Background

• The Knowledge-Based Reconstruction (KBR) technology has conventionally used 2D echocardiograms and positional data for processing into 3D representations and surface rendering for functional assessment.

• KBR utilizes anatomic cardiac landmarks and databases without border tracing.

• Our goals were (1) to investigate a new KBR system and algorithm (VMS+, Ventripoint) in conjunction with 3DE, and (2) compare results of ventricular function between VMS+ and semiautomatic 3DE contour detection methods: 4DLV 3.0 and 4DRV 2.0 (TomTec).

Methods

• 3DE was prospectively performed in 50 subjects including 25 repaired tetralogy of Fallot (TOF) and 25 age and body surface area (BSA) matched controls (iE33, Philips).

• Full-volume acquisitions of left and right ventricles (LV, RV) were made from focused apical views.

• After importing raw cartesian 3DE datasets, borders and specific anatomical structures of LV and RV were defined by placing points on standard VMS 2D scan planes.

• The resultant 3D model was used to calculate end-diastolic, end-systolic, stroke volume (EDV, ESV, SV), and ejection fraction (EF). Comparisons were made to TomTec measurements.

• The anatomical landmarks included LV apex, endocardium, interventricular septum (IVS), mitral and aortic annulus (LV); RV apex, free wall, basal bulge, IVS, tricuspid and pulmonic annulus and conal septum (RV). Using VMS+, an initial abstract model of 3D shape was generated, refined by blending and scaling to best fit, and 3D volume derived by processing through VMS-CMR libraries (Figure).

• The LV and RV volumes, function and analysis times by both methods are shown (Table).

• LV volumes showed excellent agreement between VMS+ and TomTec, while agreement was lower for RV volumes.

Results

• For TOF, age was 15.8 ± 10 yrs, BSA was 1.4 ± 0.5 m2, and for normals, age was 15.1 ± 9 yrs, and BSA 1.4 ± 0.5 m2.

Conclusions

• This study demonstrates feasibility of quantifying biventricular volumes and function using VMS+ on native 3DE datasets in normal and repaired TOF hearts.

• Analyses times with VMS+ were closer with semiautomatic border detection for the LV, however for the RV, VMS+ analysis times were longer.

• RV volumes by VMS+ were greater than those by semiautomatic border detection, likely due to better outflow tract inclusion with VMS+.

Authors have nothing to disclose.