Does vitamin D level affect cardiac ventricular functions in healthy children?

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Background

Vitamin D receptors (VDRs) are present in cardiomyocytes, vascular smooth muscle and endothelial cells. Some animal studies have demonstrated that vitamin D decreases natriuretic peptides, and amends heart failure, cardiac morphology and diastolic functions. However, limited data is available in healthy children regarding the effect of vitamin D on cardiac functions. In this prospective study, we aimed to study the effects of vitamin D levels on right and left ventricular functions in healthy subjects.

Materials and Methods

We enrolled fifty-four healthy children who were admitted to our outpatient clinic between January 2013 and June 2013. Subjects were 3 to 24 months old. We then excluded patient with following features: septal hypertrophy, valvular disease, hypertension, chronic disease such as diabetes mellitus, chronic renal failure and chronic liver disease, as these finding could influence both vitamin D status and echocardiographic data. We also did not enroll subjects with rickets.

We divided our study population into three groups according to the levels of vitamin D: subjects with ≥ 30 ng/ml 25 (OH) D were grouped as sufficient, subjects with 21-29 ng/ml 25(OH) D were grouped as insufficient, and subjects with ≤ 20 ng/ml 25 (OH) D were grouped as deficient.

Results

Vitamin D deficiency was observed in 16 patients, and vitamin insufficiency was observed in 16 cases. The vitamin D level was within normal limits in 22 cases. No significant statistical differences were observed among the parameters related with age, sex, weight and serum levels of Ca, P and ALP. As for the levels of vitamin D there was a significant difference among median values of sufficient group, insufficient group, and deficient group as expected. Analysis of the M-mode and Doppler echocardiography data showed no difference among groups. Medial mitral annular Sm and Am velocities measured by tissue Doppler echocardiography was significantly higher in subjects with insufficient and deficient vitamin D level than those who has sufficient vitamin D. Right ventricle TDI revealed that tricuspid IVCT was significantly lower in subjects with insufficient and deficient vitamin D than those who had sufficient vitamin D (p <0.024).

Discussion

In current study, we have shown that left and right ventricular diastolic functions and left ventricular systolic functions did not change at early stages of vitamin D deficiency. However, we have found that tricuspid isovolumic contraction time, early marker of systolic functions, was significantly decreased in subjects with insufficient and deficient vitamin D. To our knowledge, this is the first such study investigating the impact of vitamin D on left and right ventricular functions in healthy children.

In our study, we have observed that IVST/LVPWT ratio is not associated with the vitamin D status. M-mode parameters, LV mass indexes along with the Doppler inflow velocities were also not related to vitamin D status. TDI study parameters including mitral annulus Sm, Em, Am wave velocities, Em/Am and E/Em ratios, IVRT, IVCT, ET and MPI did not show any relation either.

In our study, medial mitral annulus Sm and Am wave velocities are directly related to the status of the vitamin D. Sm derived from TDI study is associated with EF which is an indicator of systolic function and with MPI. In our study no remarkable change obtained for EF and MPI. Although medial mitral annulus Am velocities increased, the Em/Am ratios did not show any change. A previous study reported that the LV diastolic functions determined by medial TDI could be occasionally overestimated, and lateral annulus and mean TDI parameters could be more accurate. We did not observe significant differences for any parameter in tissue Doppler echocardiography from any part.

Tricuspid annular TDI study showed no differences for Sm, Em, Am velocities, Em/Am and E/Em ratios, IVRT, ET and MPI. However, IVCT, which is an early indicator of systolic dysfunction, was significantly decreased in children with vitamin D insufficiency and deficiency.

In conclusion the level of vitamin D in healthy children did not affect the right and left ventricular diastolic functions and left ventricular systolic functions. The right ventricular systolic functions may be affected by the level of vitamin D. A larger scale study with longer follow up is required due to relatively small number of patients.