Patient populations predisposed to aortic aneurysms include patients with Marfan syndrome, bicuspid aortic valves, aortic stenosis, prosthetic aortic valves and systemic hypertension (see Table 11.3). Regular serial echocardiograms are also recommended in patients with Marfan syndrome and other diseases with a known predisposition for aortic aneurysms as well as in patients with dilated aortas due to any cause. Examples of aortic aneurysms are displayed in Figure 11.10.

Abdominal Aortic Aneurysms

On the routine transthoracic examination (TTE), the suprarenal (proximal) abdominal aorta is often imaged from the subcostal window. However, as more than 90% of AAA's are infrarenal, a normal-sized suprarenal aorta does not exclude an AAA. Typically the investigation for AAA is performed in the general ultrasound laboratory; although some echocardiographic laboratories also routinely interrogate the infrarenal abdominal aorta. Measurements of the infrarenal abdominal aorta are performed at the site of the maximum diameter below the renal arteries in the longitudinal and transverse planes; callipers are placed from outer wall to the outer wall.

Measuring the Size of the Aortic Aneurysm

When images are optimal, accurate measurement of the aortic dimensions is possible. Measurement at all levels of the thoracic aorta should be attempted including measurements at the LVOT, trans-sinus dimension, ST junction, ascending aorta, aortic arch, and descending aorta. The measurement technique for aortic dimensions is described above and demonstrated in Figure 11.7. Importantly, accurate aortic measurements are crucial as elective intervention in patients with aortic aneurysms is based on the size of the aneurysm, the rate of growth of the aneurysm as well as the underlying aetiology and symptoms (Table 11.4). Elective intervention in these patients is indicated due to the high risk of rupture or aortic dissection when aortic sizes are larger than the criteria listed. In addition, concomitant repair of the aortic root or replacement of the ascending aorta may be considered in patients undergoing aortic valve repair or replacement who have an ascending aorta or aortic root of greater than 4.5 cm.

Severity of Aortic Regurgitation

Aortic aneurysms of the aortic root and ascending aorta are often associated with AR. In these cases, AR is most commonly due to annular dilatation (see Fig. 7.44). The severity of AR is assessed in the usual manner (see Chapter 7).

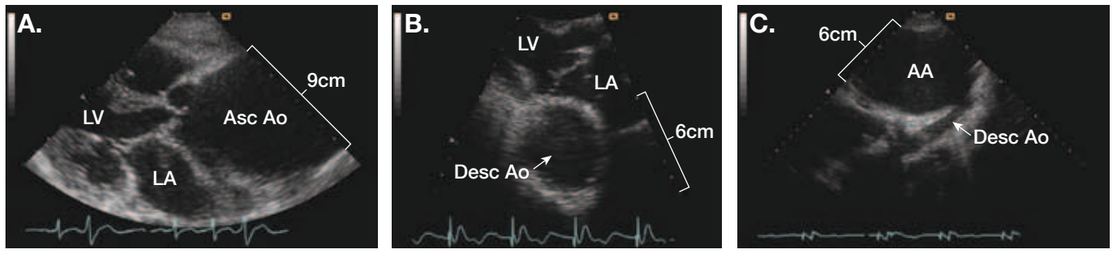

Figure 11.10 These images show three aortic aneurysm sites from three different patients. **A:** From the parasternal long axis view an aneurysm of the ascending aorta (Asc Ao) is shown; observe that the ascending aorta is approximately 9 cm wide with effacement of the sinotubular junction. **B:** From this zoomed and slightly off-axis parasternal long axis view an aneurysm of the descending aorta (Desc Ao) is shown; the maximum diameter of this aneurysm was measured at 5.6 cm. **C:** From the suprasternal view an aneurysm of the aortic arch (AA) is shown; observe that the maximum arch diameter is more than 6 cm. LA = left atrium; LV = left ventricle.

Table 11.4 Thresholds for Elective Intervention for Aortic Aneurysms based on Aortic Dimensions

Site of Aneurysm	Patient Population	Criteria
Ascending aorta	Patients with degenerative thoracic aneurysm, chronic aortic dissection, intramural hematoma, penetrating atherosclerotic ulcer, mycotic aneurysm, or pseudoaneurysm	≥ 5.5 cm
	Marfan syndrome or other genetically mediated disorders#	4.0 – 5.0 cm
	Any patient population	Growth rate > 0.5 cm/year in aorta < 5.5 cm in diameter
	Patients undergoing aortic valve repair or replacement with dilated aortic root or ascending aorta	Consider concomitant aortic root or ascending replacement if > 4.5 cm
	Marfan syndrome, other genetic diseases or bicuspid aortic valves	Ratio of maximal ascending or aortic root area (cm^2) divided by the patient's height (m) > 10
Descending thoracic aorta	General population	> 6.0 cm* > 5.5 cm ^

includes Ehlers Danlos syndrome, Turner Syndrome, bicuspid aortic valve or familial thoracic aortic aneurysms.
* repaired via open surgical technique; ^ repaired with endovascular technique or Marfan patients.
Source: Hiratzka LF, Bakris GL, Beckman JA, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM guidelines for the diagnosis and management of patients with thoracic aortic disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. *J Am Coll Cardiol.* 2010 Apr 6;55(14):e27-e129.

