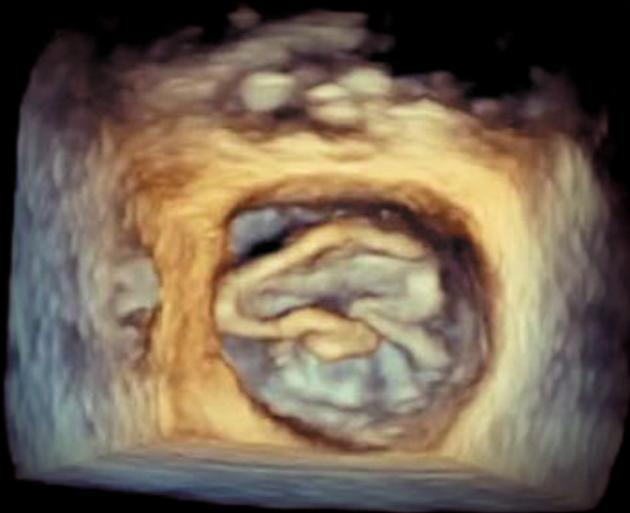


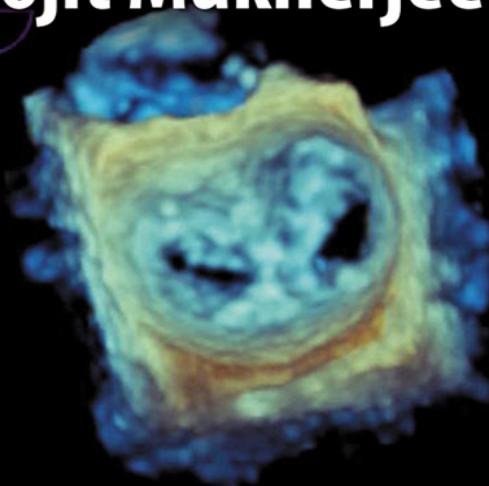


Perrino and Reeves' PRACTICAL APPROACH TO **Transesophageal Echocardiography**

Fifth Edition



Albert C. Perrino Jr
Scott T. Reeves
Joshua M. Zimmerman
Chirojit Mukherjee



Wolters Kluwer



***Perrino and Reeves'
Practical Approach
to Transesophageal
Echocardiography***

Fifth Edition

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Contents

SECTION I: ESSENTIALS OF TWO-DIMENSIONAL IMAGING

1. Principles and Technology of Two-Dimensional Echocardiography
Michelle B. Gorgone, Andrew Maslow, and Albert C. Perrino, Jr

2. Two-Dimensional Examination
Michael Benson and Candice Morrissey

3. Left Ventricular Systolic Performance and Pathology
Serena Dasani and Charles Nyman

4. Diagnosis of Myocardial Ischemia
Joachim M. Erb and Sascha Treskatsch

SECTION II: ESSENTIALS OF DOPPLER ECHO

5. Doppler Technology and Technique
Albert C. Perrino, Jr and Jennifer Decou

6. Quantitative Doppler and Hemodynamics
Benjamin Kogelschatz, Dai-Yin Lu, Ethan Tumarkin, John Ryan, and Satvik Ramakrishna

7. Echocardiographic Evaluation of Ventricular Diastolic Function
Anand R. Mehta and Wanda M. Popescu

SECTION III: VALVULAR DISEASE

8. Mitral Regurgitation
Nicholas W. Markin and Joshua M. Zimmerman

9. Mitral Valve Stenosis
Megan P. Kostibas and Mary Beth Brady

10. Mitral Valve Repair
Maurice Hogan, Chirojit Mukherjee, and Jörg Ender

11. Aortic Regurgitation
Praveen Mehrotra and Ira S. Cohen

12. Aortic Stenosis
Sophia P. Poorsattar and Jacques Neelankavil

13. Prosthetic Valves
T. Robert Feng, Albert T. Cheung, and Worasak Keeyapaj

14. Right Ventricle, Right Atrium, Tricuspid and Pulmonic Valves
Etienne J. Couture, Lars Grønlykke, and André Y. Denault

