Upon completion of this session, the participant should be able to:

- Describe the various imaging modalities used to size an AV for intervention
- State the information important to gain from each imaging modality for AV sizing
- Compare TEE to other imaging modalities for AV sizing

**Anatomy of the Aortic Root**

The aortic root begins at the ventriculo-arterial junction, incorporates three bulges and their respective valvar leaflets (the sinuses of Valsalva), and ends at a slightly thickened ridge in the aortic wall where the ascending aorta begins (the sinotubular junction). Histologically, the walls of the aortic root are composed of fibrous tissue, but there is an increase in the elastic fiber content as the upper portion blends into the elastic tissue and smooth muscle in the aortic wall media.(1) Interspersed between the bulging of the sinuses are fibrous triangles and small crescents of ventricular muscle. It is this heterogeneity of tissue that makes the aortic root a complex transition zone from the muscular left ventricle to the elastic proximal aorta. The hinge lines of the aortic valve leaflets extend from the STJ to a point below the anatomical ventriculo-arterial junction, at the so-called virtual “basal ring.” This is the point commonly measured via echocardiography as the “annulus,” although the existence of such a structure is a point of debate between surgeons and anatomists.(2)

**Measurements with TEE**

Echocardiographic measurements of the aortic root are made in the ME AV LAX view. Four measurements are of particular interest in the setting of AV surgery: the “annulus” (i.e. hinge points of the aortic valve leaflets), the diameter at the sinuses of Valsalva (typically the maximal root diameter), the sinotubular junction (STJ), and the proximal ascending aorta (usually measured within 2cm of the
Methods of Sizing AV Prosthesis

- Echocardiography
- Computed Tomography
- Magnetic Resonance
- Balloon Sizing

STJ). In general, the measurements are made at end diastole using the inner edge to inner edge technique, as this best correlates with other modalities such as MRI or CT. It should be noted, however, that most normative data for echocardiography has been established using the leading edge to leading edge technique. Unlike measurement of the left ventricular outflow tract, there is not a significant difference in these 4 parameters between systole and diastole.

Imaging Modalities for AV Sizing

The advent of transcatheter aortic valve implantation (TAVI) has increased interest in sizing of the aortic annulus and other components of the aortic root. Like standard open aortic valve replacement, pre-procedural imaging can help determine the appropriate sized prosthesis. This is probably more important in TAVI since the interventionalist cannot directly inspect the implantation site. Additionally, it must be ensured that the prosthesis does not obstruct the coronary ostia. There are multiple methods for determining the correct prosthetic valve size, each with particular advantages and disadvantages. Typically, a combination of modalities is used to assess the following:

- Aortic annulus size
- Leaflet length and calcification
- Location of the coronary ostia
- Identification of other interfering factors

Whatever modality is used, it should be recognized that the aortic annulus is not actually circular. This means that there is an inherent inaccuracy in any 2D measurement. This is one of the reasons that TEE tends to underestimate the cylindrical sizers used during surgery. Multiplanar modalities may therefore be preferred. The bi-plane function on 3D TEE probes is particularly helpful in this respect since it allows simultaneous viewing of both sagittal (i.e. long axis - where the annular measurement is typically taken)
and transverse (i.e. short axis) planes. This ensures the sagittal plane is bisecting the largest dimension of the aortic annulus and not obtaining an oblique view that would underestimate the annulus diameter.

Ideally, the ME long axis view centered on the LVOT, AV, and ascending aorta (the so-called “3-chamber” view) during mid-systole should be used for 2D measurements of the AV annulus.(7) While the right coronary cusp hinge point is usually well visualized, the upper hinge point is more difficult to see.

In general, transthoracic and TEE 2D measurements correlate well, with the TEE annular diameter about 1mm larger. Compared to multi-slice CT, the TEE measurement is about 1 – 1.5mm smaller.(8)

**Key Points**

- The aortic annulus is not perfectly circular, leading to inaccuracies in 2-dimensional measurements
- Although multi-slice CT is commonly used pre-op for TAVI, TEE remains the standard for sizing in the OR
- When using TEE, be sure to avoid oblique measurements
- While the RCC hinge point is easily visualized, the LCC/NCC point is not
- Measurement by CT will be 1 – 1.5mm larger than 2D TEE
References


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