Chapter 2
Transesophageal Echocardiography: Essential Views

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Abstract The use of a noncomprehensive basic perioperative transesophageal echocardiographic (PTE) examination, both for intraoperative monitoring and outside of the operating room, is increasing in practice. Cardiac causes of hemodynamic instability, such as ventricular dysfunction, valvular abnormalities, volume status changes, and pericardial abnormalities can be identified with the basic PTE examination. A basic PTE exam is intended to be complementary to comprehensive echocardiography, and thus the practitioner must also recognize when further investigation of an abnormality by an echocardiographer with advanced imaging skills may be required. While the consensus statement of the American Society of Echocardiography (ASE) and Society of Cardiovascular Anesthesiologists (SCA) identifies 11 views for the basic PTE examination, the additional 9 views that comprise the comprehensive examination will also be discussed for completeness.

Keywords Transesophageal echocardiography · Comprehensive perioperative transesophageal examination · Basic perioperative transesophageal echocardiography examination · Basic perioperative TEE certification · TEE perioperative guidelines

Abbreviations

TEE	Transesophageal echocardiography
PTE	Perioperative transesophageal
ASE	American Society of Echocardiography
SCA	Society of Cardiovascular Anesthesiologists
ME	Midesophageal

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AV	Aortic valve
LVOT	Left ventricular outflow tract
RA	Right atrium
LA	Left atrium
RV	Right ventricle
LV	Left ventricle
TV	Tricuspid valve
MV	Mitral valve
LAX	Long axis
SVC	Superior vena cava
IVC	Inferior vena cava
ASD	Atrial septal defect
PFO	Patent foramen ovale
RVOT	Right ventricular outflow tract
SAX	Short axis
TG	Transgastric
UE	Upper esophageal

The goal of this chapter is for the echocardiographer to become familiar with the imaging views required to perform a basic perioperative transesophageal (PTE) examination. Specific pathologies that can be appreciated in each view are discussed in subsequent chapters. As outlined by the consensus statement of the American Society of Echocardiography (ASE) and Society of Cardiovascular Anesthesiologists (SCA), the basic PTE examination focuses on acquiring the 11 most relevant views [1]. Though prior guidelines for performing a comprehensive PTE examination consists of acquiring 20 views [2], with the expansion of indications for TEE the most recent guidelines have expanded with the addition of 8 views [3] for a total of 28 views in a complete comprehensive exam. While the 11 views of a basic PTE examination will provide the information needed to monitor patients perioperatively and diagnose general etiologies of hemodynamic instability (e.g., ventricular dysfunction, valvular abnormalities, volume status changes, and pericardial abnormalities), the basic PTE echocardiographer should also be familiar with how to perform the comprehensive examination. This textbook will describe the additional views to complete a 20-view comprehensive exam. The recent addition of 8 views focus on structures such as the different pulmonary veins, left atrial appendage, and the right ventricular outflow and pulmonic valve views which would rarely be indicated in a basic PTE exam. The basic PTE examination is designed to be complementary to a comprehensive TEE examination. Therefore, consultation with an advanced PTE echocardiographer should be requested when complex pathology is anticipated or when further investigation of abnormality is desired.

Beginning echocardiographers often exhibit anxiety and fear when learning the examination with a focus on the order of the exam. Each echocardiographer will have a different approach to the TEE examination and the order of the examination is not critical. Completeness of the examination without missing important data is the most important aspect. This text will offer a suggested order of views for both a basic and comprehensive examination based upon minimizing significant probe movement between views and maximizing the data obtained (Tables 2.1 and 2.2). It is suggested for the beginning echocardiographer to perform PTE exams as often as possible, when clinically indicated, in order to develop a comfort level when moving from one view to the next and to learn anatomical relationships.

In addition to obtaining the particular image, there are specific anatomical and physiologic interrogations that should occur within the image. These interrogations are divided into two-dimensional (2D) analysis, color flow Doppler (CFD) and spectral Doppler (pulsed wave and continuous wave) interrogation. It is recommended for the beginning echocardiographer to develop a systematic approach to the interrogations as well as simply obtaining the images. For example, when obtaining the midesophageal four-chamber view, a 2D image is acquired, color flow Doppler interrogation of the mitral valve and tricuspid valve is acquired, followed by a pulsed wave or continuous wave Doppler interrogation of mitral valve and tricuspid valve inflow and regurgitation. This approach of 2D > CFD > Spectral allows an echocardiographer to develop an approach to the examination without missing data and prevents "bouncing" around the exam. Additionally, pathologies in this textbook will be summarized in the 2D > CFD > Spectral format, highlighting important findings for each interrogation.

Basic PTE Examination

The following are the 11 views as described by the ASE and SCA for performing a basic PTE examination. The additional 9 views that comprise the comprehensive exam will be subsequently discussed. Many practitioners will find that a complete 20-view examination is rarely necessary for a basic perioperative echocardiographic assessment. However, becoming familiar with all 20 views will allow the echocardiographer to become adept at choosing which views to obtain in a focused examination to evaluate for specific pathologies.

Midesophageal (ME) Four-Chamber View

The ME four-chamber view is obtained by inserting the TEE probe approximately 30–35 cm. A midesophageal position is identified by observing the left atrium at the apex of the imaging display. If the aortic valve (AV) and left ventricular outflow tract (LVOT) are visible (five-chamber view), then retroflexion of the probe and

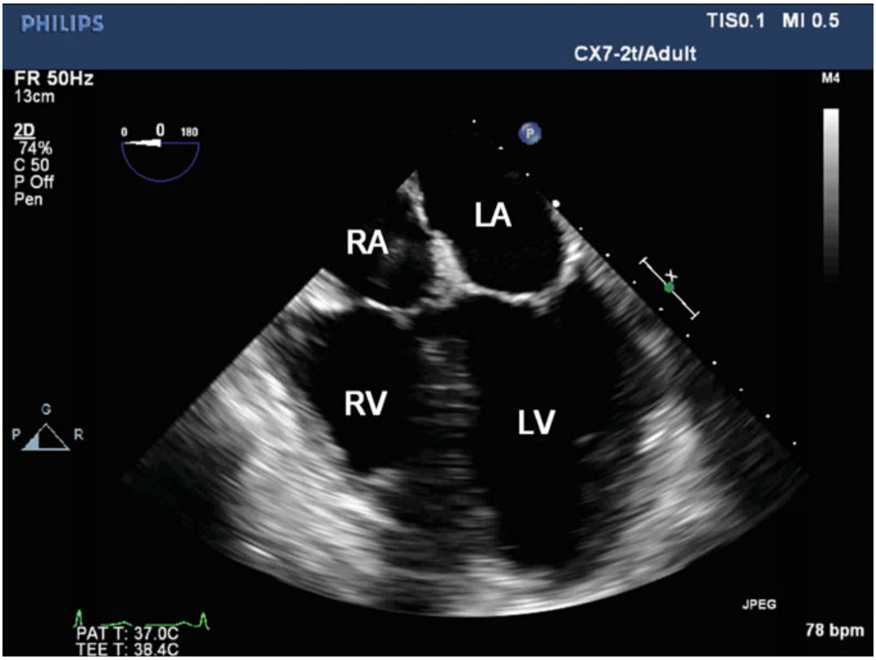


Fig. 2.1 ME four-chamber view. *RA* right atrium; *RV* right ventricle; *LA* left atrium; *LV* left ventricle

adjustment of the multiplane angle to 10° may be necessary to obtain the ME four-chamber view. Structures that should be visible in this view include the right atrium (RA), interatrial septum, left atrium (LA), right ventricle (RV), interventricular septum, left ventricle (LV), tricuspid valve (TV), and mitral valve (MV). The image depth should be adjusted so that the apex of the LV is visible as well.

The ME four-chamber view is often a readily identified and very useful view to acquire. It provides significant amounts of information, typically without any manipulation of the multiplane. Returning to this zero degree view is recommended if the echocardiographer becomes disoriented during their TEE evaluation. The ME four-chamber view allows evaluation of chamber sizes, function, valvular function, and regional wall motion of the septal and lateral walls of the LV (Fig. 2.1; Video 2.1). Two-dimensional evaluation allows inspection of LV and RV size and systolic function, evidence of wall motion abnormalities (WMA), tricuspid and mitral valve anatomy and motion, chamber sizes of RA, LA, LV and RV, and motion of the interatrial and interventricular septums. Color flow Doppler is utilized to interrogate the mitral and tricuspid valves for stenosis and regurgitation. Spectral Doppler is often utilized to measure mitral valve inflow in the evaluation of diastology and mitral stenosis.

ME Two-Chamber View

To obtain the ME two-chamber view, the multiplane angle is rotated to 80–100° until the right-sided cardiac structures are no longer visible. The probe is turned to the left and right until the LV apex is visualized in the far field. Structures that are visible in the ME two-chamber view are the left atrium, mitral valve, left ventricle, left atrial appendage (LAA), and left upper pulmonary vein (Fig. 2.2; Video 2.2). A short axis view of the coronary sinus can also be appreciated in this view. 2D evaluation focuses on regional wall motion of the anterior and inferior walls of the LV, mitral valve motion, and thrombus in the LV apex or left atrial appendage. Color flow Doppler of the MV and LAA are helpful in evaluating for regurgitation and thrombus formation respectively. Spectral Doppler can be helpful in evaluating mitral inflow and thrombus formation in the MV and LAA, respectively.

