

The Use of WaveECG and PathECG distributions in detection of ECG abnormalities among septic ICU patients

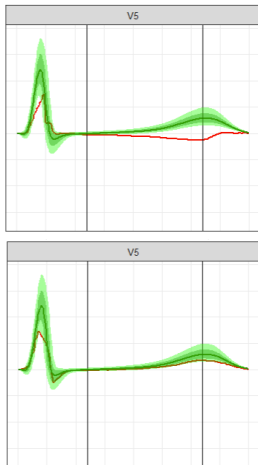
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Sepsis is a severe inflammatory reaction of the body resulting in multiorgan failure associated with mortality exceeding 50% among Intensive Care Units (ICU) patients. 12-lead ECG is performed in addition to ICU monitoring and laboratory measurements.

The aim of this study was to use the ECG waveform (WaveECG) and vectorcardiography-derived waveform position (PathECG) in comparison to the distribution of normal ECGs to investigate ECG abnormalities among septic patients without cardiac conditions.

PTB-XL dataset was used to create distribution of WaveECG and PathECG from



Lead V5: green-normal ECG distribution, red-example ECG of patients that survived

ECGs without any abnormalities. Then ECGs of septic patients were compared to these distributions to detect any deviations from the normal distribution, subsequently those deviations were examined as potential predictors of death at ICU. All ECGs were resampled to match 400 samples and keep all points of QRST comparable. Deviations from normal ECG were expressed in terms of standard deviations.

A total of 84 septic patients were investigated (52% female, median age: 61 (50-70), median ICU-time: 7 days (1-14), mortality: 57%).

Relative deviations from normal were observed across all leads and directions, with the biggest at aVR [1.41 (0.69-2.27)] and the lowest at III [0.69 (0.29-1.35)]. Sample-level analysis revealed the highest deviations at samples 350-375 [1.43 (0.72-2.16), T-wave] and the lowest at samples 0-25 [0.60 (0.37-1.04), QRS-onset].

Deviations in I, II, V2-V5, aVL and aVR were associated with death, and occurred at the T-wave or the QRS-onset. Higher deviations were observed among patients that died, however on two occasions: lead-I samples 0-25 (QRS-onset) and V4 samples 75-100 (QRS-end) surviving patients showed higher deviations. No PathECG deviations were associated with death/survival.

This study showed ECG waveform analysis compared to normal distribution can be potentially beneficial to identify septic patients at an increased risk of death. This information might be beneficial to guide treatment of septic ICU patients.