

Multimodality Imaging of Diseases of the Thoracic Aorta in Adults: From the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Endorsed by the Society of Cardiovascular Computed Tomography and Society for Cardiovascular Magnetic Resonance

Steven A. Goldstein, MD, Co-Chair, Arturo Evangelista, MD, FESC, Co-Chair, Suhny Abbara, MD, Andrew Arai, MD, Federico M. Asch, MD, FASE, Luigi P. Badano, MD, PhD, FESC, Michael A. Bolen, MD, Heidi M. Connolly, MD, Hug Cuéllar-Calàbria, MD, Martin Czerny, MD, Richard B. Devereux, MD, Raimund A. Erbel, MD, FASE, FESC, Rossella Fattori, MD, Eric M. Isselbacher, MD, Joseph M. Lindsay, MD, Marti McCulloch, MBA, RDCS, FASE, Hector I. Michelena, MD, FASE, Christoph A. Nienaber, MD, FESC, Jae K. Oh, MD, FASE, Mauro Pepi, MD, FESC, Allen J. Taylor, MD, Jonathan W. Weinsaft, MD, Jose Luis Zamorano, MD, FESC, FASE, Contributing Editors: Harry Dietz, MD, Kim Eagle, MD, John Eleftheriades, MD, Guillaume Jondeau, MD, PhD, FESC, Hervé Rousseau, MD, PhD, and Marc Schepens, MD, *Washington, District of Columbia; Barcelona and Madrid, Spain; Dallas and Houston, Texas; Bethesda and Baltimore, Maryland; Padua, Pesaro, and Milan, Italy; Cleveland, Ohio; Rochester, Minnesota; Zurich, Switzerland; New York, New York; Essen and Rostock, Germany; Boston, Massachusetts; Ann Arbor, Michigan; New Haven, Connecticut; Paris and Toulouse, France; and Brugge, Belgium*

(J Am Soc Echocardiogr 2015;28:119-82.)

TABLE OF CONTENTS

Preamble	121	B. How to Measure the Aorta	124
I. Anatomy and Physiology of the Aorta	121	1. Interface, Definitions, and Timing of Aortic Measurements	124
A. The Normal Aorta and Reference Values	121		
1. Normal Aortic Dimensions	122		

From the Medstar Heart Institute at the Washington Hospital Center, Washington, District of Columbia (S.A.G., F.M.A., J.M.L., A.J.T.); Vall d'Hebron University Hospital, Barcelona, Spain (A.E., H.C.-C.); the University of Texas Southwestern Medical Center, Dallas, Texas (S.A.); the National Institutes of Health, Bethesda, Maryland (A.A.); the University of Padua, Padua, Italy (L.P.B.); Cleveland Clinic, Cleveland, Ohio (M.A.B.); Mayo Clinic, Rochester, Minnesota (H.M.C., H.I.M., J.K.O.); the University Hospital Zurich, Zurich, Switzerland (M.C.); Weill Cornell Medical College, New York, New York (R.B.D., J.W.W.); West-German Heart Center, University Duisburg-Essen, Essen, Germany (R.A.E.); San Salvatore Hospital, Pesaro, Italy (R.F.); Massachusetts General Hospital, Boston, Massachusetts (E.M.I.); the Methodist DeBakey Heart & Vascular Center, Houston, Texas; the University of Rostock, Rostock, Germany (C.A.N.); Centro Cardiologico Monzino, IRCCS, Milan, Italy (M.P.); University Hospital Ramón y Cajal, Madrid, Spain (J.L.Z.); Johns Hopkins University School of Medicine, Baltimore, Maryland (H.D.); the University of Michigan, Ann Arbor, Michigan (K.E.); Yale University School of Medicine, New Haven, Connecticut (J.E.); Hopital Bichat, Paris, France (G.J.); Hopital de Rangueil, Toulouse, France (H.R.); and AZ St Jan Brugge, Brugge, Belgium (M.S.).

