Electromechanical mapping of the left ventricle for stem cell injection in a patient with permanent atrial fibrillation

Mapowanie elektromechaniczne lewej komory przed wszczepieniem komórek macierzystych u pacjenta z utrwalonym migotaniem przedsionków

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Stem cell therapies for improvement of the ischaemic myocardium are an emerging and promising therapeutic option. Three-dimensional NOGA mapping allows simultaneous registration of left ventricle (LV) mechanical and electrical activity, enabling assessment of myocardial viability and targeted cell delivery. However, LV mapping in patients during atrial fibrillation (AF) is considered time consuming and difficult. A 77-year-old man was admitted to our centre presenting with refractory angina. His risk factors included hypertension, hyperlipidaemia, and advanced chronic renal failure, he also had a history of permanent AF. In the past he had undergone coronary artery bypass grafting twice: in 1985 and 2002, he had also suffered from a non-ST-elevation myocardial infarction treated with percutaneous coronary intervention with a drug eluting stent implantation in 2010. At the moment of admission, he was in CCS class III despite optimal medical treatment. The patient had previously been disqualified from any further revascularisation by the Heart Team. Echocardiography revealed a mild impairment of the LV ejection fraction (LVEF 45%), with hypokinesia of the intraventricular septum and inferior wall. Single-photon emission computed tomography (SPECT) showed reversible perfusion defects in the anterolateral region. AF with short QRS duration (80 ms) and relatively good rate control (80 bpm) was observed in an electrocardiogram. The patient was enrolled to the REGENT (autologous CD133+ cells vs. placebo, double-blind, placebo-controlled RCT) trial to undergo targeted transendocardial treatment. We used a NOGA-XP System to perform electromechanical mapping and direct transendocardial cell injection. A diagnostic NOGA STAR catheter was placed in the LV under fluoroscopic guidance, and LV electromechanical mapping was performed. Completing the data necessary to build the map and localise the target area took about 60 min. The regions of hibernating myocardium defined by preserved electrical and decreased mechanical activity correlated with reversible perfusion defects detected by SPECT. Time volume graphs showed evident dyssynchrony of the hibernating areas (Fig. 1). Following the standardised NOGA injection criteria, twelve 0.2 mL injections of autologous CD133+ bone marrow stem cells or placebo (procedure double-blinded) were placed into the anterolateral viable area (> 5 mV unipolar) with low wall movement (< 6% LLS) (Fig. 2). Only limited premature ventricular contractions were detectable at injections, which can probably be explained by a reduced time window for excitation after the electrical refractory period. Total injection time was 20 min. Mapping and injection were completed within 80 min despite permanent AF. No raise in creatinine levels, pericardial effusion, and no local complications were observed in the days following the procedure. To conclude, despite technical difficulties due to irregular rhythm, electromechanical mapping on AF is feasible. Completing the procedure in patients with AF and good heart rate control does not have to be more time consuming than in patients on sinus rhythm. Additionally, time volume graphs display differences in wall movement of hibernating and normal tissue even during AF, providing us with additional information on segmental ventricular contraction synchrony.

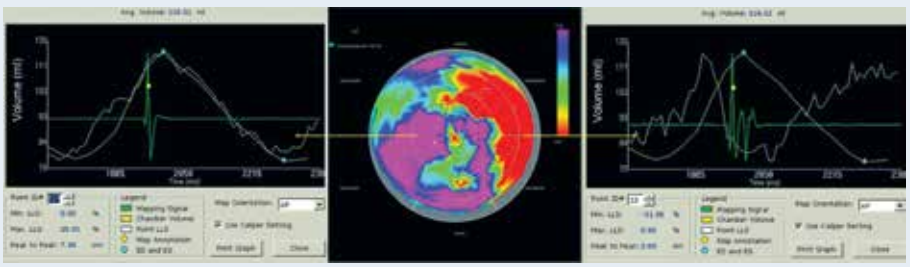

Figure 1. Time volume graphs of the normal (pink coded) and hibernating (red coded) areas

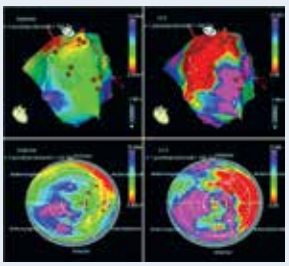

Figure 2. Injection sites of bone marrow stem cells/placebo into the anterolateral wall

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