Normal Upper Esophageal Transesophageal Echocardiography Views

Angela Jerath, MD, Andrew Roscoe, MD, and Annette Vegas, MD

A 44-year-old man presents with mixed valvular disease in association with a bicuspid aortic valve, aortic root, and arch aneurysm. An intraoperative transesophageal echocardiography (TEE) is performed to assess these lesions and exclude the presence of an aortic dissection flap.

The upper esophageal (UE) views of the aortic arch (AA) in long-axis (LAX) and short-axis (SAX) form 2 of the 20 standard images recommended during a comprehensive TEE examination.[1] This Echo Didactic session reviews the relevant anatomy of the AA, major head and neck vessels, main pulmonary artery (PA), pulmonic valve (PV), and describes both the standard and alternative views used to image and perform Doppler assessment of these structures.

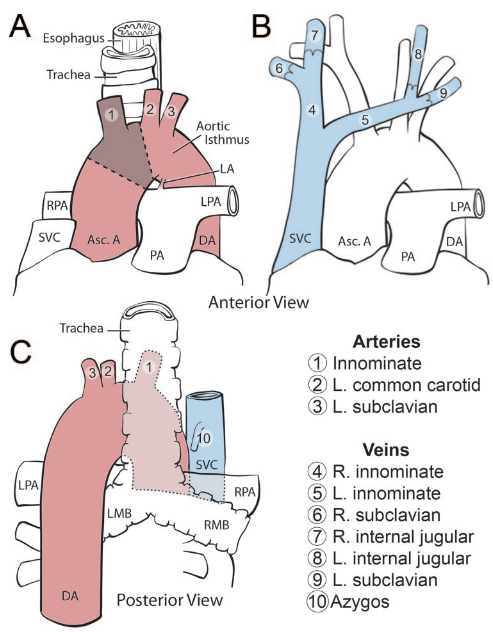
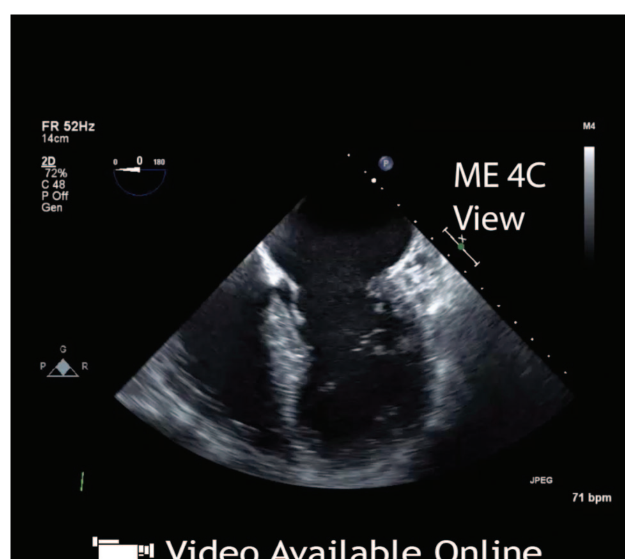


Figure 1. Normal anatomy of the great vessels. A, Anterior view of the great arteries. Interposition of the trachea creates a "blind spot" in the aortic arch (area within dotted line), which is difficult to image by transesophageal echocardiography. B, Drainage of neck veins forms the left and right innominate veins, which merge to form the superior vena cava (SVC). Note the venous valves present in the internal jugular and subclavian veins but not in the SVC or innominate veins. C, The unilateral azygos vein drains blood from the intercostal veins into the posterior-lateral aspect of the SVC. Asc A = ascending aorta; DA = descending aorta; LA = ligamentum arteriosum; LMB = left main bronchus; LPA = left pulmonary artery; PA = pulmonary artery; RMB = right main bronchus; RPA = right pulmonary artery. (Illustrations with permission of J. Crossingham.)

NORMAL ANATOMY

The AA is the transverse portion of the aorta that lies between the vertically positioned ascending and descending aorta (DA) (Fig. 1). The arch begins at the innominate artery (IA) and ends at the aortic isthmus normally spanning 5.0 cm in length and 3.0 cm in diameter. It lies superior to the left atrium, runs posteriorly and to the left, passing over the left main bronchus. The AA is overlaid by lung parenchyma and is not encased by pericardium. The major head and neck arteries arise from its superior convex aspect. These are from right/anterior to left/posterior: the larger IA, left common carotid artery (LCCA) in the middle, and left subclavian artery (LSCA) at the aortic isthmus.

The main PA is perpendicular to the AA, but lies parallel to the ascending aorta and DA. The right PA passes horizontally rightward behind the ascending aorta and superior vena cava (SVC). The left PA lies anterior to the DA and is difficult to image because of its close proximity to the left main bronchus (Fig. 1C).



Video 1. To obtain the upper esophageal aortic arch (AA) long-axis (LAX) view, start from the midesophageal (ME) 4-chamber view and turn the probe to the left to center the descending aorta (DA) in short-axis (SAX). Withdraw the probe until the aorta begins to appear oval in shape. Turn the probe slightly to the right to image the proximal portion of the AA. Reduce the image depth and use color flow Doppler to interrogate the AA.

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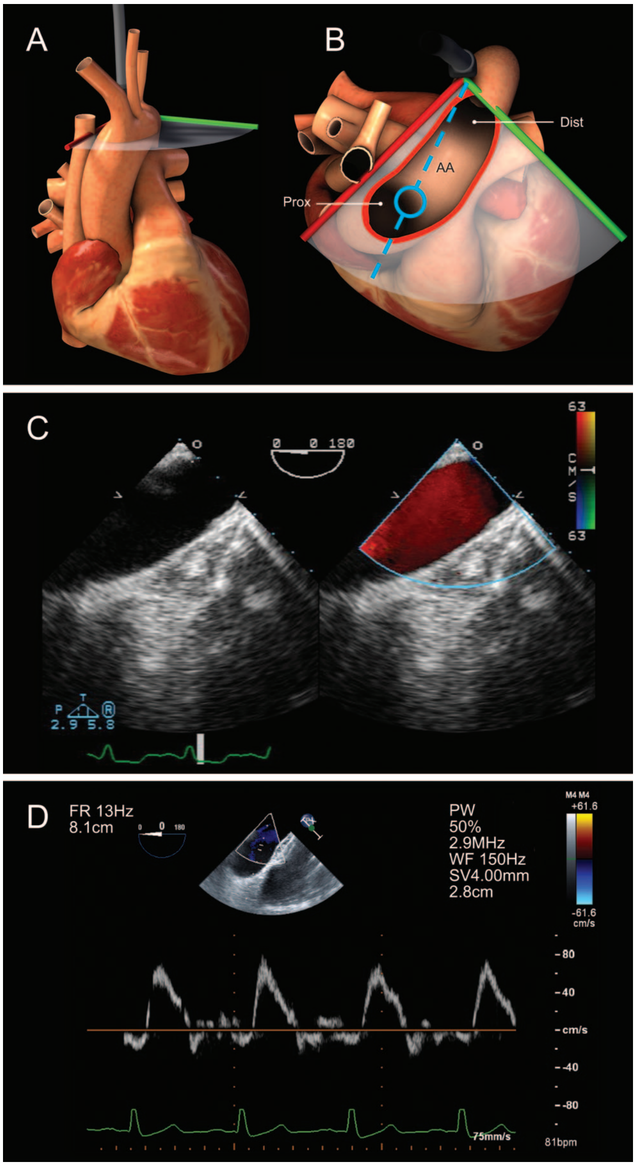


