

Uncovering electrocardiographic characteristics in subclinical pathogenic mutation carriers and arrhythmogenic cardiomyopathy patients

Manon Kloosterman*, Machteld J. Boonstra, Feddo P. Kirkels, Cornelis H. Slump, Peter Loh, Peter M. van Dam

Department of Cardiology, University Medical Center Utrecht, Utrecht, the Netherlands

Background: Arrhythmogenic cardiomyopathy (ACM) is a progressive inherited heart disease, often associated with defects in desmosomal proteins. The clinical presentation of ACM is heterogenous and diagnosis remains challenging. Recently, the prognostic role of echocardiographic deformation imaging has been demonstrated in mutation carriers who did not yet present electrocardiographic (ECG) abnormalities. Since increasing evidence suggests electrical abnormalities precede structural abnormalities, standard 12-lead ECG might not be sensitive enough to detect subtle electrical changes. Therefore, we aim to investigate whether electrical changes as recorded by body surface potential mapping (BSPM), differentiate ACM patients and subclinical mutation carriers from healthy controls.

Methods: Sixty-four-lead BSPM was obtained in two healthy controls, four subclinical mutation carriers and four ACM patients. Subject specific CT/MRI based anatomical models of the heart/torso and electrode positions were created and isopotential maps of ventricular depolarization were computed every 2 ms to study the spatiotemporal potential distribution on the torso. Two-dimensional speckle tracking was performed to obtain local ventricular mechanical deformation.

Results: All ACM patients and mutation carriers showed a different isopotential map at the end of depolarization as compared to controls. In controls the positive isopotential-gradient is directed towards the apex of the heart (Figure 1a). Both mutation carriers and ACM patients (Figure 1b,c) show an abnormal maximum towards the superior region of the torso, suggesting late ventricular activation in the sub-tricuspid region. An abnormal strain pattern of the right ventricular basal segment was present in two out of four mutation carriers and all ACM patients.

Conclusion: These still preliminary results indicate the ability of BSPM to differentiate ACM patients and mutation carriers from healthy controls based on electrocardiographic changes. Moreover, a direct relationship seems to exist between electrical and structural abnormalities. These findings have to be confirmed in larger groups of controls, mutation carriers and ACM patients.

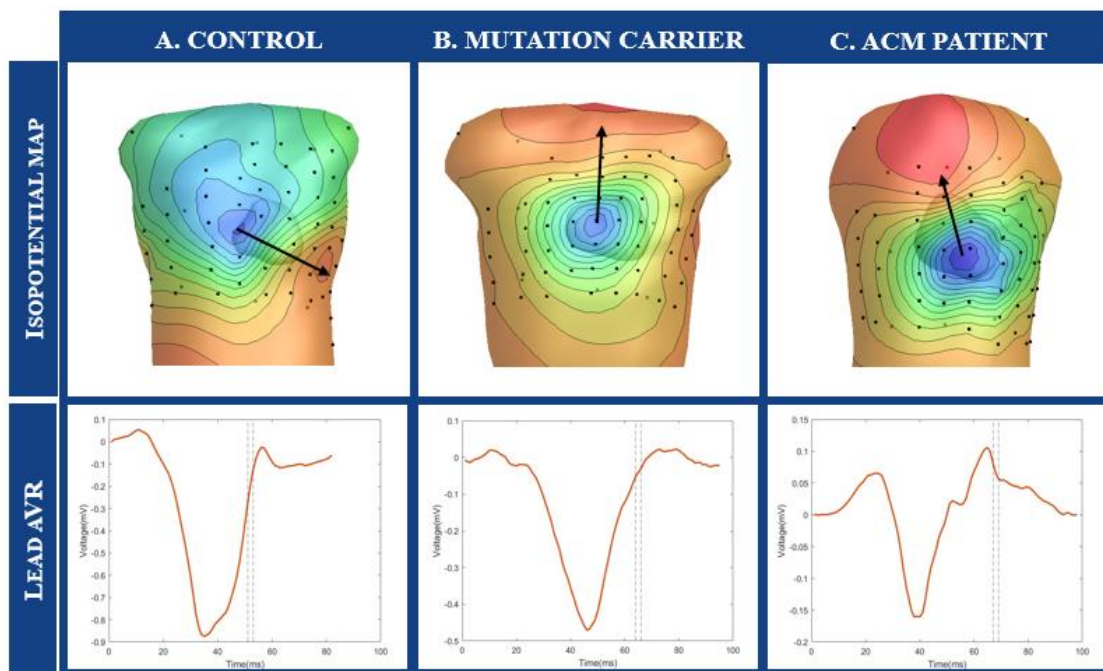


Figure 1: A typical example of an isopotential map (top panel) at 30ms before the end of QRS-end (bottom panel) in A) healthy control, B) mutation carrier and C) ACM patient (top panel). The bottom panel displays the QRS complex of lead 66, representing lead aVR of the standard 12-leads ECG. The dashed line represents the interval over which the isopotential map was computed.