

*Get Full Access and More at*

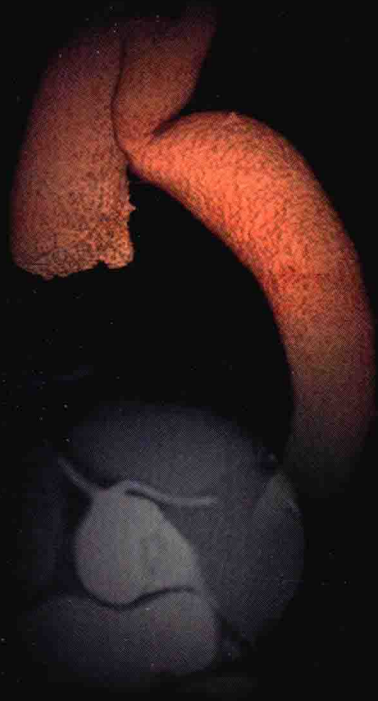
**ExpertConsult.com**

**WITH CROSS-REFERENCES TO**  
CARDIAC IMAGING: THE REQUISITES, 3RD EDITION

**2ND**  
EDITION

# Cardiac Imaging

CASE REVIEW SERIES



**GAUTHAM P. REDDY**  
**ROBERT M. STEINER**  
**CHRISTOPHER M. WALKER**

**ELSEVIER**  
SAUNDERS

# **CASE REVIEW**

## **Cardiac Imaging**

Second Edition

Copyright © 2014, 2006 by Saunders, an imprint of Elsevier Inc.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: [www.elsevier.com/permissions](http://www.elsevier.com/permissions).

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

**Notice**

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

With respect to any drug or pharmaceutical products identified, readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of practitioners, relying on their own experience and knowledge of their patients, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

**Library of Congress Cataloging-in-Publication Data**

Reddy, Gautham P., author.

Cardiac imaging : case review / Gautham P. Reddy, Robert M. Steiner, Christopher M. Walker.

– Second edition.

p. ; cm. – (Case review series)

Includes bibliographical references and index.

ISBN 978-0-323-06519-1 (pbk. : alk. paper)

I. Steiner, Robert M., author. II. Walker, Christopher M., author. III. Title. IV. Series: Case review series.

[DNLM: 1. Cardiac Imaging Techniques—methods—Problems and Exercises. 2. Cardiovascular Diseases—radiography—Problems and Exercises. WG 18.2]

RC683.5.R3

616.1'207540076—dc23

2013033292

*Senior Content Strategist:* Don Scholz

*Content Development Specialist:* Katy Meert

*Publishing Services Manager:* Deborah L. Vogel

*Project Manager:* Bridget Healy

*Design Direction:* Steven Stave

Printed in the United States of America.

Last digit is the print number: 9 8 7 6 5 4 3 2 1



Working together  
to grow libraries in  
developing countries

[www.elsevier.com](http://www.elsevier.com) • [www.bookaid.org](http://www.bookaid.org)

**Series Editor**

David M. Yousem, MD, MBA  
Professor of Radiology  
Director of Neuroradiology  
Russell H. Morgan Department of Radiology and Radiological Science  
The Johns Hopkins Medical Institutions  
Baltimore, Maryland

**Other Volumes in the CASE REVIEW Series**

Brain Imaging, Second Edition  
Breast Imaging, Second Edition  
Duke Review of MRI Principles  
Emergency Radiology  
General and Vascular Ultrasound, Second Edition  
Gastrointestinal Imaging, Third Edition  
Genitourinary Imaging, Second Edition  
Musculoskeletal Imaging, Second Edition  
Nuclear Medicine, Second Edition  
Obstetric and Gynecologic Imaging, Third Edition  
Pediatric Imaging, Second Edition  
Spine Imaging, Third Edition  
Thoracic Imaging, Second Edition  
Vascular and Interventional Imaging

**SAUNDERS****ELSEVIER**



**Gautham P. Reddy, MD, MPH**

Professor of Radiology  
Vice Chair for Education  
Director of Thoracic Imaging  
University of Washington  
Seattle, Washington

**Robert M. Steiner, MD**

Professor of Radiology  
Director, Thoracic Radiology  
Temple University Hospital  
Clinical Professor of Radiology  
The University of Pennsylvania School of Medicine  
Philadelphia, Pennsylvania

**Christopher M. Walker, MD**

Assistant Professor  
Department of Radiology  
University of Missouri-Kansas City School of Medicine  
Cardiothoracic Radiologist  
Saint Luke's Hospital of Kansas City  
Kansas City, Missouri

# CASE REVIEW

## Cardiac Imaging

SECOND EDITION

### CASE REVIEW SERIES

此为试读, 需要完整PDF请访问: [www.ertongbook.com](http://www.ertongbook.com)

To Gayatri, Maurya, and Kaniska

GPR

To Marilyn, Emily, Peter, and Sophia

RMS

To Eunhee, a fantastic mother and my best friend.  
To Elsie and Lillian, the best daughters a father could ask for.

