Repolarization Heterogeneity of Magnetocardiography Predicts Long-Term Prognosis in Patients with Acute Myocardial Infarction

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The authors report on the association of non-dipole patterns at T-peak in resting magnetocardiography (MCG) and major adverse cardiac event (MACE), including composite of death from any cause, reinfarction, and percutaneous coronary intervention, during the follow-up period (mean 6.1 years) in 124 patients with acute coronary syndromes (ACS).[1] In multivariate analysis, patients with non-dipole patterns at T-peak showed increased hazard ratios for MACE (p=0.02) and lower cumulative MACE-free survival than those with dipole patterns (p=0.02).

ACS without ST segment elevation, including unstable angina pectoris and non-ST segment elevation MI, is heterogeneous with varying short- and long-term prognoses.[2,3] Therefore, early diagnosis and risk stratification of patients at high risk for future mortality and morbidity at the time of admission to the hospital or initial diagnosis are of paramount importance for the management of ACS.[3] Although resting electrocardiography (ECG) is key in the assessment of patients with suspected ACS, the initial ECG in patients with evolving myocardial infarction (MI) is non-diagnostic in 51%.[4,5] In this context, guidelines support obtaining serial 12-lead ECGs and repeated measurements of biomarkers of myocardial necrosis during an observation of 6–12 hours to reliably rule out MI.[3]

MCG is a non-contact, non-invasive, risk- and radiation-free method that allows for the recording of magnetic fields generated by the electrical activity of the heart.[6-9] The technique measures these cardiac magnetic fields at a magnitude between 10^{-11} Tesla and 10^{-14} Tesla, which is extremely weak, compared to the earth's natural magnetic field of approximately 10^{-4} Tesla.[10] Although both ECG and MCG provide information on the same electrical activities of the heart, MCG exhibits numerous advantages. MCG does not require the use of electrode pads and allows for a relatively shorter preparation time prior to the procedure. Due to the lack of body contact, measuring magnetic fields is unaffected by conductivity of the human body, whereas electrical field detection by ECG is dependent upon body composition and electrode sensor positions.[11] The high sensitivity and the contactless, non-invasive procedural features of MCG give it value as tool for use in early diagnosis of ACS otherwise undetected by ECG.

The possible value of resting MCG investigations has been demonstrated by various working groups.[12-17] Specifically, bundle branch block (BBB) can obscure ECG diagnosis, and its presence is associated with a 50% higher false-positive admission rate in patients with suspected ACS.[18,19] Leithäuser, et al.[20] reported the usefulness of MCG for the prediction of clinically relevant coronary artery disease in patients with ACS and BBB on ECG. Using parameters from the time interval between the T_{beg} and the T_{max} as indicators of ischemia, the authors showed that specificity, sensitivity and the predictive values of MCG were markedly superior to those of troponin-I and echocardiography in patients with BBB on ECG.

In this study, the authors have clearly demonstrated that resting MCG investigation can be quickly and safely performed in patients with ACS and that non-dipole patterns at T-peak in MCG can identify patients at increased risk of subsequent MACE. Multicenter studies to determine the use and demonstrate the role of MCG in the context of ACS diagnosis are warranted.

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