Tricuspid Atresia With Atrial Septal Defect, Ventricular Septal Defect, and Right Ventricular Hypoplasia Demonstrated by Multidetector Computed Tomography

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A 34-year-old woman was referred to our department for evaluation of her known congenital heart disease (tricuspid atresia [TA] with an atrial septal defect [ASD] and a ventricular septal defect [VSD]). She had refused surgery in her adolescence and had since been followed up medically. A contrast enhancement CT examination using multidetector CT was performed by use of 2 methods.1–3

Figures 1 and 2 show a dynamic multislice cine scan (movie versions of Figures 1 and 2 can be found at http://www.circulationaha.org). Dynamic data were acquired for 25 seconds with breath-hold, with a multislice cine mode in the direct 4-chamber view position (left anterior oblique with the patient lying on her back and the gantry angle adjusted). The dynamic cine mode with multidetector CT can assess flow dynamics of the contrast material in 4 slices. The TA prevented flow from the right atrium (RA) to the right ventricle (RV); the ASD allowed a “flow jet” from the RA to the left atrium (LA); and the VSD allowed flow from the left ventricle (LV) to the RV.

Figures 3 and 4 show a multislice multicine scan to create 2D-CT and 3D-CT ventriculography.1–3 During a single breath-hold in the straight supine position, the patient’s entire heart was scanned with the multislice, multicine technique ([2.5 mm × 4 slices]×10 cine scans = 2.5 mm × 40 slices, 2.5 rotations [2.0 seconds] per cine scan). With 0.1-second-frame-interval overlapping reconstruction, 16 images in different cardiac cycles were obtained per slice. Transaxial image data sets of end-diastolic (ED) and end-systolic (ES) phases were extracted to create 2D-reformation images in cardiac axes and 3D images.

References
Figure 1. ED and ES images of 1 of 4 direct, 4-chamber view slices (5 mm thick × 4 slices) during dynamic cine CT. Illustration of anatomic information is on right. Movie (http://www.circulationaha.org) was produced by paging images reconstructed in 0.1-second intervals (10 to 26 seconds from beginning of intravenous administration of contrast medium (300 mg iodine/mL, 2 mL/s × 20 seconds). Flow dynamics of contrast medium were visible: no flow from RA to RV, flow jet from RA to LA via ASD, and flow from enlarged LV to hypoplastic RV via VSD. Open mitral valve is visible in ED image, and closed mitral valve is visible in ES image. AO indicates aorta; MV, mitral valve; PV, pulmonary vein; and RCA, right coronary artery.

Figure 2. One cardiac cycle of 4 direct, 4-chamber-view slices (5 mm thick × 4 slices). TA, ASD, VSD, enlarged LV, and hypoplastic RV are clearly demonstrated. Animated version can be found at http://www.circulationaha.org

Figure 3. 2D images of ED and ES phases in 4-chamber view and short axis. Top left, 4-chamber view (ED); top middle, basal short axis (ED); top right, midventricular short axis (ED); bottom left, 4-chamber view (ES); bottom middle, basal short axis (ES); bottom right, midventricular short axis (ES). TA, ASD, VSD, enlarged LV, and hypoplastic RV are visible.

Figure 4. 3D volume-rendering images of ED and ES phases in cut-model display (inferior and superior halves of 4-chamber plane cut). Anomalies (TA, ASD, VSD, enlarged LV, hypoplastic RV) are depicted in 3D. LV and RV volumes in ED and ES phases are also assessed. LVEDV indicates LV ED volume; RVEDV, RV ED volume; LVESV, LV ES volume; and RVESV, RV ES volume.
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