

Kwan-Leung Chan
John M. Embil
Editors

Endocarditis

Diagnosis
and Management

Second Edition

 Springer

Endocarditis

Kwan-Leung Chan • John M. Embil
Editors

Endocarditis

Diagnosis and Management

Second Edition

 Springer

Editors

Kwan-Leung Chan
Heart Institute
University of Ottawa
Ottawa, Ontario
Canada

John M. Embil
Department of Medicine
Health Sciences Centre
Winnipeg, Manitoba
Canada

ISBN 978-3-319-27782-0

ISBN 978-3-319-27784-4 (eBook)

DOI 10.1007/978-3-319-27784-4

Library of Congress Control Number: 2016933665

Springer Cham Heidelberg New York Dordrecht London

© Springer International Publishing 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Foreword (1st Edition)

Infection remains the number one killer worldwide. Nevertheless, it is the expectation that bacterial infections can be eliminated with antibiotics. Unfortunately, there remain infections due to bacteria that are difficult to detect and difficult to reach, because of minimal blood supply, with even the most potent antibiotics. One of the diseases in this category is infections that initiate on the inner lining of a vital organ, the heart. These infections are referred to as endocarditis since they involve the endocardium, the inner lining of the heart and valves. The initial site of infection is generally in areas exposed to mechanical trauma or prosthetic device. Unfortunately the damage to the heart if not treated can be fatal and often survival requires surgical replacement of one of the valves. Despite the tremendous array of antibiotics and the marked increase in potency of these drugs to eradicate bacterial infection, the efficacy of treating the relatively avascular lining of the heart or its valvular apparatus often eludes the desired effect. This is further complicated by the changing substrate for bacterial endocarditis, namely, artificial valves and devices and the increasing number of individuals who are immunosuppressed because of drug use, human immunodeficiency virus infections, or other debilitating conditions. Endocarditis due to bacteria and other agents remains a continuing threat as well as a challenge in terms of diagnosis, management, and treatment.

Drs. Chan and Embil have brought together the expertise of pathologists, infectious disease experts, cardiologists, pharmacologists, and surgeons to provide a comprehensive approach to the problem of endocarditis. The book is organized to include a chapter on the pertinent pathology followed by population studies. The diagnostic section is extensive, comprehensive, and very clearly written so that both medical and paramedical personnel can appreciate the armamentarium and its application. The management section is broad based to include the treatment of the acute and chronic forms as well as potential sequelae that may occur. Echocardiography has become a major tool in the management of endocarditis and transesophageal echocardiography is now essential in the diagnosis and management of suspected prosthetic valve endocarditis. The role of echocardiography is critically assessed in several chapters dealing with specific clinical situations. The chapters reflect the authors' first-hand experience in dealing with endocarditis. The book in essence brings together the most current and evidence-based approaches as practiced by a group of experts who are intimately involved in the management of this disease.

In a world in which longevity is sought by all and life span has doubled just in the past century, it is expected that bacterial infections will not rob us of this expanding life span. The fact that they can and do in today's world of modern technology and ever-revolving therapies remains a sobering thought. This book is an example of the thoughtful analysis that is required if we are to prevail in our long battle with serious infections such as endocarditis. It is a gem for the student, the teacher, and the practitioner.

Robert Roberts, MD, FRCPC, FACC
University of Ottawa Heart Institute
Ottawa, ON, Canada

Preface (2nd Edition)

Endocarditis is a serious disease with a high rate of morbidity and mortality. The poor outcome of patients with this condition is due in large part to the delay in making the diagnosis which frequently can be elusive. As a result of its wide spectrum of manifestations, endocarditis can mimic many different conditions ranging from stroke to renal failure. In order to minimize the delay in diagnosis, clinicians need to always be mindful of the possibility that endocarditis may be the cause of the symptoms. There have been ongoing efforts in the development of molecular probes and new imaging techniques to improve our ability to identify the disease early and reliably. New treatment strategies have been studied with the aim to prevent complications and to improve survival. This new addition will provide an update on the current prophylaxis guidelines, the new diagnostic approach in the detection of the disease, the proposed schemas to predict prognosis, and the new treatment strategies to improve the outcome of patients afflicted with this serious condition.