SECTION IV: CLINICAL CHALLENGES

15. Transesophageal Echocardiography for Coronary Revascularization and Mechanical Support
Justiaan Swanevelder, Ettienne Coetze, and Edwin Turton

16. Transesophageal Echocardiography for Transcatheter Interventions
Massimiliano Meineri, Chirojit Mukherjee, and Anna Flo Forner

17. Transesophageal Echocardiography of the Thoracic Aorta
Michele L. Sumler and Roman M. Sniecinski

18. Critical Care Echocardiography
Karel Huard, Etienne J. Couture, Marc-Antoine Lepage, and André Y. Denault

19. Transesophageal Echocardiography for Congenital Heart Disease in the Adult
Pablo Motta, Carolyn Taylor, and Wanda C. Miller-Hance

20. Cardiac Masses and Embolic Sources

21. 3D Transesophageal Echocardiography Imaging
Marcus Salvatori and Annette Vegas
22. Common Artifacts and Pitfalls of Clinical Echocardiography
Fabio Guaracino and Albert C. Perrino, Jr
23. Techniques and Tricks for Optimizing Transesophageal Images
Andrew Roscoe

APPENDICES

- A. Cardiac Cross-Section Criteria
- B. Cardiac Dimensions
- C. Hemodynamic Calculations
- D. Valve Prostheses
Albert T. Cheung
- E. Classification of the Severity of Valvular Disease

Index

Lateral (Azimuth) Resolution

Lateral resolution is the ability of the ultrasound system to distinguish between objects that are horizontally aligned and perpendicular to the path of the ultrasound beam. Beam width is a primary determinant of lateral resolution. Wide beams produce a “smeared” image of two such objects, whereas narrow beams can identify each object individually. Signal frequency and transducer size impact lateral resolution, but for typical cardiac ultrasound transducers the beam width is approximated as depth/50, yielding at 10 cm of depth a beam width of approximately 2 mm.

Elevational Resolution

Elevational resolution is the ability of the ultrasound system to distinguish between objects that are vertically aligned and perpendicular to the emitted ultrasound beam. Although 2D images appear to display a thin slice of cardiac anatomy, in actuality the information gathered from the entire thickness of the beam is averaged and displayed. For this reason, the thinner the ultrasound beam, the better the elevational resolution of the system (see Figure 1.7). Signal frequency and transducer size impact elevational resolution, but a typical cardiac ultrasound transducer has a beam height approximated as depth/30. Accordingly, at 10-cm depth the beam height is approximately 3.3 mm. Note that axial resolution offers 50% greater fidelity than that achieved in the lateral and elevational planes.