Sinus of Valsalva Aneurysms

Anatomy of the Sinus of Valsalva

Recall that the aortic root is the segment of the aorta between the LVOT and the ascending aorta; it is bounded by the basal attachment of the aortic cusps to the virtual ring proximally and the peripheral attachment of the aortic cusps to the ST junction distally (see Fig. 7.8). There are three sinuses of Valsalva which form distinct out-pouchings of the aortic wall. The sinuses originate at the aortic annulus and end at the ST junction. The sinuses are named according to the coronary arteries arising from within them; that is, the right coronary sinus, the left coronary sinus, and the non-coronary sinus.

Definition of Sinus of Valsalva Aneurysms

A sinus of Valsalva aneurysm (SVA) is a rare congenital anomaly where there is dilatation of a single sinus of Valsalva which is a result of congenital weakening or absence of the media in one of the aortic sinuses. Under the continued strain of aortic pressure, the weakened sinus gradually dilates and eventually forms an aneurysm.

Types and Associated Lesions

The most common site of a SVA is the right sinus (65% - 85%) followed by the non-coronary sinus (10% - 30%). SVA of the left sinus is very rare (< 5%). There are a number of congenital anomalies associated with a congenital SVA. For example, SVAs are commonly associated with a bicuspid aortic valve and a ventricular septal defect (VSD) is commonly associated with a right SVA. Less commonly pulmonary stenosis, coarctation, and atrial septal defect are associated with a SVA.

Complications of SVA

Rupture of a SVA results in a fistulous communication between the aorta and another site. The site of rupture and the resultant fistulous communication is dependent upon the origin of the SVA. A right SVA protrudes towards the right ventricle (RV) and/or the right ventricular outflow tract (RVOT). Therefore, rupture of a right SVA usually results in a fistulous communication between the aorta and the RV or RVOT. Less commonly a ruptured right SVA results in a fistulous communication between the aorta and the right atrium (RA).

A non-coronary SVA protrudes towards the RA. Therefore, rupture of a non-coronary SVA usually results in a fistulous communication between the aorta and the RA, and less commonly between the aorta and the RV.

A left SVA typically protrudes towards the LA but it may also protrude into the pulmonary artery, the left ventricle (LV), the myocardium, or the pericardial space beneath the left coronary artery. Rupture of the left SVA is rare; however, isolated cases of left SVA rupture into the LA, LV and pericardium have been reported. Rupture into the pericardium is almost always fatal due to the development of cardiac tamponade.

As mentioned, an associated VSD is most frequently seen with a right SVA. In particular, deformation of the right sinus of Valsalva in association with a VSD can lead to aortic valve prolapse and subsequent AR (see Fig. 7.43).

Other complications associated with an unruptured SVA have also been reported. These complications include obstruction of the RVOT, conduction abnormalities due to the compression of the bundle of His and proximal portions of the right bundle and left bundle branches, and myocardial ischaemia or infarction due to compression or obstruction of the coronary ostia by the SVA.

Echocardiography in SVA

Echocardiography is able to identify the presence of a SVA, determine the type or location of the SVA, establish the size of the SVA, and identify associated lesions and complications. SVAs are best seen from the parasternal short axis view at the level of the aortic valve. Aneurysms appear as 'ballooning' of the coronary sinus into the adjacent chamber or chambers (Fig. 11.11).

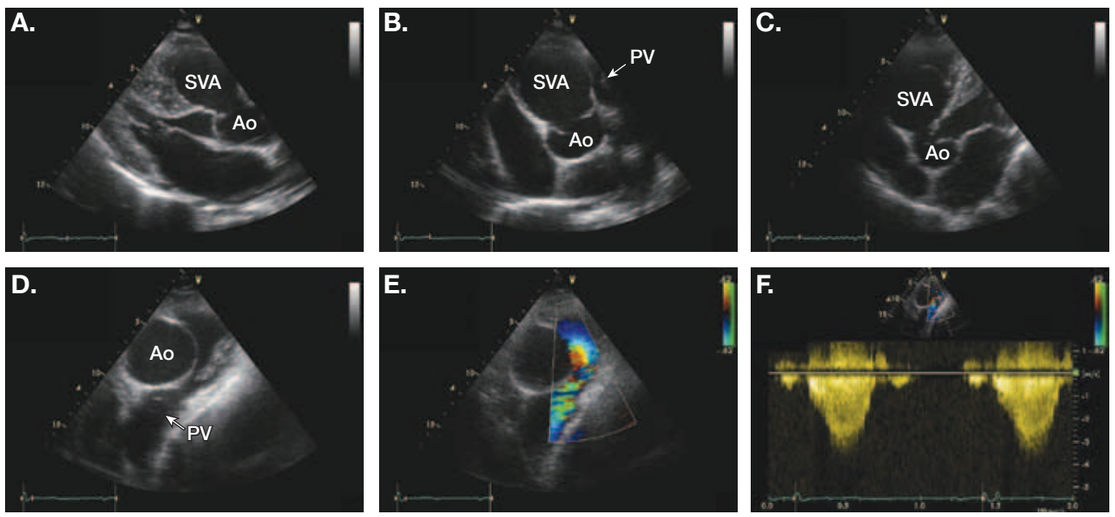

Figure 11.11 A large right sinus of Valsalva aneurysm (SVA) is shown. Images are recorded from the parasternal long axis view **(A)**, the parasternal short axis view **(B)**, the apical 5-chamber view **(C)** and a high parasternal short axis view **(D)**. Right ventricular outflow tract (RVOT) obstruction due to the significant protrusion of this aneurysm into the RVOT is also apparent **(D)**. Colour Doppler imaging **(E)** confirms the presence of turbulent flow across the RVOT. The peak velocity across the RVOT was approximately 3 m/s, yielding a pressure gradient of 36 mm Hg **(F)**. Ao = aorta; PV = pulmonary valve.