Figure 2. Upper esophageal aortic arch (AA) long-axis (LAX) view. A and B, Three-dimensional heart model with transesophageal echocardiography (TEE) plane through the LAX of the AA viewed from the top down. The green edge of the sector plane corresponds to the right of the TEE image display; the red edge is on the left of the display. A pulsed wave Doppler (PWD) sample volume is positioned in the proximal AA. C, Two-dimensional and color flow Doppler views show laminar flow in red toward the transducer during systole from the proximal to distal AA (Video 1, see Supplemental Digital Content 1, http://links.lww.com/AA/A414). D, A normal PWD spectral trace from the proximal AA is shown. (Parts A and B adapted from Virtual TEE website [http://pie.medutoronto.ca/TEE] with permission of A. Vegas.)

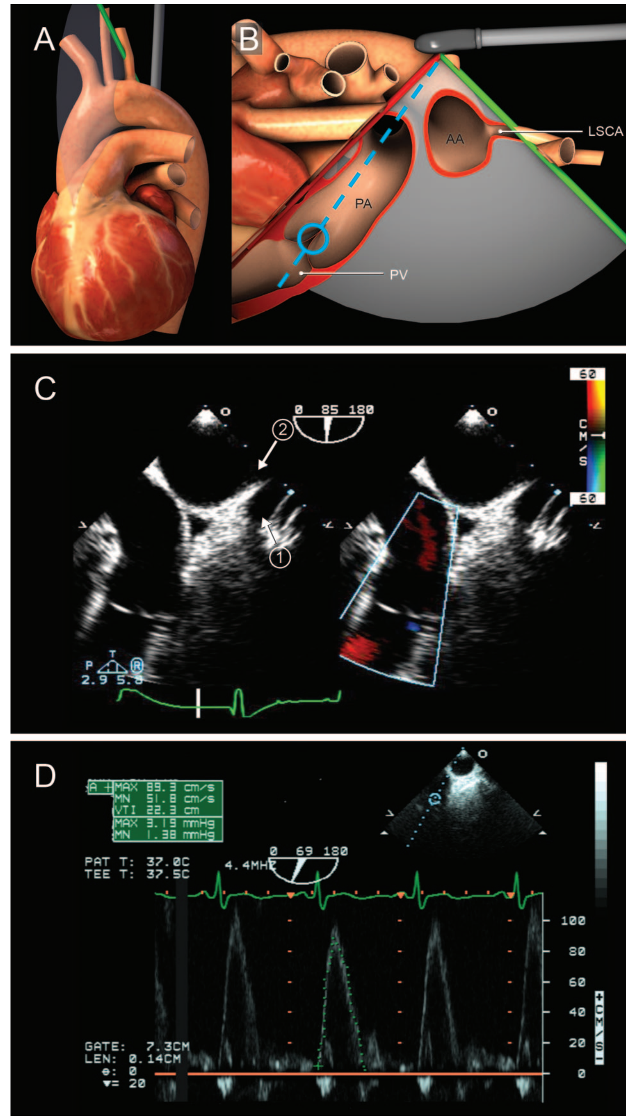
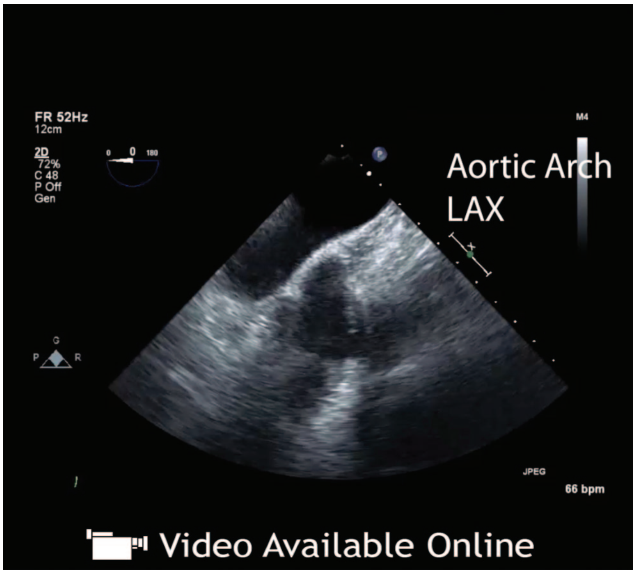


Figure 3. Upper esophageal (UE) aortic arch (AA) short-axis (SAX) view. A, Three-dimensional heart model with transesophageal echocardiography (TEE) plane through the SAX of the AA. B, Diagram of the UE AA SAX view shows the orthogonal position of the AA in SAX and main pulmonary artery (PA) in long-axis. The anterior and right cusps of the pulmonic valve (PV) are seen. A pulsed wave Doppler (PWD) sample volume is positioned in the main PA. C, Color flow Doppler (Nyquist 60 cm/s) shows no diastolic flow through the closed PV. The origin of the left subclavian artery (LSCA) (arrow 2) can be seen on the right side of the display above the left innominate vein (arrow 1). Although not shown here, the color box with a lower Nyquist limit (30 cm/s) can be positioned over the left innominate vein to demonstrate flow. D, PWD spectral trace from the main PA shows normal systolic flow toward the transducer. (Parts A and B adapted from Virtual TEE website [http://pie.med.utoronto.ca/TEE] with permission of A. Vegas.)

