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# Doppler tissue imaging in ST-elevation myocardial infarction

**AKADEMISK AVHANDLING**

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## ABSTRACT

Highly available, noninvasive and cost-effective, echocardiography remains a keystone in the evaluation of patients with coronary artery disease (CAD). Echocardiographic assessment of cardiac function at rest and during dobutamine stress has direct clinical implications. Conventional echocardiographic parameters however, are partly based on visual interpretation of cardiac motion, thereby subject to interobserver variability, especially in patients with poor image quality. As a complement, myocardial velocity imaging techniques such as Doppler tissue imaging (DTI) offer quantitative markers of cardiac function.

In the present study, we explored the feasibility and diagnostic value of DTI in the evaluation of left and right ventricular function, the presence of inducible ischemia and myocardial viability in patients with ST-elevation myocardial infarction (STEMI).

In 90 patients with STEMI (64 men and 26 women aged  $65 \pm 13$  years) echocardiography was performed at day 1, 5–7 days and 6 months after admission. At day 5–7, dobutamine stress echocardiography (DSE) with wall motion analysis (WMA) was performed, followed by coronary angiography within 24 hours. Using DTI, systolic, early and late diastolic myocardial velocities were recorded near the mitral annulus at 4 left ventricular (LV) sites, and near the tricuspid annulus in the right ventricular free wall. The myocardial performance index (MPI), a Doppler-based, combined measure of systolic and diastolic function, was calculated as the sum of the isovolumic time intervals divided by the ejection time derived from DTI at the 4 LV sites. Forty-one aged-matched healthy subjects served as controls.

In patients with complete normalization of conventional parameters of LV function at follow-up, peak systolic as well as early diastolic LV myocardial velocities were significantly reduced compared with those in healthy subjects, possibly reflecting a residual subendocardial damage.

Using peak systolic velocity in the right ventricular (RV) free wall as a marker of RV function, sensitivity and specificity of DTI in identifying patients with electrocardiographic signs of RV infarction (ST-elevation in ECG lead V4R) were 89% and 71%, respectively. Furthermore, peak RV systolic velocities remained reduced in patients with RV infarction, even after resolution of ECG changes and were still evident at 6 months' follow-up.

Use of the MPI as a marker of ischemia during DSE was shown to be feasible, and although the majority of patients did not achieve an optimal level of stress, relative changes in MPI between rest and peak stress offered reasonable diagnostic properties, superior to those of WMA. Sensitivity and specificity for detection of left anterior descending, left circumflex and right coronary artery disease were 80% and 87%, 59% and 80% and 85% and 72%, respectively.

Finally, we found that MPI during low-dose dobutamine infusion exhibits a specific pattern, similar to that of WMA, predicting late recovery of LV systolic function.

In conclusion, the use of DTI during echocardiography at rest and during dobutamine stress is feasible and allows evaluation of LV and RV function in the acute as well as the late phase after a STEMI. Furthermore, changes in MPI derived from DTI during DSE identify patients with residual CAD and predict late recovery of LV function, independently of age, troponin level and time to reperfusion treatment.