A novel tool for the quantification of local temporal delays in myocardial motion: Application to hypertrophic obstructive cardiomyopathy with biventricular pacing

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Purpose: Time-to-peak measurements are cumbersome and often confusing for quantifying local temporal changes in myocardial motion/deformation (single-point observations, only valid if peaks are clear and patterns simple). Recent spatiotemporal normalization techniques overcome these limitations, but the analysis remains descriptive. We demonstrate a technique for quantifying such changes in patients with hypertrophic obstructive cardiomyopathy (HOCM), for which pacing-induced dyssynchrony aims at reducing left ventricular outflow tract gradient.

Methods:

1) Studied population + echocardiographic acquisition

9 severely symptomatic HOCM patients (47±20y, 4 male) were studied at baseline and after 12 months of biventricular pacing. Myocardial radial displacement data were obtained from speckle-tracking on 4-chamber views, and spatiotemporally realigned for comparison in a common system of coordinates.

2) Data post-processing: matching baseline and follow-up data

Comparison of motion before and after therapy was achieved by non-rigid warping of baseline data to match follow-up data (diffeomorphic currents-based registration).

Conclusions: We demonstrated that data warping can automatically quantify temporal changes/delays in myocardial motion resulting in a more robust analysis of complex patterns. This enables a more user independent assessment of changes after therapy.

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Results:

Both temporal local shift and changes in amplitude were recovered by our method. Pacing changed the timing of the lateral wall during systole and early-systole outward motion of the septum appeared. This resulted in a significant gradient reduction (83±27 vs 36±26 mmHg, p=0.012).

References:


Duchateau N et al. Under review.