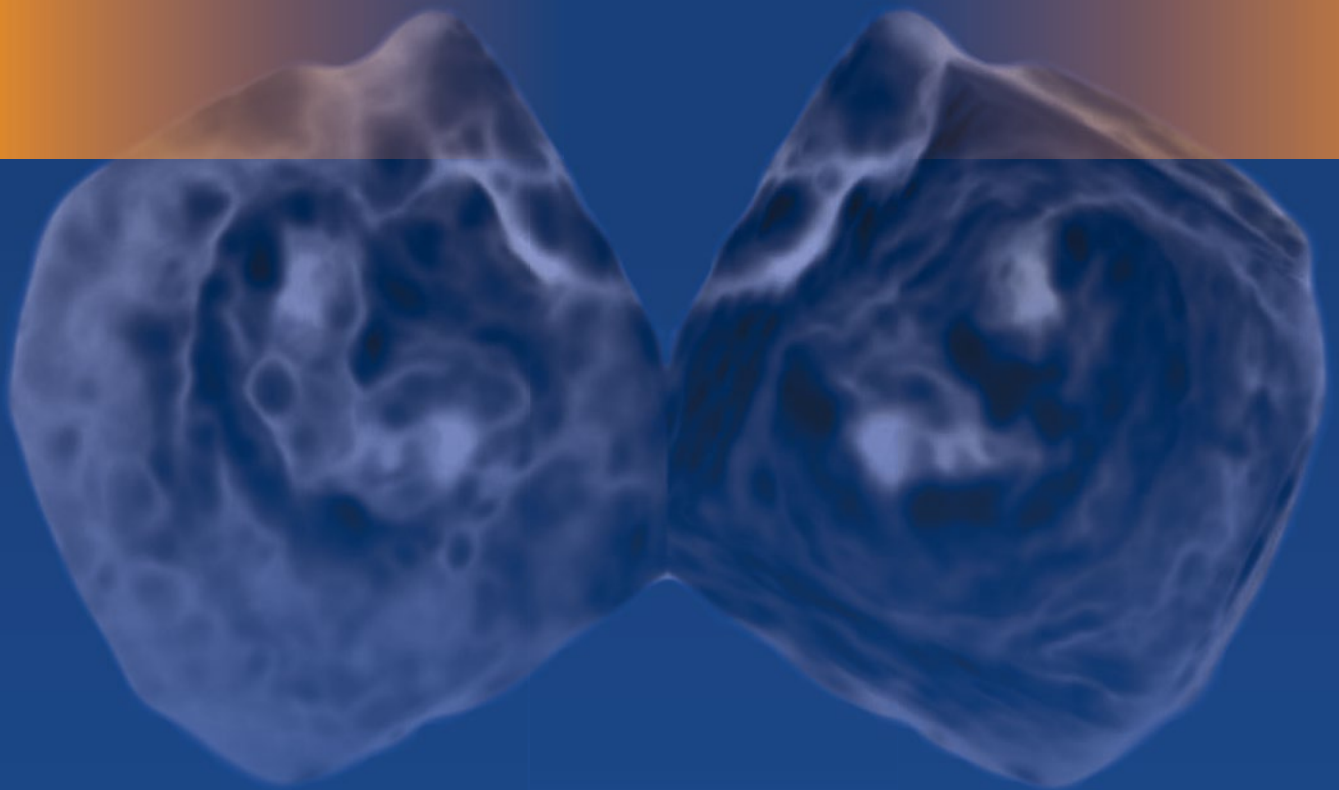


Milind Desai
Christine Jellis
Teerapat Yingchoncharoen
Editors

An Atlas of Mitral Valve Imaging



An Atlas of Mitral Valve Imaging

Milind Desai • Christine Jellis
Teerapat Yingchoncharoen
Editors

An Atlas of Mitral Valve Imaging

 Springer

Editors

Milind Desai
Department of Cardiovascular Medicine
Cleveland Clinic
Cleveland, OH
USA

Teerapat Yingchoncharoen
Cleveland Clinic
Cleveland, OH
USA

Christine Jellis
Cleveland Clinic
Cleveland, OH
USA

Additional material to this book can be downloaded from <http://extras.springer.com>

ISBN 978-1-4471-6671-9 ISBN 978-1-4471-6672-6 (eBook)
DOI 10.1007/978-1-4471-6672-6

Library of Congress Control Number: 2015940567

Springer London Heidelberg New York Dordrecht
© Springer-Verlag London 2015

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-Verlag London Ltd. is part of Springer Science+Business Media (www.springer.com)

I would like to acknowledge my wife, Rajul, and my kids, Ria and Rohan, for their tremendous support in life.

MD

To my husband and son, Dan and Hamish Waters, for their unwavering love and support. Their ongoing encouragement, understanding, and sacrifice allow me to pursue my academic dreams.

