Can functional cardiac age be predicted from ECG in a normal healthy population?

Background: In a normal healthy population, we desired to determine the most age-dependent conventional and advanced ECG parameters. We hypothesized that changes in several ECG parameters might correlate with age and together reliably characterize the functional age of the heart.

Methods: An initial study population of 313 apparently healthy subjects was ultimately reduced to 148 subjects (74 men, 84 women, in the range from 10 to 75 years of age) after exclusion criteria. In all subjects, ECG recordings (resting 5-minute 12-lead high frequency ECG) were evaluated via custom software programs to calculate up to 85 different conventional and advanced ECG parameters including beat-to-beat QT and RR variability, waveform complexity, and signal-averaged, high-frequency and spatial/spatiotemporal ECG parameters. The prediction of functional age was evaluated by multiple linear regression analysis using the best 5 univariate predictors.

Results: Ignoring what were ultimately small differences between males and females, the functional age was found to be predicted (R²=0.69, P < 0.001) from a linear combination of 5 independent variables: QRS elevation in the frontal plane (p<0.001), a new repolarization
parameter QTcorr (p<0.001), mean high frequency QRS amplitude (p=0.009), the variability parameter % VLF of RRV (p=0.021) and the P-wave width (p=0.10). Here, QTcorr represents the correlation between the calculated QT and the measured QT signal.

Conclusions:  In apparently healthy subjects with normal conventional ECGs, functional cardiac age can be estimated by multiple linear regression analysis of mostly advanced ECG results. Because some parameters in the regression formula, such as QTcorr, high frequency QRS amplitude and P-wave width also change with disease in the same direction as with increased age, increased functional age of the heart may reflect subtle age-related pathologies in cardiac electrical function that are usually hidden on conventional ECG.