Tissue Doppler and M-mode of mitral annulus: comparison of different methods to detect left ventricular dysynchrony

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Purpose: The present study aimed to assess left ventricular (LV) dysynchrony in patients with dilated cardiomyopathy (DCM) and depressed LV systolic function by comparing Tissue Doppler (TD) and M-mode of mitral annulus.

Methods: Ten patients with DCM (ischemic = 5, idiopathic = 5, mean age = 56.6 years) and 21 healthy controls, comparable for age and sex prevalence, underwent standard echocardiographic examination and also additional evaluation including simple M-mode, M-mode with superimposed color Doppler (TD), pulsed TD and off-line color TD analysis of median and lateral mitral annuli in apical 4- and 2-chamber views. Time to onset (from the onset of ECG QRS complex to the beginning of systolic contraction) and time to peak (from the onset of ECG QRS complex to the peak of systolic contraction) were measured at the level of septal, lateral, inferior and anterior levels by the different methods.

Results: The groups had similar body mass index, heart rate, systolic and diastolic blood pressure. LV ejection fraction was 37.8±6.3% in patients with DCM and 58.9±11% in controls (p<0.0001). The onset time and time to peak measured by both path analysis techniques were significantly longer in DCM than in controls at all assessed levels whereas the intergroup difference of the same intervals determined by both simple M-mode and M-mode + superimposed color Doppler TD achieved the statistical significance for time to onset but not for time to peak. In the overall population time to onset measured by the different methods were related one each other at all the assessed levels (all p<0.001) while the relations of time to peak were significant between simple M-mode and M-mode + color Doppler TD and between pulsed TD and color TD but not between M-mode and TD techniques. Ejection fraction was related to time to onset measured by any method (all p<0.0001) but with time to peak only when measured by TD technique.

Conclusions: The assessment of intraventricular dysynchrony can be reliable when measuring time to onset by both TD methods and Tissue Doppler whereas the choice of time to peak is not in agreement between the two modalities. This difference can be explained by the different physiopathological meaning of the two techniques. While TD-derived time to peak identifies the maximal myocardial velocity of systolic displacement. M-mode derived time to peak indicates the end of annular systolic displacement towards the apex.

Prognostic implication of tissue Doppler in patients with dilated cardiomyopathy

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Previous studies have shown that a ratio of early transmitral flow velocity to early diastolic velocity of mitral annulus (E/E') > 15, obtained by tissue Doppler technique correlate with left ventricular filling pressure.

Objectives: The aim of our study was to analyze if E/E' provide prognostic information in patients with dilated cardiomyopathy.

Methods: We studied 33 patients with dilated cardiomyopathy, mean ejection fraction of 31%. All the pts were submitted to routine 2D and Doppler echocardiographic examination, TDI was applied to obtain early peak velocity of the mitral annulus, pro B-type natriuretic peptide was also measured.

Results: Patients were characterized into two groups according with the value of E/E': Group I (n=15 patients) with E/E' > or = 15 and Group II (n=18 patients) with E/E' < 15. Patients were followed by 12±4 months, new hospital admission due to heart failure, cardiac transplant and death were considered as significative cardiac events. There were significative differences between the two groups regarding bidimensional (dimensions and ejection fraction) and Doppler conventional echocardiographic parameters.

In the velocities of mitral annulus obtained by TDI in two different points (septum and lateral wall), the E/A' velocities differed significantly when comparing the two groups, with low velocities in Group I. E' measured in lateral portion of mitral ring emerged as the velocity most significantly different: GI = 4.46 cm/s versus GII = 7 cm/s, p<0.001. In GI, pro-BNP was 545 (ng/ml) and in GII = 1254 (ng/ml), p<0.0036 and correlates with S1, r= -0.45, p=0.02.

During follow-up, events were more common in GI; 9 pts (60%) had events, including new hospital admission, heart transplantation and death, and in GII, events occurred in 11/12 (91.7%) with a p=0.0036. In conclusion: The ratio of early transmitral flow velocity to early diastolic velocity of mitral annulus is a powerful index to predict clinical outcomes. TDI velocities of mitral ring are expected in patients with E/E' > or = 15. Systolic velocity (S') measured in lateral portion of mitral ring under 5 cm/sec seemed to be strongly related with the prognosis, and have a correlation with the determination of proBNP levels.