CMW

I have been very gratified by the popularity and positive feedback that the authors of the Case Review Series have received on the publication of the editions of their volumes. Reviews in journals and online sites as well as word-of-mouth comments have been uniformly favorable. The authors have done an outstanding job in filling the niche of an affordable, easy-to-access, case-based learning tool that supplements the material in The Requisites series. I have been told by residents, fellows, and practicing radiologists that the Case Review Series books are the ideal means for studying for oral board examinations and subspecialty certification tests.

Although some students learn best in a non-interactive study book mode, others need the anxiety or excitement of being quizzed. The selected format for the Case Review series (which consists of showing a few images needed to construct a differential diagnosis and then asking a few clinical and imaging questions) was designed to simulate the board examination experience. The only difference is that the Case Review books provide the correct answer and immediate feedback. The limit and range of the reader's knowledge are tested through scaled cases ranging from relatively easy to very hard. The Case Review Series also offers a brief discussion of each case, a link back to the pertinent The Requisites volume, and up-to-date references from the literature.

Because of the popularity of online learning, we have been rolling out new editions on the web. We also have adjusted to the new Boards format which will be electronic and largely case-based. We are ready for the new boards! The Case Review questions have been reframed into multiple-choice format, the links are dynamic to online references, and feedback is interactive with correct and incorrect answers. Personally, I am very excited about the future. Join us.

*David M. Yousem, MD, MBA*

*Cardiac Imaging, 2<sup>nd</sup> edition* by Drs. Reddy, Steiner, and Walker explores advanced cardiac imaging including coronary and pulmonary artery CT angiography, cardiac MRI, and nuclear medicine applications. These studies are increasingly being performed emergently in the Emergency Department as part of the chest pain work up. Radiologists have been able, thru excellent training and technique advancement, to maintain a strong influence in this arena and share the spotlight with cardiologists. It is essential that we radiologists learn the anatomy and pathology as well as our clinical colleagues.

The authors have compiled a wonderful array of cases that demonstrate the power of various modalities in our imaging armamentarium. There is an emphasis on differential diagnosis, multiple choice questions, and a summary of relevant information on the entity. I expect that this edition will be the “study of choice” for residents preparing for the new boards format.

I congratulate Drs. Reddy, Steiner, and Walker for maintaining the outstanding quality of the Case Review Series and modernizing it for the online learning environment.

*David M. Yousem, MD, MBA*  
Case Review Series Editor



Since the first edition of *Cardiac Imaging* was published in 2006, the interest in cardiovascular imaging by practicing radiologists, residents-in-training, and cardiologists has greatly increased. Indications for advanced cardiac imaging utilizing MRI, CT, PET, and Echocardiography have broadened considerably, and imaging techniques have significantly improved. With the changes in the board examinations in radiology; expanding interest in certification in cardiovascular imaging by practicing physicians; and the increasing demands for expertise in cardiac imaging among radiology groups, expansion of the case selection in this second edition is particularly relevant.

In this revision, we included most of the topics and related images from the first edition and added a number of new examples of both common conditions and the more unusual disease entities that will be found in a busy clinical practice (and in the imaging board and other qualifying examinations).

The case selection now includes a greater number of multimodality examples of congenital cardiovascular disease, ischemic and non-ischemic cardiomyopathies, and vascular conditions including coronary, aortic, and pulmonary vascular disease. Advanced imaging techniques such as velocity-encoded cine MRI, and delayed enhancement strategies with CT and MRI are included.

As in the first edition, the case book is divided into three sections: Opening Round, Fair Game, and Challenge cases. Opening Round cases are straightforward and shouldn't be too difficult for most trainees and experienced imagers. Fair Game cases will generally require a greater knowledge base. Challenge cases will be more complex, of rarer incidence, and may require advanced imaging techniques.

We are confident that you will find this second edition of *Cardiac Imaging* to be a valuable addition to your library and add to your knowledge of cardiovascular imaging.