ME Long Axis (LAX) View

From the ME two-chamber view, the multiplane angle is advanced to approximately 120° when the LVOT is seen to obtain the ME LAX view. All patients are

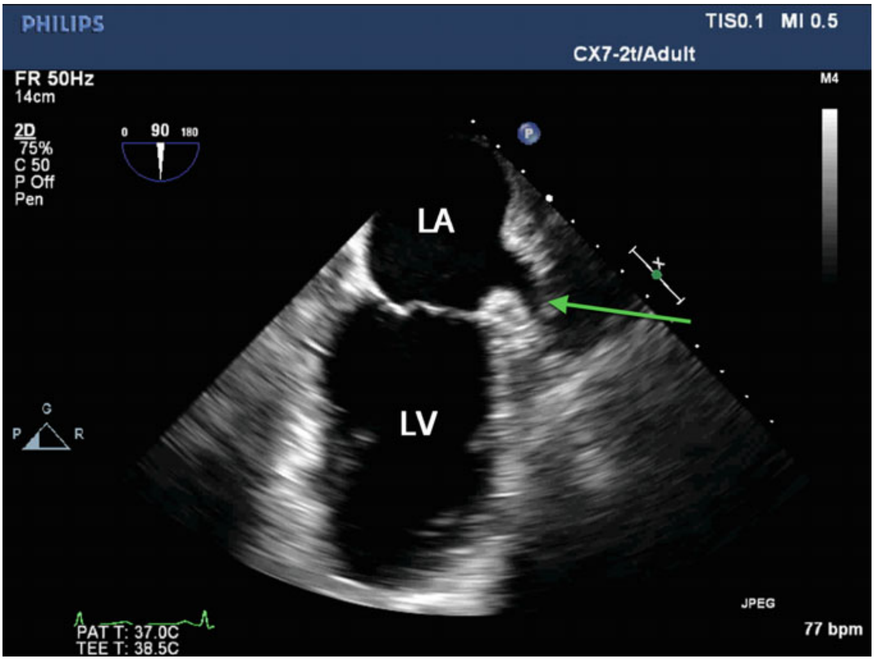


Fig. 2.2 ME two-chamber view with *green arrow* indicating the left atrial appendage. *LA* left atrium; *LV* left ventricle

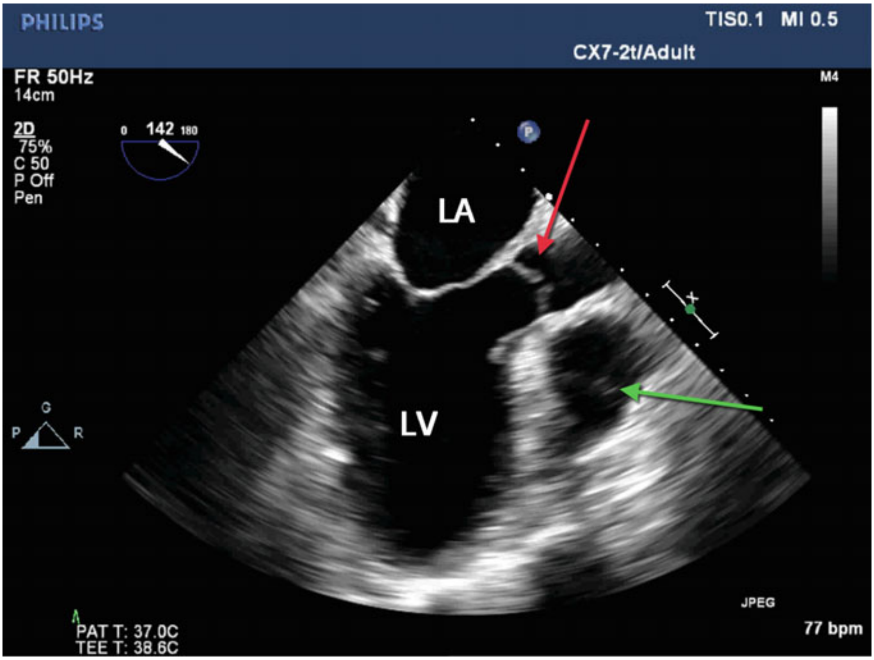


Fig. 2.3 ME LAX view with a *red arrow* indicating the aortic valve and a *green arrow* indicating the right ventricular outflow tract. *LA* left atrium; *LV* left ventricle

obviously different and therefore the multiplane degree is simply an estimate; this view may be developed in some patients as far out as 160°. The left atrium, mitral valve, left ventricle, LVOT, and aortic valve (AV) should be visible in this view (Fig. 2.3; Video 2.3). This view is similar to the ME AV LAX (see "Additional Views" below). However, rather than focusing on the AV, the LV inflow and outflow tract as well as the entirety of the LV cavity can be seen in this view. 2D assessments that can be made in the ME LAX view include chamber sizes, regional wall motion of the anteroseptal and inferolateral walls of the LV, and mitral valve and aortic valve anatomy and motion. Color flow Doppler interrogation of the MV and AV and spectral Doppler interrogation of the mitral valve is possible as well. The AV is often positioned perpendicular to the probe in this view and is therefore not conducive to spectral Doppler interrogation.

ME AV Short Axis (SAX) View

In TEE, when rotating the multiplane by 90°, the object in the center of the image will be rotated from a long axis to a short axis orientation and vice versa. From the ME LAX view, centering the AV by slowly withdrawing the probe and then

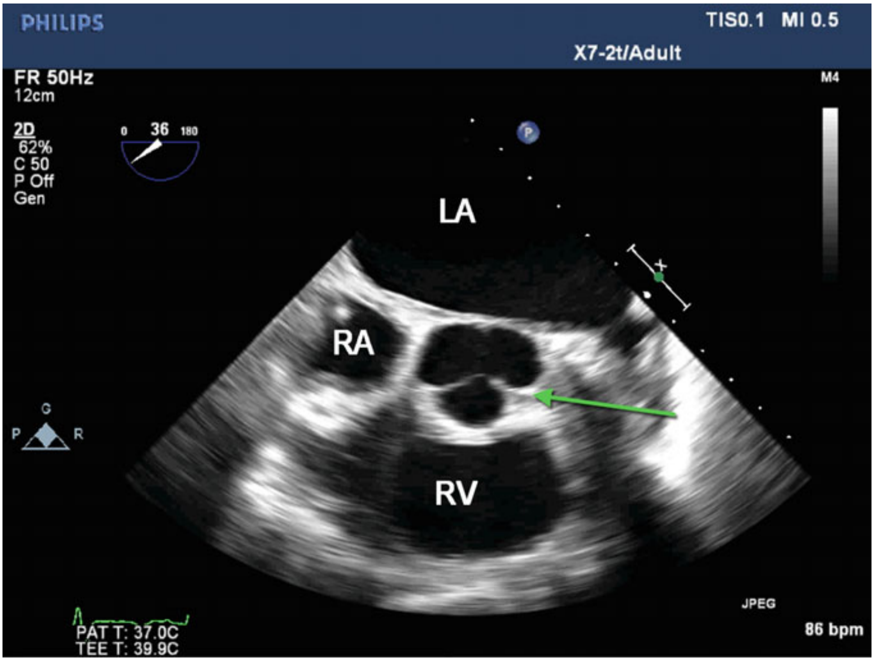


Fig. 2.4 ME AV SAX view with a *green arrow* indicating the aortic valve in short axis. *LA* left atrium; *RA* right atrium; *AV* aortic valve; *RV* right ventricle

rotating the multiplane back to 30° represents a 90° change. This will develop the ME AV SAX view with the cusps of the AV clearly seen (Fig. 2.4; Video 2.4). Two-dimensional assessment includes the general morphology of the AV (tricuspid versus bicuspid) as well as calcifications and mobility of the aortic leaflets. Color flow Doppler allows for interrogation of aortic regurgitation. Again the perpendicular orientation of the AV precludes spectral Doppler interrogation. Lastly, the interatrial septum can be identified proximal to the AV and can be evaluated for an atrial septal defect (ASD) or a patent foramen ovale (PFO).

ME Right Ventricular (RV) Inflow–Outflow View

The far field of the ME AV SAX view demonstrates the right ventricle (anterior to the aortic valve). Often the RA and part of the tricuspid valve may be visualized. Maintaining the RA and RV in view and increasing the multiplane to 60–90° will bring the right ventricular outflow tract (RVOT) and pulmonic valve into view, constituting the ME right ventricular inflow–outflow view (Fig. 2.5; Video 2.5). While

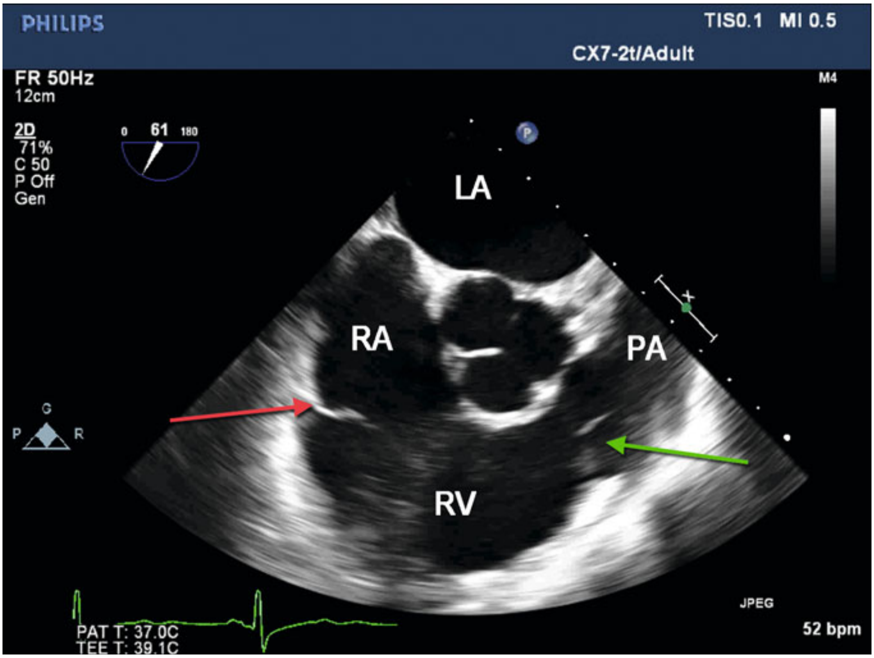


Fig. 2.5 ME RV inflow–outflow view with the *red arrow* indicating the tricuspid valve and the *green arrow* indicating the pulmonic valve. *LA* left atrium; *RA* right atrium; *RV* right ventricle; *PA* pulmonary artery

some of the AV may still be in view, the focus of this view is the RA, tricuspid valve, RV, RVOT, pulmonic valve, and the proximal pulmonary artery. The "wrapping around" nature of the right heart is demonstrated by seeing the RA, RV, and PA come around anteriorly to the AV. Two-dimensional assessment includes RV size and function, TV and PV anatomy and motion, and the position of the interatrial septum (the septum will bow away from the chamber with higher pressure). Color flow Doppler assessment focuses on the TV and PV for regurgitation and stenosis as well as the interatrial septum for a PFO or an ASD. Spectral Doppler interrogation of the TV may prove helpful in estimating PA pressure (see Chaps. 3 and 8).

