VDI vision - Analysis of Ventricular Electrical Dyssynchrony in Real-time

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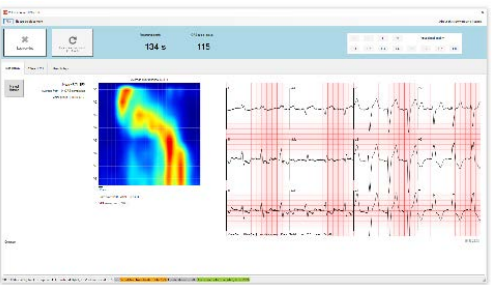
Background: Ventricular electrical dyssynchrony can be examined using ultra-high-frequency (UHF-ECG) analysis. If the analysis could be made instantly, it minimizes measurement time and allows direct optimization of pacing location. Here we introduce VDI vision, a desktop application for the acquisition and real-time processing of UHF-ECG recordings.

Method: Incoming ECG data (5kHz, 26 bits, 24 channels) from acquisition hardware (M&I, Prague, Czechia) are encoded from UDP packets. The ECG signal is processed as follows: QRS detection, pacemaker stimuli elimination, QRS clustering, amplitude envelopes in several frequency bands, and final combination into the dyssynchrony map. The map is displayed, and it is updated whenever a new QRS is detected in incoming data. The graphical user interface also contains sections to check key points of the process.



Results: We developed the VDI vision using the C# language and .NET platform. Until the end of March 2021, the VDI-monitor was used to analyze 773 and 4,849 recordings at ICRC-FNUSA hospital (Brno, Czechia) and FNKV hospital (Prague, Czechia), respectively. The median length for ICRC-FNUSA recordings was 124 (IQR 121-139) seconds. The median length for recordings at FNKV hospital was 157 seconds (IQR 127-200), less than half of measurement time from former off-line processing (median 323, IQR 312-366 seconds). Recordings were acquired from healthy subjects and patients before, during (FNKV only), and after pacemaker implantation.

Conclusion: The VDI vision delivers information about electrical ventricular dyssynchrony in real-time. The instant analysis allowed using the software during implant procedures for optimizing electrode placement and pacing. The presented real-time solution also significantly minimized measurement duration.