STRAIN AND STRAIN RATE ECHOCARDIOGRAPHY FINDINGS IN CHILDREN WITH CONGENITAL LEFT VENTRICULAR OUTFLOW TRACT OBSTRUCTION

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BACKGROUND

Congenital left ventricular outflow tract obstruction (LVOTO) accounts for 5-10% of all congenital heart disease. In clinical practice, the severity of stenois is defined using the ultrasound Doppler-derived peak instantenous aortic flow velocity or Bernoulli equation-derived pressure gradient across the stenotic segment. The therapeutic management of patients generally depends on the hemodynamic severity of the stenosis and the presence of symptoms. There is no consensus however, as to whether, how and when to treat asymptomatic patients with moderate stenosis. The main reason for intervention in this subset of patients is to avoid further deteroiation and irreversible myocardial damage. Two-dimensional speckle tracking echocardiography (2DSTE) a relatively new echocardiographic technique to quantify myocardial strain, providing comprehensive information on LV myocardial contractility. Strain and strain rate (S/SR) echocardiography is shown effective in detecting subclinical myocardial dysfunction in a spectrum of heart disease. The aim of our study was to evaluate the myocardial functions with 2DSTE in LVOTO patients with normal cardiac functions determined by conventional echocardiographic techniques and comparing them with healthy controls.

MATERIALS AND METHODS

A total of 58 patients with various degrees of isolated congenital left ventricular outflow tract obstruction (LVOTO) and normal left ventricular function determined with conventional echocardiography and 73 healthy controls were enrolled in this study. Two-dimensional cine-loop recordings of apical 4-chamber and basal short-axis views were digitally stored for off-line analysis. Conventional echocardiography parameters, longitudinal, circumferential and radial peak systolic strain and strain rate values were determined.

RESULTS

In our study we examined 58 patients with LVOTO and 73 healthy controls. By conventional echocardiography the difference were statistically significant only in terms of end-systolic interventricular septum diameter and left ventricle mass index (p<0.05) (Table-1).

Table-1: Demographic, anthropometric and conventional echocardiographic findings (mean±standard deviation)

	Control	Patient	p
Number	73	58	
M/F	39/34	44/14	
Age (months)	80.4±48.4	74.6±49.8	.49
Weight (kg)	25.1±13	23.8±14.5	.59
BSA (m^2)	0.89±0.33	0.85±0.37	.56
HR(bpm)	103.8±27.4	103.1±28.4	.90
EF	74.7±8	77.3±8.7	.09
FS	43.2±7.7	46±8.5	.07
IVSEDD (mm)	6.6±1.8	7.1±2.4	***.04****
IVSESD (mm)	10.9±2.9	12.3±2.7	.39
LVEDD (mm)	33.8±7.6	34.9±8.4	.76
LVESD (mm)	18.8±5.7	19.2±6.5	.47
PWEDD (mm)	5.7±1.36	6.1±1.4	.36
PWESD (mm)	10.6±2.4	11.2±2.4	.33
LVMI (gr/m^2)	54.1±17.1	67.6±25.4	**.01***

Global longitudinal strain (LS)(-23.12±3.6 and -24.2±3.4), and strain rate (LSR) (-1.49±0.32 and -1.6±0.32) were lower whereas circumferential strain (CS) (-25.9±4.7 and -22.4±6) and strain rate (CSR) (-1.82±0.46 and -1.66±0.51) were higher in the patient group than in control subjects. The difference were significant in terms of LSR and CS (p<0.05). The radial S and SR values were similar with a slightly lower values in the patient group (Table-2).

Table-2:Global strain and strain rate findings (mean±standard deviation)

	Control	Patient	p
Global LS	-24.2±3.4	-23.1±3.6	.09
Global LSR	-1.6±0.32	-1.49±0.32	***.04****
Global CS	-22.4±6	-25.9±4.7	***.00****
Global CSR	-1.66±0.5	-1.82±0.46	.06
Global RS	35.5±21.2	35.8±21.9	.93
Global RSR	2.2±0.71	2.3±0.97	.44

Regional S and SR analysis from apical 4C view revelaed lower LS and LSR in all segments of the septum and posterior free wall in the patient group than control group. Hovewer the difference were statistically siginificant for LS values of the basal septum and free wall and LSR values from basal segment of posterior free wall (p<0.05) (Table-3). Basal short axis views at the level of mitral valve were analysed for circumferential and radial S and SR measurements. Circumferential strain values were higher in the patient group in all segments whereas the statistically signficant difference were present between two groups in terms of those measurements from anterioseptal, posterior and inferior segments (p<0.05). There were no siginificant difference between two groups according to CSR, RS and RSR measurements in all segments (p<005).

Table-3: Regional longitudiunal S/SR findings (mean±standard deviation)

		Control	Patient	p
SB	LS	-20.7±3.4	-19.6±3.2	*.07*
	LSR	-1.45±0.3	-1.3±0.24	***.01****
SM	LS	-23.8±3.8	-23.1±3.2	*.27*
	LSR	-1.6±0.4	-1.5±0.27	*.27*
SA	LS	-28.6±5.1	-28.5±5.9	*.95*
	LSR	-2.1±0.5	-1.98±0.5	*.45*
LVB	LS	-23.3±5.8	-19.6±7.2	***.003****
	LSR	-1.9±0.46	-1.68±0.5	*.02*
LVM	LS	-23±4.8	-21.9±4.9	*.20*
	LSR	-1.65±0.4	-1.55±0.3	*.13*
LVA	LS	-23.3±5.8	-19.6±7.2	***.003****
	LSR	-1.9±0.46	-1.68±0.5	*.023*

SB: basal segment of interventricular septum, SM:mid-septum, SA: apikal septum, LVB: basal segment of free wall, LVM:mid segment of free wall, LVA: apical segment of free wall,

CONCLUSION

In conclusion: we found differences in terms of S/SR echocardiography measurements between patients with normal cardiac functions determined by conventional methods, and healthy control subjects. Compatible with the previous studies, impairment of the left ventricular long axis function occurred earlier and was more prominent in basal parts of the interventricular septum and free wall of left ventricle. According to these findings, S/SR echocardiography in addition to conventional methods in evaluation of the left ventricular functions and determining the subtle alterations in LVOTO patients, will be helpful in management and timing of the treatment.