ME Bicaval View

The ME bicaval view is obtained by rotating the multiplane angle to 90–110° and physically turning the probe clockwise. As a midesophageal view, the left atrium remains closest to the probe (apex of the imaging window), however, turning the

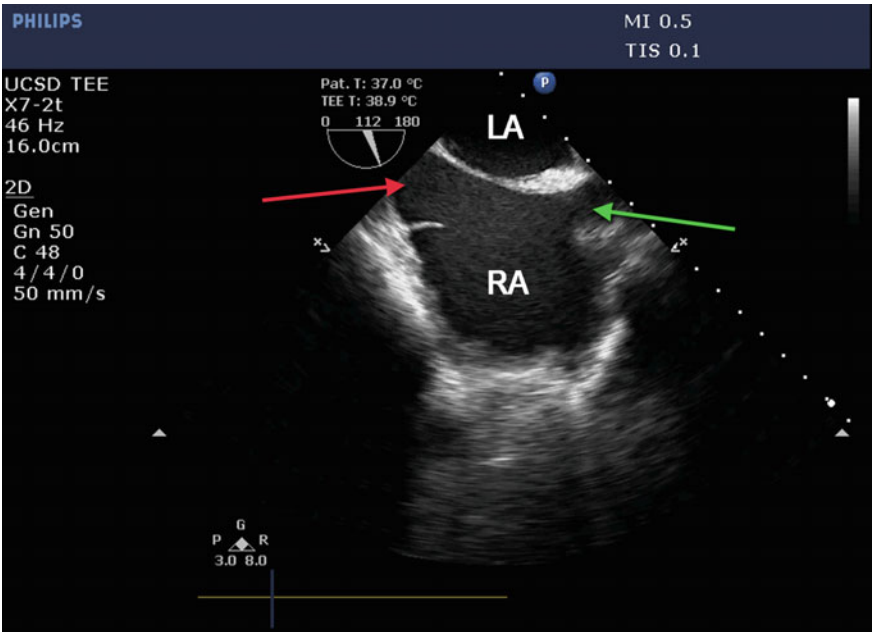


Fig. 2.6 ME bicaval view with the *red arrow* indicating the inferior vena cava and the *green arrow* indicating the superior vena cava. *LA* left atrium; *RA* right atrium

probe clockwise moves the interatrial septum into the center of the image and the right atrium into the far field. The 90° orientation places the superior vena cava (SVC) on the right and the inferior vena cava (IVC) on the left of the RA (Fig. 2.6; Video 2.6). Two-dimensional assessment focuses on atrial size, interatrial septum competency and direction (the septum bows away from the chamber with higher pressure) and anatomical variants (see Chap. 12). Additionally, the ME bicaval view can aid in the placement of central venous catheters by observing the initial wire placement in the RA. Color flow Doppler interrogation aids in detection of an ASD or a PFO. An agitated saline study may also be utilized in this view to demonstrate a PFO. Spectral Doppler is not typically employed in a ME bicaval view.

ME Ascending Aortic SAX and LAX Views

Returning the multiplane to zero degrees (roughly the ME Four-Chamber view) and then withdrawing the probe allows the development of the ME ascending aortic SAX view which provides an image of the proximal ascending aorta and bifurcation of the main pulmonary artery is visualized. Slight anteflexion of the probe and rotation of the multiplane angle from 0 to 45° may be necessary to optimize the

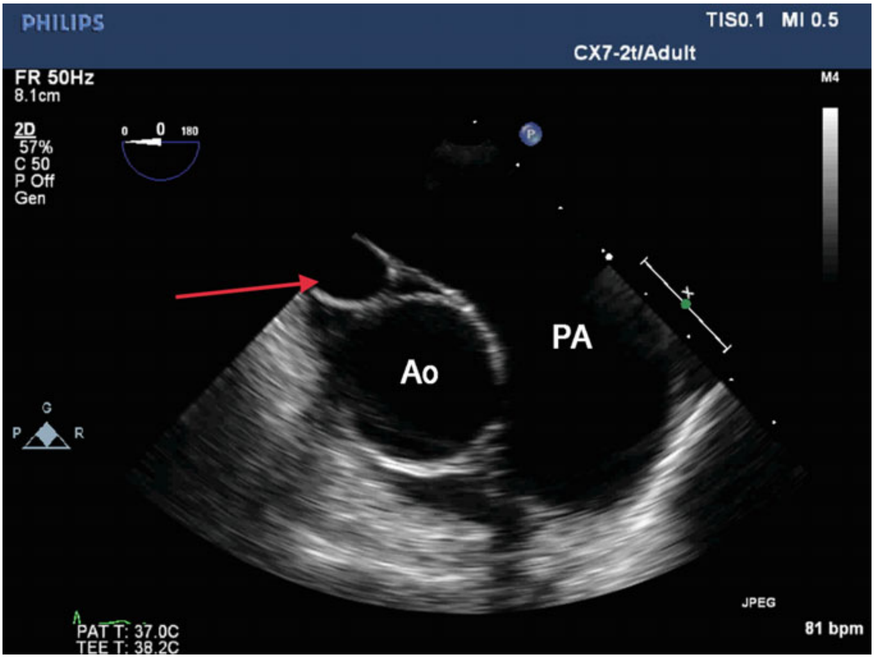


Fig. 2.7 ME Ascending Aortic SAX view with a *red arrow* indicating the superior vena cava. *Ao* ascending aorta; *PA* pulmonary artery

image (Fig. 2.7; Video 2.7). The right pulmonary artery in this view lies immediately posterior to the proximal ascending aorta in a long axis orientation. The left pulmonary artery is typically not visualized due to the interposed air-filled left main bronchus. Two-dimensional assessment is utilized for identification of aneurysms, plaque, and dissections of the ascending aorta as well as for identifying thrombus in the main or right pulmonary artery. Color flow Doppler may be helpful in the setting of aortic dissection (see Chap. 10). Spectral Doppler is often not employed in this view during a basic examination.

To obtain the ME ascending aortic LAX view, the aorta is centered in the image and the multiplane angle is rotated to approximately 90° until the right pulmonary artery is seen in the short axis while the ascending aorta is seen in the long axis (Fig. 2.8; Video 2.8). Similarly, two-dimensional assessment is utilized for identifications of aneurysms, plaque, and dissections of the ascending aorta as well as for identifying thrombus in the right pulmonary artery. Color flow Doppler may be helpful in the setting of aortic dissection while spectral Doppler is often not employed in this view during a basic examination.

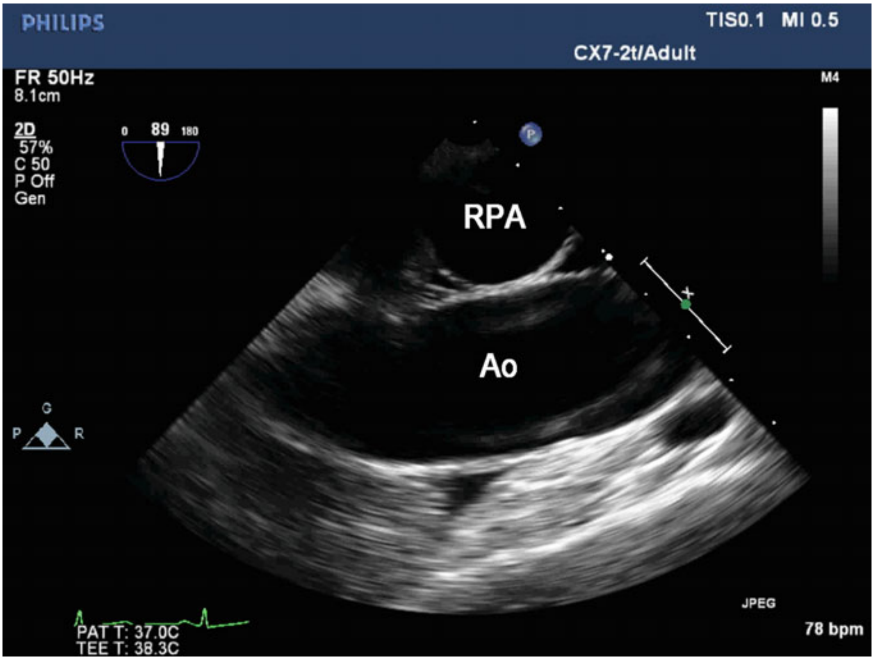


Fig. 2.8 ME Ascending Aortic LAX view. *Ao* ascending aorta; *RPA* right pulmonary artery

Transgastric (TG) Midpapillary SAX View

In order to obtain the TG midpapillary SAX view, the probe is returned to the ME four-chamber view at 0° and then advanced into the stomach. When advancing, the image on the screen will often disappear when entering into the stomach as the probe is no longer adjacent to tissue (free floating in the stomach). While keeping the multiplane angle at 0°, the probe is gradually anteflexed while the depth is adjusted until the posteromedial and anterolateral papillary muscles are visualized. A proper TG midpapillary SAX view can be difficult to obtain since proper depth and anteflexion are required to obtain a true short axis cross section of the LV. Since the posteromedial papillary muscle is closest to the TEE probe, the depth of the probe should first be adjusted until it is visualized. If the MV chordae tendinae are visible, then the probe is too high and should be advanced. Once the depth is appropriate, small adjustments to the degree of anteflexion should be made until the anterolateral papillary muscle comes into view (Fig. 2.9; Video 2.9).