CJ

To the memory of my respected father, Adisak Yingchoncharoen; my beloved mother, Sumalee Phiphitwattanaphan, for her unconditional love, encouragement, and unfailing optimism; to Professor Suradej Hongeng who always believes in me and has been more than an inspiration and tireless supporter through these many years; to all my teachers and lastly all my patients who have taught me a lot about cardiology and echocardiography.

TY

Preface

Imaging and assessment of the mitral valve provides ongoing challenges due to its complicated structure and physiology. For decades, echocardiologists have been seeking new methods to evaluate the mitral valve and quantitate valve dysfunction. From the era of M-mode through development of two-dimensional Doppler and now three-dimensional techniques, echocardiography has remained the imaging modality of choice. The fact that there are still so many measures employed to assess the mitral valve illustrates that it remains a complicated process, which is not well performed with any single parameter.

The purpose of this Atlas is to provide readers with a case-based overview of mitral valve structure and echocardiographic evaluation. The clinical scenarios illustrate how the various echocardiographic parameters provide incremental value in the accurate assessment of mitral valve dysfunction. Detailed, noninvasive assessment of the mitral valve remains integral for planning and performance of mitral valve surgery. Increasingly, echocardiographic assessment and real-time guidance are also required to facilitate percutaneous treatment options. We highlight important imaging aspects of these cases, along with salient teaching points and further recommended reading.

We have aimed to make this contemporary style of Atlas interactive and useful for individual learning as well as group teaching purposes, with the inclusion of numerous video files. Real-world examples of both common and rarer conditions are included to illustrate the breadth of mitral valve pathology and the challenges faced in acquiring optimal images. We hope that readers will enjoy exploring the mitral valve with us in this format.

Cleveland, OH, USA

Milind Desai
Christine Jellis
Teerapat Yingchoncharoen

Acknowledgments

We would like to acknowledge the sonographers, cardiologists, and imaging fellows who comprise the team behind the Cleveland Clinic Cardiovascular Imaging Center. Their tireless efforts, experience, enthusiasm, and expertise on a daily basis are proudly represented by the images comprised within this Atlas. We also acknowledge the advice and assistance provided by Lee Klein and the editorial team at Springer Publishers.

Contents

1 Mitral Valve Nomenclature	1
Christine Jellis	
2 Assessment of Mitral Valve Function	17
Christine Jellis and Teerapat Yingchoncharoen	
3 Calcific Degenerative Mitral Disease	31
Teerapat Yingchoncharoen	
4 Degenerative Mitral Valve Disease: Prolapse and Flail	43
Christine Jellis	
5 Rheumatic Mitral Valve Disease	69
Teerapat Yingchoncharoen	
6 Mitral Valve Devices	89
Christine Jellis	
7 Infective Endocarditis	147
Teerapat Yingchoncharoen	
8 Hypertrophic Cardiomyopathy and Mitral Valve Disease	171
Milind Desai	
9 Congenital Mitral Valve Diseases	179
Teerapat Yingchoncharoen	
10 Mitral Regurgitation Complicating Myocardial Infarction	193
Teerapat Yingchoncharoen	
11 Mitral Valve Prostheses	205
Christine Jellis	
12 Applications of Stress Echocardiography in Mitral Valve Disease	255
Christine Jellis	
13 Cardiac Masses and Miscellaneous	269
Teerapat Yingchoncharoen	
Index	281

