

# DAVIES



L I F E   I S   A   T E S T . . . P A S S   I T !



**1-2-3 STEP**  
Ultrasound Education & Test  
Preparation

**Step 1** Review text

**Step 2** Mock examination

**Step 3** Q&A memory skills  
flashcard drill

# Adult Echo Review

**2nd Edition**

**Adult Echocardiography**

A Q&A Review for the ARDMS Specialty Exam

Continuing Education Activity

SDMS-Approved

**12**

CME Credits

CAROL MITCHELL | BRIDGETT WILLEY

# **Adult Echocardiography Review**

**A Q&A REVIEW FOR THE ARDMS ADULT ECHOCARDIOGRAPHY EXAM**

# **Adult Echocardiography Review**

**A Q&A REVIEW FOR THE ARDMS ADULT ECHOCARDIOGRAPHY EXAM**

2nd Edition

**2018**

**Carol Mitchell, PhD, RDMS, RDCS, RVT, RT(R), ACS, FASE, FSDMS**  
University of Wisconsin School of Medicine and Public Health  
Madison, Wisconsin

**Bridgett Willey, MS, RDMS, RVT, RDCS, RT(R)**  
UW Health  
Madison, Wisconsin



Copyright © 2018 by Davies Publishing, Inc.



All rights reserved. No part of this work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic or mechanical, including photocopying, scanning, and recording, without prior written permission from the publisher.

Davies Publishing, Inc.  
32 South Raymond Avenue  
Pasadena, California 91105-1961  
Phone 626-792-3046  
Facsimile 626-792-5308  
e-mail [info@daviespublishing.com](mailto:info@daviespublishing.com)  
[www.daviespublishing.com](http://www.daviespublishing.com)

A handwritten signature in dark ink that reads "Mike Davies". The signature is fluid and cursive, with the first name "Mike" and last name "Davies" clearly distinguishable.

Michael P. Davies, Publisher  
Christina J. Moose, Editorial Director  
Charlene Locke, Production Manager  
Janet Heard, Operations Manager  
Satori Design Group, Inc., Design

Printed and bound in the United States of America

ISBN 978-0-941022-81-1

## Library of Congress Cataloging-in-Publication Data

Names: Mitchell, Carol Kaye Chenoweth, 1966- author. | Willey, Bridgett, author.  
Title: Adult echocardiography review : a Q&A review for the ARDMS adult echocardiography exam / Carol Mitchell, Bridgett Willey.  
Description: 2nd edition. | Pasadena, California : Davies Publishing, Inc., [2017] | Preceded by Echocardiography review / Barton A. Bean, editor ; Kathleen A. Oss, associate editor. Pasadena, Calif. : Appleton Davies, c1990. | Includes bibliographical references and index.  
Identifiers: LCCN 2016052313 | ISBN 9780941022811 (alk. paper)  
Subjects: | MESH: Echocardiography | Examination Questions  
Classification: LCC RC683.5.U5 | NLM WG 18.2 | DDC 616.1/207543076--dc23 LC  
record available at <https://lccn.loc.gov/2016052313>

# Reviewers

---

**Tess Behrends, RVT, RDCS(AE)(PE), FASE**  
Congenital Sonographer  
Children's Hospital Colorado  
Aurora, Colorado

**Merri L. Bremer, EdD, RN, RDCS, ACS, FASE**  
Program Director, Advanced Cardiovascular  
Sonography Program  
Mayo Clinic  
Rochester, Minnesota

**Deborah L. Crabbe, MD, FACC, FAHA**  
Associate Professor of Medicine  
Temple Heart and Vascular Institute  
Lewis Katz School of Medicine  
Temple University  
Philadelphia, Pennsylvania

**Victoria Delaney, MA, BS, RDCS, RVT, FASE**  
Echocardiographer, St. Mary Mercy Hospital  
and Monroe Regional Hospital  
Adjunct Professor, Mercy College of Ohio  
Toledo, Ohio

**Joy D. Guthrie, PhD, ACS, RDMS, RDCS, RVT,  
FSDMS, FASE**  
Technical Director, IAC Pediatric and Fetal  
Echo Lab  
Program Director, Advanced Cardiac  
Sonography Program  
Assistant Professor of Medicine, UCSF-Fresno  
Community Regional Medical Center  
Fresno, California

**Jeffrey C. Hill, BS, ACS, FASE**  
Program Director, Catheterization &  
Electrophysiology Technology Programs  
The Hoffman Heart & Vascular Institute of  
Connecticut, School of Cardiovascular  
Technology  
Saint Francis Hospital and Medical Center  
Hartford, Connecticut

**Smadar Kort, MD, FASE**  
Stony Brook Heart Institute  
Stony Brook, New York

**Christopher J. Kramer, BA, RDCS, ACS,  
FASE**  
Program Director, Echocardiography  
Ultrasound  
Aurora Health Care  
Milwaukee, Wisconsin

**Annmarie Lobdell, MHS, RDMS, RDCS, RVT**  
Clinical Technology Consultant  
Mindray | ZONARE  
Mahwah, New Jersey

**Jessica L. Murphy, BS, RRT, RCP, NPS, RDCS,  
RVT, RCS, CCT**  
Program Director, Diagnostic Cardiovascular  
Sonography  
Alvin Community College  
Alvin, Texas

**R. Fernando Roth, MD, FACC, FACP, FASE**  
Medical Director, Echocardiography  
Foothill Cardiology  
California Heart Medical Group, Inc.  
Pasadena, California

**Kerry E. Weinberg, PhD, MA, MPA, RT(R),  
RDMS, RDCS, FSDMS**  
Director and Associate Professor  
Diagnostic Medical Sonography Program  
School of Health Professions  
Long Island University  
Brooklyn, New York

**Kristen Wendling, BS, RDMS, RDCS**  
Program Chair, Cardiovascular Technology–  
Cardiac Sonography Program  
Arkansas Tech University  
Ozark, Arkansas

**Sharon R. Whitcraft, MA Ed, RVT, RVS, RCS**  
Department Chair, Allied Health Programs  
Santa Fe College  
Gainesville, Florida

# Preface to the 2nd Edition

---

THE SECOND EDITION of *Adult Echocardiography Review* has been completely rewritten, expanded, and fully updated to cover all the topics identified on the Adult Echocardiography exam given by the American Registry for Diagnostic Medical Sonography (ARDMS). We have increased the number of questions to 687 registry-like items, and the mock exam now contains over 200 images and illustrations. Mastery of these items and their underlying concepts will thoroughly arm you to pass this ARDMS specialty exam to obtain the Registered Diagnostic Cardiac Sonographer (RDCS) credential—or simply to cross-train for added expertise. Those sitting for the Registered Cardiac Sonographer (RCS) exam administered by Cardiac Credentialing International (CCI) will likewise find that these items will bolster and solidify their preparation. Designed as an adjunct to your regular study, this mock exam will help you precisely determine your strengths and weaknesses so that you can study most effectively.

## Facts about *Adult Echocardiography Review*

- ▶ This mock exam covers the material on the ARDMS exam content outline in effect as of 2018. Readers are advised to check the ARDMS website, [www.ardms.org](http://www.ardms.org), for the latest updates. This mock exam itself is continuously updated and revised as necessary, and readers can check Davies' website for the latest Study Alerts and other product updates at <http://www.daviespublishing.com/Product-Updates-C220.aspx>.
- ▶ The mock exam focuses exclusively on the Adult Echocardiography specialty exam to ensure thorough coverage of even the smallest subtopic and task on the exam. (For those preparing for the Sonography Principles and Instrumentation exam, see Davies' *Ultrasound Physics Review: SPI Edition*, available at [www.daviespublishing.com](http://www.daviespublishing.com).)
- ▶ We use the most current ARDMS content outline as a guideline for coverage. It is, in fact, our table of contents.
- ▶ The second edition of *Adult Echocardiography Review* contains 687 registry-like questions and more than twice the number of images and schematics—over 200—as appeared in the first edition. For those wishing to view the real-time echocardiographic video clips on which several of these images are based, we highly recommend purchase of the interactive mock exam, available on CD-ROM or in a downloadable version from [www.daviespublishing.com](http://www.daviespublishing.com).
- ▶ While otherwise in ARDMS exam format, this Davies mock exam makes deliberate and judicious use of answer-choice formats that occasionally depart from those on the ARDMS exam. We use multiple-choice items with five, not four, possible choices—thereby increasing both the difficulty of each question and the time needed to answer it. We also sprinkle in a few answer-choice variants (such as “A and B” and “not/except” items). The point? To give you not only practice for the registry exam but also an educational tool that will exercise those neural pathways in more than one direction. Registry candidates who stretch beyond the standard format and master these items at an average rate of 1 minute apiece will be exceptionally well prepared for the actual exam.
- ▶ The answer key located in Part 8 contains not only the answers but also concise explanations that are clear and authoritatively referenced for fact checking and further study.
- ▶ Part 9 contains sixteen “tutorials”—extended explanations of key concepts in echocardiography and the conditions it interrogates. These tutorials are referenced throughout Part 8, the answer key.