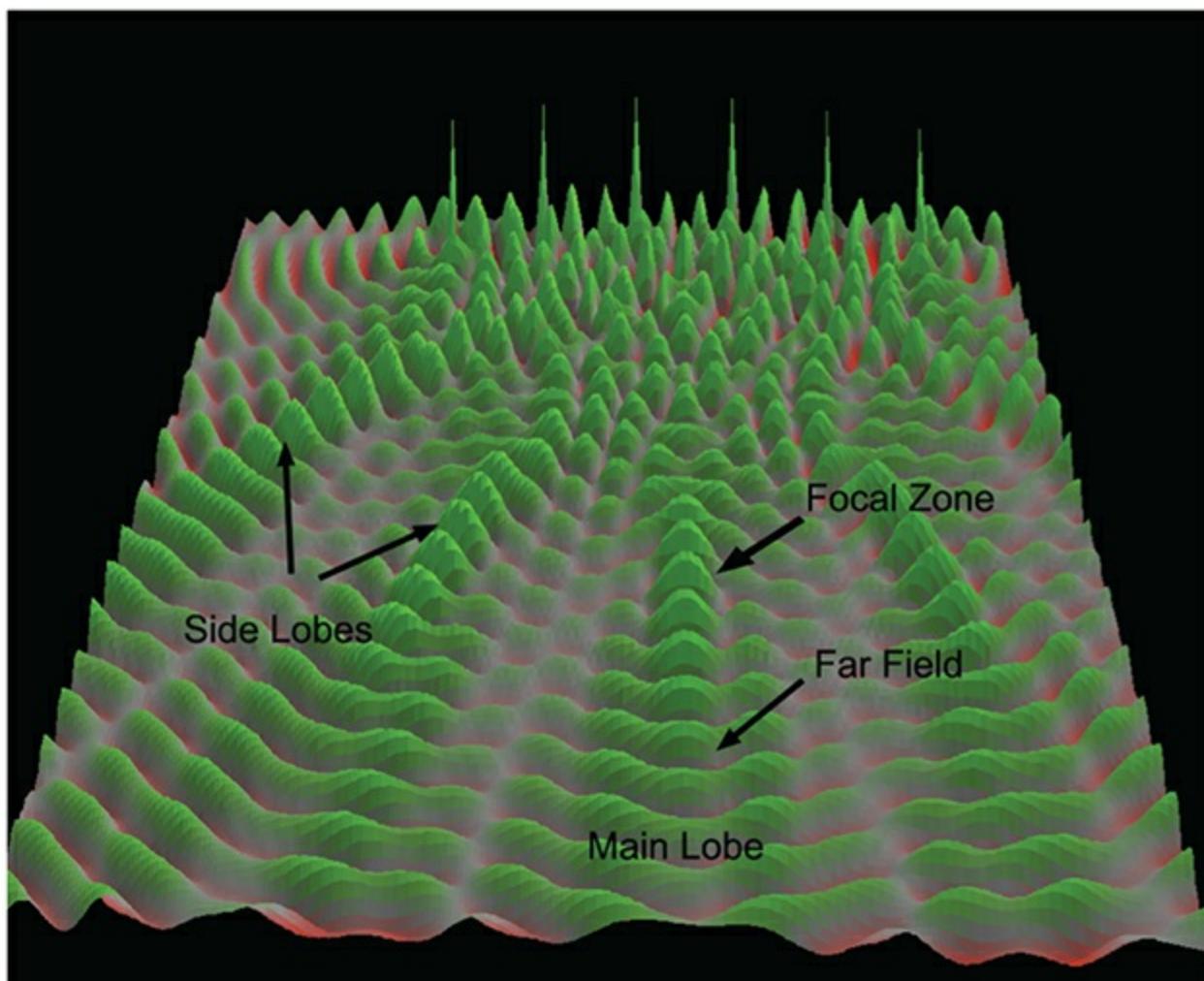
Optimizing Resolution

The interplay of the transducer size, signal frequency, and focal length and the distance of the structure of interest determine beam width and height. The beam is narrowest in the near-field or focal zone and divergent in the far field. Resolution is therefore better in the near field and decreases in the far field. Factors that lengthen the near field, such as a higher transducer frequency and a larger transducer radius, improve lateral and elevational resolution. Focusing further decreases the width of the ultrasound beam and improves lateral and elevational resolution at the focal point. However, focusing often increases beam divergence distal to the focal zone, with an associated loss of lateral and elevational resolution. These factors explain why it is preferable to position a transducer with a relatively high frequency (smaller wavelength) close to the target of interest to optimize both lateral and elevational resolution. More precise measurements are made along the axial plane due to the superior resolution in this orientation.

Extraneous Sound Beams

Side Lobes

Unfortunately, in addition to the powerful forwardly directed beam of sound energy produced by linear array transducers, additional beams of sound are emitted that travel off-axis to the main beam (Figure 1.9;  Video 1.1). These extraneous beams of sound, called side lobes, can significantly affect imaging quality because the transducer incorrectly processes their reflections as reflections of the main beam. Consequently, structures off-axis to the imaging plane appear incorrectly located on the 2D image.



