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IMAGING VIGNETTE

Noncontrast 3D CMR Imaging for Aortic Valve Annulus Sizing in TAVR

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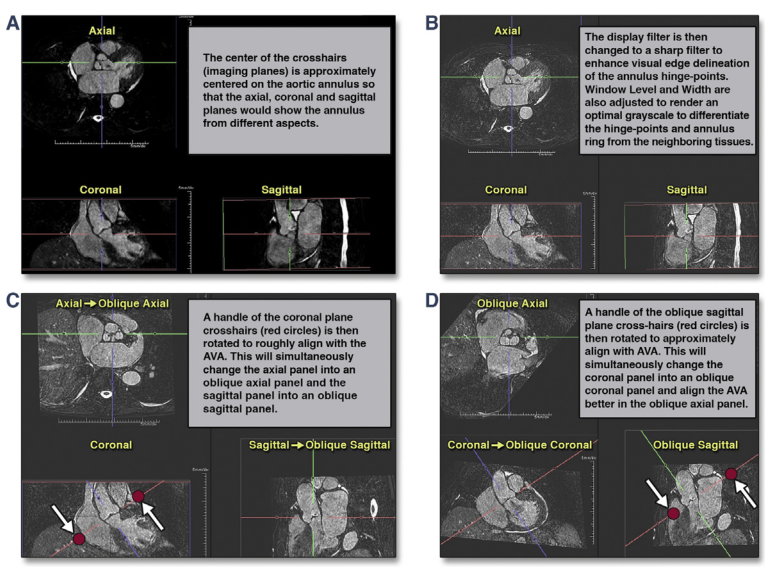
COMPUTED TOMOGRAPHIC IMAGING HAS BECOME THE REFERENCE STANDARD FOR AORTIC ANNULUS SIZING IN PATIENTS evaluated for transcatheter aortic valve replacement. However, many of these patients have underlying renal dysfunction that precludes safe use of radiographic contrast. In such patients,

FIGURE 1 **Steps in Post-Processing, Analysis, and Measurement of Noncontrast Cardiac Magnetic Resonance Multiplanar Reformats (Part 1)**



Imaging data was post-processed, analyzed, and measured with TeraRecon Aquarius iNtuition version 4.4.11 (Foster City, California). **(A)** The center of the crosshairs (imaging planes) is approximately centered on the annulus. **(B)** A sharp filter and an optimal window setting are selected to render an optimal grayscale to differentiate the aortic valve hinge-points and annulus ring from the neighboring tissues. **(C)** A handle of the coronal plane crosshairs **(red circles)** is then rotated to roughly align with the annulus. This will simultaneously change the axial panel into an oblique axial panel and the sagittal panel into an oblique sagittal panel. **(D)** A handle of the oblique sagittal plane crosshairs **(red circles)** is then rotated to approximately align with the annulus. This will simultaneously change the coronal panel into an oblique coronal panel and align the annulus better in the oblique axial panel. AVA = aortic valve annulus.