- ▶ This mock examination has been approved by the Society of Diagnostic Medical Sonography (SDMS) as a CME activity. A CME application form, quiz, and full submission instructions are included in Part 10. Passing this quiz will qualify the applicant for 12 CME credits. (A modest administrative processing fee applies at the time of submission, and more than one person may submit this activity for CME credit.) These credits are accepted by ARDMS, the Alliance for Physician Certification and Advancement (APCA), CCI, and the American Registry of Radiologic Technologists (ARRT) toward meeting their CME requirements. Some credentials carry stipulations regarding specialty areas in which CME credits may be earned. Always check with the organization that governs your credential(s). All the credits in this activity may be applied to maintain the RDCS and RCS credentials.
- ▶ A section of “Suggested Readings”—current authoritative text references and echocardiography resources—appears in Part 11.
- ▶ Finally, Part 12 functions as an index to the ARDMS exam content outline. Although the questions are already organized according to the current version of this outline, some questions pertain to more than one of the clinical tasks on the outline. In Part 12, the ARDMS tasks are cross-referenced to any *and all* questions in this mock exam that pertain to that task, so you can target your study on specific areas of the exam. We also encourage you to consult the ARDMS website at [www.ardms.org](http://www.ardms.org) for the latest information and updates on the Adult Echocardiography specialty examination.

## ARDMS Advanced Item Type (AIT) Questions

All the ARDMS exams now include Advanced Item Type (AIT) questions that assess practical sonography instrumentation skills. For the Adult Echocardiography specialty exam, these AIT questions include what ARDMS calls “Hotspot” questions. Hotspot items display an image and question, requiring you to indicate the correct answer by marking directly on the image using your cursor. This type of question is considered advanced because it requires a higher level of clinical thinking and processing than required when you are answering a conventional multiple-choice question. In Davies’ mock exam, similar questions are identified as *AIT—Hotspot* questions. These items ask you to identify what an arrow in the image is pointing at or to indicate the label on an image that corresponds to the correct answer.

Another type of AIT question, the *AIT—SIC* (Semi-Interactive Console) item, requires the examinee to use a semi-interactive console to correct a problem with the image presented. These items are currently limited to the Sonography Principles and Instrumentation (SPI) examination, but as a bonus feature we have identified items in this mock exam that test what you need to know to answer these questions successfully.

Finally, PACSim items—case-based Picture Archive and Communication Simulation questions—are not included in this Adult Echo mock exam. Currently ARDMS does not use this type of question in its Adult Echo exam, although we would not rule out the possibility that such questions might appear in future versions of the exam. These multifaceted and interactive items are designed to simulate a reading workstation experience, a picture archive and communication system. Each item presents a brief case description, or clinical history. Candidates must read the case/clinical history of the patient, evaluate existing image(s), and complete the ultrasound report by selecting options from a drop-down menu. Those interested in PACSim items can locate a wealth of information, including sample questions and a video tutorial, on the ARDMS website at <http://www.ardms.org/Pages/PACS.aspx>.



## How to Use This Mock Exam

*Adult Echocardiography Review* effectively simulates the content of the ARDMS Adult Echocardiography specialty exam. Current ARDMS standards call for approximately 150 multiple-choice questions to be answered during a three-hour period. That is, you will have an average time of just over 1 minute to answer each question. Timing your practice sessions according to the number of questions you need to finish will help you prepare for the pressure experienced by Adult Echocardiography candidates taking this exam. It also helps to ensure that your practice scores accurately reflect your strengths and weaknesses so that you can study more efficiently and with greater purpose in the limited time you are able to devote to preparation.

**IMPORTANT NOTE:** *Although many of our customers remark on similarities between our questions and those of the actual exam, do not be misled into thinking you should memorize these questions and answers. They are here to give you practice, to teach you things you may not know, and to reveal your strengths and weaknesses so that you know where to put your energy as you prepare for the exam.*

ARDMS test results are reported as a “scaled” score that ranges from a minimum of 300 to a maximum of 700. A scaled score of 555 is the passing score—the “passpoint” or “cutoff score” for all ARDMS examinations. The scaled score is simply a conversion of the number of correct answers that also, in part, takes into account the difficulty of a particular question. You can search on the Internet for “Angoff scoring method” if you want to learn more about scaled scoring. Suffice it to say that it helps to ensure the fairness of the exams.

We include below and strongly recommend that you read “Taking and Passing Your Exam,” by Don Ridgway, RVT, who offers useful tips and practical strategies for taking and passing the ARDMS examinations.

Finally, you have not only our best wishes for success but also our admiration for taking this big and important step in your career.

*Carol Mitchell*

Carol Mitchell, PhD, RDMS, RDCS, RVT, RT(R), ACS, FASE, FSDMS

*Bridgett Willey*

Bridgett Willey, MS, RDMS, RVT, RDCS, RT(R)



# Taking and Passing Your Exam

---

by Don Ridgway, RVT\*

## ***Preparing for Your Exam . . .***

**Study.** And then study some more. Knowing your stuff is the most important factor in your success. Start early, set a regular study schedule, and stick to it. Make your schedule specific so you know exactly what to study on a particular day. Write it down. Establish realistic goals so that you don't build a mountain you can't climb.

As to what you study, don't just read aimlessly. Focus your efforts on what you need to know. Rely on a core group of dependable references, referring to others as necessary to firm up your understanding of specific topics. Let the ARDMS exam outline guide you. And use different but complementary study methods—texts, flashcards, and mock exams—to exercise those neural pathways.

**Ease down on studying the week before.** Wind down, reduce stress, build confidence, and rest up. Don't cram! And no studying the night before. You had your chance. Watch a movie, relax, go to bed early, and sleep well.

**Organize your things the night before.** Lay out comfortable clothes (including a sweater or sweatshirt in case the testing center is cold), pencils, your ARDMS test-admission papers, car and house keys, glasses, prescriptions, directions to the test center, and any other personal items you might need. Be prepared!

## ***The Day of Your Exam . . .***

Eat lightly. You do not want to fall asleep during the exam. Go easy on the coffee or tea so your bladder doesn't distract you halfway through the exam.

**Arrive early.** Plan to arrive at the test center early, especially if you haven't been there before. Take directions, including the telephone number of the testing center in case you have to make contact en route. You don't need a wrong-offramp adventure.

**Be confident.** As you wait for the exam to begin, smile, lift both hands, wave them toward yourself, and say, "Bring it on."

## ***During the Exam . . .***

**Read each question twice before answering.** Guess how easy it is to get one word wrong and misunderstand the whole question!

**Try to answer the question before looking at the choices.** Formulating an answer before peeking at the possibilities minimizes the distraction of the incorrect answer choices, which in the test-making business are called—guess what?—distractors.

---

\*Don Ridgway is the author of *Introduction to Vascular Scanning: A Guide for the Complete Beginner* and editor of *Vascular Technology Review*. He is Professor Emeritus at Grossmont College in El Cajon, California.

**Knock off the easy ones first.** First answer the questions you feel good about. Then go back for the more difficult items. Next, attack the really tough ones. Taking notes on long or tricky questions often can jog your memory or put the question in new light. For questions you just cannot answer with certainty, eliminate the obviously wrong answer choices and then guess.

**Guessing.** Passing the exam depends on the number of correct answers you make. Because unanswered questions are counted as incorrect, it makes sense to guess when all else fails. The ARDMS itself advises that it is to the candidate's advantage to answer all possible questions. Guessing alone improves your chances of scoring a point from 0 (for an unanswered question) to 25% (for randomly picking one of four possible answers). Eliminating answer choices you know or suspect are wrong further improves your odds of success. By using your knowledge and skill to eliminate two of the four answer choices before guessing, for example, you increase your odds of scoring a point to 50%.

