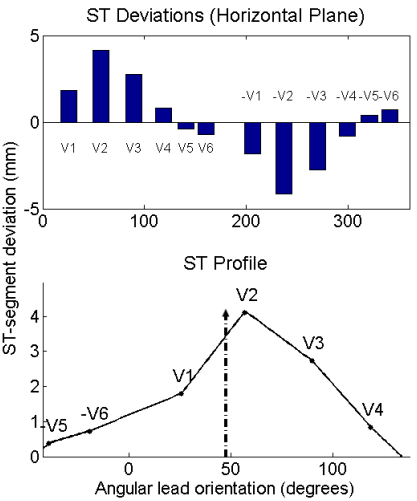
ECG-based Estimation of Area at Risk in Acute Myocardial Infarction

A Schou[1], USL Grove[1], T Worbech[1], MP Andersen[1], CJ Terkelsen[2], HE Bøtker[2], AK Kaltoft[2], SS Nielsen[2], JJ Struijk[1]

[1]Aalborg University, Aalborg, Denmark
[2]Skejby Hospital, Århus University, Århus, Denmark

Introduction: Knowledge of the myocardial Area at Risk (AAR) in Acute Myocardial Infarction (AMI) may affect risk stratification and early triage. Ischemic myocardium is associated with an injury current resulting in ST-segment deviations in the ECG. We hypothesized that, apart from the location, also the extent of the AAR could be estimated from the spatial distribution of the ST-segment deviations.

Methods: Standard 12-lead ECGs were obtained from 75 AMI patients (30 LAD, 17 LCX, 28 RCA) together with SPECT images (injection prior to coronary intervention). ST-segment deviations were measured at J + 40 ms in the precordial leads and were organized spatially according to the Dower lead vectors. By inclusion of hypothetical inverted leads, a semi-circle of ST-deviations, centered on the direction of the ST-injury vector, was obtained: the ST-profile. Subsequently, the spatial width, flatness, and amplitude features of the ST profile were calculated. A linear regression model between the AAR and the ST-profile features was calculated.



Results: Correlations between AAR and the ST-profile features were as follows. Width: r = -0.14 (p=0.22); flatness: r = 0.03 (p=0.77); sum of amplitudes: r = 0.57 (p<0.01); max. amplitude: r = 0.55 (p<0.01). The correlation between the AAR and the R-vector magnitude was r = -0.41 (p<0.01).

An optimal combination of the parameters: sum of amplitudes, R-vector amplitude and automatic division of the estimates into LAD versus non-LAD as the culprit artery, yielded r = 0.64 (p<0.01).

Conclusion: The extent of the AAR can be estimated by the amplitude(s) of the ST deviations and R-peak, whereas the spatial distribution of the ST deviations is indicative only of the location of the AAR, not of its size.