The structure of the previous edition is preserved. The book is divided into three sections with the first section covering the historical perspective and basic principles, the second section dealing with the diagnosis and management approaches, and the last section on specific clinical situations that pose management dilemmas. All the chapters have been updated to include new information from the recent studies. In particular, the approach to the use of antibiotic prophylaxis has been extensively revised to discuss the implications of the current guidelines on clinical practice, and the development of new imaging modalities such as positron emission tomography in the early diagnosis of endocarditis is critically reviewed. Echocardiography particularly transesophageal echocardiography is indispensable in the diagnosis and management of this disease. The recent development of three-dimensional echocardiography has provided unique perspectives of cardiac structures and may be useful in the assessment of perivalvular complications. This additional information can be crucial in optimizing outcome during surgical intervention. The role of three-dimensional echocardiography is illustrated with representative images and has been included in the chapter on echocardiography. The treatment of endocarditis has been updated by the inclusion of the current guidelines together with an appraisal of the recently published randomized trial on the effect of early surgery on embolic events.

This update is timely and should be of interest to all clinicians involved in the care of patients with this serious disease. We believe that this new edition will be a

good resource for internists, infectious disease specialists, cardiologists, and cardiac surgeons alike.

We thank all the contributors for the thoughtful and comprehensive treatment of their topics. Our deepest appreciation goes to our families for their patience and support during the preparation of the book.

Contents

| | | |
|-----------|--|------------|
| 1 | Perspectives on the History of Endocarditis | 1 |
| | Allan Ronald | |
| 2 | Pathologic Findings: Valvular Destruction, Perivalvular Abnormalities and Extracardiac Findings | 9 |
| | John P. Veinot | |
| 3 | Changing Populations: The Elderly, Injection Drug Users, Health-Care Associated Endocarditis and Immunocompromised Patients | 31 |
| | Yoav Keynan and Ethan Rubinstein | |
| 4 | Microbiology of Infective Endocarditis and Microbiologic Diagnosis | 49 |
| | Stuart Skinner, Beverly Wudel, and Stephen E. Sanche | |
| 5 | Prophylaxis of Endocarditis | 67 |
| | Donald C. Vinh and John M. Embil | |
| 6 | Diagnostic Approach to Endocarditis | 91 |
| | James W. Tam, Nasir Shaikh, Bohdan Bybel, and Davinder S. Jassal | |
| 7 | Role of Transthoracic and Transesophageal Echocardiography in the Management of Endocarditis | 117 |
| | Christopher Johnson and Kwan-Leung Chan | |
| 8 | Surgical Management: Indications, Timing and Surgical Techniques | 153 |
| | Elsayed Elmistekawy, Vincent Chan, and Thierry Mesana | |
| 9 | Treatment of Endocarditis | 181 |
| | Donald C. Vinh and John M. Embil | |
| 10 | Blood Culture Negative Endocarditis | 281 |
| | Yoav Keynan, Stephanie Smith, and Thomas J. Marrie | |

| | | |
|-----------|---|------------|
| 11 | Prosthetic Valve Endocarditis and Cardiovascular Device Related Infections | 311 |
| | Tamara Leah Remington and Karen Doucette | |
| 12 | Pediatric Infective Endocarditis and Congenital Heart Disease | 333 |
| | Sarah Forgie | |
| 13 | Systemic Embolism in Endocarditis: Incidence, Risk Factors, Clinical Significance and Treatment Strategies | 357 |
| | Omid Salehian and Kwan-Leung Chan | |
| 14 | Neurological Complications of Endocarditis: Pathophysiologic Mechanisms and Management Issues | 375 |
| | Christopher R. Skinner | |
| | Index | 397 |