The subclavian and internal jugular veins combine to form an innominate vein on each side of the neck. The left innominate vein runs obliquely anterior above the arch wall joining the right innominate vein to form the SVC (Fig. 1B). Venous valves are present in the subclavian and internal jugular veins but not in the innominate veins or SVC. The smaller unilateral azygos vein loops over the right main bronchus draining into the posterolateral portion of the SVC.

IMAGING THE AA

Imaging of the proximal and mid-AA is made difficult by the interposition of the tracheobronchial tree creating a blind spot (Fig. 1C). This region may be better imaged with epiaortic or suprasternal transthoracic ultrasound scanning.[2] The distal AA is easily imaged using the 2 standard TEE UE AA views in 2-dimensional (D) and real-time 3D, although the latter adds little additional information.



Video 2. To obtain the upper esophageal (UE) aortic arch (AA) short-axis (SAX) view, start from the UE AA long-axis (LAX) view and hold the probe stationary while increasing the omniplane angle to 60° to 90°. Color flow Doppler at a Nyquist of 54 cm/s over the main pulmonary artery shows systolic red flow toward the probe and a small diastolic blue jet of pulmonic insufficiency.

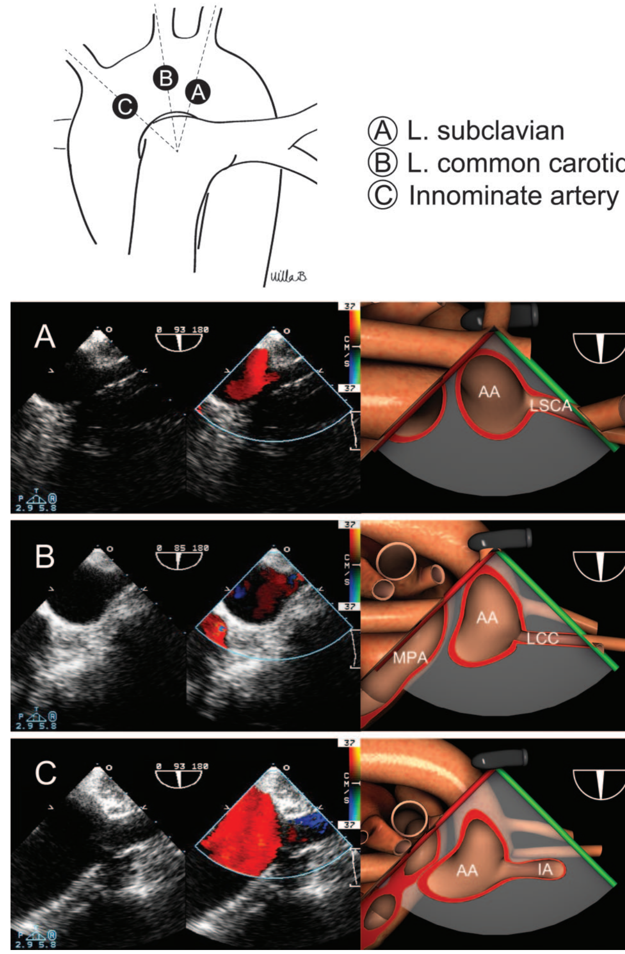


Figure 4. Transesophageal echocardiography (TEE) imaging of the aortic arch (AA) vessels. A, Left subclavian artery (LSCA); B, left common carotid (LCC) artery; and C, innominate artery (IA) are imaged by turning the probe from right to left in the upper esophageal (UE) AA short-axis (SAX) view (Video 3, see Supplemental Digital Content 3, http://links.lww.com/AA/A416). MPA = main pulmonary artery. (Illustration with permission of W. Bradshaw; parts A through C adapted from Virtual TEE website [http://pie.med.utoronto.ca/TEE] with permission of A. Vegas.)

UE AA LAX VIEW

This view is obtained at 0° by turning the probe to the left from the midesophageal 4-chamber view to image the DA in SAX. The probe is withdrawn with a slight rightward turn to follow the natural tortuosity of the aorta and maintain the DA in SAX in the center of the display (Video 1, see Supplemental Digital Content 1, http://links.lww.com/AA/A414). The oval-shaped AA is seen at 20- to 25-cm depth from the incisors (Fig. 2). The image is optimized by slightly turning the probe right to elongate the AA and reducing the display depth to 6 to 8 cm. The AA is seen traversing the display from left in the far-field (proximal AA) to the right in the near-field (distal AA). Acoustic "dropout" in the near field from intimal calcification often obscures the posterior arch wall.

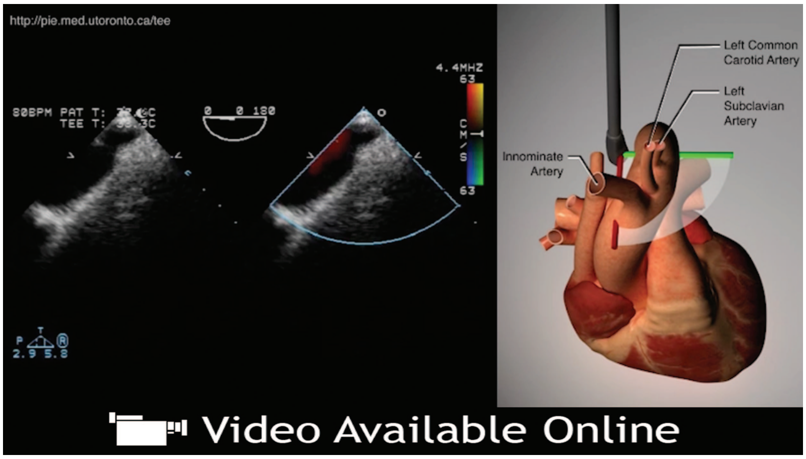
UE AA SAX VIEW

This view is obtained from the UE AA LAX by increasing the omniplane angle to 60° to 90° and display depth to 10 to 12 cm to visualize the main PA (Fig. 3) (Video 2, see Supplemental Digital Content 2, http://links.lww.com/AA/A415). The mid-AA appears in SAX in the center of the display. Turning the probe to the left brings the LSCA origin and left innominate vein into view on the display right. On the display left, the main PA and PV are shown in LAX.

AA ARTERIAL BRANCHES

TEE identification of all 3 AA arterial branches is challenging. Movements of the probe tip by flexion and turning the probe can improve imaging around the interposed trachea.[3] Gentle probe manipulation is recommended to avoid UE injury. In an awake patient, the high probe position (15–20 cm) is poorly tolerated and may precipitate probe removal. AA branch vessel images are obtained by turning the probe from left to right in the UE AA SAX view (Fig. 4) (Video 3, see Supplemental Digital Content 3, http://links.lww.com/AA/A416).