The TG midpapillary SAX view is commonly used during intraoperative monitoring and may frequently be the first view assessed during hemodynamic instability. Two-dimensional assessment includes volume status, LV systolic function, and regional wall motion. The TG midpapillary SAX view is especially useful because all three coronary arteries that perfuse the different segments of the

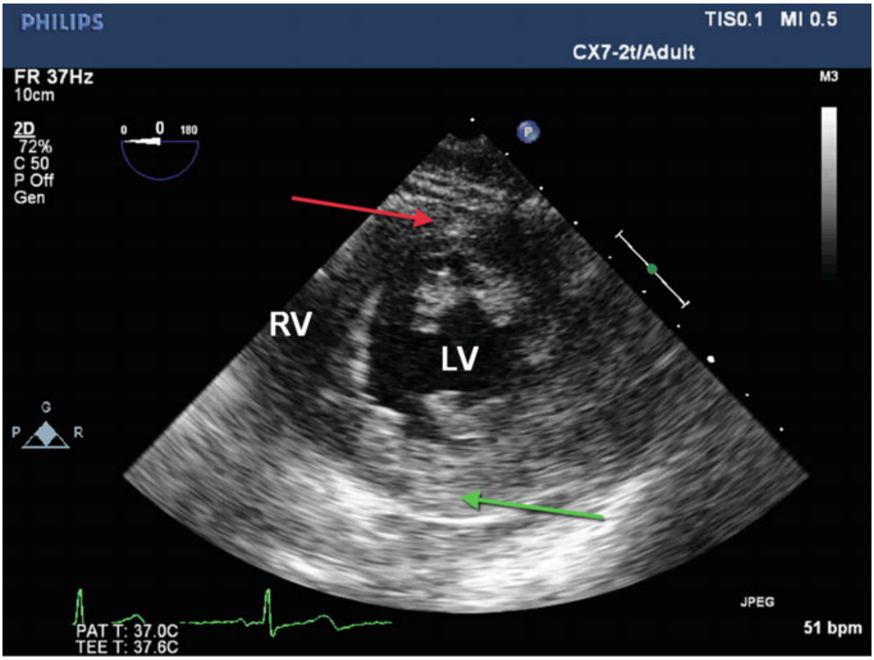


Fig. 2.9 TG midpapillary SAX view. The *green arrow* indicates the anterior wall of the left ventricle (LV), while the *red arrow* indicates the inferior wall of the LV. *RV* right ventricle

myocardium can be assessed simultaneously. However, it is important to remember that this view only provides a single cross-sectional view of the LV and inadequate coronary perfusion to the base and apex of the LV will not be detected (see Chap. 4—Left Ventricular Systolic Function). Color flow Doppler and spectral Doppler are typically not employed in this view.

Descending Aortic SAX and LAX Views

To obtain the descending aortic SAX view, the probe is returned to the ME four-chamber view at 0° and turned counterclockwise until the circular-shaped descending aorta appears in the apex of the image display. To enlarge and optimize the image, the image depth is decreased and the focus moved to the near field (Fig. 2.10; Video 2.10). The probe can then be withdrawn and advanced, imaging the entire descending aorta in short axis. The aortic arch is reached when the aorta appears elongated at the apex of image display (see "Additional Views" below). At any point during the evaluation of the SAX of the descending aorta, the multiplane

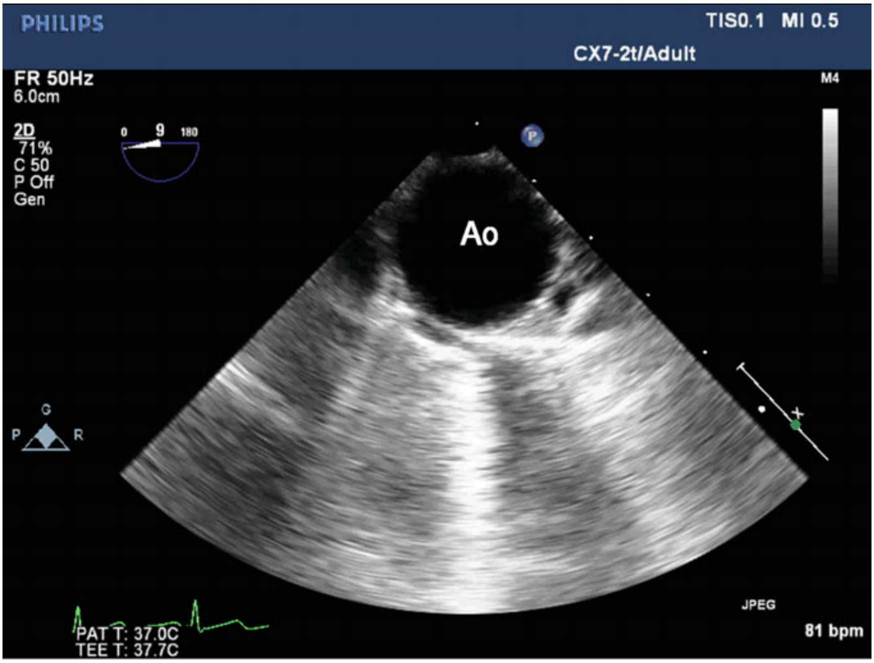


Fig. 2.10 Descending aortic SAX view. *Ao* descending aorta

angle can be rotated to approximately 90° to obtain the descending aortic LAX view (Fig. 2.11; Video 2.11). Two-dimensional assessment in these views includes aortic diameter, degree of atherosclerosis, and presence of a dissection. Color flow Doppler may be helpful in a dissection (see Chap. 10) while spectral Doppler of a descending aortic LAX view may be helpful in assessing aortic valve regurgitation (see Chap. 7). In addition, the presence of a left pleural effusion (anterior to the descending aorta) can be identified in the descending aortic SAX view (Fig. 2.12; Video 2.12).

Additional Views

When added to the basic PTE exam, the following 9 additional views described below make up a comprehensive TEE examination and are included for completeness.

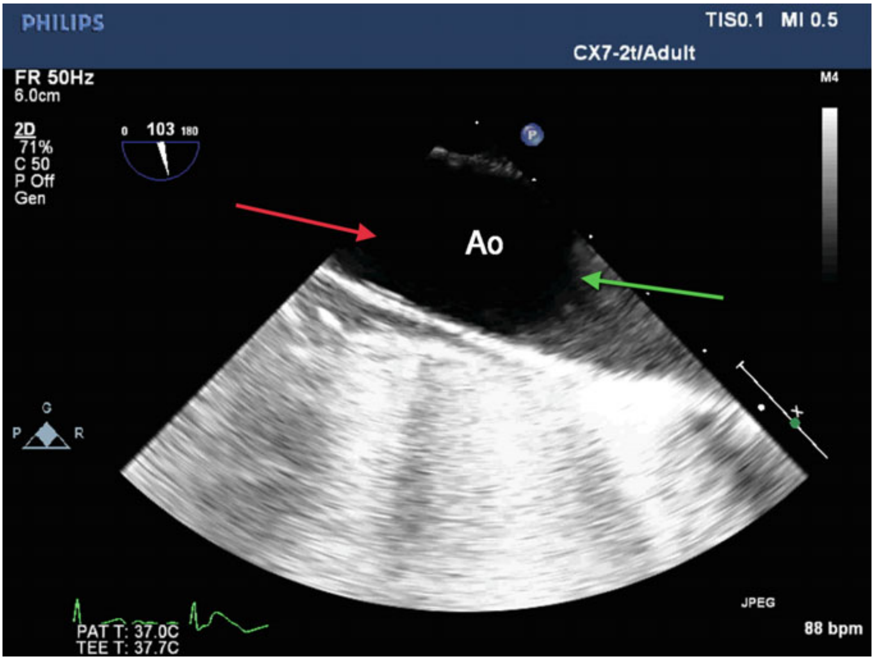


Fig. 2.11 Descending aortic LAX view. The *green arrow* indicates proximal while the *red arrow* indicates distal aortic segments. *Ao* descending aorta

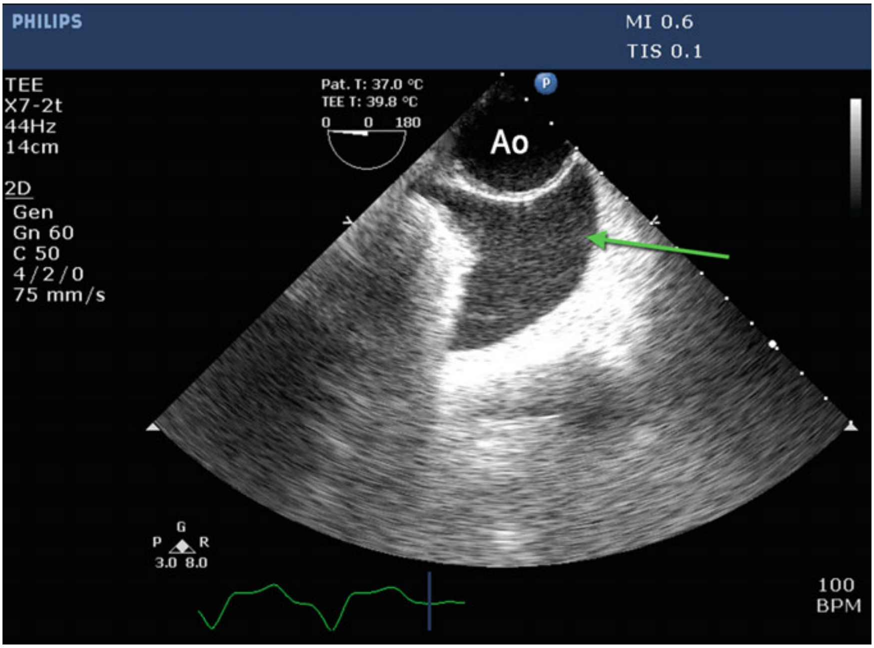


Fig. 2.12 Descending aortic SAX view with a left pleural effusion (*green arrow*). *Ao* descending aorta

ME Mitral Commissural View

From the ME four-chamber view with the mitral valve positioned in the center of the image, the multiplane angle is rotated to approximately 60° to obtain the ME mitral commissural view. As the coaptation line of the MV is curved ("smile shaped"), the ME mitral commissural view will image through the coaptation line twice, giving the appearance of a posterior leaflet on the left and right with a central anterior leaflet portion. This view is helpful in evaluating the location of mitral valve pathology given that multiple scallops (P3-A2-P1) of the mitral valve can be seen (see Chap. 6). Other structures that can be seen include papillary muscles, chordae tendinae, and the coronary sinus (Fig. 2.13; Video 2.13). This view generally involves a 2D assessment of MV leaflet motion as well CFD for localizing regurgitation.

