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A review of advances in ECG based cardiac ischemia monitoring for in-hospital application

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Real-time ST-segment monitoring for ischemia detection was introduced for clinical use in the 80's. To overcome the earlier systems' limitation on the number of ECG leads monitored, systems that support continuous diagnostic 12-lead ECG acquisition were subsequently developed. Derived 12-lead ECGs from 5-wire and 6-wire monitoring lead sets were also developed when direct 12-lead acquisition using a 10-wire lead set was not practical. Several innovative graphical solutions were developed to manage the large amount of data associated with continuous 12-lead ST monitoring, including ST-map for better visual tracking of ST measurements and deviations from a baseline, STEMI-map for more accurate tracking of STEMI criteria and ST-topology for more efficient ST trend review. A single-valued parameter, ST-index, was also developed to reduce the space required for displaying 12 ST measurements. To further improve diagnostic accuracy of acute ischemia/infraction detection, two 12-lead ECG based methods suitable for both continuous monitoring and diagnostic ECG application are being developed. The Vessel-Specific Leads (VSLs) method measures ST elevation from 3 optimal leads, calculated from the 12-lead ECG, for detecting ST-segment deviation during coronary occlusion. Preliminary results show that the method can identify acute ischemia with higher sensitive and specificity in comparison to the currently used STEMI criteria applied to the same 12 standard leads. The Computed Electrocardiographic Imaging (CEI) method presents a bulls-eye polar plot of the heart surface potentials based on inverse calculation from the body-surface potential map derived from the 12-lead ECG. Early results show that this method could be a useful clinical decision support tool for increasing the accuracy of ECG-based triage of chest-pain patients.

Biography

John Wang has received his MS degree in Physics from Northeastern University, Boston and MS degree in Aeronautics and Astronautics from MIT, Cambridge. He has more than 30 years' industrial experience in the development of patient monitoring devices and is currently a Principal Scientist with Philips Healthcare responsible for the development of ECG monitoring algorithms and related applications used in all Philips' patient monitoring devices. He has over 50 publications and 9 issued patents. He is an AAMI ECG Committee Member responsible for developing industry standards for ECG devices. He is also an Editorial Board Member of the *Journal of Electrocardiology* and a Referee for several biomedical signal processing journals and conferences.

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