- The LSCA origin is identifiable in most patients from a slight leftward probe turn in the UE AA SAX view. Alternatively, probe withdrawal during imaging of the DA easily displays the LSCA origin at the transition of the DA into the distal AA in the UE AA LAX view (Video 1, see Supplemental Digital Content 1, http://links.lww.com/AA/A414).
- Rightward probe turning from the UE AA SAX view of the LSCA images the main PA in LAX and the LCCA origin in two-thirds of patients.
- Further rightward probe turning and flexion from the LCCA origin may show in one-third of patients, the more anterior broad-based IA in LAX with an



Video 3. To visualize the aortic arch (AA) arterial vessels, start from the upper esophageal (UE) AA long-axis (LAX) view at 0° optimized to image the distal AA. Increase the omniplane angle to 90° and turn the probe slightly to the left to view the left subclavian artery in LAX. From this view, slowly turning the probe right images the left common carotid artery and with further rightward turning, the broad based innominate artery.

off-axis AA view. Withdrawing the probe while keeping the IA in view demonstrates its division into the right subclavian artery and common carotid artery.

VENOUS STRUCTURES

A variable length of the left innominate vein is often visualized anterior to the AA in both standard UE AA views (Fig. 3). It is readily identifiable in the presence of a catheter and is opacified by contrast injected into a left arm vein. On each side, the carotid artery accompanies the internal jugular vein, which unites with the subclavian vein forming the innominate veins in the upper mediastinum (Fig. 1B). These neck vessels are unreliably imaged in the modified UE AA views and beyond the scope of a routine TEE examination.[4] The small azygos vein is best imaged entering the SVC posteriorly (Fig. 1C) in the midesophageal ascending aorta view rotated to the right to look near the distal right PA rather than in the UE AA views.[4]

DOPPLER

Color flow Doppler distinguishes vascular structures by visualizing the blood flow and its temporal characteristics. The use of color flow Doppler and pulsed wave Doppler in vessels differentiates the higher-velocity (Nyquist limit 50–60 cm/s) predominantly systolic flow in arteries from the lower-velocity (Nyquist limit 30 cm/s) continuous flow present in veins.

Parallel alignment of the main PA with the spectral Doppler beam in the UE AA SAX view accurately interrogates blood flow velocity of the PA and PV (Fig. 3). Cardiac output (CO) can be calculated from measurements of the main PA diameter (d) and PA velocity time integral (VTI): $CO = 0.785\ d^2 \times VTI$. The shunt fraction can be calculated in the presence of an atrial septal defect or ventricular septal defect by comparing the pulmonary to systemic flow (Qp:Qs). In the UE AA LAX view, the pulsed wave Doppler signal positioned in the AA can detect normal early, from otherwise abnormal, diastolic flow reversal.

Teaching Points

- Standard and alternative upper esophageal (UE) views are used to view the aortic arch (AA), main pulmonary artery (PA), pulmonic valve (PV), and major head and neck vessels, except for the azygos vein.
- The AA appears round in UE AA short-axis (SAX) view and oval shaped in the UE AA long-axis (LAX) view. The UE AA SAX view shows the orthogonal relationship of the main PA (LAX) to the AA (SAX).
- The AA arterial branches can be visualized from the UE AA SAX by slow rightward turning of the probe to image, in order: the left subclavian artery, left common carotid artery, and the innominate artery.
- The UE AA SAX provides ideal alignment for spectral Doppler interrogation of the main PA and PV, which can also be used to assist cardiac output and shunt fraction calculations.

DISCLOSURES

Name: Angela Jerath, MD.
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Name: Andrew Roscoe, MD.
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Name: Annette Vegas, MD.
Contribution: This author helped prepare the manuscript.
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Upper Esophageal Transesophageal Echocardiography Views Pathology

Annette Vegas, MD, and Angela Jerath, MD

A 35-year-old woman presents for a combined thymoma resection and ligation of a patent ductus arteriosus (PDA). An intraoperative transesophageal echocardiography (TEE) study is performed to confirm complete ligation of the PDA.

Our previous report described the use of the upper esophageal (UE) views of the aortic arch (AA) in long-axis (LAX) and short-axis (SAX) to examine the AA, its arterial branches, innominate veins, pulmonary artery (PA), and pulmonic valve (PV).[1] In this echo didactic session, we discuss the clinical utility and some limitations of these views in identifying variant anatomy, foreign material, and pathology using 2-dimensional (D) imaging, color flow Doppler (CFD), and spectral Doppler (Table 1).

VARIANT ANATOMY

Variations in anatomy of the thoracic great vessels are uncommon. A right-sided AA is the variant most often visualized in the UE AA views. It may be associated with other congenital heart lesions, usually tetralogy of Fallot. Three types of right-sided AA have been anatomically defined although these are indistinguishable by TEE (Fig. 1).[2] The UE AA LAX view best shows a right-sided AA with the distal AA at the apex of the sector display, but in contrast to the left-sided AA, the proximal AA appears on the right of the display (Fig. 2) (Video 1, see Supplemental Digital Content 1, http://links.lww.com/AA/A417, and Video 2, see Supplemental Digital Content 2, http://links.lww.com/AA/A418).

Other variants include a left-sided superior vena cava (LSVC) and anomalous left main coronary artery originating from PA (ALCAPA), which are poorly imaged in the UE views and better seen in midesophageal (ME) views.[3] The LSVC runs lateral to the AA and drains into the coronary sinus. Suspicion of its presence is raised by identifying a dilated coronary sinus that opacifies during a left arm peripheral venous contrast study. The LSVC is identified as an echo-free space between the left atrial appendage and left upper PV in a ME 60° view.

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PATHOLOGY

Pulmonic Pathology

Closer proximity of the PV and main PA to the TEE probe in the UE AA SAX view improves visualization of anatomic detail compared with the ME views. The main PA diameter (normal 1.5–2.1 cm) is easily measured at any level beyond the PV to confirm a dilated PA from pressure or volume overload. Additional PA pathology such as a pulmonary embolus can also be seen in the main PA.