**Pace yourself; watch the time.** Work methodically and quickly to answer those you know, and make your best guesses at the gnarly ones. Leave no question unanswered.

**Don't despair 50 minutes into the exam.** At some point you may feel that things just aren't going well. Take 10 seconds to breathe deeply—in for a count of five, out for a count of five. Relax. Recall that you need only about three out of four correct answers to pass. If you've prepared reasonably well, a passing score is attainable even if you feel sweat running down your back.

### ***Taking the Exam on Computer . . .***

Some candidates express concern about taking the registry exam on a computer. Most folks find this to be pretty easy; some find it offputting, at least in prospect. But the computerized exams are quite convenient: You can take the exam at your convenience (a far cry from the days of one exam per year), you know whether or not you passed before you leave the testing center (compare that to waiting weeks and even months, as used to be the case), and you can reschedule the exam after 90 days if you happen not to pass the first time (rather than waiting another six months to a year). Another good point: The illustrations are said to be clearer on computer than in the booklets at a Scantron-type exam.

Taking the test by computer is not complicated. The center even gives you a tutorial to be sure you know what you need to do. You sit in a carrel with a computer and answer the multiple-choice questions by pointing and clicking with a mouse. There is a clock on the display letting you know how much time is left. Use it to pace yourself. Scratch paper is available; make liberal use of it.

You can mark questions for answering later. A display shows which questions have not been answered so you can return to them. When you have finished, you click on "DONE," and you find out immediately whether you passed.

It's nothing to be afraid of. The principles are the same as those for any exam. Be methodical and keep breathing.

## ***Summary . . .***

### **Preparing for the exam:**

- Study.
- Use flashcards.
- Join a study group.
- Wind down a week before.
- Don't cram.
- Relax!

### **The day of your exam:**

- Eat lightly, avoid coffee.
- Arrive early.
- Take a sweater.
- Be confident!

### **During the exam:**

- Read each question twice.
- Answer the question before looking at the answer choices.
- Answer the easy ones first.
- Guess when necessary.
- Pace yourself.
- Don't despair.

### **Taking the exam on computer:**

- Just point and click.
- Take notes.
- Mark and return to the hard questions.
- Use the onscreen clock to pace yourself.
- Be methodical.
- Breathe!

# Contents

---

Reviewers v

Preface to the 2nd Edition vii

Taking and Passing Your Exam x

Color Plates xvii

## **PART 1 Anatomy and Physiology 1**

### *Normal anatomy 2*

Assess aorta and sinus of Valsalva

Assess cardiac anatomy

Assess coronary sinus

Assess pericardium

Assess valve structure

Assess vessels of venous return

Assess wall segments

### *Normal physiology 21*

Assess response to stress testing

Assess systolic and diastolic function

Assess valve function

Assess venous return

Identify the phases of the cardiac cycle

## **PART 2 Pathology 35**

### *Abnormal physiology and perfusion 36*

Assess aneurysms

Assess aorta and sinus of Valsalva

Assess aortic valve regurgitation

Assess aortic valve stenosis

Assess arrhythmias and conduction disturbances

Assess cardiac thrombi, masses, and tumors

Assess congenital heart disease

Assess coronary arteries

Assess diastolic function

Assess endocarditis

Assess ischemic cardiac diseases

Assess left ventricle

Assess mitral valve regurgitation

- Assess mitral valve stenosis
- Assess pericardial disease
- Assess pulmonary artery
- Assess pulmonic valve regurgitation
- Assess pulmonic valve stenosis
- Assess right ventricle
- Assess segmental wall-motion abnormalities
- Assess septal defects
- Assess systolic function
- Assess tricuspid valve regurgitation
- Assess tricuspid valve stenosis
- Assess valve structure and function
- Assess various congenital etiologies of heart disease
- Assess venous return
- Evaluate for the presence of Ebstein anomaly
- Evaluate for the presence of patent ductus arteriosus
- Evaluate for the presence of tetralogy of Fallot
- Identify and evaluate coarctation of the aorta
- Identify and evaluate endocardial cushion defect
- Identify Marfan syndrome

*Postoperative evaluation*      118

- Assess valve repair or replacement

### **PART 3 Integration of Data**      125

*Incorporate outside data*      126

- Assess clinical history or medical records

### **PART 4 Protocols**      129

*Measurement techniques*      130

- Assess aortic valve
- Assess diastolic function
- Assess Doppler recordings and measurements
- Assess great vessels
- Assess left atrium
- Assess left ventricle
- Assess mitral valve
- Assess pulmonary artery pressure
- Assess pulmonic valve
- Assess right ventricle
- Assess shunt ratios
- Assess systolic function
- Assess tricuspid valve

	<i>Nonsonographic techniques</i>	162
	Perform provocative maneuvers	
	<i>Sonographic imaging views</i>	164
	Assess apical views	
	Assess parasternal views	
	Assess subcostal views	
	Assess suprasternal notch views	
<b>PART 5</b>	<b>Physics and Instrumentation</b>	171
	<i>Artifacts</i>	172
	Assess Doppler artifacts	
	Assess imaging artifacts	
	<i>Hemodynamics</i>	176
	Utilize ultrasound contrast agents	
	<i>Imaging instruments</i>	178
	Adjust console settings to achieve optimal Doppler recording	
	Adjust console settings to achieve optimal imaging display	
	Utilize M-mode	
	Utilize nonimaging probe	
	Utilize saline contrast	
<b>PART 6</b>	<b>Managing Medical Emergencies</b>	189
	Recognize contraindications to contrast agents	190
<b>PART 7</b>	<b>Patient Care</b>	191
<b>PART 8</b>	<b>Answers, Explanations, and References</b>	195
<b>PART 9</b>	<b>Tutorials on Key Topics in Adult Echocardiography</b>	307
	<i>Tutorial 1: Coronary Artery Territory and Cardiac Wall Segments</i>	
	<i>Tutorial 2: The Athletic Heart</i>	
	<i>Tutorial 3: Phases of Diastole</i>	
	<i>Tutorial 4: Diastolic Dysfunction</i>	
	<i>Tutorial 5: Electrocardiograms for Echocardiography</i>	
	<i>Tutorial 6: Mitral Valve Stenosis</i>	
	<i>Tutorial 7: Aortic Valve Stenosis</i>	
	<i>Tutorial 8: Pulmonic Valve Stenosis</i>	
	<i>Tutorial 9: Mitral Valve Regurgitation</i>	
	<i>Tutorial 10: Aortic Valve Regurgitation</i>	
	<i>Tutorial 11: Calculating Right Ventricle Systolic Pressure (RVSP)</i>	
	<i>Tutorial 12: Endocarditis</i>	

