

Local areas of earlier repolarization cause epicardial repolarization heterogeneity in patients with apparently idiopathic ventricular fibrillation

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Background: Sudden cardiac arrest is often due to ventricular fibrillation (VF). In 5–10% of cases, no cause can be identified despite extensive cardiac examination, hence the designation idiopathic VF. Early repolarization with down sloping ST segments has been previously identified in patients with idiopathic VF. Early repolarization may increase repolarization heterogeneity with steep local repolarization time gradients, and thus form a substrate for idiopathic VF.

Purpose: To study the presence of local earlier repolarization and increased repolarization dispersion in idiopathic VF patients with noninvasive electrocardiographic imaging (ECGI).

Methods: A validated, non-commercial, potential-based formulation of ECGI was performed in 17 patients with idiopathic VF and 10 controls with no structural or electrical abnormalities. The ECGI measurement consisted of a body surface potential map with 184–256 electrodes in combination with a CT scan to obtain the torso and heart geometries. ECGI provided local epicardial repolarization times (RT) and RT isochrones. We determined the 1st (RT1%) and 99th percentile (RT99%) of RTs, the total epicardial RT dispersion (ERD: RT99%-RT1%), and the mean RT. Heart-rate corrected QT (QTc), TpTe intervals, and presence of the ER pattern

were determined from the 12-lead ECG. All metrics were normalized to the body-surface Q.

Results: QTc and TpTe did not differ between the two groups ($P=0.40$ and $P=0.83$, respectively, Figure 1, panel A). One (10%) control subject and three (17.6%) idiopathic VF patients showed an ER pattern on the 12-lead ECG, with a down sloping ST segment only in 2/4 of the latter. With ECGI, the mean RT was similar between the groups ($P=0.31$), but the ERD was significantly increased in patients with idiopathic VF ($P=0.01$, figure 1, panel B). Moreover, RT1% was significantly lower in idiopathic VF patients in comparison to the controls ($P=0.002$), whereas the RT99% did not differ significantly ($P=0.40$). Subgroup analysis between ER positive and negative patients did not yield significantly different RT results.

Conclusion: Noninvasive ECGI, in contrast to the 12-lead ECG, revealed a wider range of epicardial RTs in patients with idiopathic VF, implying increased repolarization heterogeneity. This heterogeneity is caused by areas of earlier repolarization. Our data indicate the value of noninvasively diagnosing these repolarization abnormalities, and suggest promising potential value of the 1st percentile of RT to identify idiopathic VF patients with true early repolarization.

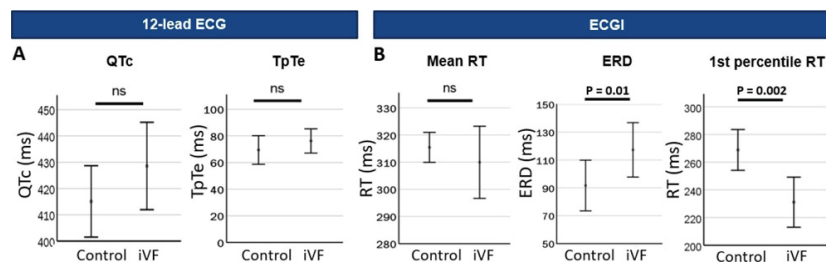


Figure 1