Assessment of the native PV cusps (anterior and right) or prosthetic valve function by 2D imaging and CFD across the PV (Nyquist 50–60 cm/s) may reveal turbulent systolic flow suggestive of pulmonic stenosis or a regurgitant diastolic jet from pulmonic insufficiency (Fig. 3) (Video 3, see Supplemental Digital Content 3, http://links.lww.com/AA/A422).[4,5]

Good alignment between the PV and Doppler beam accurately quantifies these lesions using spectral Doppler (Table 2).[4,5] The use of pulsed wave Doppler can more precisely isolate the source of the pressure gradient, although continuous wave Doppler avoids aliasing and best quantifies the peak gradient. Pathology in the right ventricular outflow tract such as infundibular stenosis is not well appreciated in the UE views and is better visualized in ME or transgastric images.

Aortic Pathology

TEE is superior to transthoracic echocardiography in imaging AA pathology.[6,7] Alternative imaging modalities (computerized tomography, magnetic resonance imaging) or epiaortic imaging may better define AA pathology in regions suboptimally imaged by the UE views such as the proximal AA (blind spot from the trachea) and posterior aortic wall (near-field dropout). Aortic insufficiency can be identified in the UE AA views using CFD and spectral Doppler. Holodiastolic flow reversal can be shown by pulsed wave Doppler in the distal AA although only its presence in the descending thoracic aorta is specific for at least moderate aortic insufficiency.[4]

Aortic atheroma seen in the UE AA views is characterized by location, extent, and mobility using multiple 2D or a single real-time 3D TEE image. Extensive atheromatous disease should prompt careful epiaortic scanning to reduce the risk of embolization and stroke before aortic cannulation.[8]

Aortic dissection can be rapidly diagnosed at the bedside with high sensitivity and specificity using TEE. A Stanford type A aortic dissection involves the AA and requires open surgical repair.[6] The role of TEE is to localize the intimal tear, differentiate true and false lumens, and assess for dissection flap involvement of the major AA branch vessels.[7] Precise localization of the intimal tear guides treatment, which relies on occluding the entry tear site. Differentiation of true and false lumens is based on lumen size, pulsation, and flow direction by CFD and spectral Doppler. Involvement of the major AA branch

Table 1. Upper Esophageal Views Variants, Pathology, and Foreign Material

Great vessel variants

- Right-sided arch (0.1% general population)
- Left-sided superior vena cava (0.5%–2.0% general population)
- Anomalous left main coronary artery originating from pulmonary artery (ALCAPA)

Structure	Pathology	Foreign material and procedures
Aortic arch	Atheroma, aneurysm, dissection, coarctation	Aortic cannula, intraaortic balloon catheter, endovascular aneurysm repair stents
Pulmonary artery	Embolism, patent ductus arteriosus	Pulmonary artery catheter
Pulmonic valve	Stenosis, insufficiency	Balloon dilatation procedure, transcatheter valve placement
Innominate vein	Thrombus	Venous catheter, pacer wire

vessels increases the risk of stroke and influences the site of invasive arterial monitoring.

An AA aneurysm most frequently extends from dilation of the ascending aorta. Measurement of the mid-AA diameter is best obtained from the circular appearance in the UE AA SAX view (Fig. 4). Operative repair of an AA aneurysm is considered when the aneurysmal segment diameter exceeds 5 cm or twice that of a normal segment or earlier at 4.0 cm with aortopathies such as Marfan syndrome.[6,7]

Aortic coarctation (CoA) is a segmental narrowing of the aorta generally located at the aortic isthmus between the left subclavian artery (LSCA) and ductus arteriosus (Fig. 1). This is a relatively common congenital cardiac abnormality (5%–8%) that may be associated with other clinically significant lesions, for example, PDA, ventricular septal defect, and bicuspid aortic valve. TEE is less useful than transthoracic echocardiography to diagnose and assess the severity of CoA because Doppler alignment is poor. Nevertheless, a modified UE AA view may show dilation of the aorta proximal to the CoA, with turbulent color flow present at or just distal to the LSCA. TEE is a useful adjunct during balloon dilation and endovascular stent placement to manage CoA (Video 2, see Supplemental Digital Content 2, http://links.lww.com/AA/A418).

AORTIC PULMONARY SHUNTS

A PDA is a remnant of the distal sixth AA, which connects the PA to the inferior aspect of the aorta near the LSCA (Fig. 1). Although this is usually detected in infancy at >3 months of age, the diagnosis of PDA can be made in adulthood by which time it may have become calcified. It is typically seen in modified UE AA views with probe manipulation to visualize the origin of the LSCA, aorta, and PA in the same image (Fig. 4) (Video 4, see Supplemental Digital Content 4, http://links.lww.com/AA/A423).[9] Continuous high-velocity left to right flow is most often seen in the PDA from the aorta to PA using CFD and continuous

