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Acute effects of right ventricular apical pacing on regional left ventricular function

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Antibradycardia Pacing

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Background: Cardiac pacing is an effective and common treatment for the management of patients suffering with symptomatic bradycardia. Typically endocardial pacemaker leads in the ventricle are placed within the apex due to the ease of positioning and long-term stability. Nevertheless several trials have suggested right ventricular (RV) pacing may have a deleterious effects on left ventricular (LV) structure and systolic function, resulting in an increased risk of heart failure and death.

It is hypothesised RV pacing induces mechanical dyssynchrony, in turn causing LV dysfunction, although the specific cause of the detrimental effect is currently unknown. Furthermore, it is unknown whether the induced mechanical dyssynchrony follows a predictable pattern amongst pacemaker patients across LV regions.

Purpose: To compare intrinsic LV contraction with regional contractility induced by acute RV pacing in patients with bradycardia pacemakers using 2-dimensional (2D) speckle-tracking strain imaging and ejection fraction response.

Methods: The study group consisted of a subgroup of 26 consecutive patients recruited to an observational cohort study of patients with implanted bradycardia pacemakers in a single tertiary centre. Patients were assessed 6 weeks post pacemaker implant, had sufficient quality images for analysis, and all had underlying intrinsic rhythm. 2D echocardiographic datasets were collected during periods of intrinsic rhythm and after 1 minute of forced RV apical pacing in a synchronous mode where possible. Regional contractility was assessed by 2-dimensional speckle-tracking strain imaging for each dataset. Ejection fraction was calculated using Simpson’s Biplane method.

Results: An acute decrease in regional strain was observed in most LV regions during RV apical pacing compared to intrinsic rhythm. Regional strain measures were significantly reduced during RV pacing in the basal anteroseptum (-9.8±6.7% vs -14.0±6.26% respectively; p=0.009), apical septum (-15.9±5.9% vs -19.9±4.5% respectively; p=0.005), mid inferior (-13.6±5.7% vs -17.5±3.5% respectively; p=0.005), apical inferior (-14.0±7.0 vs -17.8±4.4 respectively; p=0.006), and apex (-14.0±3.9% vs -16.6±4.1% respectively; p=0.05). These reductions did not cause a difference in overall global longitudinal strain (-13.3±2.5% vs -14.5±2.8%; p=0.15).

Ejection fraction response was reduced during RV apical pacing compared with intrinsic rhythm (from 56±6% vs 53±6%; p<0.001). This was driven by a difference in LV end systolic volume (65.1±21.6mls vs 58.5±16.8mls; p=0.003), without a change in end diastolic volume.

Conclusion: Pacemaker patients display regional reductions in LV function after an acute period of RV pacing. This supports the theory that RV pacing directly contributes to LV dysfunction. Future research to risk stratify pacemaker patients and select lead site prior to implantation should include regional assessment as well as
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