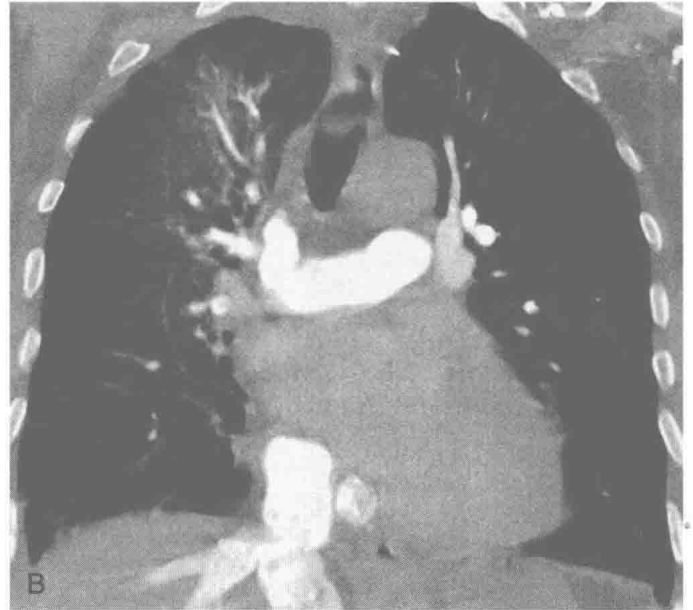
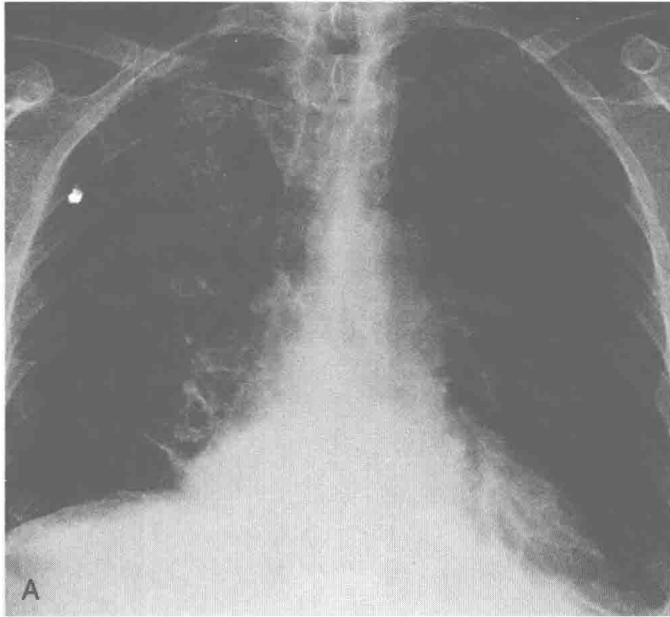
Gautham P. Reddy  
Robert M. Steiner  
Christopher M. Walker

<b>Opening Round</b>	<b>1</b>
<b>Fair Game</b>	<b>101</b>
<b>Challenge</b>	<b>239</b>
<b>Index of Cases</b>	<b>321</b>
<b>Index of Terms</b>	<b>323</b>

---

# Opening Round





History: No patient history is available.

1. What should be included in the differential diagnosis for ground-glass opacity? (Choose all that apply.)
  - A. Pulmonary edema
  - B. Pneumonia
  - C. Pulmonary hemorrhage
  - D. Adenocarcinoma in situ (bronchioloalveolar cell carcinoma)
2. If this patient presented with fever and a productive cough, what is the most likely diagnosis?
  - A. Right upper lobe pulmonary edema
  - B. Atypical pneumonia
  - C. Pulmonary hemorrhage
  - D. Adenocarcinoma in situ (bronchioloalveolar cell carcinoma)
3. If this patient presented with severe chest pain and no infectious symptoms, what would be the most likely diagnosis?
  - A. Right upper lobe pulmonary edema
  - B. Atypical pneumonia
  - C. Pulmonary hemorrhage
  - D. Adenocarcinoma in situ (bronchioloalveolar cell carcinoma)
4. If acute mitral regurgitation is the suspected diagnosis based on the chest radiograph and clinical presentation, what is the next best step in management?
  - A. CT
  - B. Echocardiography
  - C. Follow-up radiograph
  - D. MRI

## CASE 1

**Severe and Acute Mitral Regurgitation**

1. A, B, C, and D

2. B

3. A

4. B

**Reference**

Schnyder PA, Sarraj AM, Duvoisin BE, et al: Pulmonary edema associated with mitral regurgitation: prevalence of predominant involvement of the right upper lobe, *AJR Am J Roentgenol* 161(1):33-36, 1993.

