Assessment of left ventricular dyssynchrony and prediction of response to cardiac resynchronization therapy: a new three-dimensional echocardiography integral-based indicator of longitudinal strain

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Background So far, all attempts to improve patient selection for cardiac resynchronization therapy (CRT) by echo-derived mechanical dyssynchrony indices have failed. The aim of this study is to assess the performances of a new software for automatic quantification of integrals 3D regional longitudinal strain signals, combining temporal and functional information to explore left ventricular (LV) mechanics and to assess its potential value to predict CRT response.

Methods 48 heart failure patients in sinus rhythm, referred for CRT device implantation (mean age: 65 years; LV ejection fraction: 26%; QRS duration: 160 milliseconds [160-170]) were prospectively assessed. 34 pts had positive response defined as LV end-systolic volume decrease >15% at 6-month. 3D longitudinal strain curves were exported for analysis by custom-made algorithms. The integrals of longitudinal strain signals were automatically measured and calculated for all 17 LV segments from the beginning of the cardiac cycle to the instant of the corresponding longitudinal strain peak (IL, peak).

Results The standard deviation of IL, peak (SDIL, peak) for all 17 LV segments was larger in CRT responders than non-responders (1.18% s-1 [0.96; 1.35] versus 0.83% s-1 [0.55; 0.99], p=0.007). SDIL, peak (odds ratio [OR]: 12.1; 95% CI: 0.81-180, p=0.078) and septal flash (OR: 14.1; 95% CI: 3.08-64.9, p= 0.001) were the only potential echocardiographic predictors of CRT response. The optimal cut-off value of SDIL, peak to predict response was 1.037%·s-1. In the 18 patients without septal flash, SDIL, peak was significantly higher in CRT responders (figure 1).

Conclusions This new automatic analysis software of 3D longitudinal strain curves might be helpful to improve prediction of CRT response.

Effects of hemodialysis on Doppler echocardiographic indices

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Objective Evidence exists that left ventricular function is impaired in chronic uremic patients. Conventional echocardiographic (TTE) parameters of systolic and diastolic function of the left ventricle (LV) have been shown to be load dependent. However, the impact of pre-load reduction on tissue Doppler (TD) parameters of LV function is incompletely understood.

The aim of this study is to evaluate the effect of a single hemodialysis (HD) session on LV systolic and diastolic function using pulsed Doppler echocardiography and pulsed tissue Doppler imaging (TDI).

Methods The study group included 30 uremic patients on maintenance HD, free from clinically overt cardiac dysfunction who underwent echocardiography with pulsed TDI 30min prior and 30min after a HD session.

Results Fluid volume removed by HD was 2260±560cm³. HD led to reduction in LV end-diastolic volume (p=0.006), end-systolic volume (p=0.001), left atrium volume (p<0.001), peak early (E-wave) trans-mitral flow velocity (p<0.001), the ratio of early to late Doppler velocities (E/A) of diastolic mitral inflow (p=0.001). A significant change in peak S velocity and peak D velocity of pulmonary vein flow after HD was noted after HD (p=0.035 and p=0.002 respectively). The ratio of early to late TDI diastolic velocities (E/A) on the lateral side of the mitral annulus decreased significantly after HD (p=0.012). Velocity of flow progression (Vp) during diastole was not affected by pre-load reduction. Pulmonary artery systolic pressure and the diameter of the inferior vena cava decreased significantly (p<0.001 and p=0.001, respectively) after HD.

Conclusion We conclude that most of the Doppler-derived indices of diastolic function are pre-load-dependent and velocity of flow progression was minimally affected by preload reduction in HD patients.