ME AV LAX View

To obtain the ME AV LAX view, the multiplane angle is rotated to 120–140° followed by a slight clockwise turn of the probe. In this view, the LVOT, aortic

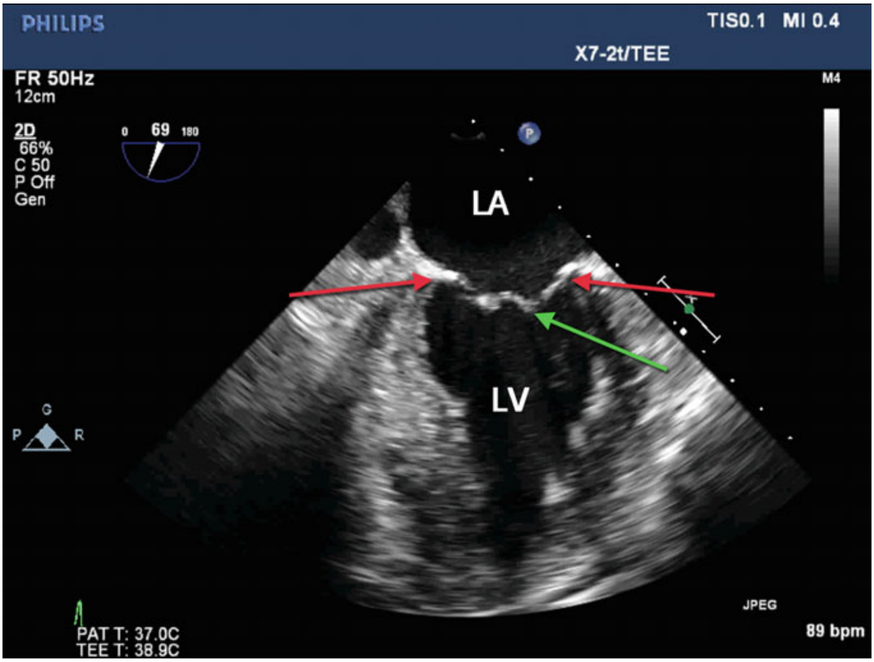


Fig. 2.13 ME mitral commissural view. The *red arrows* indicate posterior mitral valve leaflet, while the *green arrow* indicates anterior mitral valve leaflet. *LA* left atrium; *LV* left ventricle

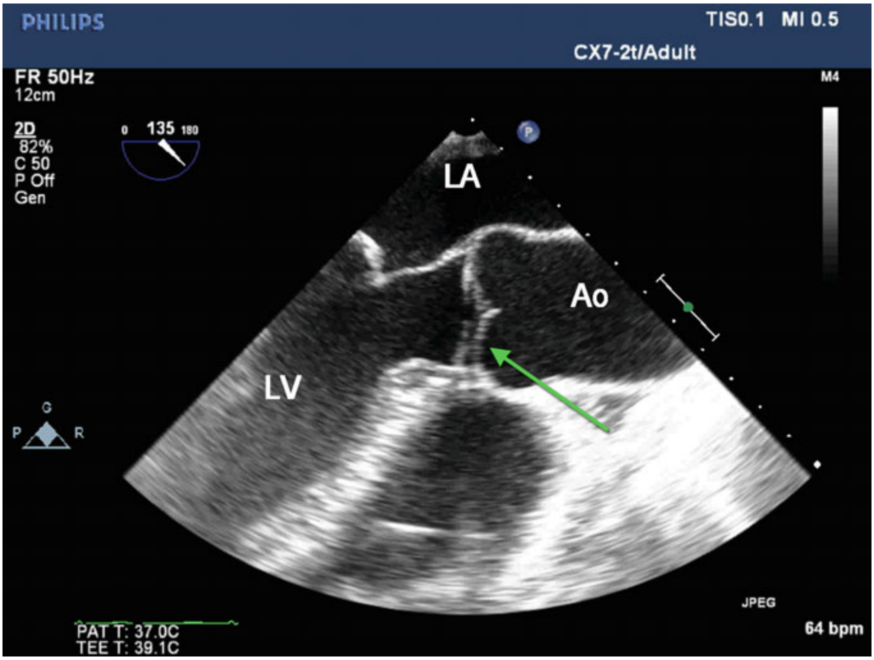


Fig. 2.14 ME AV LAX view with the aortic valve indicated by the *green arrow*. *LA* left atrium; *LV* left ventricle; *Ao* proximal ascending aorta

valve, sinus of Valsalva, sinotubular junction, and proximal ascending aorta should be visualized well (Fig. 2.14; Video 2.14). Compared to the ME LAX view, the ME AV LAX view allows better evaluation of aortic valve function both structurally and with color flow Doppler, measurements of structures from the annulus to the proximal ascending aorta, as well as appreciation of atherosclerotic plaques and dissections.

TG Basal SAX View

From the ME four-chamber view, the probe is advanced into the stomach and then anteflexed to obtain the TG basal SAX view of the LV. If the papillary muscles of the LV (TG midpapillary SAX view) are seen, then the probe is slowly withdrawn until the mitral valve or “fish mouth” comes into view (Fig. 2.15; Video 2.15). This view can be used to evaluate calcifications of the mitral valve and estimate mitral

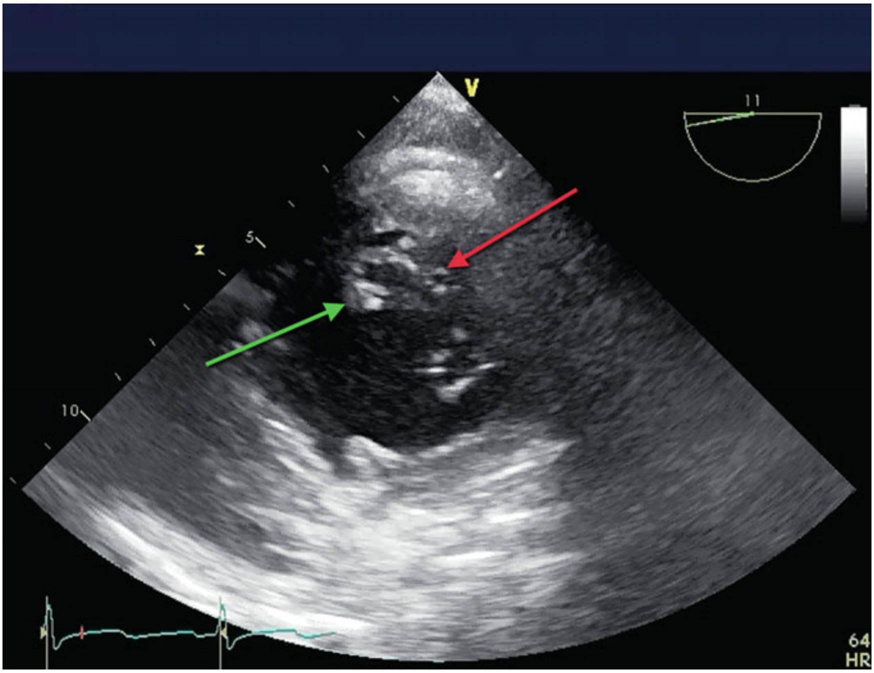


Fig. 2.15 TG basal SAX view with the *green arrow* indicating edge of the anterior mitral valve leaflet and the *red arrow* indicating the posterior mitral valve leaflet

valve area using planimetry for 2D assessment and localizing regurgitation using CFD (see Chap. 6).

TG Two-Chamber View

From the TG midpapillary SAX view, the multiplane angle is rotated to approximately 90–110° to obtain the TG two-chamber view. This view provides a lengthwise view of the LV for evaluation of regional wall motion abnormalities. The posterior wall is located at the apex of imaging sector while the anterior wall is located at the bottom, allowing visualization of the base, mid and apical segments of both walls (Fig. 2.16; Video 2.16).

TG LAX View

From the TG two-chamber view, the multiplane angle is rotated further to approximately 120–140° until the LVOT and aortic valve comes into view at the 4

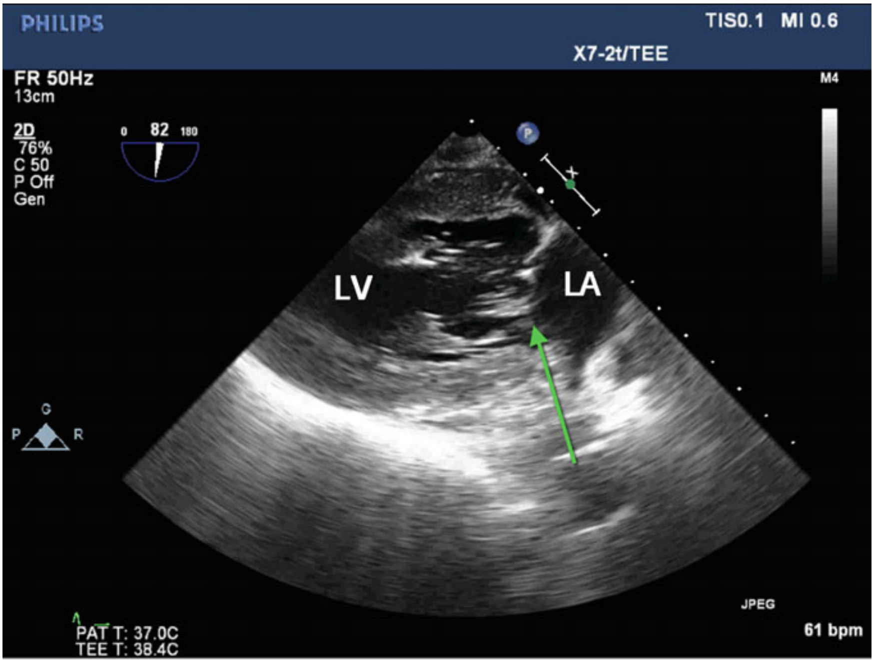


Fig. 2.16 TG two-chamber view with the *green arrow* indicating the mitral valve. Note the papillary muscles and chordae attached to the mitral valve. *LA* left atrium; *LV* left ventricle

o'clock position. In addition to the deep TG LAX view (see below), this view is useful for spectral Doppler interrogation of the LVOT and aortic valve (Fig. 2.17; Video 2.17).