**Cross-Reference**

*Cardiac Imaging: The REQUISITES*, ed 3, pp 191-194.

**Comment***Pathophysiology*

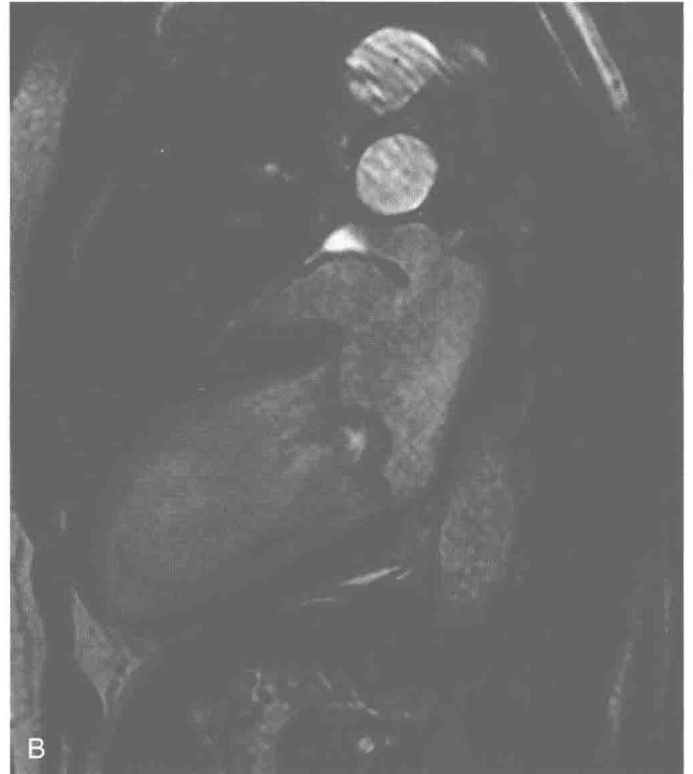
Asymmetric right upper lobe pulmonary edema is seen in 9% of adults and 22% of children with severe mitral regurgitation. In adults, it is usually caused by a flail posterior valve leaflet secondary to myocardial infarction. A flail posterior leaflet causes the mitral regurgitant jet to be preferentially directed into the right superior pulmonary vein; this leads to focal increased hydrostatic pressure and pulmonary edema within the right upper lobe. In the setting of chest pain, acute mitral regurgitation must be considered and can be confirmed with echocardiography.

*Imaging*

The radiograph (Fig. A) and CT scan (Fig. B) show asymmetric right upper lobe ground-glass opacity. The differential diagnosis varies depending on the patient's clinical presentation. In the setting of fever and productive cough, the imaging findings are consistent with atypical pneumonia. In this case, the patient had severe chest pain and acute myocardial infarction. Echocardiography confirmed severe mitral regurgitation.

**Notes**





History: A patient presents with cardiac arrhythmia and undergoes evaluation for arrhythmogenic right ventricular dysplasia.

1. What should be included in the differential diagnosis for mitral regurgitation? (Choose all that apply.)
  - A. Mitral valve prolapse
  - B. Myocardial ischemia
  - C. Dilated cardiomyopathy
  - D. Endocarditis
2. What is the most likely diagnosis?
  - A. Mitral valve prolapse
  - B. Myocardial ischemia
  - C. Dilated cardiomyopathy
  - D. Endocarditis
3. Which imaging plane is ideal for diagnosing this condition?
  - A. Four-chamber
  - B. Short-axis
  - C. Left ventricular outflow tract (3-chamber)
  - D. Right ventricular outflow tract
4. Which of the following is a potential complication of this condition?
  - A. Aortic dissection
  - B. Mitral stenosis
  - C. Arrhythmia
  - D. Patent foramen ovale

## Mitral Valve Prolapse with Mitral Regurgitation

1. A, B, C, and D

2. A

3. C

4. C

### References

Feuchtnner GM, Alkadhi H, Karlo C, et al: Cardiac CT angiography for the diagnosis of mitral valve prolapse: comparison with echocardiography, *Radiology* 254(2):374-383, 2010.