*Tutorial 13: Atrial Septal Defects*

*Tutorial 14: Tetralogy of Fallot*

*Tutorial 15: Dextrotransposition of the Great Arteries*

*Tutorial 16: Use of CW Doppler or High PRF Doppler in the Presence of Stenosis*

**PART 10 Application for CME Credit 341**

**PART 11 Suggested Readings 375**

**PART 12 ARDMS Exam Content Outline Tasks Cross-Referenced to Mock Exam Questions 379**



PART 1

# **Anatomy and Physiology**

---

*Normal anatomy*

*Normal physiology*

## Normal Anatomy

*Assess aorta and sinus of Valsalva*

*Assess cardiac anatomy*

*Assess coronary sinus*

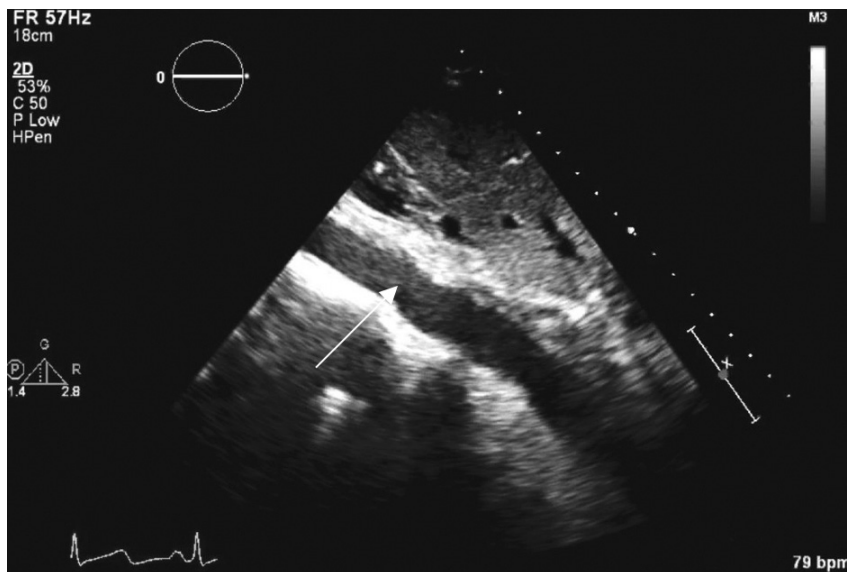
*Assess pericardium*

*Assess valve structure*

*Assess vessels of venous return*

*Assess wall segments*

1. The arrow in this image is pointing to the:

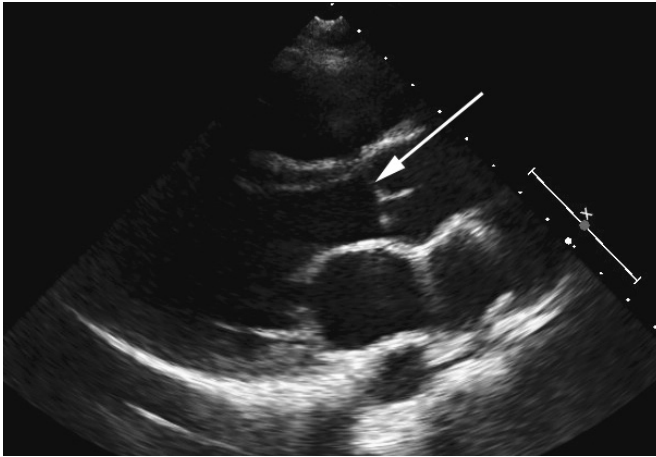


- A. Inferior vena cava
- B. Abdominal aorta
- C. Right renal vein
- D. Superior mesenteric artery
- E. Crux of the diaphragm

### **AIT—Hotspot**

2. In a normal left-sided aortic arch, the first branch should be the:
- A. Aberrant right subclavian artery
  - B. Right common carotid artery
  - C. Innominate artery
  - D. Left common carotid artery
  - E. Left subclavian artery

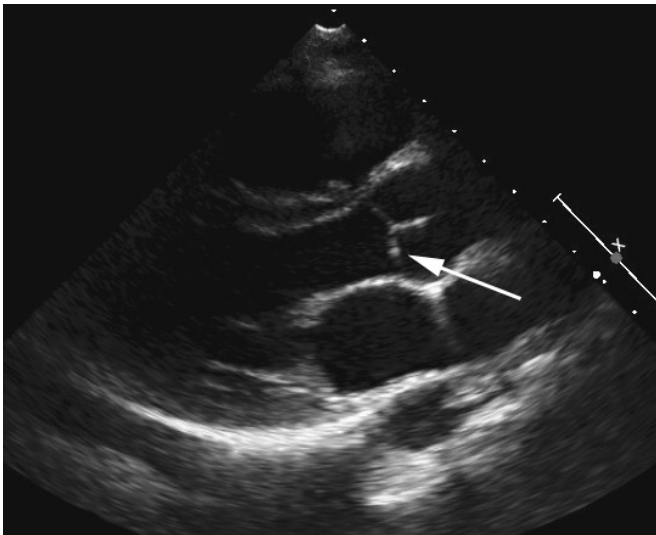
3. The branches arising from the aortic arch are the:
- A. Coronary sinus, left upper pulmonary vein, and right upper pulmonary vein
  - B. Right coronary artery and left coronary artery
  - C. Left pulmonary artery and right pulmonary artery
  - D. Left circumflex artery and left anterior descending artery
  - E. Innominate, left common carotid, and left subclavian arteries
4. In this parasternal long-axis view, the arrow is pointing to the:



- A. Right coronary cusp
- B. Left coronary cusp
- C. Noncoronary cusp
- D. Septal leaflet
- E. Anterior leaflet

***AIT—Hotspot***

5. In this parasternal long-axis view, the arrow is pointing to the:

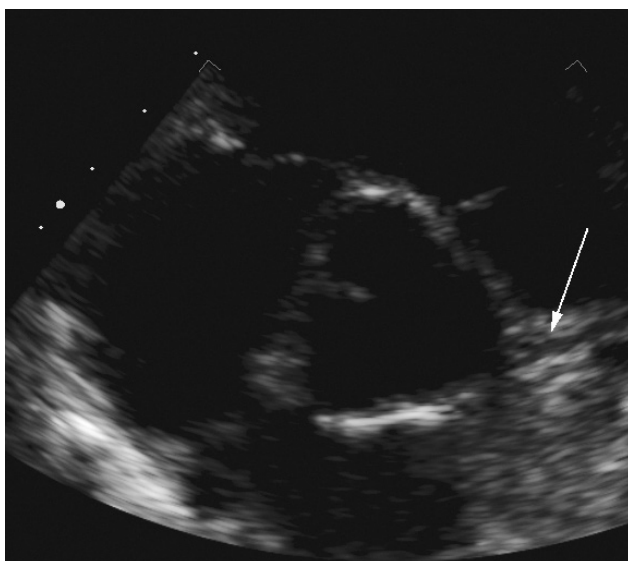


- A. Right coronary cusp
- B. Left coronary cusp

- C. Noncoronary cusp
- D. Septal leaflet
- E. Anterior leaflet

**AIT—Hotspot**

6. The weakest point of the aorta is the:
  - A. Origin of the coronary arteries
  - B. Origin of the innominate artery
  - C. Isthmus
  - D. Origin of the renal arteries
  - E. Bifurcation into the iliac arteries
7. Name the layers of the heart walls in order from inner to outer:
  - A. Endocardium, myocardium, and epicardium
  - B. Epicardium, endocardium, and myocardium
  - C. Myocardium, epicardium, and endocardium
  - D. Pericardium, myocardium, and endocardium
  - E. Myocardium, pericardium, and epicardium
8. The atrioventricular node is located in the:
  - A. Superior portion of the right atrium near the point where the superior vena cava enters
  - B. Inferior portion of the right atrium, near the opening of the coronary sinus and the center of Koch's triangle
  - C. First centimeter of the interventricular septum
  - D. Basal portion of the ventricular septum
  - E. Apical portion of the ventricular septum
9. The arrow in this image is pointing to the:

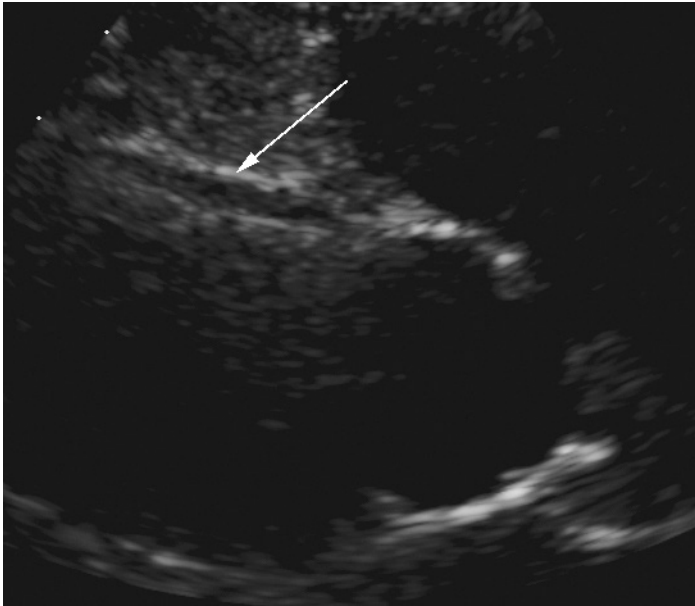


- A. Coronary sinus
- B. Right coronary artery

- C. Left anterior descending coronary artery
- D. Left circumflex artery
- E. Left main coronary artery

**AIT—Hotspot**

10. In this image the arrow is pointing to the:



- A. Coronary sinus
- B. Right coronary artery
- C. Left anterior descending coronary artery
- D. Left circumflex artery
- E. Left coronary artery