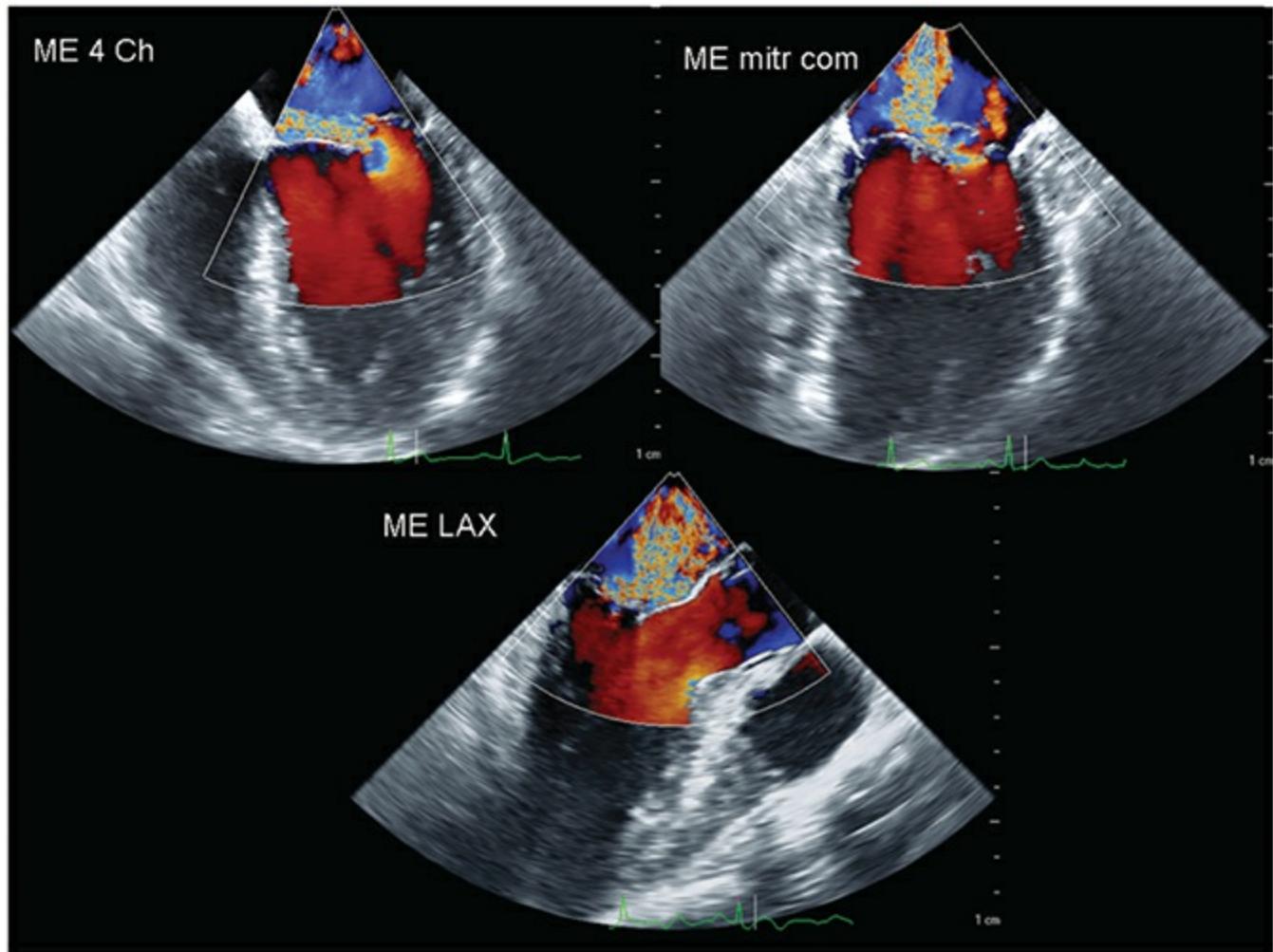


FIGURE 10.23 Color flow Doppler of type II regurgitation, caused by excessive leaflet motion, in this case prolapse affecting the P2 segment. The resulting jet is eccentric, and blood is directed over the corresponding, nonaffected (A2) leaflet. ME LAX, midesophageal long axis.

