Automated QT Interval Measurement in Holter ECGs Recorded at 180 and 1000 Samples per Second

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QT interval measurement is important when studying the effects of drugs on cardiac repolarization using Holter recorders typically having sampling rates ranging from 128 to 1000 samples/sec (s/s). This study assessed the effect of sampling rate on automated QT measurements.

Methods ECGs were recorded in 16 healthy volunteers using dual snap electrodes that allowed simultaneous connection to two Holter recorders (Model H12+, Mortara Inc) recording at 180 and 1000(s/s). Thirty 10 second snapshots of ECGs were extracted at various heart rates from each subject. Recordings were resampled to 180, 500 and 1000s/s using the Antares package and also upsampled from 180 to 1000s/s using H Scribe (Mortara Inc). QT was measured by 3 algorithms: Cal ECG (AMPS LLC) which handles data at any sampling rate, the University of Glasgow (Uni-G) Program operating at 500s/s and the Veritas algorithm (Mortara Inc) operating at 1000s/s.

Results 1) QT was significantly longer (5.0 ± 6.3ms, $p < 0.001$) in the 180s/s ECGs than in the 1000s/s ECGs analysed by Cal ECG. 2) The difference decreased when ECGs were resampled to the same sampling rate before measurement, e.g 180s/s to 500s/s vs 1000 to 500s/s (2.5 ± 4.5ms by Uni-G and 1.8 ± 5.5ms by CalECG) and 180 to 1000s/s vs 1000s/s (2.6 ± 6.2ms) by Cal ECG. 3) Using Cal ECG, mean QT remained longer than the 1000s/s gold standard (345ms) in ECGs acquired at 180s/s (350ms) , even after up-sampling to 500s/s (347ms) or 1000s/s (348ms) - similarly with Veritas where there was a 5ms decrease in 180s/s data upsampled to 1000s/s vs the gold standard.

Conclusion QT measured from Holter ECGs sampled at 180s/s is longer than from ECGs sampled at 1000 s/s. Differences reduce when 180s/s data is upsampled to 1000s/s. Those involved in clinical trials where QT measurement is vital need to be aware of these findings.