Left Ventricular Diastolic Function Assessed by Echocardiography and Tissue Doppler Imaging is a strong Predictor of Cardiovascular Events in Patients with Diabetes Mellitus Type 2

Peter Blomstrand, Martin Engvall, Karin Festin, Torbjörn Lindström, Toste Länne, Eva Maret, Fredrik H Nyström, John Maret-Ouda, Carl Johan Östgren, Jan Engvall

Abstract nr 11866 AHA, Chicago November 2014

European Heart Journal – Cardiovascular Imaging, in press
Background
Diabetes mellitus is associated with hypertension, coronary artery disease, heart failure, and cerebrovascular disease. Screening for the early signs of atherosclerotic disease allows for timely interventions, which may benefit patients with diabetes mellitus.

Aims
The aim of this study was to evaluate the independent role of peak global longitudinal strain and E/é ratio in predicting major cardiovascular events in middle-aged patients with type 2 diabetes, and compare this to the predictive ability of pulse pressure, HbA1c, aortic pulse wave velocity and intima media thickness of the carotid arteries.

Methods
We prospectively investigated 406 consecutive patients, aged 55-65 years, with diabetes mellitus, recruited from 13 primary healthcare centers in Östergötland, Sweden, who participated in the CARDIPP (Cardiovascular Risk factors in Patients with Diabetes – a Prospective study in Primary Care) study.
Peak Global Longitudinal Strain (GLS)

A measurement of left ventricular systolic function or myocardial deformation.

Derived from the speckle tracking technique. The systolic shortening is calculated as a mean value from 18 segments and expressed in %.

GLS has been shown to be more reproducible and less load dependant than LVEF.
E/é

A measurement of left ventricular diastolic function.

The ratio of the early passive transmitral inflow velocity (E) to pulsed tissue Doppler velocity of the septal mitral annulus during passive filling (e’), i.e. the ratio between flow and wall velocity.

E/e´ reflects left ventricular filling pressure.

Diastolic dysfunction was defined as an E/e´ ratio > 15.
Results
Twelve cases of myocardial infarction and seven cases of stroke were identified during the follow-up period of 67 ± 17 months.

Table. Predictors of cardiovascular events using Cox proportional hazard model

<table>
<thead>
<tr>
<th></th>
<th>Univariate analysis</th>
<th>Multivariate analysis *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR (95% CI)</td>
<td>p</td>
</tr>
<tr>
<td>Age (year)</td>
<td>1.07 (0.92 to 1.25)</td>
<td>0.374</td>
</tr>
<tr>
<td>Female gender</td>
<td>1.88 (0.76 to 4.64)</td>
<td>0.169</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>1.08 (0.99 to 1.18)</td>
<td>0.089</td>
</tr>
<tr>
<td>Global strain (%)</td>
<td>1.20 (1.01 to 1.43)</td>
<td>0.042</td>
</tr>
<tr>
<td>E/é ratio</td>
<td>1.12 (1.06 to 1.18)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pulse pressure (mm Hg)</td>
<td>1.06 (1.03 to 1.10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>1.42 (1.06 to 1.91)</td>
<td>0.020</td>
</tr>
<tr>
<td>Pulse wave velocity (m/s)</td>
<td>1.20 (0.99 to 1.46)</td>
<td>0.064</td>
</tr>
<tr>
<td>Carotid IMT (mm)</td>
<td>0.50 (0.04 to 5.96)</td>
<td>0.583</td>
</tr>
</tbody>
</table>

* adjusted for age and gender
Left Ventricular Diastolic Function Assessed by Echocardiography and Tissue Doppler Imaging is a strong Predictor of Cardiovascular Events in Patients with Diabetes Mellitus Type 2

**Figure 1.** ROC analyses comparing global longitudinal strain, E/é, pulse pressure and HbA1c for prediction of cardiovascular events

**Figure 2.** Incremental value of E/é and pulse pressure to HbA1c for prediction of cardiovascular events, adjusted for age and gender

**Figure 3.** Kaplan-Meyer analysis of the E/é ratio dicotomized at ≤ 15 or > 15 and the subsequent cardiovascular events
Conclusions

Left ventricular diastolic dysfunction expressed as $E/é$ is a strong predictor of myocardial infarction and stroke in middle-aged patients with diabetes mellitus, comparable to HbA1c and pulse pressure, superior to global longitudinal strain, aortic pulse wave velocity and carotid intima media thickness.