Deep TG LAX View

With the multiplane angle at 0°, the probe is advanced deep into the stomach, anteflexed, left-flexed, and then slowly withdrawn until the deep TG LAX view is imaged (Fig. 2.18; Video 2.18). In this view, the LVOT and aortic valve are aligned parallel with the ultrasound beam. This parallel orientation allows for optimal spectral Doppler interrogation. Slow turning of the probe to the left or right may be needed for proper alignment. Two-dimensional interrogation focuses on the LV apex (at the apex of the image sector), the mitral and aortic valves, as well as the ventricular walls. Color flow Doppler interrogation focuses on the MV and AV.

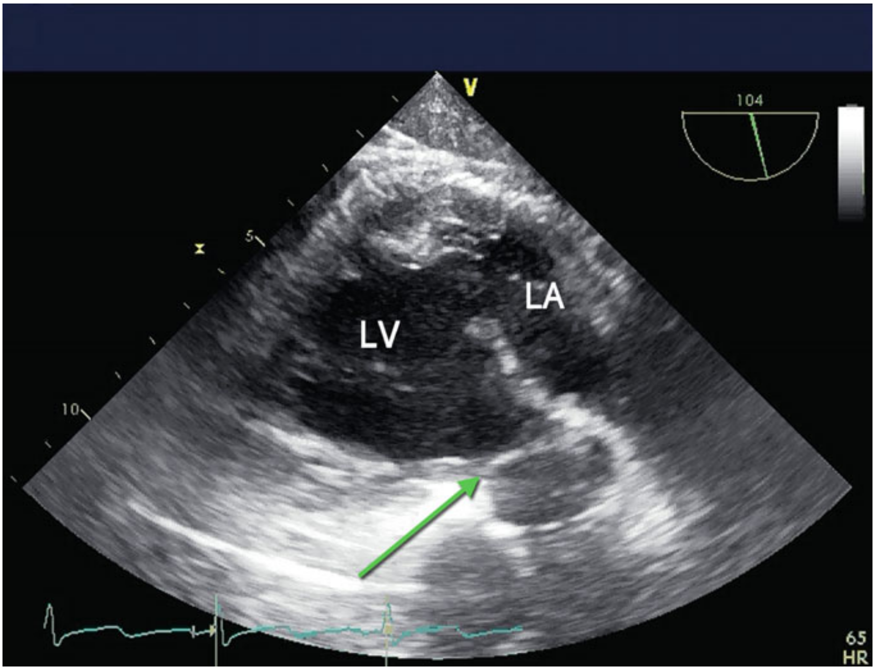


Fig. 2.17 TG LAX view with the *green arrow* indicating the aortic valve. *LA* left atrium; *LV* left ventricle

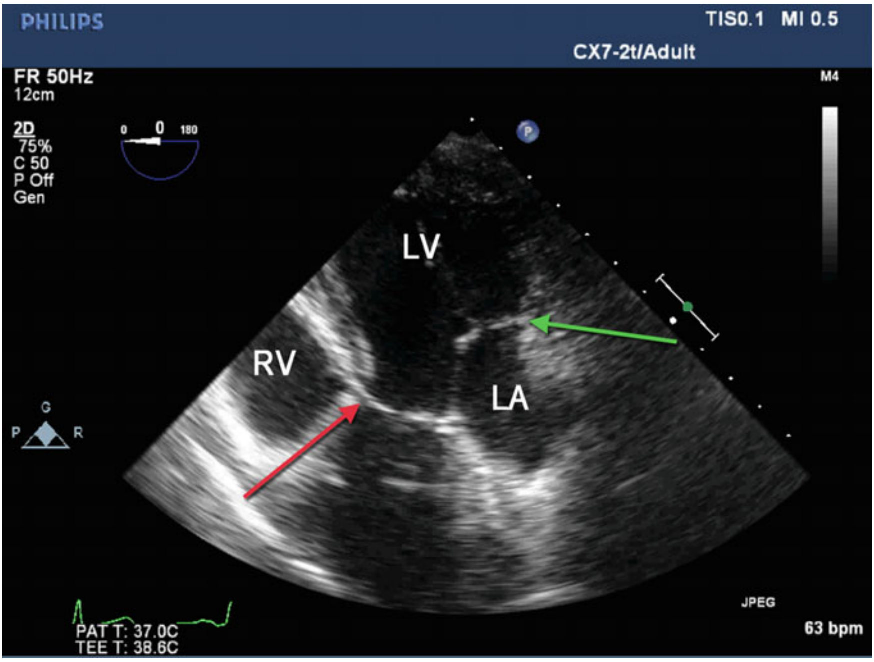


Fig. 2.18 Deep TG LAX view. The *green arrow* denotes the mitral valve, while the *red arrow* indicates the aortic valve. *LA* left atrium; *LV* left ventricle; *RV* right ventricle

Spectral Doppler interrogation includes pulsed wave Doppler evaluation of the LVOT as well as continuous wave Doppler evaluation of the AV. This information will be helpful in detecting aortic valve gradients, aortic valve area, and cardiac output (see Chap. 3).

TG RV Inflow View

Starting from the TG midpapillary SAX view, the probe is turned slightly clockwise until the RV is in the center of the image sector and the multiplane angle subsequently advanced to 90–110° until the TG RV inflow view is seen (Fig. 2.19; Video 2.19). This view can be used to evaluate the function and thickness of the RV free wall as well as tricuspid valve annular size and leaflet motion. The perpendicular orientation of the TV precludes spectral Doppler analysis of the TV.

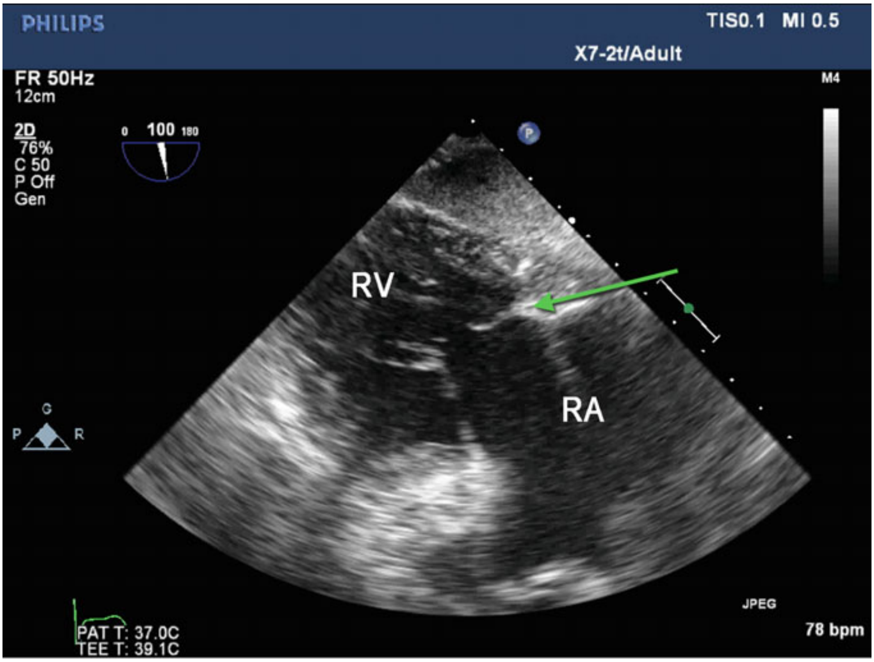


Fig. 2.19 TG RV inflow view. The *green arrow* indicates the tricuspid valve. *RA* right atrium; *RV* right ventricle

Upper Esophageal (UE) Aortic Arch LAX and SAX Views

From the ME descending aortic SAX view (Fig. 2.10; Video 2.10), the probe is slowly withdrawn and turned clockwise (to maintain the aorta in the center of the imaging sector) until the aorta begins to elongate. Once the aorta has elongated into an oval shape, the UE aortic arch LAX view has been developed. The image depth may need to be decreased to optimize visualization (Fig. 2.20; Video 2.20). This view can be used to evaluate atherosclerotic plaques in the aortic arch as well as aneurysms and dissections. To obtain the UE aortic arch SAX view, the mutiplane angle is rotated to 70–90°. This places the aortic arch in a SAX view as well as brings the pulmonic valve and main pulmonary artery into view on the left-hand side of the screen. Because of the parallel alignment of the pulmonic valve and main pulmonary artery with the spectral Doppler line, Doppler interrogation of the pulmonary valve can be performed in this view. Other structures that can also be visualized include the left subclavian artery and the brachiocephalic vein (Fig. 2.21; Video 2.21).