List of Videos

- Video 3.1** Transthoracic echocardiography (TTE), parasternal long-axis view showing a mass with round, smooth borders and a heterogeneous echo density located at the posterior mitral annulus
- Video 3.2** TTE, apical four-chamber view showing a posterior mitral annulus mass
- Video 3.3** TTE, apical two-chamber view showing a posterior mitral annulus mass
- Video 3.4** Three-dimensional (3D) TTE, parasternal long-axis view again showing a mass with round, smooth borders and a heterogenous echo density located at the posterior mitral annulus
- Video 3.5** TTE, apical four- chamber view showed bright echodensities along the mitral annular plane involving both anterior and posterior aspects of the annulus, as well as calcified subvalvular apparatus
- Video 3.6** TTE, apical four- chamber view with Doppler color flow imaging shows mild mitral regurgitation and turbulent flow across the mitral valve during diastole, consistent with mitral stenosis
- Video 3.7** 3D reconstruction of the mitral valve in short axis, demonstrating heavy leaflet and annular calcification, which restricts leaflet opening
- Video 3.8** Parasternal long-axis view with simultaneous color Doppler imaging. Both mitral leaflets and mitral-aortic intervalvular fibrosa are thickened and calcified with moderate (2+) central mitral regurgitation and aortic regurgitation
- Video 3.9** Biplane imaging of the mitral valve in parasternal and short-axis views (*right*), shows severe bileaflet thickening, with reduced leaflet excursion
- Video 4.1** Transesophageal 3D reconstruction of the mitral valve demonstrating prolapse of the middle and lateral posterior leaflet scallops (P1 & P2)
- Video 4.2** Transesophageal echo biplane (0° and 90°) view of the mitral valve demonstrating prolapse of P2 & P2
- Video 4.3** The same views with color Doppler, demonstrating eccentric, anteriorly directed mitral regurgitation, which was classified as 3–4+
- Video 4.4** Transesophageal 120° view confirms flail involving the middle posterior leaflet scallop (P2)
- Video 4.5** Transesophageal 120° view, zooming up on the flail middle posterior leaflet scallop (P2)
- Video 4.6** Color Doppler (transesophageal 120° view) demonstrating severe, anteriorly directed MR. Note wide vena contracta; proximal isovelocity surface area (PISA) measurements likely underestimate severity of MR owing to jet eccentricity
- Video 4.7** Three-dimensional (3D) reconstruction of the mitral valve demonstrating the flail middle posterior leaflet scallop (P2)
- Video 4.8** Parasternal long-axis view in two-dimensional (2D) and color Doppler imaging demonstrating posterior leaflet prolapse with eccentric, anteriorly directed mitral regurgitation
- Video 4.9** Apical long-axis view demonstrating that the anterior mitral valve regurgitation is severe

- Video 4.10** Parasternal long-axis imaging of the mitral valve demonstrates bileaflet mitral valve prolapse
- Video 4.11** Comparison with color Doppler imaging reveals severe central and anteriorly directed mitral regurgitation
- Video 4.12** Zooming in on imaging of the mitral valve in a parasternal long-axis view demonstrates anterior mitral valve leaflet prolapse with a flail posterior leaflet
- Video 4.13** Apical four-chamber 2D and color Doppler imaging demonstrates the posterior leaflet flail with severe, highly eccentric, anteriorly directed mitral regurgitation
- Video 4.14** Transthoracic parasternal long-axis view demonstrating thickened and elongated mitral valve leaflets consistent with myxoid degeneration. There is bileaflet prolapse, with the bodies of the distended leaflet segments billowing beyond the plane of the annulus (posterior greater than anterior). The mitral annulus appears dilated. No calcification is noted
- Video 4.15** Apical two-chamber transthoracic view demonstrating prominent prolapse of the medial posterior leaflet (P3) with resultant anteriorly directed mitral regurgitation
- Video 4.16** Transesophageal 0° view of the mitral valve, demonstrating severe bileaflet prolapse (A2 and P2). The billowing medial scallop of the posterior leaflet (P3) is intermittently visible
- Video 4.17** Transesophageal 0° view of the mitral valve, demonstrating significant turbulence of transvalvular flow associated with the posterior leaflet. The jet of mitral regurgitation is not well appreciated because of its eccentric, anteriorly directed trajectory
- Video 4.18** Transesophageal 30° view of the mitral valve rotated medially to demonstrate prolapse and flail of the P3 scallop with severe, anteriorly directed mitral regurgitation on color Doppler imaging
- Video 4.19** Preoperative simultaneous 2D and color Doppler imaging of the mitral valve viewed at 0° by transesophageal echocardiography. Flail of the middle scallop of the anterior leaflet (A2) is seen, with a resultant highly eccentric jet of severe, posteriorly directed mitral regurgitation
- Video 4.20** Postoperative simultaneous 2D and color Doppler imaging of the mitral valve viewed at 0° by transesophageal echocardiography. The mitral valvuloplasty is noted, with shortening and repair of the anterior leaflet. The mitral valve opens well and has no residual regurgitation
- Video 4.21** Transesophageal 62° view demonstrating flail of the posterior mitral valve leaflet (P2/P3 region)
- Video 4.22** Transesophageal 62° view demonstrating significant associated mitral regurgitation due to leaflet coaptation, although the severity and direction of the jet are not well appreciated on this view
- Video 4.23** Transesophageal 87° view demonstrating that the flail segment primarily involves the region between the P2 and P3 scallops
- Video 4.24** Transesophageal 129° view demonstrates a significant jet of medially directed mitral regurgitation with a PISA radius of 0.94 cm, which gives an estimated regurgitant orifice area of 0.44 cm²
- Video 4.25** This 3D zoom view of the mitral valve from the left atrium demonstrates the flail posterior leaflet in the region between the P2 and P3 scallops
- Video 5.1** Transesophageal echocardiography (TEE) showed thickened mitral valve with restricted opening
- Video 5.2** Color flow imaging showed diastolic flow acceleration across the mitral valve during diastole
- Video 5.3** Three-dimensional imaging of the ventricular side of the mitral valve showed limited opening of the valve