NEURONAL NETWORK-BASED TEXTURE ANALYSIS: FEASIBILITY STUDY ON PREDICTION OF POSTINFARCTION MYOCARDIAL VIABILITY

Poster Contributions
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Background: Defining early post-infarction (MI) viability is difficult - current methods require inotropic stimulation or are not suited for bedside use (magnetic resonance, CMR). We hypothesized that native or contrast-enhanced myocardial texture studied at rest, 7 days after reperfused ST-elevation MI contains information regarding the transmurality of necrosis.

Methods: we used 222 heart echo images (native or contrast - obtained in myocardial perfusion echocardiography by iv Sonovue injection and Contrast Perfusion Sequence ,CPS detection) obtained from 26 patients for texture analysis with custom software (MaZDa 4.20). 299 image features were calculated for defined regions of interest (including 9 features from histogram,6 from gradient matrix, 20 from run length matrix, 220 from co-occurrence matrix, and 44 from wavelet transform). 8 most reproducible parameters were selected based on lowest intraclass variance and classification error minimalization approach. CMR gadolinium late enhancement imaging defined transmurality of necrosis. Linear and non-linear(neuronal network) discriminative analysis (DA) was performed to identify the optimal predicting the necrosis extent by CMR.

Results: Neuronal network DA allowed correct classification regarding the absence of necrosis in 79% of segments and in 84% of images representing different levels of transmurality (=<50% or >50%), based on resting contrast imaging (red component of CPS color scale). DA applied to native grayscale images yielded worse results (68% and 79% correct classification). Discrimination of segments into 3 classes: no necrosis/1-50% necrosis/>50% necrosis by MRI was 70% correct for CPS and 60% correct for native images ant could not be obtaqined by linear DA.

Conclusions: Our initial results indicate that neuronal network based texture analysis of echocardiogram may provide useful data on myocardial viability early after MI without need for stress testing. Myocardial contrast enhancement allowed a superior classification of viability as compared to native grayscale images. Selected texture features, mainly related to entropy measures are thus useful for early post-MI detection of myocardial necrosis.