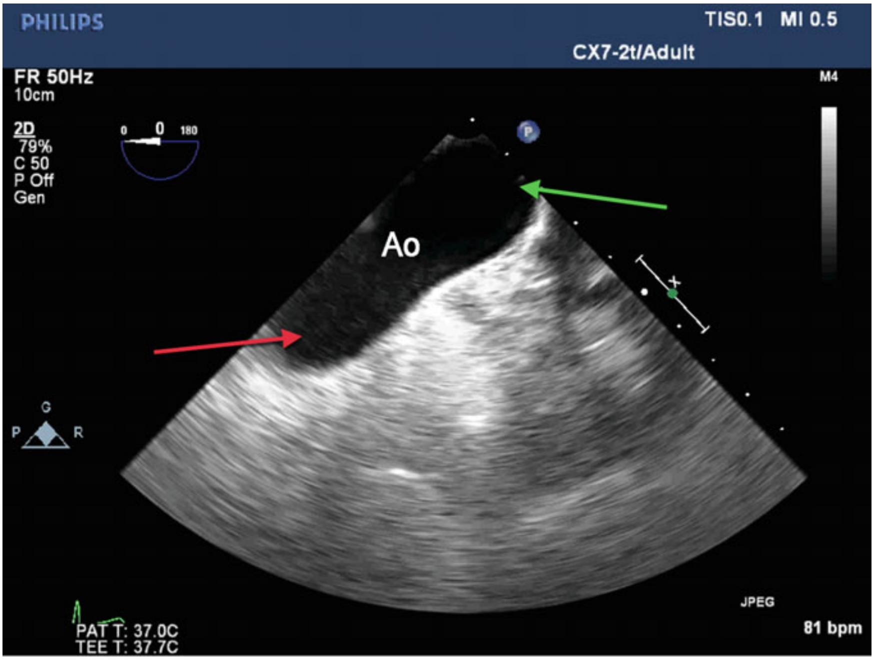


Fig. 2.20 UE aortic arch LAX view with the *green arrow* denoting distal aortic arch (Ao) and the *red arrow* denoting proximal aortic arch

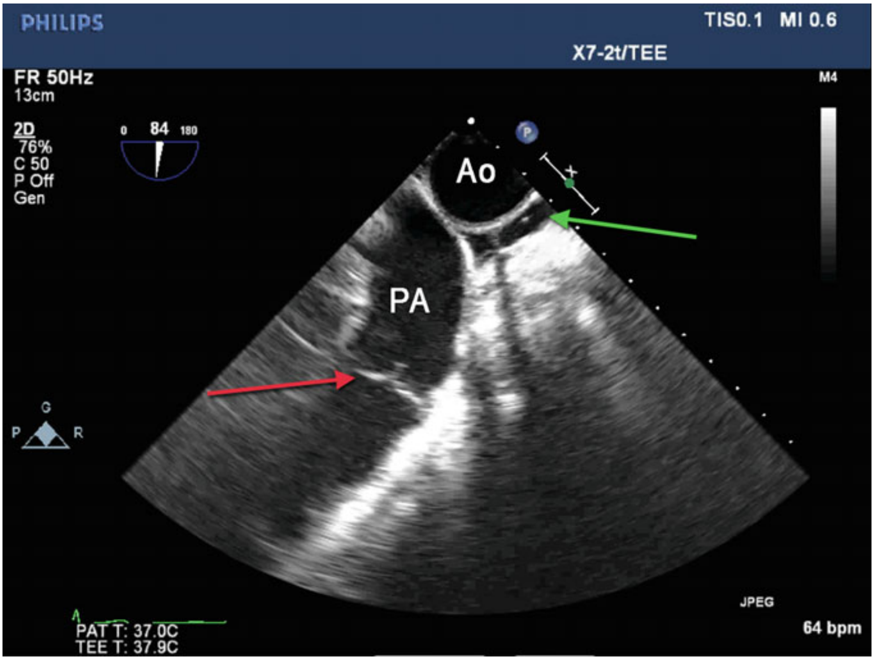
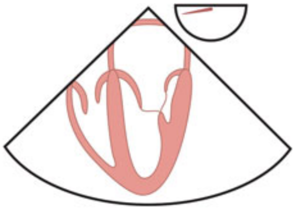
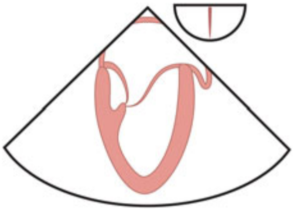
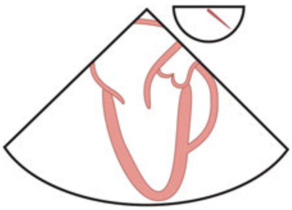
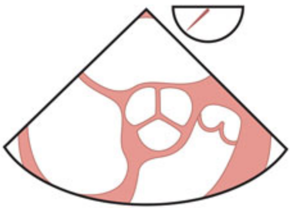


Fig. 2.21 UE aortic arch SAX view. The *red arrow* indicates the pulmonic valve while the *green arrow* indicates the brachiocephalic vein. *PA* main pulmonary artery; *Ao* aortic arch

Conclusion

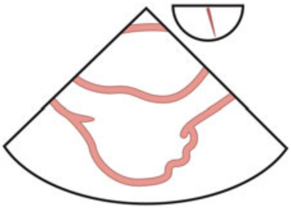
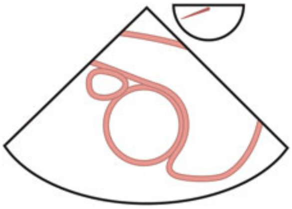
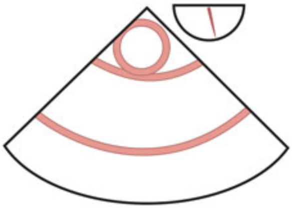
The individual views of the basic and comprehensive PTE exam are discussed above. Again the performed order of the views is not essential. Developing a systematic approach to the order of the views as well as modalities of interrogation is important in order to establish a consistent approach to perioperative echocardiography. Tables 2.1 and 2.2 outline a suggested order of views for the basic and comprehensive PTE exam, respectively.

Table 2.1 Basic perioperative transesophageal echocardiography exam

Image order	Image name	Image depiction	2D > CFD > Spectral
1	ME four chamber		*2D* • Chamber sizes: **RA/LA/RV/LV** • Systolic function: **RV/LV** • Ischemia detection: **RV/LV** • Valvular anatomy/motion: **TV/MV** *CFD* • Valvular pathology: **TV/MV** • Interatrial septum: **PFO/ASD** *Spectral* • Inflow velocities: **TV/MV** • Estimating PASP: **TV**
2	ME two chamber		*2D* • Chamber sizes: **LA/LV** • Systolic function: **LV** • Ischemia detection: **Anterior/Inferior LV** • Valvular anatomy/motion: **MV** *CFD* • Valvular pathology: **MV** • Thrombus: **LAA** *Spectral* • Inflow velocities: **MV**; **LUPV** • Thrombus: **LAA**
3	ME long axis		*2D* • Chamber sizes: **LA/LV/LVOT/AV/Ao** • Systolic function: **LV** • Ischemia detection: **AntSept/InfLat LV** • Valvular anatomy/motion: **MV/AV** *CFD* • Valvular pathology: **MV/AV** *Spectral* • Inflow velocities: **MV**
4	ME AV short axis		*2D* • Chamber sizes: **LA** • Valvular anatomy/motion: **AV** *CFD* • Valvular pathology: **AV** • Interatrial septum: **ASD/PFO** *Spectral* • Not typically utilized

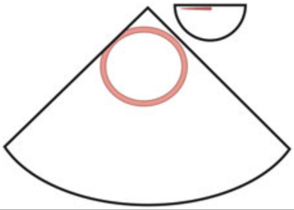
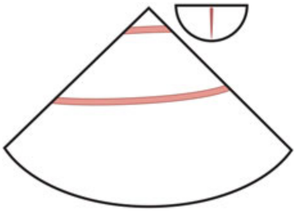
(continued)

Table 2.1 (continued)

Image order	Image name	Image depiction	2D > CFD > Spectral
5	ME RV inflow–outflow		*2D* • Chamber sizes: **RA/RV/PA/LA** • Systolic function: **RV** • Ischemia detection: **RV** • Valvular anatomy/motion: **TV/PV** *CFD* • Valvular pathology: **TV/PV** *Spectral* • Estimating PASP: **TV**
6	ME bicaval		*2D* • Chamber Sizes: **LA/RA** • Interatrial Septum: Competency *CFD* • Interatrial Septum: **ASD/PFO** *Spectral* • Not typically utilized
7	ME ascending aortic SAX		*2D* • Vessel sizes: **Ao/PA/SVC** • Dissection/Plaque: **Ao** • Thrombus: **PA/RPA** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
8	ME ascending aortic LAX		*2D* • Vessel sizes: **Ao/RPA** • Dissection/Plaque: **Ao** • Thrombus: **RPA** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
9	TG midpapillary SAX		*2D* • Chamber size: **LV** • Ischemia detection: **LV** (**3 Coronaries**)/**RV** *CFD* • Not typically utilized *Spectral* • Not typically utilized

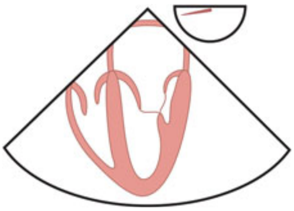
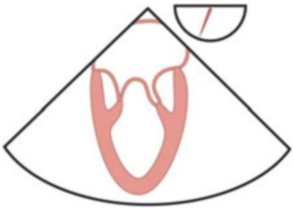
(continued)

Table 2.1 (continued)

Image order	Image name	Image depiction	2D > CFD > Spectral
10	Descending aortic SAX		*2D* • Vessel size: **Ao** • Dissection/Plaque: **Ao** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
11	Descending aortic LAX		*2D* • Vessel size: **Ao** • Dissection/Plaque: **Ao** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized

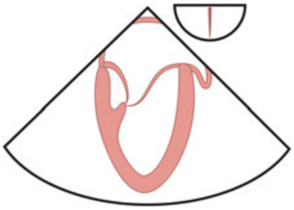
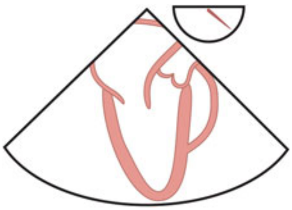
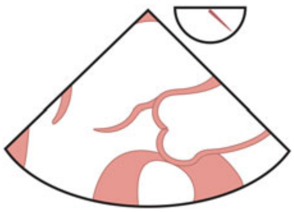
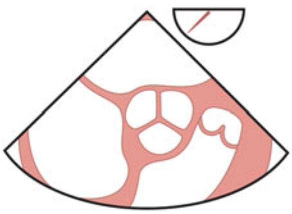
Abbreviations ME midesophageal; *TG* transgastric; *LAX* long axis; *SAX* short axis; *2D* two dimensional; *CFD* color flow doppler; *RA* right atrium; *LA* left atrium; *RV* right ventricle; *LV* left ventricle; *MV* mitral valve; *AV* aortic valve; *TV* tricuspid valve; *PV* pulmonic valve; *LVOT* left ventricular outflow tract; *PFO* patent foramen ovale; *ASD* atrial septal defect; *LAA* left atrial appendage; *LUPV* left upper pulmonary vein; *Ao* aorta; *PA* pulmonary artery; *RPA* right pulmonary artery; *AntSept* anterior septal wall; *InfLat* inferolateral wall; *SVC* superior vena cava
Adapted from Shanewise et al. [2]