**AIT—Hotspot**

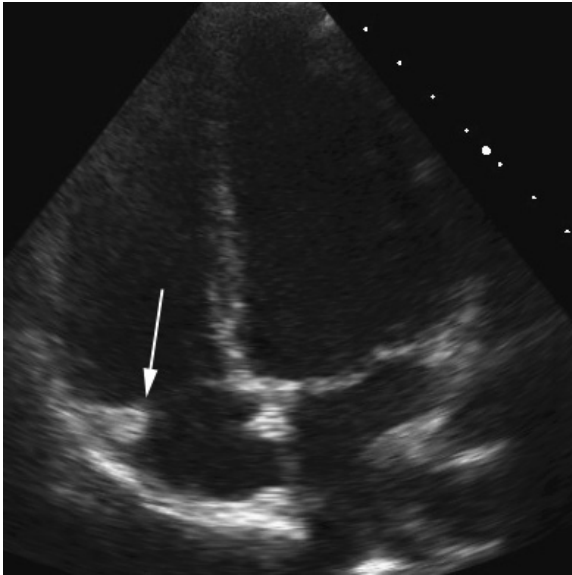
11. The pulmonary artery branches into the:

- A. Coronary sinus, left upper pulmonary vein, and right upper pulmonary vein
- B. Right coronary artery and left coronary artery
- C. Left pulmonary artery and right pulmonary artery
- D. Left circumflex artery and left anterior descending artery
- E. Innominate, left common carotid, and left subclavian arteries

12. The sinoatrial node is located in the:

- A. Superior portion of the right atrium
- B. Inferior portion of the right atrium
- C. First centimeter of the interventricular septum
- D. Basal portion of the ventricular septum
- E. Apical portion of the ventricular septum

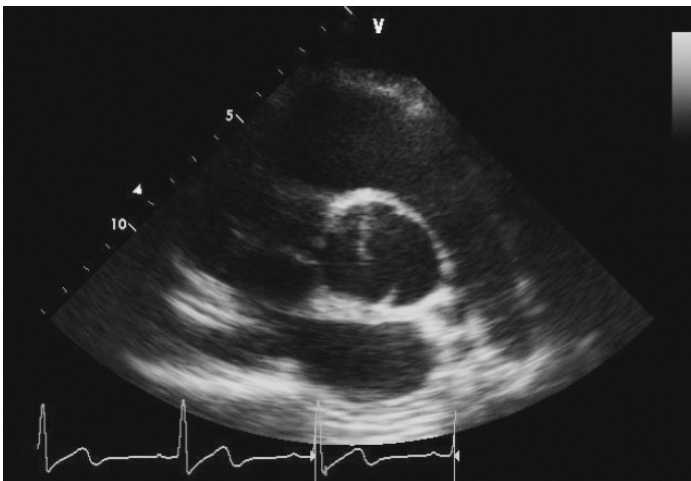
29. The arrow in this image is pointing to the:



- A. Anterior leaflet of the tricuspid valve
- B. Septal leaflet of the tricuspid valve
- C. Lateral leaflet of the tricuspid valve
- D. Posterior leaflet of the tricuspid valve
- E. Right leaflet of the tricuspid valve

**AIT—Hotspot**

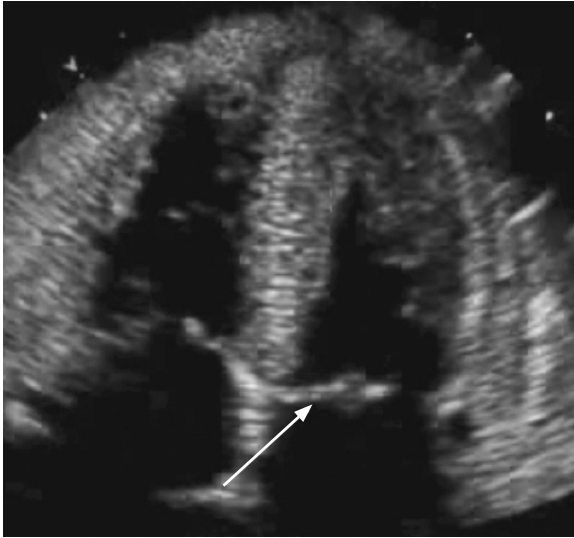
30. A 27-year-old male presents for echocardiography. What is demonstrated on the following image?



- A. Tricuspid aortic valve
- B. Bicuspid aortic valve
- C. Unicuspid valve
- D. Quadricuspid valve
- E. Truncal valve

**AIT—Hotspot**

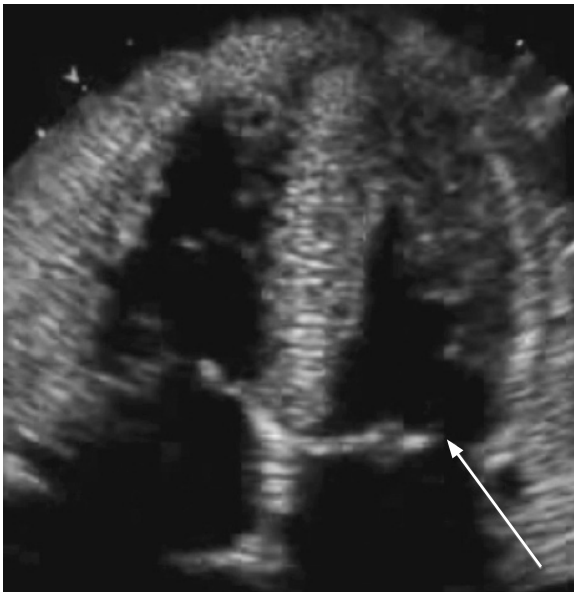
39. What is the arrow pointing to?



- A. Anterior leaflet
- B. Posterior leaflet
- C. Septal leaflet
- D. Thebesian leaflet
- E. Medial leaflet

**AIT—Hotspot**

40. What is the arrow pointing to?

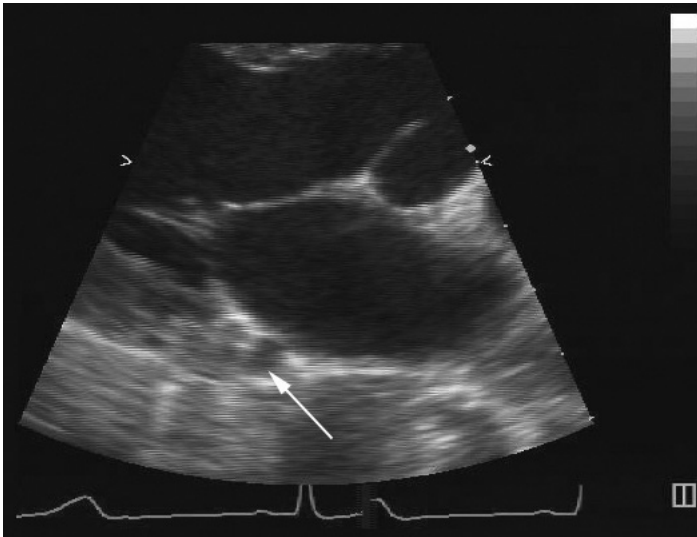


- A. Anterior leaflet
- B. Posterior leaflet
- C. Septal leaflet
- D. Thebesian leaflet
- E. Medial leaflet

**AIT—Hotspot**



41. The great cardiac vein and the small anterior cardiac vein drain the right and left ventricles into which of the following?
- A. Right ventricle
  - B. Left ventricle
  - C. Left atrium
  - D. Right atrium
  - E. Superior vena cava
42. The arrow in this image is pointing to the:

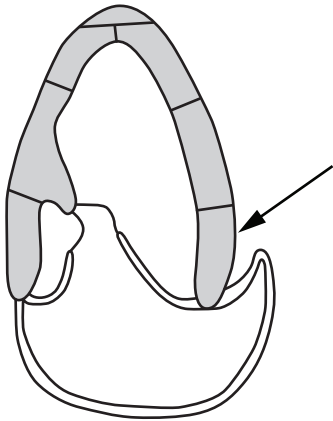


- A. Descending aorta
- B. Dilated right coronary sinus
- C. Normal coronary sinus
- D. Right coronary artery aneurysm
- E. Left coronary artery aneurysm

***AIT—Hotspot***

43. Which view best demonstrates the inferior vena cava?
- A. Parasternal long-axis view
  - B. Parasternal short-axis view
  - C. Apical four-chamber view
  - D. Subcostal view
  - E. Suprasternal notch view
44. In the hepatic vein spectral Doppler waveform, what does the S wave represent?
- A. Early-diastolic inflow
  - B. Atrial contraction
  - C. Systolic annular motion
  - D. Septal anterior motion
  - E. Tricuspid valve closure

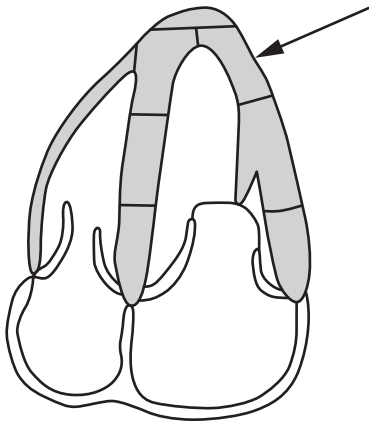
56. Which left ventricular segment is the arrow pointing to in this image?



