

Echocardiographic assessment of diastolic dysfunction in children with congenital heart disease – correlations with invasive data

Dragulescu A, Mroczek D., Chaturvedi R.C., Benson L., Redington A., Friedberg M.K., Jaeggi E.T., Mertens L.

The Hospital for Sick Children, Toronto, Canada

Introduction (or Basis or Objectives): Diastolic dysfunction is an important cause of heart failure in adult population. Studies regarding diastolic dysfunction in children are scarce and with small numbers of patients.

Methods: Fifty patients scheduled for the left heart catheterization were prospectively enrolled in the study. After induction of general anesthesia a short functional echocardiography was performed including all standard diastolic parameters measured according to current guidelines. Once arterial access was gained a catheter was advanced into the left ventricle (LV) and high-fidelity pressure measurements were performed using a Millar catheter. Invasive diastolic parameters (Tau, min dP/dT, max -dP/dT and end diastolic pressure (EDP)) were measured on the pressure tracings.

Results: Study population consisted in 4 groups of patients: aortic coarctation (CoA, n=16), aortic stenosis (AS, n=8), Kawasaki disease (Kw, n=15) and heart transplant patients (HTx, n=11). Mean age at procedure was 10±5 years with no differences between groups. Patients with outflow tract obstruction (OTO, including CoA and AS) had significantly higher EDP, Tau values and LV mass index than those without (HTx and Kw) (see table). Also, they had longer deceleration time and IVRT, higher pulmonary S/D ratio but similar E/A ratio; septal and lateral tissue velocities (e') were lower and E/e' ratio increased compared to patients without OTO (see table). Only 7 patients had prolonged Tau (5 CoA, 2 AS), of which 3 had completely normal echo data, while 4 had abnormal e' lateral and E/e' ratio, 2 pts also with increased E/Vp ratio, all other parameters being within normal range. Nineteen patients (14 with OTO) had EDP>12mmHg, associated with prolonged Tau in 5 pts. There were no significant correlations between echo parameters and LV EDP, while Tau correlated with IVRT (R=0.4) and E/Vp (R=0.35), p<0.05. E/e' ratio >2SD for age was a good predictor of EDP higher than 12mmHg (OR: 12.8, 95% CI: 2.4-78, sensitivity 58%, specificity 90%).

Conclusions: Elevated filling pressures are relatively common in patients with outflow tract obstruction but are not necessarily associated with early relaxation abnormalities. Echocardiographic parameters correlate poorly with invasive measurements of diastolic function. Increased E/e' ratio is a predictor of elevated filling pressures with relatively low sensitivity.

	Outflow tract obstruction* (n=24)	No outflow tract obstruction (n=26)	p
End diastolic pressure (mmHg)	16.3±4.1	9±4.8	p<0.001
Max -dP/dT (mmHg/sec)	1037.3±474.1	1002.4±345.7	p=0.38
Min dP/dt (mmHg/sec)	-1185.5±350.8	-1104.7±382.9	p=0.22
Tau (msec)	42.8±12.8	33±7.6	p<0.001
Left ventricular mass index (g/m ^{2.7})	43.6±18.5	30.1±7.5	p<0.001
Mitral E/A ratio	110.8±20.4	97.9±22.9	p=0.45
Mitral deceleration time (msec)	156.4±37.9	132.5±33.6	p=0.016
IVRT (msec)	65.67±13.1	59.3±12.7	p=0.047
Pulmonary S/D ratio	1.1±0.2	0.76±0.2	p<0.001
Mitral A – PV A reversal duration (msec)	20±22	13±15	p=0.1
e' lateral (cm/sec)	11.7±3	14.1±4	p=0.013
e' septal (cm/sec)	10.8±1.9	13±3.1	p=0.002
E/mean e' ratio	10.9±3.8	8±2	p<0.001
Mitral flow propagation velocity (cm/sec)	61±16.2	62.5±14.5	p=0.37
Mitral E/ flow propagation velocity ratio	2.1±0.7	1.7±0.4	p=0.023
Left atrial volume index (ml/m ²)	29.7±8	27.3±5	p=0.1

*3 patients had blended mitral inflow