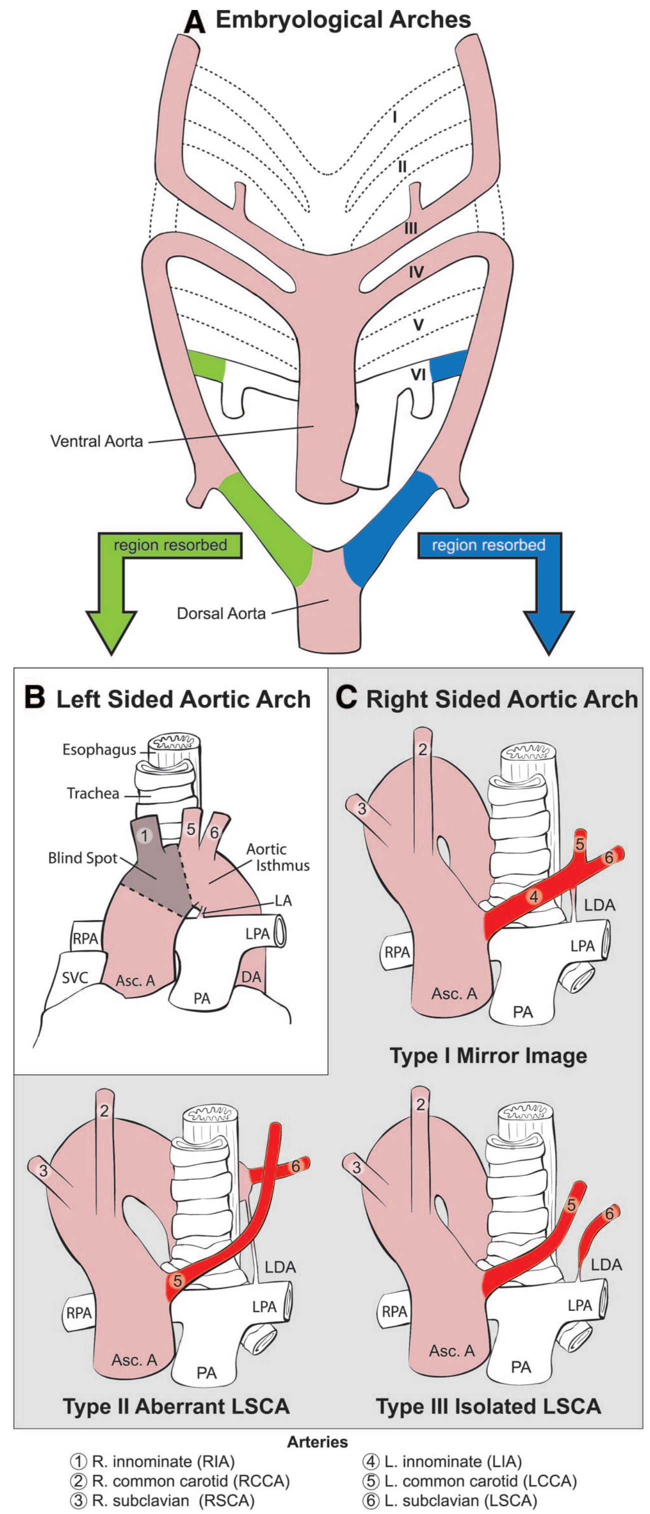


Figure 1. Aortic arch variants. A, The third and fourth embryological arches and ventral aorta form the adult aortic arch, head and neck vessels. B, Resorption of the right dorsal aorta produces the normal left-sided aortic arch. C, Abnormal resorption of the left dorsal aorta produces a right-sided aortic arch with 3 types of branch vessel anatomy. Type I is a mirror image of the left-sided arch, type II is the most common variant with an aberrant left subclavian artery (LSCA), and type III is the rarest form with LSCA disconnection from the arch. LA = ligamentum arteriosum. (Illustrations with permission of J. Crossingham.)

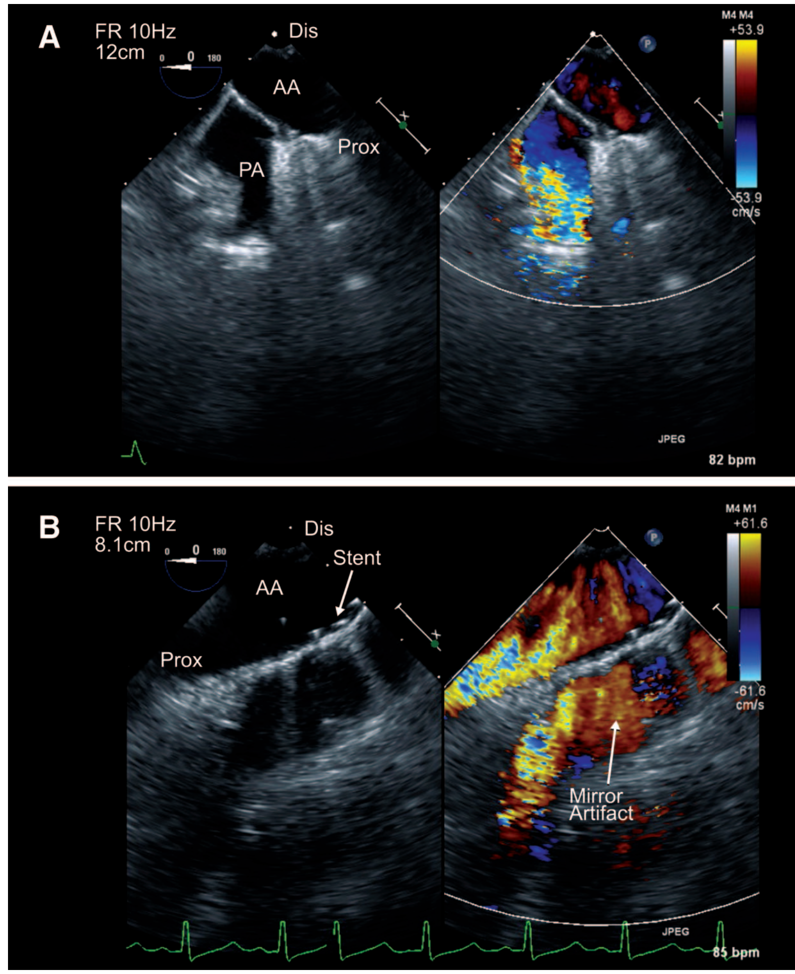
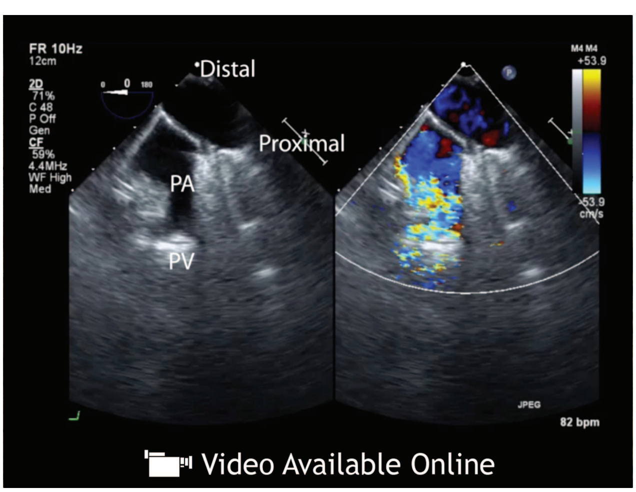
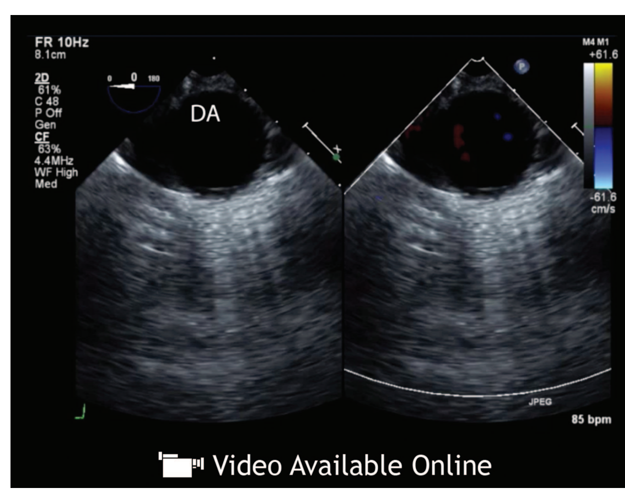


Figure 2. Right- and left-sided aortic arches (AAs), mirror artifact. A, Right-sided AA is shown in an upper esophageal (UE) AA long-axis (LAX) view with the proximal AA to the right of the display. This patient had tetralogy of Fallot with turbulent flow seen in the main pulmonary artery (PA) by color flow Doppler indicating pulmonic stenosis (Video 1, see Supplemental Digital Content 1, http://links.lww.com/AA/A417). Note that the PA and AA are seen in LAX in this view at 0°. B, Mirror artifact of a left-sided AA shows a duplicate sized AA in the far field in this color Doppler UE AA LAX view. An aortic stent (arrow) has been deployed in the distal AA to correct a coarctation of the aorta (Video 2, see Supplemental Digital Content 2, http://links.lww.com/AA/A418). Prox = proximal; Dis = distal.



