Use of strain, strain rate, tissue velocity imaging and endothelial function for early detection of cardiovascular involvement in young diabetics

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Topic(s): 
Tissue Doppler, Speckle Tracking and Strain Imaging

Citation: 
Funding Acknowledgements: 
None

Background: Subtle structural and functional changes may precede the onset of overt global left ventricular dysfunction and obvious reduction of ejection fraction (EF), especially in young diabetics. Data pertaining to tissue velocity indices (TVI) and strain imaging to assess regional myocardial function and flow mediated vasodilatation is limited in young patients with diabetes.

Purpose: To evaluate conventional echocardiography parameters, tissue doppler indices, global and regional strain, carotid intimal medial thickness (CIMT), endothelial dependent (FMD) and independent function (NMD) of brachial artery in young patients (age < 18 years) with type 1 diabetes and compare them with matched controls.

Methods: Conventional echocardiography parameters, tissue velocity indices (TVI) parameters along with strain (S), and strain rate (SR) in basal and mid left ventricular (LV) lateral wall, right ventricular (RV) lateral wall and septum were measured in 50 young diabetics (age 15.16±2.95 years, mean HBA1c 8.15±1.37 gm %) and 25 controls (age 15.60±2.51 years). Flow-mediated dilatation (FMD), nitrate mediated dilatation and carotid intimal medial thickness (CIMT) were also estimated.

Results: Conventional echocardiography parameters were similar in patients and controls however deceleration time of the mitral inflow velocity (EDT) was significantly shorter in patients when compared with controls (149.06±31.66 vs. 184.56±19.27 ms, p<0.05). Lateral early diastolic myocardial velocity (LV-Em) was significantly lower (10.30±0.99 vs. 11.67±3.21, p<0.05) whereas lateral late diastolic myocardial velocity (LV-Am) was significantly higher than controls (11.73±1.44 vs. 8.82±1.69, p<0.05), thus a significantly lower ratio of early/late diastolic velocity at the basal segment of lateral LV (LV-Em/LV-Am). Lower strain values at the basal lateral LV (21.39 ± 4.12 vs. 23.78 ± 2.02; p<0.05), mid lateral LV (21.43 ± 4.27 vs. 23.17 ± 1.92; p<0.05), basal septum (20.59 ± 5.28 vs. 22.91 ± 2.00; p<0.05), and mid septum (22.06 ± 4.75 vs. 24.10 ± 1.99; p<0.05) as compared to controls. SR at the basal and mid segments of the lateral LV wall and at the basal septum were also significantly lower in diabetic subjects. Strain rate (SR) in mid septal, basal and mid RV were lower than controls although not statistically significant. Patients also had significantly lower flow mediated dilatation (FMD) (8.36 ± 4.27 vs. 10.57 ± 4.12, p<0.05) implying endothelial dysfunction.

Conclusion: Left ventricular strain indices are impaired in asymptomatic children and adolescents with type 1 DM despite absence of overt heart failure and normal ejection fraction. Early detection of subclinical regional myocardial dysfunction by deformation analysis including strain and strain rate may be useful in the asymptomatic diabetic population. In addition, evidence of endothelial dysfunction in the form of impaired flow mediated vasodilatation was observed in the diabetic children.
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