Coned down intraoperative radiograph after successful aortic root, either retrospectively or by ECG triggering. ECG gating should be performed when imaging the common femoral arteries. Maximum slice thickness 1 mm, and imaging is obtained with breath holding. ECG gating should be performed when imaging the aortic root, either retrospectively or by ECG triggering during image acquisition. Imaging should be performed during systole since this is when the aortic annulus is largest. Additionally, the annulus adopts a more rounded configuration during systole, as opposed to more oval during diastole.

Transcatheter Aortic Valve Replacement (TAVR) is a new, minimally invasive alternative to open aortic valve replacement which has recently been approved for surgical replacement. The Ten Minute TAVR CT- A Guide to Efficient and Effective Interpretation Of Pre-Procedure CTA Using Automated Software

Christopher Coleman, MD; Pragnesh Parikh, MD; Patricia Mergo, MD; Brian Shapiro, MD
Department of Radiology, Mayo Clinic, Jacksonville, FL

Figure 1
Edwards SAPIEN Transcatheter Heart Valve shown alone and mounted on the deployment balloon.

Figure 2
Center line illustration and the reconstructed CT generated automatically. From here, cross-sectional measurements from the LVEF through the femoral arteries can be recorded.

Figure 3
Computer-generated short and long axis diameter and cross sectional areas of the iliofemoral trees based on center line reformating. The note outline excludes areas of large calcifications. The true luminal cross-sectional area is probably more closely approximated by an outline which bisects these areas of calcified plaque.

Figure 4
Sinus of Valsalva. This plane is orthogonal to the left ventricular outflow tract, and can be measured automatically after center-line formation.

Figure 5
Sinotubular junction measurements can also be obtained from software analysis.

Figure 6
Descending aorta cross sectional area and minimum visceral dimensions.

Figure 7
Aortic annulus with manual measurements of short and long axis and cross sectional area. The annulus plane is determined by finding the lowest insertion point of the valve cusp and performing manual reconstruction until all three cusp insertions are in a single plane.

Figure 8
After the annulus plane is identified, distance from the coronary cusps to the ostia of the left main and right coronary arteries can be measured. These measurements still must be made by hand.

Protocol
CT imaging should include the aortic root through the common femoral arteries. Maximum slice thickness is 1mm, and imaging is obtained with breath holding. ECG gating should be performed when imaging the aortic root, either retrospectively or by ECG triggering during image acquisition. Imaging should be performed during systole since this is when the aortic annulus is largest. Additionally, the annulus adopts a more rounded configuration during systole, as opposed to more oval during diastole.

Measurements
- Multipleplanar reconstructions and software-assisted center line drawing provides a cross-sectional view of the desired portion of the aortic root.
- Iliac arteries evaluated for tortuosity and dense calcifications.
- Narrowest luminal diameter of each iliac/common femoral artery identified
- Dictate the size of the sheath that can be introduced into the vessel and whether a transapical approach is required.
- Fewer generation systems can be placed through an 18 French sheath, for which the suggested minimum vessel lumen diameter ranges from 6.0-6.5 mm.
- Over-sized sheaths can result in serious vascular injury.
- Cross sectional measurements derived from software center line reconstruction
  - Aortic sinus (Fig. 4)
  - Sinotubular junction (Fig. 5)
  - Maximum dimension of the ascending and descending aorta (Fig. 6)
- The software attempts to assess the aortic annulus plane but manual manipulation is often required.
  - Annulus is in plane formed by the inferior most insertion point of each of the three coronary cusps (Fig. 7).
  - Oval approximation is created, and the short and long axis diameter, circumference and cross sectional area are calculated.
  - Not necessarily orthogonal to the left ventricular outflow tract.
  - Then distance from the coronary ostia to the annulus plane can be assessed (Fig. 8).
- Qualitative burden of valve calcification evaluated to minimize risk of occluding coronary ostia with compressed valve calcifications, as the valve implant displaces the native valve and its calcifications, rather than replace them.

Major Teaching Points:
1. Pre-procedure planning is vital to the success of TAVR.
2. CTA is critical to evaluate the entire aortofemoroiliac arterial system, which is often tortuous in the target population. CTA also appears to more accurately measure the aortic annulus.
3. Computer software can simplify and expedite the CTA planning for TAVR by using vessel centerlines to ensure orthogonal measurements. However, some manual manipulation is often required, during the aortic annulus measurement, as it is often not orthogonal to the left ventricular outflow tract.
4. Automated vessel measurements can underestimate luminal diameter in heavily calcified arteries, as vessel lumen estimates tend to completely exclude large wall calcifications. Relfections in software algorithms would be helpful to improve this shortcoming.

References