Personal Sensor-System Modalities Evaluation for Simplified ECG Recording in Self-Care

Asta Krupaviciute*, Jocelyne Fayn, Eric McAdams, Christine Verdier, Chris Nugent and Paul Rubel

MTIC-EA4171, INSERM, Bron, France

Self-care is increasingly encouraged in order to detect cardiac events as early as possible. Herein, we propose a new design of a wearable sensor-system, produced in three different sizes: small (S), medium (M) and large (L), for simplified ECG recording anywhere, at anytime. It resembles a bib with four embedded electrodes which, when it is placed on the thorax, enables the recording of the three pseudo-orthogonal leads I, II and V2 according to the Mason-Likar system. Its main advantages include that it is easy to wear, it enables the measurement of the spatiotemporal ECG information while minimizing noise artefacts, it provides any given individual with a sensor-system size suitably adapted to his/her personal characteristics, and it overcomes problems associated with inter-recording variations in electrode positions, thus enabling more accurate serial ECG analysis. Our research goal is then to establish the most appropriate sensor-system size for each citizen, which thus produces ECG signals with a diagnostic information content that is closest to that of standard ECG. In order to evaluate the possible automation of this selection process, we performed a series of experiments on eight healthy volunteers. Six ECGs were recorded on each subject by using either our prototype sensor-systems or the standard and Mason-Likar recording systems. The same experiment was repeated some months later for three of the subjects to assess reproducibility. Synthesized 12-lead ECGs were computed from the 3-lead ECGs, using two patient-specific transformation models based on ANN and on regression, and compared to the recorded 12-lead ECGs, which were also compared. We present the results of the 280 ECG comparisons in terms of correlation, RMS value, changes in diagnosis probability and changes of some of the ECG measurements, and relate them to the personal characteristics of the subjects. We show that sensor-system personal adjustment can be and should be performed automatically on the basis of the ECG signal information and not of the chest/clothes size of the individuals.