Han Y, Peters DC, Salton CJ, et al: Cardiovascular magnetic resonance characterization of mitral valve prolapse, *JACC Cardiovasc Imaging* 1(3):294-303, 2008.

### Cross-Reference

*Cardiac Imaging: The REQUISITES*, ed 3, pp 192-193.

### Comment

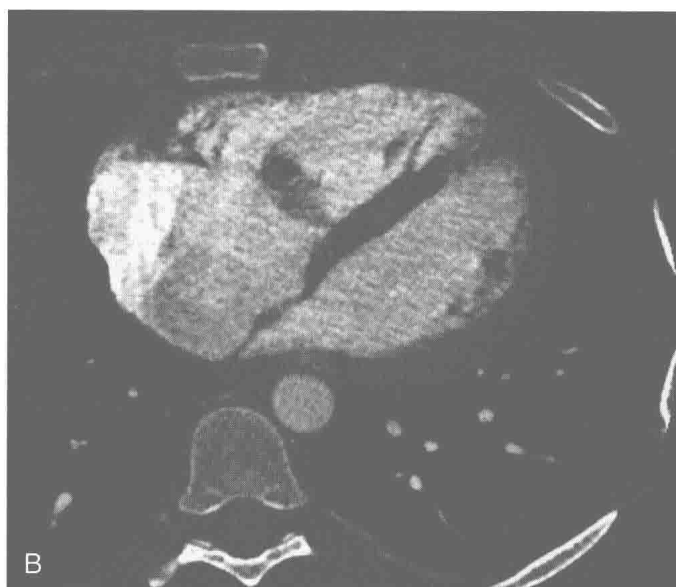
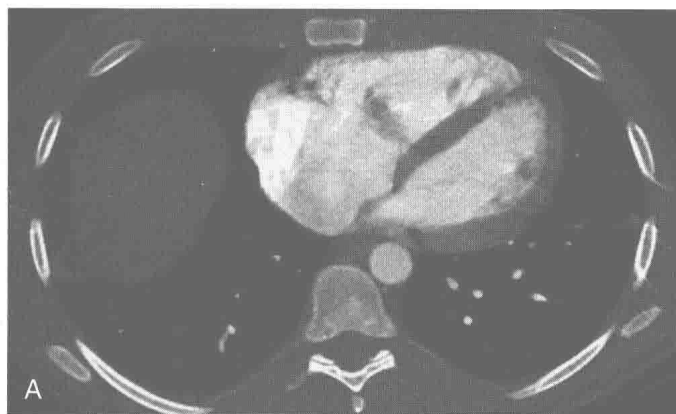
#### Epidemiology

Mitral valve prolapse affects 2% to 3% of the population and is the most common cause of severe nonischemic mitral regurgitation requiring surgery (Fig. A). It is defined by greater than 2 mm of atrial displacement of the valve leaflets (measured on left ventricular outflow tract or vertical long-axis [2-chamber] images) with respect to the mitral annulus (Fig. B). There are two types of mitral valve prolapse: billowing (as shown in this case) and flail leaflet (caused by chordal rupture secondary to endocarditis or rheumatic heart disease). Mitral valve prolapse is most commonly due to myxomatous degeneration of mitral leaflets but can also be seen in patients with atrial secundum septal defects, connective tissue disorders, and recent diuretic use.

#### Imaging

Mitral valve prolapse may be incorrectly diagnosed if only four-chamber images are viewed secondary to the natural saddle shape of the mitral annulus. Myxomatous leaflet (defined as a leaflet thickness measuring >5 mm) predisposes patients to fatal arrhythmia, severe mitral regurgitation, and endocarditis. It is important to identify mitral valve prolapse on cardiac CT or MRI examinations performed for other reasons because these patients may benefit from endocarditis prophylaxis or anticoagulation therapy.

### Notes



History: A patient presents with chest pain.

- What should be included in the differential diagnosis of a valvular mass? (Choose all that apply.)
  - Angiosarcoma
  - Thrombus
  - Vegetation
  - Myxoma
  - Papillary fibroelastoma
- What is the most common valvular tumor?
  - Thrombus
  - Papillary fibroelastoma
  - Myxoma
  - Angiosarcoma
- What is the most likely diagnosis?
  - Wegener granulomatosis
  - Angioinvasive aspergillosis
  - Septic pulmonary embolism
  - Papillary fibroelastoma
- In regard to this diagnosis, which valve is most commonly affected in intravenous drug users?
  - Aortic valve
  - Mitral valve
  - Pulmonary valve
  - Tricuspid valve