

Estimation of Chest Compression Rate and Detection of Hands-off Intervals during Resuscitation with Automated External Defibrillators

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Introduction: Quality of chest compressions (CC) is key for patient's survival to cardiac arrest. Current resuscitation guidelines recommend CC rates between 100 and 120 per minute. Incorporating real-time feedback on CC rate in automated external defibrillators (AED) could enhance CC quality. In addition, automatic detection of pauses in CC (hands-off intervals) could allow continuous rhythm analysis during resuscitation.

Aim: To design a method for computing CC rate and detecting CC pauses using the transthoracic impedance (TTI) signal acquired from the AED defibrillation pads.

Materials and methods: Thirty-five episodes with durations above 1000 seconds were randomly selected from a database of AED recordings collected by Emergentziak-Osakidetza (Basque Country, Spain). Episodes contained the ECG and the TTI signals, which were resampled to 250 sps. Episodes were randomly split into a training (10 episodes) and a test subset. A CC pause was annotated when CC were interrupted for more than 3 s.

Our method computes the autocorrelation of the TTI signal using a 2-s analysis window. The position of the highest peak in the range 0.25-0.8 s is used to compute CC rate. A CC pause is detected when computed CC rate equals zero. The method was optimized using the training set.

Results: With the test set, the method reported a sensitivity/positive predictive value (PPV) in the detection of CC pauses of 97.64%/92.48%. Reliable CC rates were obtained with a sensitivity/PPV of 99.03%/98.61%. Unreliable CC rates were reported only in 0.9% of the cases. CC rate measurement error was not computed due to lack of gold standard.

Conclusions: A method based on the autocorrelation of the TTI signal allows reliable detection of CC pauses and estimation of CC rates, enhancing current AED functionality.