- A. Basal septal segment
- B. Basal lateral segment
- C. Basal inferior segment
- D. Basal inferolateral segment
- E. Basal anterior segment

**AIT—Hotspot**

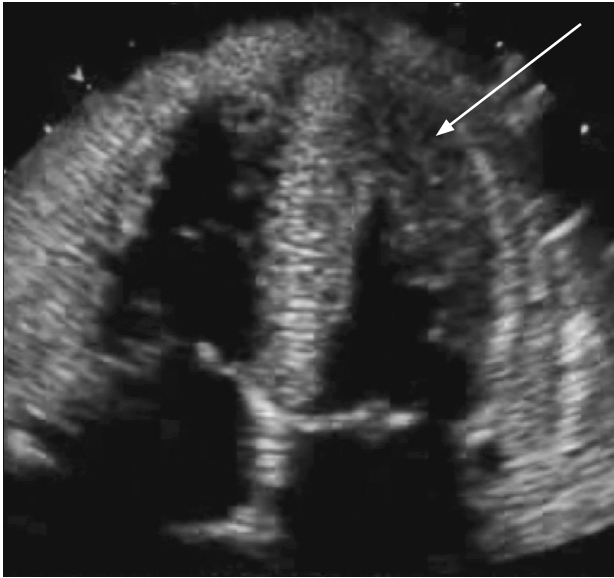
57. Which left ventricular segment is the arrow pointing to in this image?



- A. Apical septal segment
- B. Apical lateral segment
- C. Apical anterolateral segment
- D. Apical inferoseptal segment
- E. Apical inferior segment

**AIT—Hotspot**

58. Which left ventricular segment is the arrow pointing to in this image?



- A. Apical septal segment
- B. Apical lateral segment
- C. Apical anterolateral segment
- D. Apical inferoseptal segment
- E. Apical inferior segment

***AIT—Hotspot***

**Normal Physiology**

*Assess response to stress testing*

*Assess systolic and diastolic function*

*Assess valve function*

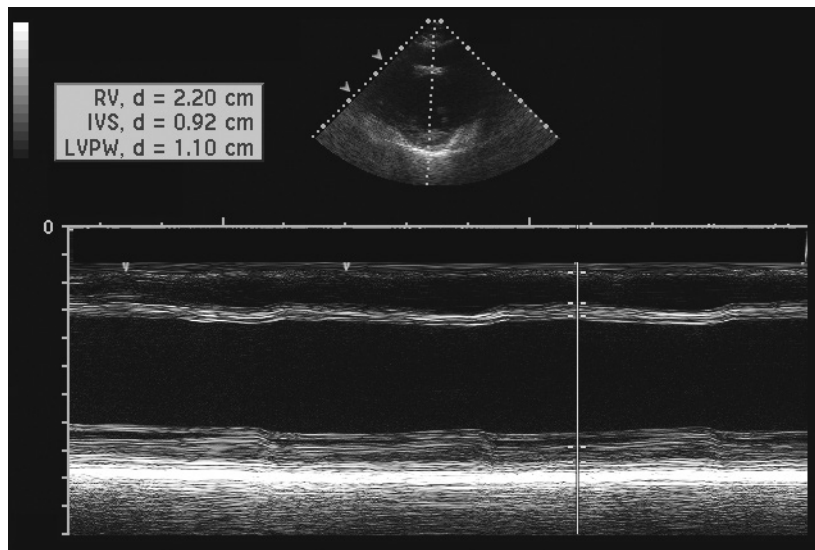
*Assess venous return*

*Identify the phases of the cardiac cycle*

---

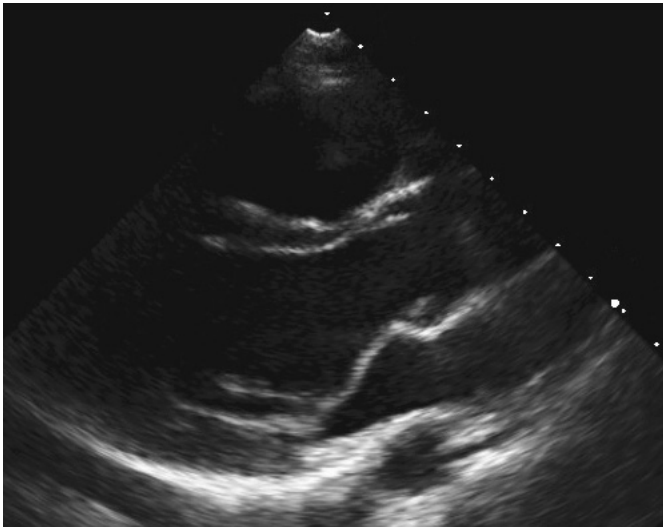
59. During a normal stress test, the coronary arteries should dilate to provide more blood to the:
- A. Myocardium
  - B. Epicardium
  - C. Endocardium
  - D. Visceral pericardium
  - E. Parietal pericardium
60. Reasons for early termination of exercise stress echocardiography include all of the following EXCEPT:
- A. Arrhythmias
  - B. Malignant hypertension
  - C. Significant angina
  - D. Fatigue
  - E. Extreme chest pain
61. All of the following are key elements in the interpretation of stress echocardiography EXCEPT:
- A. Minimum workload
  - B. Duration of exercise
  - C. Symptoms
  - D. Blood pressure response
  - E. Wall segment motion
62. Normally in dobutamine stress echocardiography, the cardiac output:
- A. Increases
  - B. Decreases by 10%
  - C. Decreases by 25%
  - D. Remains the same
  - E. Is unaffected by dobutamine stress

77. This image demonstrates an estimated ejection fraction of:



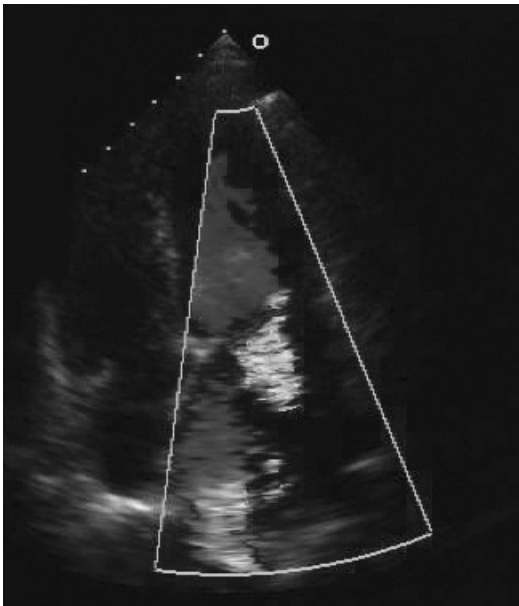
- A. 15%–25%
  - B. 30%–40%
  - C. 50%–60%
  - D. 60%–70%
  - E. 80%–90%
78. A patient presents with concentric left ventricular hypertrophy, a five-year history of uncontrolled hypertension, and an E/A ratio of 2.1. Which of the following would be the accurate classification of diastolic dysfunction in this patient?
- A. Normal
  - B. Grade 0
  - C. Grade I
  - D. Grade II
  - E. Grade III
79. A 50-year-old male with an E/A ratio of 3.6 and a reversal of flow velocity of 0.36 m/sec has:
- A. Normal diastolic function
  - B. Prolonged filling time
  - C. Restrictive filling
  - D. Pseudonormalization
  - E. No diastolic function
80. The reversal flow velocity used to assess diastolic function with pulmonary inflow is given by measuring which of the following?
- A. E wave
  - B. C wave
  - C. S wave
  - D. D wave
  - E. A wave

81. When using Doppler tissue imaging to assess left ventricular diastolic function, you should place the cursor:
- A. At the septal and lateral mitral annulus
  - B. In the lateral left ventricular wall
  - C. In the inferior left ventricular wall
  - D. In the anterior left ventricular wall
  - E. A and C
82. This parasternal long-axis view demonstrates the aortic valve during:



