Electrocardiographic Markers of Fibrosis in Cardiomyopathy: A Beginning of a Long Journey

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Identifying asymptomatic patients with myocardial disease with feasible clinical tools in order to reduce cardiac events is of great importance. Accumulation of myocardial fibrosis is a common feature in almost all cardiac diseases. Eventually, excessive amounts of fibrosis will lead to heart failure; however, during a relatively long latency phase, fibrosis already results in a risk for life-threatening arrhythmias and sudden cardiac death (SCD). Additionally, myocardial reformation as a consequence of fibrosis is very variable. Environmental and/or genetic factors in different individuals cause loss of systolic functional properties in one and launch refractory hypertrophy in others which results in even more diversity in individual risk assessment. Even when systolic function remains intact, mainly due to refractory hypertrophy, accumulation of fibrosis causes areas of slow conduction in the ventricular wall which is a traditional requirement for arrhythmogenicity [1]. Therefore, identifying myocardial fibrosis with feasible methods is a very interesting research topic. Currently, the most credible examination on detecting myocardial fibrosis is cardiac magnetic resonance imaging (cMRI). Occurrence of late gadolinium enhancement (LGE) in cMRI, which accurately shows focal fibrotic lesions, has been associated with increased

risk for ventricular arrhythmias in both dilated and hypertrophic cardiomyopathy (HCM) [2, 3]. Furthermore, cMRI T1 relaxation time seems promising for identifying scattered interstitial fibrosis, which is undetected in LGE imaging, but can potentially cause similar risk for arrhythmias [4]. The only problem is that at the moment, cMRI cannot be considered as a screening tool due to availability and pricing issues. Further prescreening is needed in choosing the right patients for cMRI.

One of the most common, or at least most recognized, causes for nonischemic SCD is HCM which has been speculated to be the most common cause for SCD among young athletes. The current European Society of Cardiology guidelines for HCM focus on prior symptoms, echocardiographic parameters, and hemodynamical reactions during exercise. The only ECG-related risk parameter is occurrence of nonsustained ventricular tachycardia. Until now, no ECG morphology or cMRI fibrosis parameters are included [5].

Electrocardiogram has been a cheap and widely accessible examination worldwide for decades. The applicability of ECG in the assessment of risk for adverse events, in another setting than emergency care, has been under major research efforts during the last decade. One interesting

new comer in this field has been the inferolateral early repolarization (ER) pattern, which has been considered as a normal variant for decades, but has recently been associated with increased risk for cardiac death and SCD in the general population and in many cardiac diseases, including HCM [6–8]. At the moment, there is no consensus on whether the slur or notch in the terminal part of the QRS complex is caused by ER of delayed depolarization.

In the current issue of *Cardiology*, Azevedo et al. [9] present the association of myocardial fibrosis, hypertrophy, and inferolateral ER pattern among HCM patients.

They show that inferolateral ER is associated with a higher left ventricular mass in cMRI, but not with LGE. Therefore, it would seem that ER might not be a good marker for fibrosis in HCM patients. However, the study did not seem to answer whether relaxation time derived from T1 mapping was associated with ER which would be also interesting due to the association with scattered interstitial fibrosis. In this respect, the job is not done yet. The authors do bring forth a major concept which needs to be explored in all myocardial diseases, including acquired myocardial diseases.

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