Contributors

Bohdan Bybel, MD, BSc. Med Departments of Nuclear Medicine, Radiology, Health Sciences Centre, Winnipeg, MB, Canada

Kwan-Leung Chan, MD, FRCPC, FAHA, FACC Division of Cardiology, Department of Medicine, University of Ottawa Heart Institute, Ottawa, ON, Canada

Vincent Chan, MD, MPH, FRCSC Cardiac surgery, Ottawa Heart Institute, Ottawa, ON, Canada

Karen Doucette, MD, MSc Division of Infectious Diseases, Department of Medicine, University of Alberta, Edmonton, AB, Canada

Elsayed Elmistekawy, MD Cardiac Surgery, Ottawa Heart Institute, Ottawa, ON, Canada

John M. Embil, MD, FRCPC Section of Infectious Diseases, Department of Medicine, University of Manitoba, Winnipeg, MB, Canada

Infection Prevention and Control Unit, Health Sciences Centre, Winnipeg, MB, Canada

Sarah Forgie, MD, MEd, FRCPC Pediatrics, Faculty of Medicine and Dentistry, University of Alberta, Stollery Children's Hospital, Edmonton, AB, Canada

Davinder S. Jassal, MD, FACC, FRCP(C) Section of Cardiology, Department of Internal Medicine, College of Medicine, Faculty of Health Sciences, University of Manitoba, St. Boniface Hospital, Winnipeg, MB, Canada

Yoav Keynan, MD, PhD Internal Medicine, Medical Microbiology and Community Health Sciences, Faculty of Health Sciences, University of Manitoba, Winnipeg, MB, Canada

Thomas J. Marrie, MD Department of Medicine, Dalhousie University, Chester Basin, NS, Canada

Thierry Mesana, MD, PhD, FRCSC Cardiac Surgery, Ottawa Heart Institute, Ottawa, ON, Canada

Tamara Leah Remington, MD, MSc, FRCPC Division of Infectious Diseases, Department of Medicine, University of Alberta, Grey Nun's Community Hospital, Edmonton, AB, Canada

Allan Ronald, OG, OM, MD, FRCPC, FRSC, FAHS Department of Internal Medicine, St. Boniface General Hospital/University of Manitoba, Winnipeg, MB, Canada

Ethan Rubinstein Section of Infectious Diseases, Faculty of Health Sciences, University of Manitoba, Winnipeg, MB, Canada

Omid Salehian, MD, MSc, FRCPC, FACC, FAHA Division of Cardiology, Internal Medicine, Hamilton General Hospital, Hamilton, ON, Canada

Stephen E. Sanche, MD, FRCPC Division of Infectious Diseases, Department of Medicine, University of Saskatchewan, Saskatoon, SK, Canada

Nasir Shaikh, MBBS Section of Cardiology, Department of Internal Medicine, St. Boniface General Hospital, Winnipeg, MB, Canada

Christopher R. Skinner, MD, FRCPC, DABSM, B. Eng Division of Neurology, Department of Medicine, Ottawa Hospital, Ottawa, ON, Canada

Stuart Skinner, MD, FRCPC Division of Infectious Diseases, Department of Medicine, Regina General Hospital, Regina, SK, Canada

Stephanie Smith, MD, MSc, FRCPC Division of Infectious Diseases, University of Alberta, Edmonton, AB, Canada

James W. Tam, MD, FRCP(C), FACC Section of Cardiology, Department of Internal Medicine, St. Boniface Hospital, Winnipeg, MB, Canada

John P. Veinot, MD, FRCPC Pathology and Laboratory Medicine, The Ottawa Hospital, Ottawa, ON, Canada

Donald C. Vinh, MD Department of Infectious Diseases, McGill University Health Centre – Research Institute, Montreal, QC, Canada

Beverly Wudel, MD Division of Adult Infectious Diseases, Department of Medicine, University of Manitoba, Winnipeg, MB, Canada

Perspectives on the History of Endocarditis

1

Allan Ronald

Abstract

Bacterial endocarditis was an invariably lethal usually subacute illness until the advent of penicillin. Six decades later it continues to often present enigmatically. However management has improved enormously with more exact etiological and anatomical diagnosis by means of blood culture and cardiac ultrasound, antimicrobial regimens are almost always effective and surgical interventions can usually ensure adequate cardiac function. Now over 90 % of patients are well 1 year after an episode of endocarditis. This is a good news story and a host of clinicians and scientists have made seminal contributions.