- A. Isovolumic relaxation time
  - B. Isovolumic contraction time
  - C. Diastasis
  - D. Diastole
  - E. Systole
83. The first heart sound represents:
- A. Closure of the AV valves
  - B. Closure of the semilunar valves
  - C. Atrial contraction
  - D. Ventricular contraction
  - E. Rapid early-diastolic filling of the left ventricle
84. The second heart sound represents:
- A. Closure of the mitral valve
  - B. Closure of the tricuspid valve
  - C. Closure of both the semilunar valves
  - D. Atrial contraction
  - E. Rapid early-diastolic filling of the left ventricle

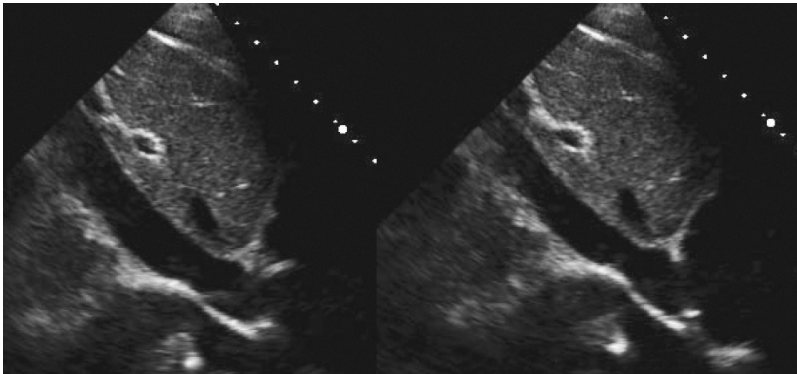
85. A 65-year-old female presents with ventricular arrhythmia. The regurgitant fraction is estimated to be 38%. What is demonstrated in this image? (See Color Plate 1 on page xvii.)



- A. Trivially physiologic mitral regurgitation
  - B. Mild mitral regurgitation
  - C. Moderate mitral regurgitation
  - D. Moderate to severe mitral regurgitation
  - E. Severe mitral regurgitation
86. Which of the following is/are associated with mitral stenosis?
- A. Pan-systolic murmur
  - B. Blowing early-diastolic murmur
  - C. Opening snap murmur
  - D. Systolic ejection murmur with crescendo-decrescendo
  - E. B and C
87. You are asked to pay particular attention to the semilunar valves. These valves are the:
- A. Mitral and aortic valves
  - B. Mitral and tricuspid valves
  - C. Pulmonic and tricuspid valves
  - D. Aortic and pulmonic valves
  - E. Mitral and pulmonic valves
88. The posterior leaflet of the mitral valve appears to have a smaller excursion than the anterior leaflet because:
- A. It is intersected at an angle that does not show its full size
  - B. The leaflet never completely opens
  - C. Its excursion is smaller
  - D. Its shape is different from that of the anterior leaflet
  - E. C and D

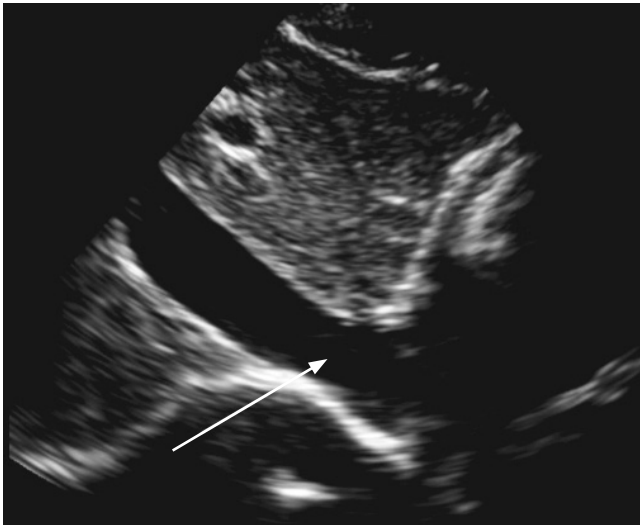


89. The best two-dimensional echo view for Doppler analysis of the tricuspid valve inflow is the:
- A. Parasternal long-axis view
  - B. Parasternal short-axis view
  - C. Apical four-chamber view
  - D. Suprasternal long-axis view
  - E. Subcostal four-chamber view
90. The best two-dimensional echo view for Doppler analysis of the mitral valve inflow is the:
- A. Parasternal long-axis view
  - B. Parasternal short-axis view
  - C. Apical four-chamber view
  - D. Apical five-chamber (LVOT) view
  - E. Subcostal four-chamber view
91. The mitral valve opens when:
- A. The pressure in the left atrium exceeds the pressure in the left ventricle
  - B. The pressure in the left ventricle exceeds the pressure in the left atrium
  - C. The pressure in the right atrium exceeds the pressure in the right ventricle
  - D. The pressure in the right ventricle exceeds the pressure in the right atrium
  - E. The pressure in the left atrium and left ventricle are equal
92. When evaluating a patient with an enlarged coronary sinus, you should check for:
- A. Kawasaki disease
  - B. Persistent left superior vena cava
  - C. Interrupted inferior vena cava
  - D. Wall-motion abnormality due to ischemia
  - E. Takayasu's arteritis
93. The image on the left was taken with the patient breathing normally. The image on the right was taken when the patient sniffed. Based on these images, what is the best estimate of this individual's central venous pressure?



- A. 0 mmHg
- B. 3 mmHg
- C. 5 mmHg
- D. 8 mmHg
- E. 15 mmHg

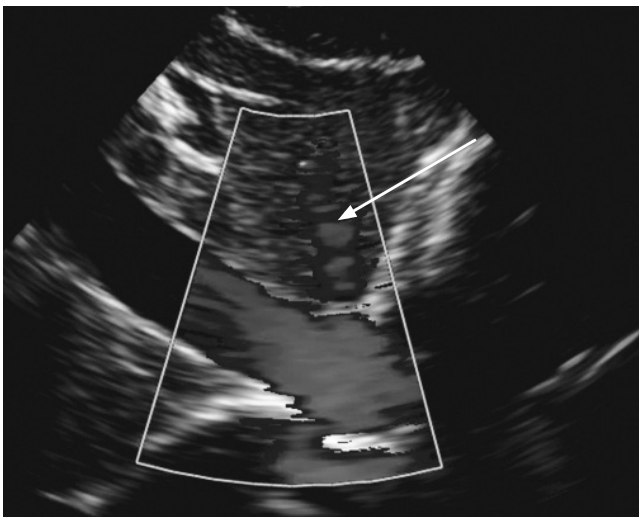
94. What is the arrow pointing to in this image?



- A. Inferior vena cava
- B. Superior vena cava
- C. Hepatic vein
- D. Pulmonary vein
- E. Coronary sinus

**AIT—Hotspot**

95. What is the arrow pointing to in this image? (See Color Plate 2 on page xviii.)

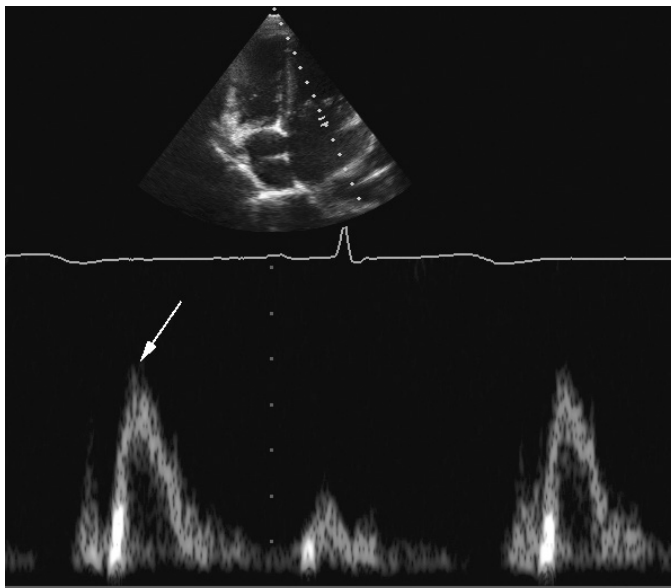


- A. Inferior vena cava
- B. Superior vena cava
- C. Hepatic vein
- D. Pulmonary vein
- E. Coronary sinus

