory and successful treatment of cardiovascular and coronary disorders in the operating room—led to a proliferation of both catheterization laboratories and cardiac surgical suites around the world in the 1960s and 1970s.

The 1970s also saw the development of a variety of new imaging techniques, including echocardiography, nuclear imaging, computed tomography, and magnetic resonance imaging, which have allowed noninvasive assessment of cardiac structure and function. This represented an enormous advance and reduced the need for diagnostic cardiac catheterization. Yet, invasive cardiologists did not gradually disappear, and cardiac catheterization laboratories did not close. Instead, after Andreas Gruentzig's gigantic leap forward in 1977, when he demonstrated that atherosclerotic obstructions in coronary arteries could be treated successfully by inflating a balloon near the tip of a cardiac catheter, many invasive cardiologists "morphed" into interventional cardiologists. Soon balloon angioplasty was supplemented by stenting, and this approach was extended to relieving obstructions in the renal, femoral, carotid, and other systemic arteries. Percutaneous treatment of stenotic mitral and aortic valves with balloon valvotomy soon followed. More recently, transcatheter aortic valve replacement has transformed the outlook of patients with aortic stenosis at high risk for surgical valve replacement, and transcatheter mitigation of mitral regurgitation is now under development as well. Catheter-based treatment of many congenital cardiac lesions is being widely practiced. Pumps incorporated into catheters inserted into the left ventricle by interventional cardiologists retrograde through the aortic valve

can treat acute heart failure. The proliferation of such interventional procedures and of percutaneous devices is continuing, indeed accelerating.

As a consequence of these important advances, interventional cardiology has become a robust subspecialty, with its own subspecialty board, training programs, journals, and international meetings. It is grounded in conventional cardiology and interfaces with radiology, with both cardiac and vascular surgery, and with pediatrics and neurology as well. There is a growth of so-called "hybrid" interventional suites in which both percutaneous and operative procedures can be performed sequentially in the same patient, in parallel with the development of multidisciplinary "heart teams." As a consequence, the lines that previously separated cardiology from these other disciplines are becoming blurred.

Dr. Deepak L. Bhatt accepted the responsibility of editing *Cardiovascular Intervention*. While this comprehensive text focuses primarily on coronary interventions, it also describes interventions in valvular heart disease, congenital heart disease, advanced heart failure, as well as diseases of various systemic arterial beds and of the aorta. Dr. Bhatt brings a wealth of personal experience to this task. As a practicing interventional cardiologist, he faces the clinical problems that are discussed in this book on a daily basis. He is also an experienced clinical trialist, which provides him with the ability to assess the validity of the myriad studies published in this field as well.

Dr. Bhatt has assembled a group of talented, experienced authors for preparing *Cardiovascular Intervention*. The book is well illustrated and contains 431 figures and 116 tables that summarize an enormous amount of material. It is as up to date as this month's journals and meetings. This text offers great value to trainees and practitioners in this field, as well as to radiologists, cardiovascular surgeons and general cardiologists who interact frequently with interventional cardiologists.

We are proud to welcome *Cardiovascular Intervention* to the growing family of Companions to *Braunwald's Heart Disease*.

**Eugene Braunwald
Douglas Zipes
Peter Libby
Robert Bonow
Douglas Mann**

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Preface

Cardiovascular intervention has saved many lives and improved quality of life. The widespread adoption of cardiovascular intervention worldwide has, in part, led to a decrease in the rate of cardiovascular death for several conditions—though in absolute terms, due to the aging of the population and increasing urbanization, the population at risk is growing and the global cardiovascular epidemic continues.

Few areas in medicine have advanced as meaningfully and rapidly as cardiovascular intervention. The field now encompasses complex coronary intervention, peripheral arterial and venous procedures, cerebrovascular intervention, congenital heart disease, and valvular as well as other structural heart intervention. The care of this panoply of diseases involves multidisciplinary teams increasingly housed in heart and vascular centers, designed around optimizing the patient experience as opposed to the silos of physician and surgeon specialties of the past.

What was previously only treatable with a scalpel can currently be approached with a catheter. This transformation of several open surgical procedures to truly minimally invasive interventional procedures has been of great benefit to patients. Additionally, this evolution potentially allows many more patients to be served even in relatively resource-poor settings and with greater cost effectiveness in all economic environments.

For decades now, innovation and intervention have gone hand in hand. Pioneers in cardiovascular intervention have boldly pushed the boundaries of what is possible. Physicians, scientists, and engineers from industry have served as valuable partners in this exciting journey. The advances in devices, pharmacotherapies, and procedural techniques would not have been possible without this collaboration. As well, the free flow of information across countries and specialties has allowed cardiovascular intervention to mature at an impressive pace for what—viewed within the larger context of medicine—is still a relatively young field.

The resulting explosion of the required knowledge base for practitioners in the field of cardiovascular intervention has created a challenge—how to keep up! In this companion to *Braunwald's Heart Disease*, world-renowned

authors provide the latest data to inform decision making in cardiovascular intervention. Furthermore, they provide details on the technical aspects of optimizing procedural care. This focus on both cognitive and procedural elements of cardiovascular intervention provides a needed resource in this dynamic field.

In joining the great lineage of the *Heart Disease* family, *Cardiovascular Intervention: A Companion to Braunwald's Heart Disease* aims to provide the wide variety of health care personnel involved with cardiovascular intervention with evidence-based information critical for successfully ensuring the best possible care. It is meant as an aid to make decisions at the bedside, as a reference text for specific questions, and also as a resource for scientific inquiry and investigation. Cardiovascular intervention is a very visual specialty, and this book has ample figures and abundant videos to provide that necessity. Frequent online supplements will keep the book vibrant in an era of rapid change, with the textbook portion anchoring that knowledge which has stood the test of time. Electronic links with *Braunwald's Heart Disease* and other companion textbooks should make for a comprehensive, current, and visually compelling resource in cardiovascular intervention that is placed within the larger universe of cardiovascular disease care.

My dream is that interventional cardiologists, cardiac and vascular surgeons, interventional radiologists and neurologists, trainees, medical students, nurses and nurse practitioners, physician assistants, industry partners, and others involved with patients undergoing cardiovascular interventions can learn from this book, guiding them in the daily care of their patients. As such, my sincere hope is that these diverse readers find *Cardiovascular Intervention: A Companion to Braunwald's Heart Disease* to be a valuable educational tool that conveys the passion the authors and I feel for the beauty and grandeur of cardiovascular intervention.

**Deepak L. Bhatt, MD, MPH, FACC, FAHA,
FSCAI, FESC**