Mid systolic septal deceleration in hypertrophic cardiomyopathy: clinical value and insights into the pathophysiology of outflow tract obstruction by tissue Doppler echocardiography

O-A Breithardt, G Beer, B Stolle, F Lieder, A Franke, T Lawrenz, P Hanrath, H Kuhn


Hypertrophic cardiomyopathy (HCM) is an inherited cardiac disorder characterised by abnormal left ventricular (LV) hypertrophy in the absence of severe aortic stenosis and hypertension. The presence of a dynamic gradient in the left ventricular outflow tract (LVOT) above 30 mm Hg at rest is associated with an increased mortality.1 Surgical myectomy or transcoronary ablation of septal hypertrophy (TASH) is indicated in patients with persistent symptoms and gradients > 50 mm Hg under resting or provoked conditions, despite medical treatment.2 We recently described a characteristic mid systolic septal deceleration (MSSD) pattern in the velocity trace of the basal septum obtained by tissue Doppler imaging (TDI),3 but the diagnostic value of the MSSD pattern in a larger patient population is still unknown.

PATIENTS AND METHODS
Twenty six HCM patients (15 male, mean (SD) age 48 (17) years, septal wall thickness > 15 mm) were studied by transthoracic resting echocardiography (GE-Vingmed Vivid 7 Pro, Horten, Norway). In addition to the standard measurements, we analysed longitudinal septal motion by colour Doppler methodology. 4 Our TDI results demonstrated that the presence of LVOT obstruction is not limited to alterations in blood pressure and flow, but has also an impact on LV mechanical function.

RESULTS
All patients showed normal systolic LV size and function (mean (SD) LV end diastolic diameter 40 (5) mm, LV end systolic diameter 22 (6) mm, fractional shortening 46 (10)%), and significant LV hypertrophy (interventricular septum 22 (5) mm; posterior wall 14 (3) mm). The average LVOT resting gradient was 49 (35) mm Hg. A clinical relevant LVOT resting gradient (> 30 mm Hg) was observed in 15/26 patients (58%) and in 14 of those associated with mitral systolic anterior motion (SAM) and mid systolic septal contact. An MSSD pattern was present in 15/26 patients (58%) and occurred in all patients simultaneously to the development of LVOT obstruction. The present study was limited to gradient evaluation at rest and did not systematically evaluate the influence of exercise on the LVOT gradient and on septal TDI patterns. Some patients may develop significant LVOT obstruction and an MSSD pattern during exercise despite a non-significant resting gradient. Thus, the absence of an MSSD pattern at...

Abbreviations: S1, early systolic peak; HCM, hypertrophic cardiomyopathy; LV, left ventricular; LVOT, left ventricular outflow tract; MSSD, mid systolic septal deceleration; S2, second systolic velocity peak; SAM, systolic anterior motion; TDI, tissue Doppler imaging.
rest does not exclude the presence of LVOT obstruction during exercise.

In conclusion, the presence of an MSSD pattern in the septal TDI velocity trace, defined and identified by the presence of two systolic velocity peaks and a sudden interpolated deceleration notch, identifies HCM patients with clinically important LVOT obstruction. TDI analysis of septal longitudinal motion patterns may constitute a new diagnostic tool additional to the conventional continuous wave Doppler examination for gradient measurement. It may help to verify the presence of an LVOT gradient, particularly in difficult imaging conditions such as exercise testing and in the presence of mitral regurgitation. This additional information is likely to reduce the number of false negative studies in patients where conventional Doppler methods fail to identify the site of gradient development, and it will identify false positive cases where the continuous wave Doppler beam has been misaligned and records mitral regurgitation instead of the LVOT velocity. Whether the presence or absence of an MSSD notch will improve risk stratification in HCM patients, or whether it may help to validate the response to treatment, remains to be studied prospectively.

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