Video 1. A right-sided aortic arch (AA) and pulmonic stenosis is shown in this upper esophageal AA long-axis clip using 2-dimensional and color flow Doppler in a patient with tetralogy of Fallot. PA = pulmonary artery; PV = pulmonic valve.



Video 2. A normal left-sided aortic arch (AA) with an aortic stent positioned in the distal AA to correct a coarctation is seen in an upper esophageal (UE) AA long-axis (LAX) view as the probe is withdrawn from a descending aorta (DA) short-axis view. A mirror image artifact of the AA is shown with color Doppler in the UE AA LAX view in the latter portion of the clip.

wave Doppler, although the shunt may become right to left in the presence of increased PA pressures. TEE may help guide percutaneous closure of a PDA and confirm absence of flow after open surgical procedures.

CANNULAE AND ENDOVASCULAR PROCEDURES

The aortic cannula used for arterial access during cardiopulmonary bypass is routinely positioned in the mid to

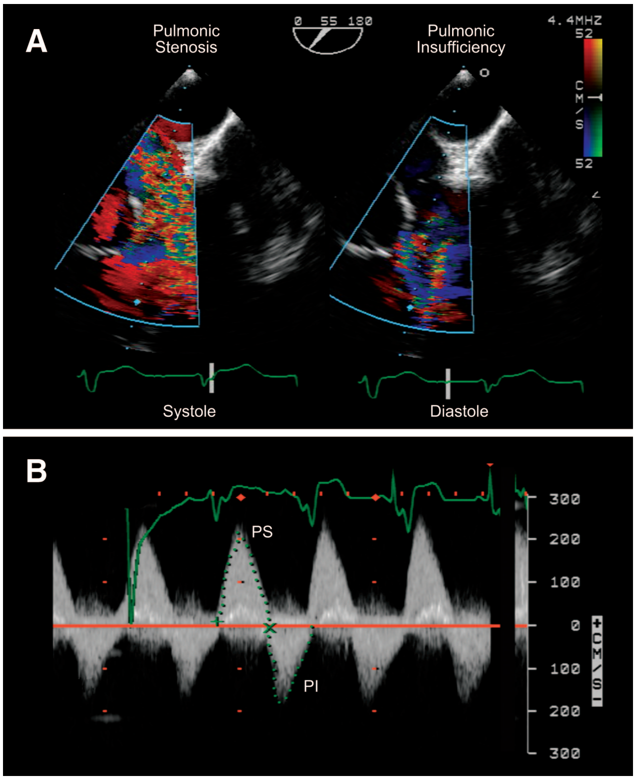
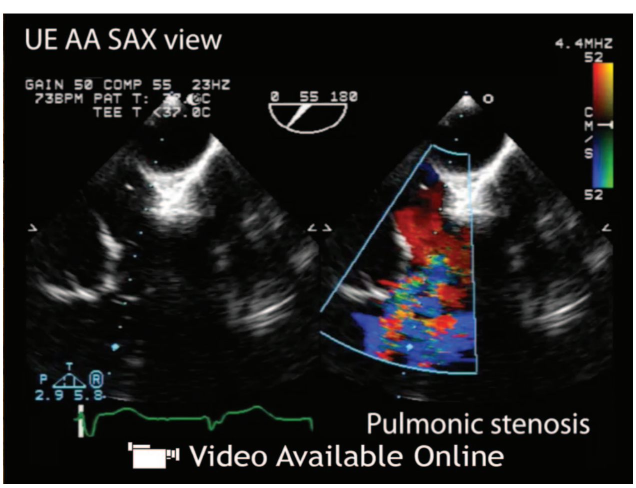


Figure 3. Pulmonic valve pathology. A, These upper esophageal aortic arch short-axis views with color flow Doppler show both turbulent systolic flow from pulmonic stenosis (PS) and diastolic flow from pulmonic insufficiency (PI). B, The continuous wave spectral Doppler trace confirms a peak systolic gradient of 42 mm Hg consistent with moderate PS and a dense holodiastolic trace of severe PI (Video 3, see Supplemental Digital Content 3, http://links.lww.com/AA/A422).



Video 3. Upper esophageal (UE) aortic arch (AA) short-axis (SAX) clip using color Doppler (Nyquist 52 cm/s) that shows combined pulmonic stenosis apparent during systole as turbulent antegrade flow and pulmonic insufficiency during diastole.

distal ascending aorta, which falls into a blind spot for TEE imaging of the aorta (Fig. 1). Thus, assessment of correct cannula position as it extends into the proximal AA and any associated aortic cannulation complications (e.g., aortic dissection, intramural hematoma) are well imaged in

Table 2. Quantification of Severity of Pulmonic Valve Stenosis and PI[4,5]

Pulmonic stenosis	Mild	Moderate	Severe
Peak velocity (m/s)	<3	3–4	>4
Peak gradient (mm Hg)	<36	36–64	>64
Pulmonic insufficiency			

- Color flow Doppler (Nyquist 50–60 cm/s): broad jet, jet length >10 mm is more than mild PI
- Continuous wave Doppler: dense PI signal
- Dilated right ventricle

PI = pulmonic insufficiency.

