Dyssynchrony Imaging

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A novel echocardiographic method to quantify regional mechanical dyssynchrony

Summary

Dyssynchrony Imaging (DI), Toshiba's novel Doppler technology, is used as a quantitative clinical tool for rapid assessment of dyssynchrony in patients with suspected myomechanical dysfunction. From the parasternal short axis view, DI is applied by Toshiba's exclusive "angle-correction" technology and in apical views by standard Doppler imaging. Thus, DI permits evaluation of virtually all myocardial segments.

History

The patient was a 48-year-old male with ETOH (alcohol) abuse, coronary artery disease and hypertension who presented with severe shortness of breath and productive cough. The QRS duration was equivalent to 152 ms. An echocardiogram was ordered to assess left ventricular function, valvular disease and dyssynchrony.

Echo findings

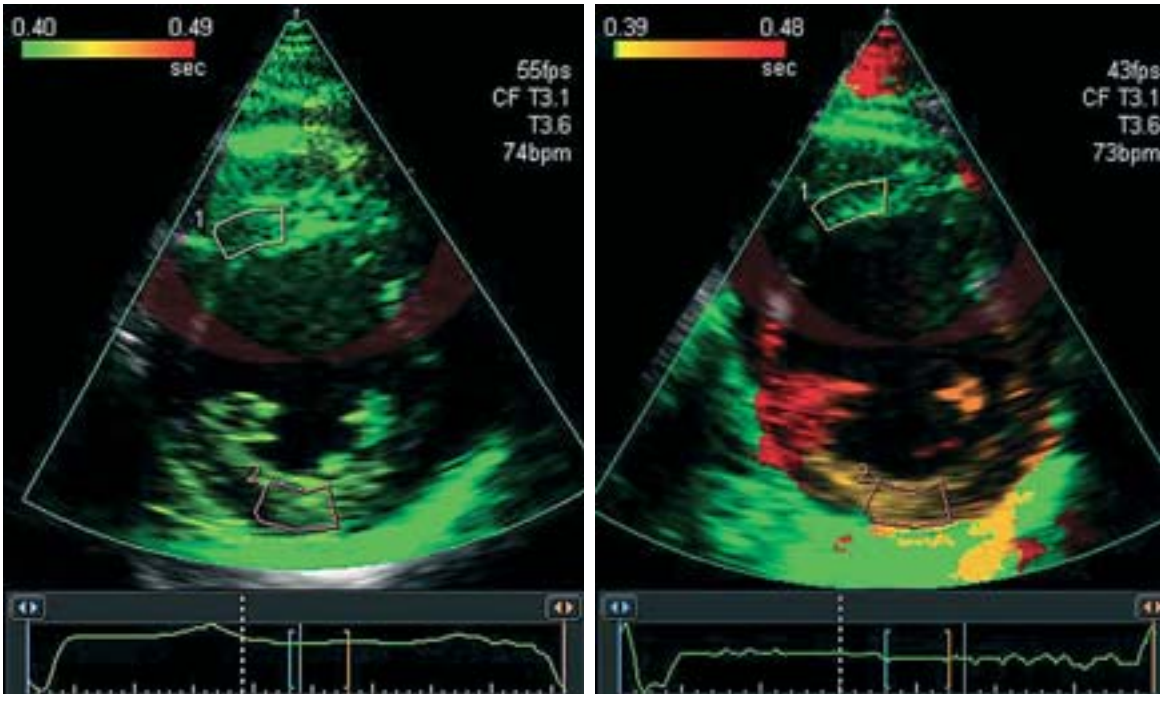
A dilated left ventricle was evident with severely reduced systolic function, EF=15-20%. No significant valvular disease was noted, however, significant dyssynchrony was present. The patient was referred for a biventricular (Bi-V) pacemaker.

Pre Bi-V Dyssynchrony Imaging

With Toshiba's angle-correction technology from the parasternal short axis view, DI rapidly identifies late conduction (yellow-to-orange-to-red colour

Fig. 2: Pre Bi-V. Myocardial Displacement Imaging TCA. Difference in peak-to-peak myocardial displacement = 185 ms

Fig. 1: DI. Pre Bi-V pacing



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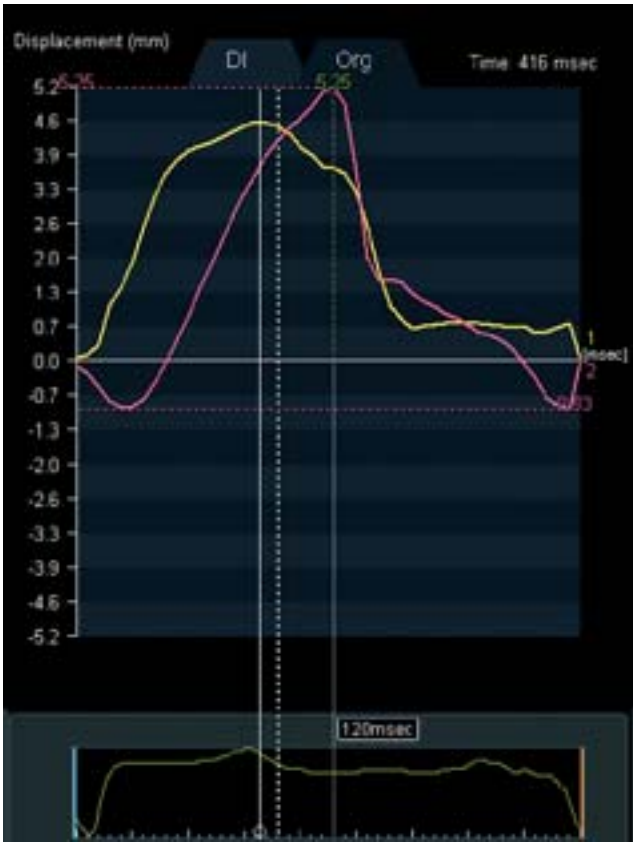

