



**Karolinska  
Institutet**

**Institutionen för klinisk forskning och utbildning,  
Södersjukhuset**

# Prognostic and diagnostic value of tissue Doppler in patients with systolic heart failure

**AKADEMISK AVHANDLING**

som för avläggande av medicine doktorsexamen vid Karolinska  
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av

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## ABSTRACT

Heart failure (HF) is a condition where the heart fails to meet the need of delivery of oxygen and energy to the tissues. In spite of advances in the recent decades, the prognosis is still serious with a mortality risk comparable to severe cancer. The most common heart imaging method today is ultrasound of the heart, or echocardiography. The prognosis in HF is affected by several factors. In the latest 1-2 decades, the diastolic function and the function of the right ventricle (RV) have been shown to be important for the prognosis in HF.

The purpose of the present thesis was to evaluate the diagnostic and prognostic properties of a relatively new echocardiographic method, tissue Doppler imaging (TDI). TDI measures the velocities of the myocardial tissue throughout the cardiac cycle. It has been shown to be a simple, sensitive and reproducible method to evaluate systolic and diastolic function of the LV and the RV. Another aim was to examine the prognostic power of myocardial performance index (MPI), a Doppler based index, calculated as the sum of isovolumic time intervals divided by the ejection time.

173 patients admitted to the cardiology clinic at Södersjukhuset (Stockholm general South hospital) due to acute HF and reduced systolic function (LV ejection fraction, LVEF  $\leq$  40%) were included in the study.

Echocardiography was performed and TDI velocities were measured at 4 sites of the LV and at RV free wall. We performed two diagnostic studies (papers I and V), and three prognostic studies (paper II-IV).

**In study I** the diastolic function of 126 patients with sinus rhythm was evaluated with TDI and conventional methods, so called transmitral Doppler blood flow. Almost one third of the patients had a pattern on transmitral blood flow that could not be distinguished from normal diastolic function, but TDI showed that the vast majority of these patients had diastolic dysfunction. With TDI, the diastolic function could be assessed in all patients.

**In paper V**, 41 patients with newly diagnosed HF were examined again after 3-6 months when HF medication was titrated to adequate doses. At follow-up, all conventional echocardiographic parameters were improved, but the TDI parameters hardly changed at all.

**In paper II-III**, the prognostic value of TDI parameters was studied. With a shorter follow-up period, the variable  $E/e'$ , a non-invasive measure of left sided filling pressure, was shown to be an independent predictor of cardiovascular (CV) mortality during the study period (HR 3.8, p 0.014). In paper III, the follow-up period was longer, and a new TDI parameter from the RV (the sum of RV systolic and diastolic velocities) was found to be the only variable associated with a combined end-point of CV mortality and HF hospitalization.

**In study IV**, we showed that TDI-derived MPI was an extremely powerful tool to predict the prognosis in the longer term. Having MPI  $>$  0.67 indicated a 13-fold increased risk of CV mortality.

*In conclusion*, TDI is a highly feasible method to assess cardiac function in patients with HF, and a better method to evaluate diastolic function. In the shorter term  $E/e'$  is a moderately strong and independent predictor of CV mortality, and in the longer term, MPI is a powerful marker of prognosis. TDI-derived expressions of RV function are also of some importance. TDI seems to be more stable than conventional echo parameters after treatment with HF medication.

*Key words:* Heart failure, Echocardiography, Tissue Doppler, Diastolic function, Myocardial performance index, Prognosis.