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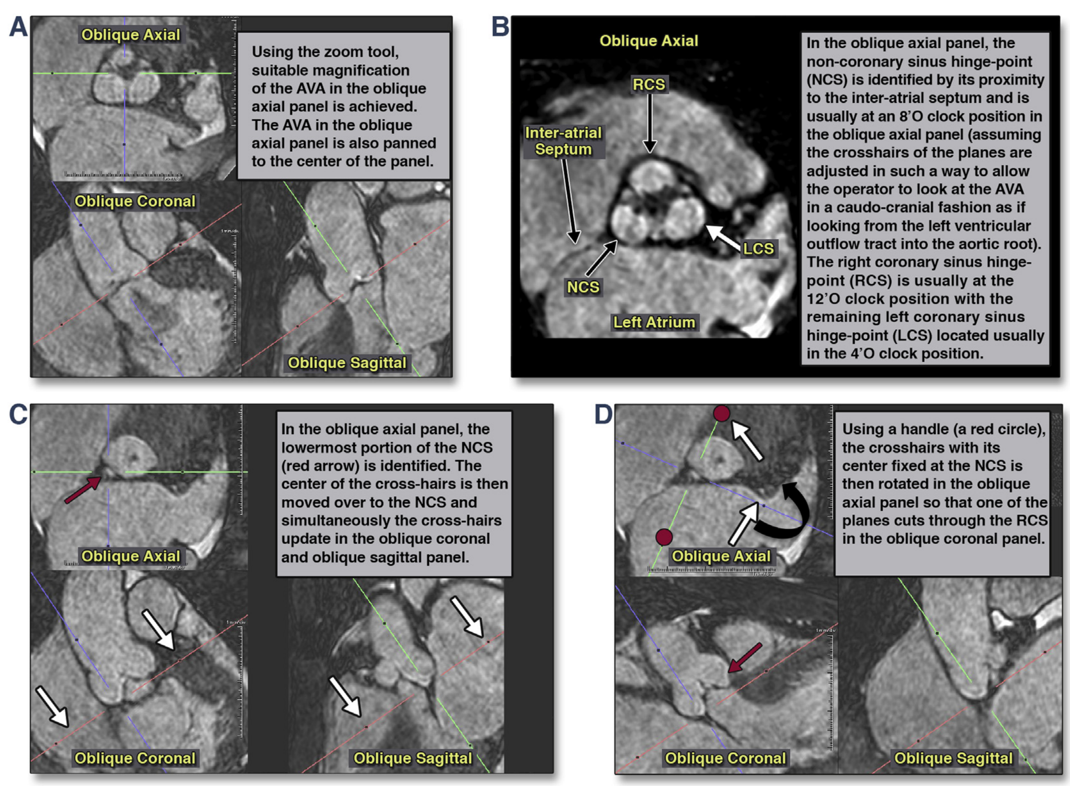
free-breathing noncontrast, navigator-gated 3-dimensional magnetic resonance imaging whole-heart acquisition (nc-cMRI) data can be effectively used for 3-dimensional aortic annulus sizing. nc-cMRI is performed with a 1.5-T whole body magnetic resonance imaging scanner (Philips Achieva, Philips Healthcare, Andover, Massachusetts) using a 16-channel phased array heart synergy coil (shortest repetition time, shortest echo time, flip angle 90°). Reconstruction is on a 512×512 matrix resulting in a final voxel resolution of $0.59 \times 0.59 \times 0.75\ mm^3$. In this prospective observational study with 35 consecutive eligible patients with severe aortic stenosis (Table 1), no significant propensity-adjusted differences in perimeter, area, and average, maximum, and minimum diameters were found between nc-cMRI and cardiac computed tomography angiography diastolic measurements. With the exception of the minimum annulus diameter being significantly smaller with nc-cMRI (difference = 0.4139, 95% confidence interval [CI]: 0.0721 to 0.7556, $p = 0.02$), similar results were observed when nc-cMRI was compared to cardiac computed tomography angiography end-systolic measurements. Figures 1 to 5 document the step-by-step process of image analysis and measurement.

For patients in whom contrast administration is not advisable, nc-cMRI provides an accurate alternative to cardiac computed tomography angiography for annular sizing. The annulus perimeter and the average diameter vary less than the annulus area during cardiac cycle in patients with severe aortic stenosis, and are better suited to size the annulus before transcatheter aortic valve replacement.

FIGURE 2 Steps in Post-Processing, Analysis, and Measurement of Noncontrast Cardiac Magnetic Resonance Multiplanar Reformats (Part 2)



(A) Using the zoom tool, suitable magnification of the annulus in the oblique axial panel is achieved and centered. **(B)** In the oblique axial panel, the noncoronary sinus hinge-point (NCS) is identified by its proximity to the interatrial septum. The right coronary sinus hinge-point (RCS) and the left coronary sinus hinge-point (LCS) are then easily identified. **(C)** In the oblique axial panel, the multiplanar reformat slices are then scrolled through to first identify the lowermost portion of the NCS **(red arrow)**. The center of the crosshairs is then moved over to the NCS. **(D)** Using a handle **(red circle)**, the crosshairs with its center fixed at the NCS is then rotated in the oblique axial panel so that one of the planes cuts through the RCS in the oblique coronal panel. Abbreviation as in Figure 1.