Fig. 3: DI. Post Bi-V pacing

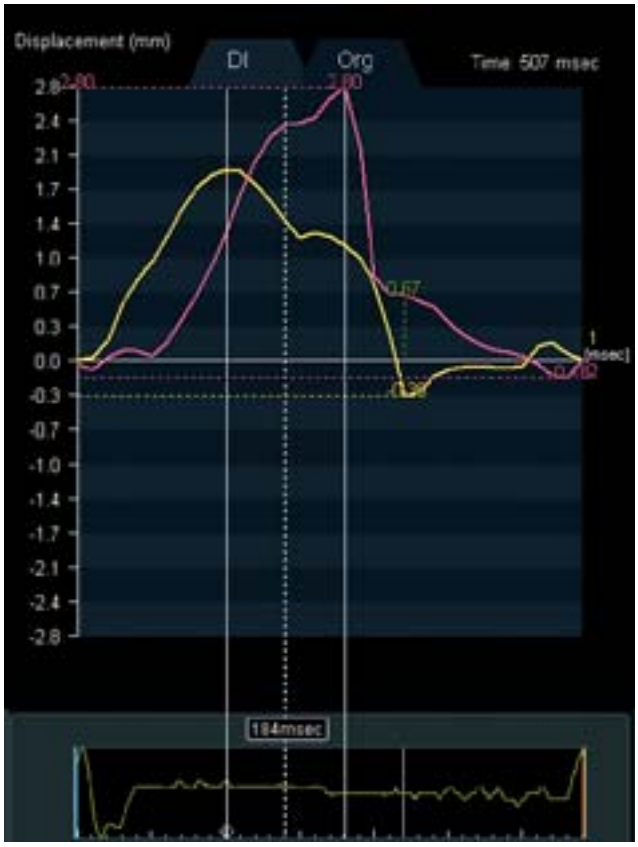

Fig. 4: Post Bi-V. Myocardial Displacement Imaging TCA. Difference in peak-to-peak myocardial displacement = 120 ms.

Doppler coding) of the inferior, posterior and lateral walls. A region of interest (ROI) is placed in the septum and posterior wall to measure dyssynchrony (Fig. 1).

DI quantitative time curve analysis (TCA) demonstrates significant delay between the septum and posterior wall with a peak-to-peak displacement difference of 185 ms consistent with intraventricular dyssynchrony (Fig. 2).

Post Bi-V Dyssynchrony Imaging

DI rapidly identifies acute visual improvement in conduction (significantly less yellow-to-orange with absence of red colour Doppler coding) indicating no significant dyssynchrony; ROIs are then placed in the same location (Fig. 3). TCA demonstrates a substantial improvement in peak displacement of both walls:

pre Bi-V: septum = 1.9 mm, posterior wall = 2.8 mm
post Bi-V: septum = 4.6 mm, posterior wall = 5.3 mm

A significant reduction in peak-to-peak displacement between the septum and posterior wall also occurred; peak-to-peak displacement decreased from 185 ms to 120 ms respectively (Fig. 4). These findings demonstrate acute improvement in myocardial mechanical function with less dyssynchrony immediate to post bi-ventricular pacing.

Discussion

Cardiac resynchronization therapy (CRT) for Bi-V pacing can improve regional left ventricular (LV) mechanical function in patients with heart failure and left bundle branch block (LBBB). In most patients, Bi-V pacing and CRT improves ejection efficiency and LV remodeling by decreasing LV chamber size and end-diastolic volume. CRT may reduce patient symptoms, increase quality of life and decrease overall mortality. Traditional methods for identification of dyssynchrony rely on the surface electrocardiogram (ECG). However, LV electrical delay (i.e., LBBB) is not always associated with LV mechanical delay (i.e., delayed wall motion). Importantly, patients with significant intraventricular dyssynchrony, irrespective of QRS duration, may benefit from CRT and Bi-V pacing. Therefore, there is a need for rapid, quantitative assessment of regional ventricular function to identify LV mechanical delay.

Echocardiographic screening has been an important tool for assessing LV mechanical dyssynchrony and now, with the development of Dyssynchrony Imaging, rapid, accurate and quantitative assessment of regional mechanical motion is a reality.

In short, Dyssynchrony Imaging, Toshiba's novel Doppler technology, facilitates rapid visual assessment of LV mechanical dyssynchrony and provides quantitative evaluation of regional myocardial mechanical function pre- and immediate post-bi-ventricular pacing.