The following authors reported no actual or potential conflicts of interest in relation to this document: Federico M. Asch, MD, FASE, Michael A. Bolen, MD, Heidi M. Connolly, MD, Hug Cuéllar-Calàbria, MD, Martin Czerny, MD, Richard B. Devereux, MD, Harry Dietz, MD, Raimund A. Erbel, MD, FASE, FESC, Arturo Evangelista, MD, FESC, Rossella Fattori, MD, Steven A. Goldstein, MD, Guillaume Jondeau, MD, PhD, FESC, Eric M. Isselbacher, MD, Joseph M. Lindsay, MD, Marti McCulloch, MBA, RDCS, FASE, Hector I. Michelena, MD, FASE, Christoph Nienaber, MD, FESC, Mauro Pepi, MD, FESC, Marc Schepens, MD, Allen J.

Taylor, MD, and Jose Luis Zamorano, MD, FESC, FASE. The following authors reported relationships with one or more commercial interests: Suhny Abbara, MD, serves as a consultant for Perceptive Informatics. Andrew Arai, MD, receives research support from Siemens. Luigi P. Badano, MD, PhD, FESC, has received software and equipment from GE Healthcare, Siemens, and TomTec for research and testing purposes and is on the speakers' bureau of GE Healthcare. Kim Eagle, MD, received a research grant from GORE. John Eleftheriades, MD, has a book published by CardioText and is a principal investigator on a grant and clinical trial from Medtronic. Jae K. Oh, MD, received a research grant from Toshiba and core laboratory support from Medtronic. Hervé Rousseau, MD, serves as a consultant for GORE, Medtronic, and Bolton. Jonathan W. Weinsaft, MD, received a research grant from Lantheus Medical Imaging.

Attention ASE Members:

The ASE has gone green! Visit www.aseuniversity.org to earn free continuing medical education credit through an online activity related to this article. Certificates are available for immediate access upon successful completion of the activity. Nonmembers will need to join the ASE to access this great member benefit!

Reprint requests: American Society of Echocardiography, 2100 Gateway Centre Boulevard, Suite 310, Morrisville, NC 27560 (E-mail: ase@asecho.org).

0894-7317/\$36.00

Copyright 2015 by the American Society of Echocardiography.

<http://dx.doi.org/10.1016/j.echo.2014.11.015>

Abbreviations

AAS = Acute aortic syndrome**AR** = Aortic regurgitation**ASE** = American Society of Echocardiography**BAI** = Blunt aortic injury**BSA** = Body surface area**CT** = Computed tomography**CTA** = Computed tomographic aortography**CXR** = Chest x-ray**EACVI** = European Association of Cardiovascular Imaging**EAU** = Epi-aortic ultrasound**GCA** = Giant-cell (temporal) arteritis**ICM** = Iodinated contrast media**IMH** = Intramural hematoma**IRAD** = International Registry of Acute Aortic Dissection**MDCT** = Multidetector computed tomography**MIP** = Maximum-intensity projection**MR** = Magnetic resonance**MRI** = Magnetic resonance imaging**PWV** = Pulsewave velocity**STJ** = Sinotubular junction**TA** = Takayasu arteritis**TEE** = Transesophageal echocardiography**TEVAR** = Transthoracic endovascular aortic repair**3D** = Three-dimensional**TTE** = Transthoracic echocardiography**2D** = Two-dimensional**ULP** = Ulcerlike projection