Table 2.2 Comprehensive perioperative transesophageal echocardiography exam

Image order	Image name	Image depiction	2D > CFD > Spectral
1	ME four chamber		*2D* • Chamber sizes: **RA/LA/RV/LV** • Systolic function: **RV/LV** • Ischemia detection: **RV/LV** • Valvular anatomy/motion: **TV/MV** *CFD* • Valvular pathology: **TV/MV** • Interatrial septum: **PFO/ASD** *Spectral* • Inflow velocities: **TV/MV** • Estimating PASP: **TV**
2	ME mitral commissural		*2D* • Chamber sizes: **LA/LV** • Valvular anatomy/motion: **MV** *CFD* • Valvular pathology: **MV** • Thrombus: **LAA** *Spectral* • Inflow velocities: **MV** • Thrombus: **LAA**

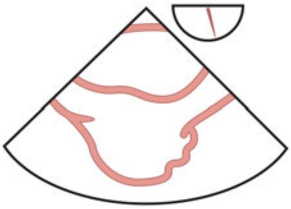
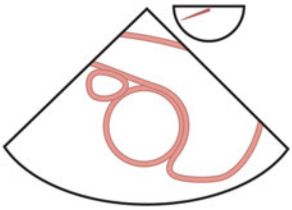
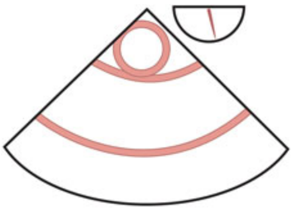
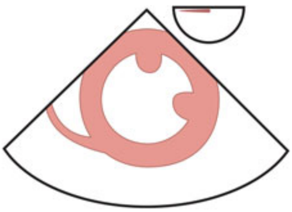
(continued)

Table 2.2 (continued)

Image order	Image name	Image depiction	2D > CFD > Spectral
3	ME two chamber		*2D* • Chamber sizes: **LA/LV** • Systolic function: **LV** • Ischemia detection: **Anterior/Inferior LV** • Valvular anatomy/motion: **MV** *CFD* • Valvular pathology: **MV** • Thrombus: **LAA** *Spectral* • Inflow velocities: **MV; LUPV** • Thrombus: **LAA**
4	ME long axis		*2D* • Chamber sizes: **LA/LV/LVOT/AV/Ao** • Systolic function: **LV** • Ischemia detection: **AntSept/InfLat LV** • Valvular anatomy/motion: **MV/AV** *CFD* • Valvular pathology: **MV/AV** *Spectral* • Inflow velocities: **MV**
5	ME AV LAX		*2D* • Chamber sizes: **LVOT/AV Annulus/Ao** • Valvular anatomy/motion: **AV** *CFD* • Valvular pathology: **AV** *Spectral* • Typically not utilized
6	ME AV short axis		*2D* • Chamber sizes: **LA** • Valvular anatomy/motion: **AV** *CFD* • Valvular pathology: **AV** • Interatrial septum: **ASD/PFO** *Spectral* • Not typically utilized

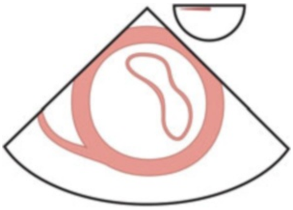
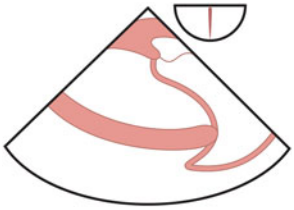
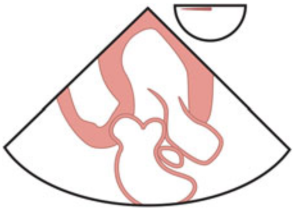
(continued)

Table 2.2 (continued)

Image order	Image name	Image depiction	2D > CFD > Spectral
7	ME RV inflow–outflow		*2D* • Chamber sizes: **RA/RV/PA/LA** • Systolic function: **RV** • Ischemia detection: **RV** • Valvular anatomy/motion: **TV/PV** *CFD* • Valvular pathology: **TV/PV** *Spectral* • Estimating PASP: **TV**
8	ME bicaval		*2D* • Chamber sizes: **LA/RA** • Interatrial septum: competency *CFD* • Interatrial septum: **ASD/PFO** *Spectral* • Not typically utilized
9	ME ascending aortic SAX		*2D* • Vessel sizes: **Ao/PA/SVC** • Dissection/Plaque: **Ao** • Thrombus: **PA/RPA** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
10	ME ascending aortic LAX		*2D* • Vessel sizes: **Ao/RPA** • Dissection/Plaque: **Ao** • Thrombus: **RPA** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
11	TG midpapillary SAX		*2D* • Chamber size: **LV** • Ischemia detection: **LV (3 Coronaries)/RV** *CFD* • Not typically utilized *Spectral* • Not typically utilized

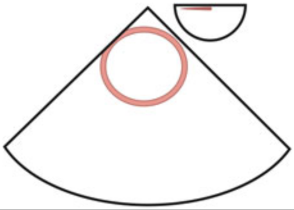
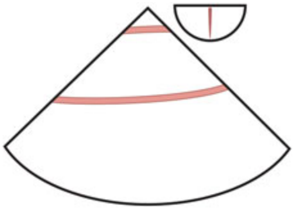
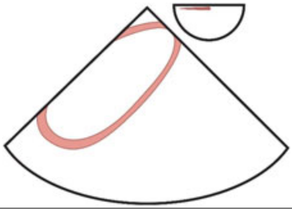
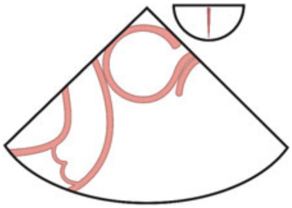
(continued)

Table 2.2 (continued)

Image order	Image name	Image depiction	2D > CFD > Spectral
12	TG basal SAX		*2D* • Chamber size: **LV** • Ischemia detection: **LV (3 Coronaries)/RV** • Valvular anatomy/motion: **MV** *CFD* • Valvular pathology: **MV** *Spectral* • Not typically utilized
13	TG two chamber		*2D* • Chamber size: **LV** • Ischemia detection: **Anterior/Inferior LV** *CFD* • Not typically utilized *Spectral* • Not typically utilized
14	TG LAX		*2D* • Chamber size: **LV** *CFD* • Valvular pathology: AV *Spectral* • Outflow velocities: **LVOT/AV**
15	Deep TG LAX		*2D* • Chamber size: **LV** • Ischemia detection: **Sept/Lat/Apex LV** • Valvular anatomy and motion: **MV/AV** *CFD* • Valvular pathology: **MV/AV** *Spectral* • Outflow velocities: **LVOT/AV**
16	TG RV inflow		*2D* • Chamber sizes: **RV/RA/TV Annulus** • Ischemia detection: **RV Free Wall** • Valvular anatomy and motion: **TV** *CFD* • Valvular pathology: **TV** *Spectral* • Typically not utilized

(continued)

Table 2.2 (continued)

Image order	Image name	Image depiction	2D > CFD > Spectral
17	Descending aortic SAX		*2D* • Vessel size: **Ao** • Dissection/Plaque: **Ao** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
18	Descending aortic LAX		*2D* • Vessel size: **Ao** • Dissection/Plaque: **Ao** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
19	UE aortic arch LAX		*2D* • Vessel size: **Ao** • Dissection/Plaque: **Ao** *CFD* • Dissection: **Ao** *Spectral* • Not typically utilized
20	UE aortic arch SAX		*2D* • Vessel size: **Ao/PA** • Dissection/Plaque: **Ao** *CFD* • Dissection: **Ao** • Valvular pathology: **PV** *Spectral* • Valvular/PA velocities: **PV/Main PA**

Abbreviations ME midesophageal; *TG* transgastric; *UE* upper esophageal; *LAX long axis*; *SAX* short axis; *2D* two dimensional; *CFD* color flow Doppler; *RA* right atrium; *LA* left atrium; *RV* right ventricle; *LV* left ventricle; *MV* mitral valve; *AV* aortic valve; *TV* tricuspid valve; *PV* pulmonic valve; *LVOT* left ventricular outflow tract; *PFO* patent foramen ovale; *ASD* atrial septal defect; *LAA* left atrial appendage; *LUPV* left upper pulmonary vein; *Ao* aorta; *PA* pulmonary artery; *RPA* right pulmonary artery; *AntSept* anterior septal wall; *InfLat* inferolateral wall; *Sept* septal wall; *Lat* lateral wall; *SVC* superior vena cava

Adapted from Shanewise et al. [2]

References

1. Reeves ST, Finley AC, Skubas NJ, Swaminathan M, Whitley WS, Glas KE, et al. Basic perioperative transesophageal echocardiography examination: a consensus statement of the american society of echocardiography and the society of cardiovascular anesthesiologists. J Am Soc Echocardiogr. 2013;26(5):443–56.
2. Shanewise JS, Cheung AT, Aronson S, Stewart WJ, Weiss RL, Mark JB, et al. ASE/SCA guidelines for performing a comprehensive intraoperative multiplane transesophageal echocardiography examination: recommendations of the American Society of Echocardiography Council for Intraoperative Echocardiography and the Society of Cardiovascular Anesthesiologists Task Force for Certification in Perioperative Transesophageal Echocardiography. J Am Soc Echocardiogr. 1999;12(10):884–900.
3. Hahn RT, Abraham T, Adams MS, Bruce CJ, Glas KE, Lang RM, et al. Guidelines for performing a comprehensive transesophageal echocardiographic examination: recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr. 2013;26(9):921–64.