Analysis of Heart Rate Adaptation in Long-Term ECG Recordings Using RR-Binning

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Understanding how the heart rate (HR) affects different ECG segments is required to assess the presence of abnormalities in the ECG. The 24-hour Holter offers an opportunity to investigate this relationship. We propose two methods to investigate this relationship using RR-binning: a subject specific and a population based profile. We used daytime recordings (7 am to 11 pm, lead X) from 157 healthy subjects (78 males, aged 37 $\pm$ 15 years) and (79 females, aged 38 $\pm$ 16 years) from the Telemetric and Holter ECG Warehouse. The subject specific ECG profile was created by grouping the cardiac beats according to the previous RR-interval and calculating a median beat for each RR-interval. The population based profile was generated as the median of subject specific profiles. The same procedure was applied for 51 AMI subjects grouped by location of infarction. Group 1 (anterior/ant. lateral) included 23 subjects (17 males, aged 52 $\pm$ 14 years) and (6 females, aged 68 $\pm$ 15 years). Group 2 (inferior/inf. lateral) included 28 subjects (22 males, aged 55 $\pm$ 12 years) and (6 females, aged 62 $\pm$ 15 years). Both AMI groups had acute and stable phase recordings. The profiles were used to assess T-wave adaptation to HR. Population based T-wave adaptation to HR was observed for healthy subjects (R^2=0.90) but was less less pronounced for AMI subjects (group 1: R^2=0.08, acute and R^2=0.31, stable) and (group 2: R^2=0.23, acute and R^2=0.20, stable). At the subject level, T-wave adaptation to HR was R^2=0.78 for healthy subjects, and for AMI subjects: (group 1: R^2=0.92, acute and R^2=0.62, stable) and (group 2: R^2=0.85, acute and R^2=0.79, stable). There was a difference in T-wave amplitude adaptation to HR between AMI and healthy subjects for population-based profiles, which was not present at the subject-specific level.