**AIT—Hotspot**

96. The normal appearance of the S wave on the pulmonary vein Doppler signal is:
- A. Above the baseline in systole with annular motion
  - B. Below the baseline in systole with annular motion
  - C. Above the baseline in diastole with early opening of the mitral valve
  - D. Below the baseline in diastole with early opening of the mitral valve
  - E. Below the baseline during the isovolumic relaxation time
97. What is the normal appearance of the S wave on the hepatic vein Doppler signal?
- A. Above the baseline in systole with annular motion
  - B. Below the baseline in systole with annular motion
  - C. Above the baseline in diastole with early opening of the tricuspid valve
  - D. Below the baseline in diastole with early opening of the tricuspid valve
  - E. Below the baseline during the isovolumic relaxation time
98. What is the normal appearance of the D wave on the pulmonary vein Doppler signal?
- A. Above the baseline in systole with annular motion
  - B. Below the baseline in systole with annular motion
  - C. Above the baseline in diastole with early opening of the mitral valve
  - D. Below the baseline in diastole with early opening of the mitral valve
  - E. Below the baseline during the isovolumic contraction time
99. What is the normal appearance of the D wave on the hepatic vein Doppler signal?
- A. Above the baseline in systole with annular motion
  - B. Below the baseline in diastole with early opening of the tricuspid valve
  - C. Below the baseline in systole with annular motion
  - D. Below the baseline during the isovolumic relaxation time
  - E. Above the baseline in diastole with early opening of the tricuspid valve
100. What does the A wave represent on the pulmonary vein Doppler waveform?
- A. Blood flow with atrial annular motion
  - B. Blood flow with atrial contraction
  - C. Blood flow with atrial regurgitation
  - D. Blood flow with mitral early inflow
  - E. Blood flow with pulmonary artery regurgitation
101. Atrial contraction occurs after which wave in the electrocardiographic (ECG) cycle?
- A. P wave
  - B. Q wave
  - C. R wave
  - D. S wave
  - E. T wave

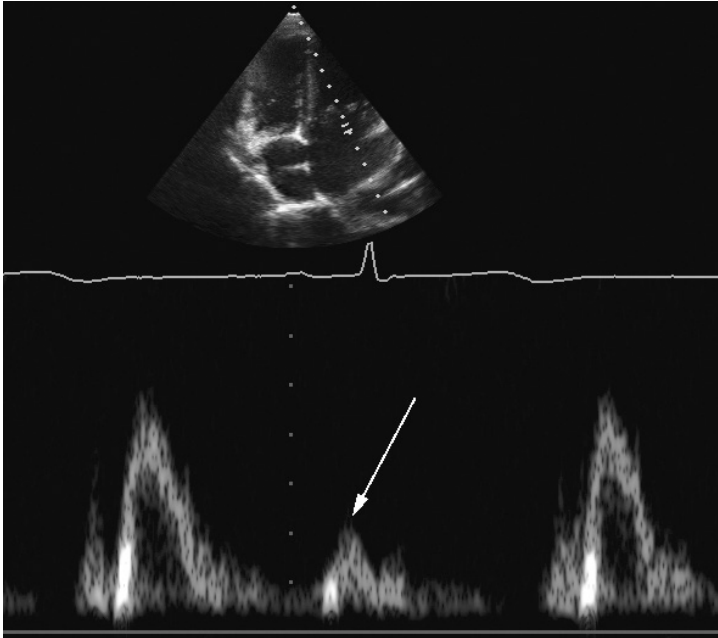
102. The clinical definition of *diastole* is:
- A. The interval from aortic valve closure to mitral valve closure
  - B. The interval between aortic valve closure and pulmonic valve closure
  - C. The interval from aortic valve opening to aortic valve closure
  - D. The interval between mitral valve opening and tricuspid valve closure
  - E. The interval from mitral valve opening to mitral valve closure
103. The four phases of diastole are:
- A. Isovolumic contraction, early-systolic filling, diastasis, and isovolumic relaxation
  - B. Isovolumic contraction, early-diastolic filling, diastasis, and atrial contraction
  - C. Isovolumic relaxation, early-diastolic filling, diastasis, and atrial contraction
  - D. Isovolumic relaxation, early-diastolic filling, atrial contraction, and isovolumic contraction
  - E. Isovolumic relaxation, atrial contraction, diastasis, and isovolumic contraction
104. The term *excitation-contraction coupling* refers to:
- A. A process that results in an absolute refractory state
  - B. A process in which there is relaxation of the cardiac muscle
  - C. A process in which an electrical discharge allows changes in cell membrane permeability that result in cardiac muscle contraction
  - D. A process in which a muscle cell is unable to initiate an electrical charge
  - E. A process in which the cardiac muscle cannot contract
105. The isovolumic relaxation time period ends when the:
- A. Mitral valve opens
  - B. Mitral valve closes
  - C. Aortic valve opens
  - D. Aortic valve closes
  - E. Pulmonic valve opens
106. The arrow in this image is pointing to the:



- A. Isovolumic time period
- B. Early-diastolic filling phase
- C. Diastasis phase
- D. Atrial contraction phase
- E. Isovolumic contraction time period

***AIT—Hotspot***

107. The arrow in this image is pointing to the:



- A. Isovolumic time period
- B. Early-diastolic filling phase
- C. Diastasis phase
- D. Atrial contraction phase
- E. Isovolumic contraction time period

***AIT—Hotspot***

108. The P wave on an electrocardiogram (ECG) represents:

- A. Ventricular depolarization
- B. Ventricular relaxation
- C. Atrial depolarization
- D. Atrial relaxation
- E. Isovolumic contraction time period

# Adult Echocardiography Review 2nd Edition

Test yourself before the ARDMS tests you! The new 2nd Edition of *Adult Echocardiography Review* illuminates the facts and principles on which you will be tested, hones your test-taking skills, and reveals your strengths and weaknesses by exam topic. Covering the topics and tasks on the Adult Echo specialty exam outline published by ARDMS, this review contains more than 680 registry-like questions together with answers, clear explanations, and references for further study. More than 200 image-based cases and schematic illustrations prepare you to tackle images, anatomy, and pathology on the exam. Coverage includes the major echocardiographic views and protocols; normal anatomy and physiology; structural, congenital, and other pathologies; physics and hemodynamics; patient care; and measurement techniques and calculations to assess cardiac function—all in approximate proportion to the exam itself. *Adult Echocardiography Review* is very effective in combination with *Ultrasound Physics Review*. Supplement your study with the CD-ROM or Download version to gain access to more than 30 video clips of real-time echocardiograms. Why are the Davies mock exams so popular and effective? Because they contain the same kinds of thought-provoking questions you will find on the exam! SDMS-approved for 12 hours' continuing medical education credit. Davies catalog #11071.

## About the authors . . .

**Carol Mitchell**, PhD, RDMS, RDCS, RVT, RT(R), ACS, FASE, FSDMS, is Assistant Professor of Cardiovascular Medicine at the University of Wisconsin School of Medicine and Public Health. Her primary research interests are in the evaluation of plaque characteristics and composition to assess the extent of flow limitations and to evaluate for patients' vulnerability to plaque—with the goal of identifying patients who may benefit from more aggressive management.



**Bridgett Willey**, MS, RDMS, RVT, RDCS, RT(R), is the founder and director of HOPE—the Health Occupations and Professions Exploration program—which pairs high school students with a mentor and other resources to prepare them to enter the health care professions, and Program Director of the University of Wisconsin Hospital & Clinics (UWHC) School of Diagnostic Medical Sonography (DMS). Bridgett has a strong passion to help make all healthcare providers more culturally sensitive and to diversify the healthcare workforce.

**The Newest Interactive Mock Exams from Davies** are the most effective and featuresome available today. They are truly interactive, fun, and packed with regularly updated and peer-reviewed content for the SPI (Physics), Abdomen, Vascular, Ob/Gyn, Breast, MSK, Fetal Echo, and Adult Echo registry examinations. Work in Test or Study Mode, and easily customize your sessions to focus on specific exam topics. Hundreds of continuously variable questions and images in registry format. Clear, simple explanations and current references. Expert tutorials on key concepts. Additional explanatory images. Test timer. The program instantly analyzes your performance, topic by topic. Automatically review missed questions with one click. Available CME credit. A snap to use. Order toll-free at 1-877-792-0005 or download from our website.



ISBN 978-0-941022-81-1

DaviesPublishing.com

