The intra-cardiac blood flow kinetic energetics of the systemic right ventricle in patients with hypoplastic left heart syndrome

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The impact of diastolic flow energetics on cardiac functions remains unknown in patients with hypoplastic left heart syndrome (HLHS), however the many hemodynamic parameters of chamber and wall kinetics were reported to affect the cardiac performance in HLHS.

We investigated the intra-cardiac blood flow kinetic energy loss (EL) of systemic right ventricle in 15 patients with HLHS after Fontan procedure (mean age at 7.7y), by using a novel imaging modality of Vector Flow Mapping (VFM) (Hitachi-ALOKA ltd), compared to those of the left ventricle (LV) in 16 normal healthy children (mean age at 8.9y).

Method We first recorded three-chamber view of the systemic ventricle with color Doppler echocardiogram by Prosound F75 with VFM imaging mode. Then we calculated the blood flow kinetic energy loss (EL) from the reconstructed velocity vector components transformed into Cartesian coordinate system as previously reported by Itatani K. Jpn J Appl. Phys 2013;52:07HF16). The EL data were indexed by measuring a ratio of EL to the inflow kinetic energy (KEin) through systemic atrioventricular valve in diastole.

Result EL/KEin was significantly increased in HLHS (0.17+/- 0.1) than in N (0.06+/-0.03) as Fig.1. (p<0.005), although fractional area change was not significantly different in HLHS (0.42+/-0.08) from in N (0.49+/-0.04).

In conclusion, the systemic right ventricle of HLHS loses more flow kinetic energy in diastole than LV in N, which may contributes to cardiac performance in a long term besides the changes of other chamber and wall kinetics.