

18th Annual Cardiologists Conference

June 19-21, 2017 Paris, France

Improved acute myocardial ischemia detection by vessel-specific leads (VSLs) derived from the 12-lead ECGJohn J Wang^{1,2}¹Philips Healthcare, USA²B Milan Horáček Dalhousie University, Canada

To further improve existing criteria recommended by ACC/ESC for identifying patients with ST elevation myocardial infarction (STEMI) from the 12-lead ECG, we have developed new criteria based on ST deviation calculated from 3 “optimal” vessel-specific leads (VSLs) derived from the 12-lead ECG. The performance of the VSLs vs. STEMI criteria was evaluated using two independent datasets of 12-lead ECGs: the *Glasgow* dataset included admission ECGs of 116 patients who were hospitalized for chest pain and underwent contrast-enhanced cardiac MRI that confirmed AMI in 58 patients (50%) and the *Lund* dataset included ECGs of 100 patients (75% males, age: mean/range 52/12-83 years) chosen to represent five subgroups with various causes of pathological ST-deviation, other than acute coronary occlusion: ventricular pre-excitation ($n=12$), acute pericarditis ($n=26$), ERS ($n=14$), LVH ($n=26$), and LBBB ($n=22$). Both STEMI criteria and VSLs method with and without an augmented LVH-specific derived lead were tested. Sensitivity (SE) and specificity (SP) were calculated and used as the performance measures for comparison. For the *Glasgow* dataset, STEMI criteria yielded SE/SP of 43/98%, whereas the VSLs improved SE/SP to 60/98%. The most significant increase in diagnostic performance appeared in patients with LCx occlusion ($n=13$): SE was improved from 31% to 69%. For the *Lund* dataset, SP test results using the STEMI and VSLs criteria were 100%/92%, 4%/88%, 29%/100%, 100%/96%, and 64%/68% for the five subgroups: pre-excitation, pericarditis, ERS, LVH, and LBBB, respectively. For the whole group, SP results were 57% for the STEMI criteria and 88% for the VSLs method. The performance improvement was statistically significant ($p < 0.001$). Based on these results we conclude that the new VSLs method has the potential to outperform the existing STEMI criteria in identifying patients who should receive emergent reperfusion therapy. This finding needs to be corroborated further on a larger study population.



Figure 1. Three bipolar vessel-specific leads (VSLs) with their positive/negative poles marked by +/- signs on the mean BSPM at J point at peak ischemia induced by balloon inflation: (Left) LAD occlusion, (Middle) LCx occlusion, and (Right) RCA occlusion. The map was constructed from 120 leads, on an unrolled cylindrical projection of the chest, with sites of 6 precordial leads indicated by red squares.

Biography

John J Wang received the M.S. degree in physics from Northeastern University, Boston, and the 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. John 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. John has served as a chair/co-chair for a number of conferences and was also an organization committee member for three Computing in Cardiology annual meetings. John has also served as a consultant/reviewer for NIH on SBIR grant application.

john.j.wang@philips.com