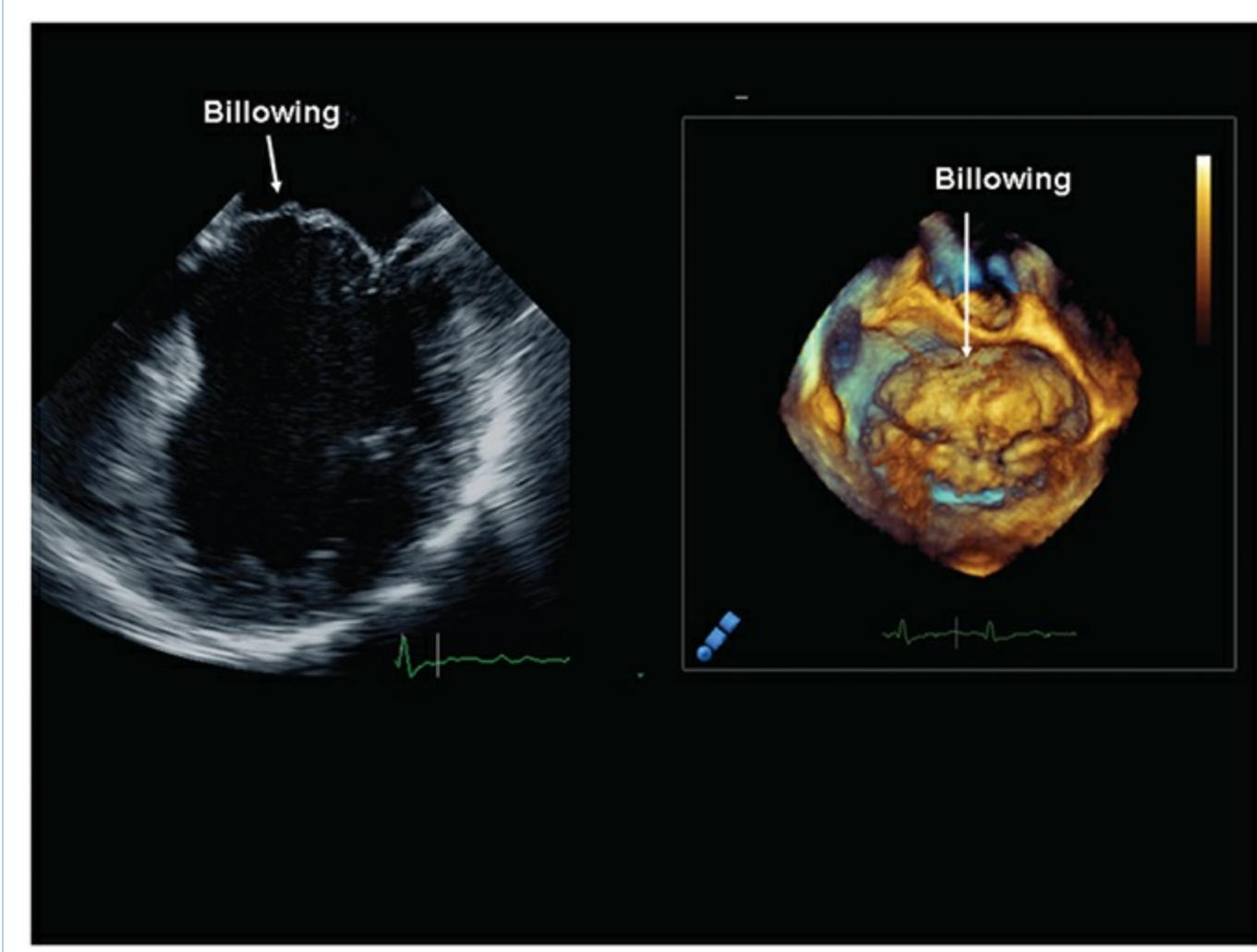


FIGURE 10.25 ME four-chamber view (left) and 3D en face view of the mitral valve from the left atrium (right) both showing extensive billowing of the anterior mitral leaflet. The body of the leaflet, but not its free edge, is pushed over the level of the mitral annulus.

2. Prolapse describes displacement of one or both leaflet edges above the plane of the mitral annulus where the free margin is directed to the left ventricle (Figure 10.26). It is often associated with chordal elongation but can also be associated with chordal rupture ( Videos 10.8-10.13). The regurgitant jet seen with color flow Doppler is always directed over the noninvolved segments in patients with type II dysfunction ( Videos 10.9-10.11).

embolization, 540–541, 541f
fibroma, 539, 540f
lipomas, 536, 538f
metastatic tumors, 540, 541f
myxomas, 536, 537f
normal cardiac structures mistaken for, 537f
papillary fibroelastoma, 536, 538, 539f
rhabdomyomas, 539
Cardioband, 417–420, 418–420f
Cardiomyopathy
 amyloid restrictive, 84f
 arrhythmogenic, 82
 dilated, 79, 81, 82f
 hypertrophic, 78–79, 80f, 81f
 left ventricular hypertrabeculation, 83
 non-dilated left ventricular, 82
 peripartum or postpartum cardiomyopathy, 85
 restrictive, 82–83, 83t
 strain in, 84f
 takotsubo syndrome, 85
 variants, 79f
Cardioplegia, 374–375, 374f
Carpentier–Edwards model 6625 porcine bioprosthetic mitral valve, 310f
Carpentier–Edwards model 6900 bovine pericardial bioprosthetic mitral valve, 310f
Carpentier–Edwards PERIMOUNT Magna valve, 310f