2. Geometry of Different Aortic Segments: Impact on Measurements 126
 - a. Aortic Annulus 126
 - b. Sinuses of Valsalva and STJ 126
 - c. Ascending Aorta and More Distal Segments 126
- C. Aortic Physiology and Function 127
 1. Local Indices of Aortic Function 127
 2. Regional Indices of Aortic Stiffness: Pulse-wave Velocity (PWV) 128
- II. Imaging Techniques 129
 - A. Chest X-Ray (CXR) 129
 - B. TTE 129
 - C. TEE 130
 1. Imaging of the Aorta 130
 - D. Three-Dimensional Echocardiography 131
 - E. Intravascular Ultrasound (IVUS) 131
 1. Limitations 131
 - F. CT 131
 1. Methodology 132
 - a. CTA 132
 - i. Noncontrast CT before Aortography 133
 - ii. Electrocardiographically Gated CTA 133
 - iii. Thoracoabdominal CT after Aortography 133
 - iv. Exposure to Ionizing Radiation 134
 - v. Measurements 134
 - G. MRI 135
 1. Black-Blood Sequences 135
 2. Cine MRI Sequences 135
 3. Flow Mapping 135
 4. Contrast-Enhanced MR Angiography (MRA) 135
 5. Artifacts 136
 - H. Invasive Aortography 136
 - I. Comparison of Imaging Techniques 137
- III. Acute Aortic Syndromes 138
 - A. Introduction 138
 - B. Aortic Dissection 138
 1. Classification of Aortic Dissection 138
 2. Echocardiography (TTE and TEE) 139
 - a. Echocardiographic Findings 140
 - b. Detection of Complications 141
 - c. Limitations of TEE 141
 3. CT 141
 4. MRI of Aortic Dissection 143
 5. Imaging Algorithm 144
 6. Use of TEE to Guide Surgery for Type A Aortic Dissection 144
 7. Use of Imaging Procedures to Guide Endovascular Therapy 146
 8. Serial Follow-Up of Aortic Dissection (Choice of Tests) 147
 9. Predictors of Complications by Imaging Techniques 148
 - a. Maximum Aortic Diameter 148
 - b. Patent False Lumen 148
 - c. Partial False Luminal Thrombosis 149
 - d. Entry Tear Size 149
 - e. True Luminal Compression 149
 10. Follow-Up Strategy 149
 - C. IMH 149
 1. Introduction 149
 2. Imaging Hallmarks and Features 149
 3. Imaging Algorithm 151
 4. Serial Follow-Up of IMH (Choice of Tests) 151
 5. Predictors of Complications 151
 - D. PAU 151
 1. Introduction 151
 2. Imaging Features 151
 3. Imaging Modalities 152
 - a. CT 152
 - b. MRI 152
 - c. TEE 152
 - d. Aortography 152
 4. Imaging Algorithm 153
 5. Serial Follow-Up of PAU (Choice of Tests) 153
- IV. Thoracic Aortic Aneurysm 153
 - A. Definitions and Terminology 153
 - B. Classification of Aneurysms 154
 - C. Morphology 154
 - D. Serial Follow-Up of Aortic Aneurysms (Choice of Tests) 154
 1. Algorithm for Follow-Up 155
 - E. Use of TEE to Guide Surgery for TAAs 155
 - F. Specific Conditions 156
 1. Marfan Syndrome 156
 - a. Aortic Imaging in Unoperated Patients with Marfan Syndrome 156
 - b. Postoperative Aortic Imaging in Marfan Syndrome 157
 - c. Postdissection Aortic Imaging in Marfan Syndrome 157
 - d. Family Screening 157
 2. Other Genetic Diseases of the Aorta in Adults 157
 - a. Turner Syndrome 157
 - b. Loeys-Dietz Syndrome 157
 - c. Familial TAAs 157
 - d. Ehlers-Danlos Syndrome 157
 3. BAV-Related Aortopathy 157
 - a. Bicuspid Valve-Related Aortopathy 157
 - b. Imaging of the Aorta in Patients with Unoperated BAVs 158
 - c. Follow-Up Imaging of the Aorta in Patients with Unoperated BAVs 158
 - d. Postoperative Aortic Imaging in Patients with BAV-Related Aortopathy 158
 - e. Family Screening 159
- V. Traumatic Injury to the Thoracic Aorta 159
 - A. Pathology 159
 - B. Imaging Modalities 160
 1. CXR 160
 2. Aortography 160
 3. CT 160

Download English Version:

<https://daneshyari.com/en/article/5609658>

Download Persian Version:

<https://daneshyari.com/article/5609658>

[Daneshyari.com](https://daneshyari.com)