

Intraventricular Flow Profile in the Single Left Ventricle Palliated with Fontan Using Echocardiographic Contrast Particle Imaging Velocimetry.

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Background: The purpose of this investigation was to test the hypothesis that intraventricular flow patterns in the palliated single left ventricle (SLV) differs from the normal LV. High-resolution echocardiographic contrast particle imaging velocimetry (PIV) was used to investigate rotation intensity and kinetic energy dissipation of SLV flow in patients with Fontan procedure compared with normal controls.

Methods: Thirty subjects (7 with SLV Fontan, age 19.5 ± 9.1 years, 5 female/ 2 male and 23 normal controls, age 38.7 ± 8.4 years, 10 female/ 13 male) underwent prospective contrast imaging using the lipid-encapsulated microbubble (Definity, Lantheus Medical). A mechanical index of 0.4, three-beat high-frame rate (>60 Hz) captures, and harmonic frequencies were used. Rotation intensity and kinetic energy dissipation of LV flow was studied using flow post-processing software (Hyperflow 6.0-1.3 TomTec).

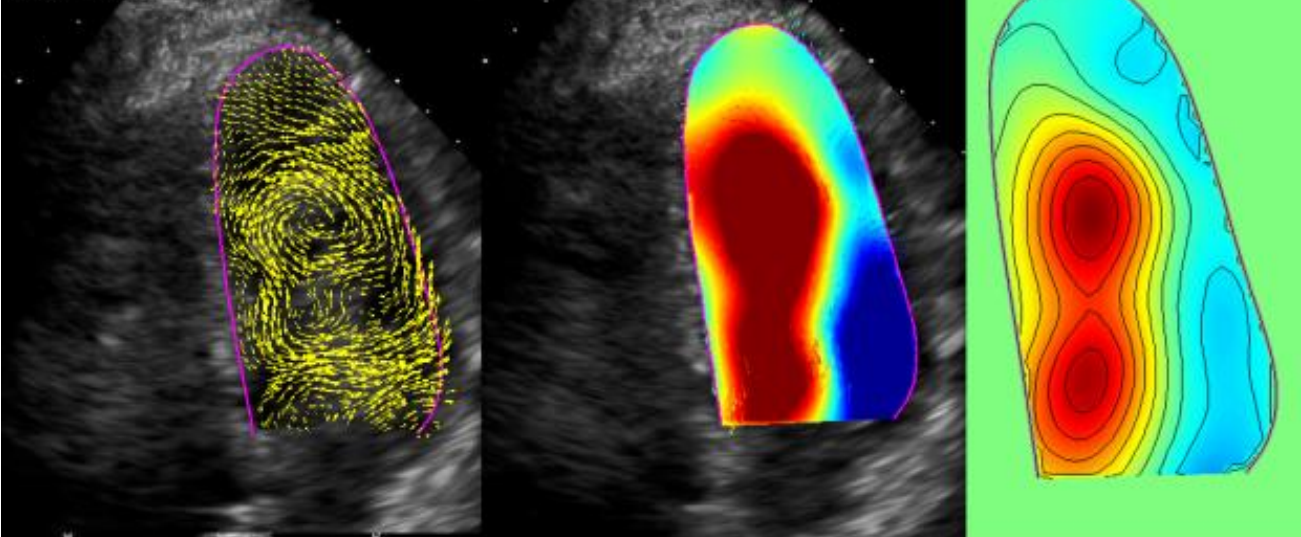
Results: Measurable LV planar maps were obtained in all 7 patients with Fontan and in the 23 controls (Figure). Compared with the normal LV, steady-streaming (heartbeat-averaged) flow rotation intensities were higher for the SLV (0.49 ± 0.08 vs 0.29 ± 0.08 , $P < 0.001$), whereas kinetic energy dissipation in SLV was lower (0.35 ± 0.15 vs 1.52 ± 0.69 , $P < .001$).

Conclusions: Echocardiographic PIV derived intraventricular flow characteristics and planar maps for the SLV in Fontan differ from those in the normal LV. The rotation intensity and energy dissipation indices may be quantitative markers of ventricular compliance abnormalities in the SLV.

Keywords

- Congenital heart surgery
- Fontan repair
- Hypoplastic left heart syndrome
- Cardiac blood flow

Normal LV



Single LV