CCTGA. *See* Congenitally corrected transposition of the great arteries (CCTGA)
CCUS. *See* Critical care ultrasound (CCUS)
Ceramic piezoelectric crystal, ultrasound transducer, 7, 7f
Chamber compliance, 152
CHD. *See* Congenital heart disease (CHD)
Chiari network, 585, 586f
Clean envelope, 118
Closure backflow, 303, 313
CO. *See* Cardiac output (CO)
CoA. *See* Coarctation of the aorta
Coarctation of the aorta (CoA)
 anatomy, 498, 499f
 management, 498
 pathophysiology, 498
 transesophageal echocardiographic evaluation, 498–500
Color flow Doppler (CFD), 609–610, 609–610f
Color gain, 609
Color scale displays, 609
Complex aortic atheromas, 546–547, 546f
Compression control, 608, 609f
Congenital coronary artery anomalies
 anatomy, 526, 527f, 528
 management, 528
 pathophysiology, 528
 transesophageal echocardiographic evaluation, 528–529, 528f
Congenital heart disease (CHD), 476
 aortic stenosis
 anatomy, 500
 management, 500
 pathophysiology, 500
 transesophageal echocardiographic evaluation, 500–502, 501–502f
 atrial septal defect
 anatomy, 482, 484, 485f, 486f
 coronary sinus defects, 484
 management, 485–486
 ostium primum defects, 482
 ostium secundum defects, 482
 pathophysiology, 484–485, 486f
 sinus venosus defects, 482, 484
 transesophageal echocardiographic evaluation, 486–490, 487–491f
 classification of, 480
 based on physiology of the defect, 480
 based on presence or absence of cyanosis, 480
 based on severity of disease, 480
 coarctation of the aorta
 anatomy, 498, 499f
 management, 498
 pathophysiology, 498
 transesophageal echocardiographic evaluation, 498–500