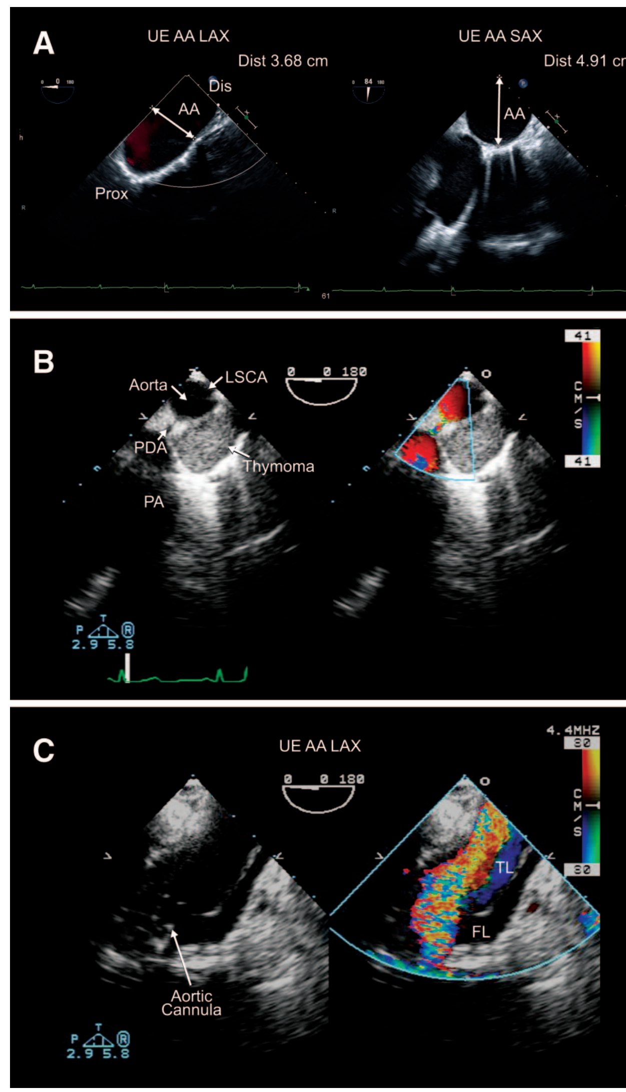
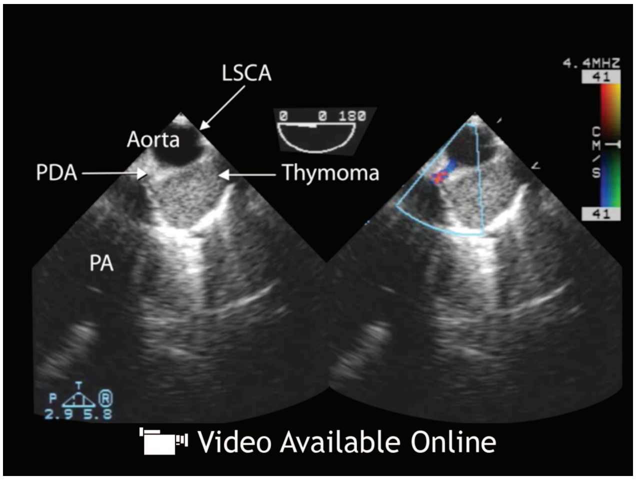


Figure 4. Aortic arch pathology. A, The diameter of an aortic arch (AA) aneurysm is best measured from the circular appearance of the aorta in the upper esophageal (UE) short-axis (SAX) view (superior-inferior walls) compared with the UE long-axis (LAX) view (anterior-posterior walls). B, Color Doppler in a modified UE view shows flow through a patent ductus arteriosus (PDA) between the aorta and main pulmonary artery (PA). The patient also had a thymoma anterior to the AA (Video 4, see Supplemental Digital Content 4, http://links.lww.com/AA/A423). C, UE LAX view of a distal ascending aortic cannula (arrow) correctly positioned in the true lumen (TL) of the proximal AA in a patient with an aortic dissection (Video 4, http://links.lww.com/AA/A423). Dis = distal; dist = distance; FL = false lumen; LSCA = left subclavian artery; prox = proximal.



Video 4. Part 1: Continuous turbulent flow is seen through the narrow orifice between the aorta and the main pulmonary artery (PA) just at the level of the left subclavian artery (LSCA) in this modified upper esophageal (UE) view with color Doppler in a patient with a patent ductus arteriosus (PDA). Part 2: This UE aortic arch (AA) long-axis (LAX) clip shows flow in an aortic cannula properly positioned in the true lumen (TL) of a patient with an aortic dissection that extended into the aortic arch. FL = false lumen.

the UE AA LAX view (Fig. 4) (Video 4, see Supplemental Digital Content 4, http://links.lww.com/AA/A423). The AA should be routinely assessed post-decannulation for these complications.

High placement of an intraaortic balloon catheter tip may be visible in the distal AA beyond the LSCA in both UE AA views.[10] Correct positioning of a Swan-Ganz catheter in the main PA can be easily imaged in the UE AA SAX view.

When used in conjunction with fluoroscopy, TEE can offer valuable incremental information during the deployment of endovascular grafts in the thoracic aorta. Standard and modified UE AA views can identify thoracic aortic pathology, confirm guidewire placement, aid graft positioning, and assess for endoleaks.[11] Absence of flow in the LSCA by CFD during graft deployment suggests proximal vessel occlusion that may require urgent intervention.

ARTIFACTS

Reverberation and acoustic shadowing from an atheromatous calcified aorta conceals structures anterior to the AA including the left innominate vein, PA, and PV. Mirroring of the AA from the overlying aortic-pleural interface creates a duplicate 2D and color "double barreled aorta" (Fig. 2) (Video 2, see Supplemental Digital Content 2, http://links.lww.com/AA/A418).[12] Linear side-lobe artifacts from a Swan-Ganz catheter, which can be mistaken for a dissection flap, typically appear in the ascending aorta rather than the AA.[5] Venous valves in the subclavian and internal jugular veins may appear as linear mobile echoes in these vessels and should not be mistaken for a dissection flap.

Teaching Points

- Common (atheroma, aneurysm, and dissection) and uncommon (coarctation and patent ductus arteriosus) aortic pathologies involving the aortic arch (AA) may be identified and assessed using standard and alternative upper esophageal (UE) views.
- Transesophageal echocardiography probe proximity and spectral Doppler alignment make the UE AA short-axis view ideal to assess and quantify pulmonic valve pathology (pulmonic stenosis and pulmonic insufficiency).
- A right-sided AA, with its top left to bottom right orientation, is the only great vessel variant easily imaged in the UE AA long-axis view.
- Standard and alternative UE views can be used to identify and facilitate correct deployment of foreign material such as catheters, cannula, wires, and stents in the aorta and pulmonary artery.
- Imaging artifacts in the aorta are common and may make it difficult to exclude aortic pathologies such as aortic dissection.

DISCLOSURES

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Contribution: This author helped prepare the manuscript.
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