Keywords

History of progress with endocarditis • Residual controversies • Major contributors

Key Points

1. Major advances in the diagnosis and treatment of endocarditis over the past 70 years have transformed our ability to care for and cure this illness.
2. Access to surgical expertise has dramatically improved the prognosis of patients with endocarditis.
3. Endocarditis remains an elusive diagnosis because of its many disguises.
4. Early diagnosis and prompt correctly chosen antimicrobial therapy are the most effective way to minimize mortality and morbidity.

A. Ronald, OC, OM, MD, FRCPC, MACP, FRSC, FCAHS
Department of Internal Medicine, St. Boniface General Hospital/University of Manitoba,
C5124-409 Tache Ave, Winnipeg, MB R2H 2A6, Canada
e-mail: aronald@ms.umanitoba.ca

© Springer International Publishing 2016

K.-L. Chan, J.M. Embil (eds.), *Endocarditis: Diagnosis and Management*,
DOI 10.1007/978-3-319-27784-4_1

Case Study

Alfred Reinhart was born in 1907 and contracted rheumatic fever at age 10. Rheumatic fever left him with severe aortic insufficiency and for about 10 years he had a diastolic blood pressure of zero. He graduated from Harvard Medical School at age 21. He became ill with *Streptococcus viridans* in 1931. He faced this “incurable” disease with dignity and went on to provide a vivid chronicle of his clinical illness.

The following is his description of extrasystoles [1]:

The extrasystole has always affected me as if it were a cannon ball, shot point blank at my brain. The sensation is that of a terrific explosion, occurring within the narrow and limited confines of a calcified skull, which refuses to yield to the compressive force. It is like an irresistible force against an immovable object. Most of the time I am helpless before it and simply wait patiently in terror until the ordeal has passed.

Reinhart was convinced he had endocarditis when he noticed petechiae on his wrist [1]:

At approximately one-quarter to twelve that night, I remember distinctly getting up from my chair and from the table, where my books lay, and taking off my suit coat. No sooner had I removed the left arm of my coat, than there was on the ventral aspect of my left wrist a sight which I never shall forget until I die. There greeted my eyes about fifteen or twenty bright red, slightly raised, hemorrhagic spots about 1 millimeter in diameter which did not fade on pressure and which stood defiant, as if they were challenging the very gods of Olympus. I had never seen such a sight before, I have never seen such a sight since, and I hope I shall never see such a sight again. I took one glance at the pretty little collection of spots and turned to my sister-in-law, who was standing nearby, and calmly said, “I shall be dead within six months”.

He died of endocarditis following complications with splenic infarcts, retroperitoneal hemorrhage, embolic stroke, subarachnoid hemorrhage, and pulmonary edema.

This case illustrates some of the protean manifestations of endocarditis, vividly described by an observer with medical knowledge. Despite major advances in the diagnosis and treatment of endocarditis, it remains an elusive diagnosis, and the complications which afflicted Reinhart are still observed today.

Historical Perspective

Historical perspectives are fraught with interpretation and bias. For this author, particular points of interest include recollections and reminiscence from 58 years of medical learning and practice, as an observer to both the science and the management of endocarditis and the personal triumphs and failures in the care of patients with endocarditis. My goal is to provide a historical perspective on what many regard as the most intriguing of infections.

Several authors attribute the initial description to clinicians and pathologists in the seventeenth and eighteenth centuries who described the clinical course and