

The use of Tissue Doppler Imaging in assessing right and left ventricle diastolic function in children with growth hormone deficiency before and after one-year therapy with growth hormone



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Background

Growth hormone (GH) therapy has a clear positive effect on many parameters including many metabolic and physiologic functions as well as its effect on growth. It has also been shown that GH therapy exerts a significant effect on cardiac morphology and function as shown by echocardiography.

Aim

To investigate left and right ventricle (LV, RV) diastolic function by Tissue Doppler imaging (TDI) in pre-pubertal GHD children before and after one year therapy with GH versus the standard M-mode as well as the Doppler imaging techniques.

Patients and Methods

A prospective case-control study performed on 23 pre-pubertal GHD patients and 14 age, sex and body mass index (BMI) matched controls. TDI was done before and one year after therapy with GH.

Results

GHD patients showed significant impairment in RV and LV diastolic functions by TDI when compared to controls.

One-year therapy with GH showed significant decrease in both ratios denoting improvement in the net diastolic functions, in addition to the lack of difference of cardiac parameters between cases and controls at end of study denoting its cardiac role.

Table 1 Baseline LV and RV diastolic functions in patients and controls by TDI

Parameter	Patients (n=23)		Controls (n=14)		p
	Mean ±SD	Range	Mean ±SD	Range	
A'm (cm/s)	5.16 ± 0.6	3.9 – 6.9	7.4 ± 0.3	6.9 – 7.9	0.00*
E'm/A'm	2.62 ± 0.35	2 – 3.56	1.82 ± 0.1	1.6 – 2	0.00*
Em/E'm	6.78 ± 0.52	5.7 – 7.7	6.7 ± 0.55	6.1 – 8.1	0.74
E't (cm/s)	11.6 ± 0.94	10.5 – 13.9	14.7 ± 0.97	12.9 – 16.1	0.00*
A't (cm/s)	5.93 ± 0.71	4.3 – 7.5	7.7 ± 0.65	6.4 – 9	0.00*
E't/A't	1.97 ± 0.15	1.8 – 2.4	1.89 ± 0.08	1.75 – 2	0.08
Et/E't	5.99 ± 0.63	4.9 – 7.2	4.69 ± 0.52	3.7 – 5.8	0.00*

Table 2: Comparison of cardiac dimensions and mass by M-mode echocardiography between patients in first and second visits

Parameter	Visit 1 (n=23)		Visit 2 (n=19)		p
	Mean ±SD	Range	Mean ±SD	Range	
LVEDd (mm)	36.7 ± 2.1	32.3–39.5	36.0 ± 2.1	32.3–39.5	0.005*
LVESVi (ml/m ²)	20.7 ± 1.1	19 – 22.7	21 ± 1.07	19.3–22.8	0.000*
LVEDVi (ml/m ²)	41.1 ± 1.4	38 – 44	41.9 ± 1.4	38.5–44.4	0.000*
LVMi (gm/m ²)	50.1 ± 4.3	36.7–57.5	51.2 ± 4.2	37.2–58.3	0.002*
LVPWd (mm)	7.1 ± 0.8	5.7 – 8.1	7.3 ± 0.83	5.7 – 8.2	0.000*
IVSd (mm)	7.1 ± 0.7	5.6 – 8.1	7.2 ± 0.82	5.6 – 8.2	0.000*

Table 3: Comparison of cardiac dimensions, mass and functions by Doppler echocardiography between patients in first and second visits

Parameter	Visit 1 (n=23)		Visit 2 (n=19)		p
	Mean ±SD	Range	Mean ±SD	Range	
IVRT (ms)	48.9 ± 1.4	46.9–53.5	48.5 ± 1.39	46.4 – 53	0.000*
DT of Em (ms)	92.1 ± 2.6	87.9–96.4	91.6 ± 2.6	87.8–96.2	0.000*
Em (cm/s)	91.2 ± 5.1	82.4–104.5	91.6 ± 5.3	83– 104.9	0.000*
Am (cm/s)	45.9 ± 4.9	40 – 57	45.3 ± 5	39.7– 56.5	0.000*
Et (cm/s)	69.8 ± 5.1	57 – 78	70.2 ± 5.6	57.4–78.4	0.000*
At (cm/s)	72.1 ± 6.3	61.7–80.1	71.5 ± 6.6	60.5–79.5	0.000*
Et/At	0.97 ± 0.1	0.87–1.23	0.99 ± 0.1	0.89– 1.26	0.000*
Em/Am	1.99 ± 0.1	1.6 – 2.4	2 ± 0.22	1.6 – 2.4	0.34

Table 4: Comparison of LV and RV diastolic functions by TDI between patients in first and second visits

Parameter	Visit 1 (n=23)		Visit 2 (n=19)		p
	Mean ±SD	Range	Mean ±SD	Range	
E'm (cm/s)	13.4 ± 0.75	12.1 – 14.9	13.5 ± 0.68	12.4 – 14.7	0.12
A'm (cm/s)	5.16 ± 0.6	3.9 – 6.9	7.2 ± 0.71	6 – 8.5	0.000*
E'm/A'm	2.62 ± 0.35	2 – 3.56	1.8 ± 0.12	1.6 – 2.1	0.000*
Em/E'm (cm/s)	6.78 ± 0.52	5.7 – 7.7	6.8 ± 0.62	5.9 – 8.3	0.69
E't (cm/s)	11.6 ± 0.94	10.5 – 13.9	14.6 ± 0.87	12.9 – 15.8	0.000*
A't (cm/s)	5.93 ± 0.71	4.3 – 7.5	7.7 ± 0.55	6.7 – 8.9	0.000*
E't/A't	1.97 ± 0.15	1.8 – 2.4	1.8 ± 0.1	1.7 – 2.1	0.05*
Et/E't	5.99 ± 0.63	4.9 – 7.2	4.7 ± 0.5	3.8 – 5.6	0.000*

Discussion

The results of this cross sectional study proved the beneficial effect of GH therapy on cardiac performance in terms of dimensions and functions in children with GHD.

Abnormal LV diastolic function is an important feature in GH-deficient patients. TDI was more sensitive in assessing both LV and RV diastolic impairment in children with untreated GHD compared to standard Doppler imaging echocardiography. Diastolic early and late filling at mitral and tricuspid annuli were lower in patients when compared to controls denoting diastolic impairment.

Our results show that the conventional echocardiography is not sensitive enough to detect subtle alterations in cardiac structure caused by GHD.

Accordingly it is highly recommended in patients with GHD to do cardiac assessment with TDI instead of only using conventional echocardiography.

Conclusion

GH treatment increased cardiac mass, deceleration time of early peak velocity of the mitral valve, isovolumic relaxation time, and myocardial performance index, without affecting other parameters of cardiac function as assessed by conventional echocardiography and TDI. The statistically proven non significant difference as regards LV and RV diastolic functions by TDI between cases and controls after one year GH therapy strongly confirms the cardiac role of GH.

References

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