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MetroHealth Medical Center

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Abstract Submission Form

Poster Title: **Machine Learning Predicts Pulseless Electrical Activity and Ventricular Arrhythmia in EMS Patients**

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Location of Laboratory: **Rammelkamp 652**

Category: **Cardiac Physiology**

Background: Cardiac rearrest after successful return of spontaneous circulation (ROSC) presents a substantial challenge to successful resuscitation, rendering it a high priority for emergency care research. Rearrest is commonly due to ventricular tachycardia/fibrillation (VT/VF) or pulseless electrical activity (PEA), each with poorly understood mechanisms and diametrically opposed treatments. ECG heart rate variability (HRV) has been used to predict rearrest; however, whether it can predict rearrest type and if repolarization (T-wave) features previously associated with cardiac arrest can improve accuracy is unknown.

Hypothesis: Machine learning can predict rearrest type and is enhanced by including repolarization features.

Methods: Emergency medical services (EMS) patients were divided into 2 groups: those that had PEA rearrest (n=30) or VT/VF rearrest (n=19). ECG segments (1-2 minutes) were obtained after ROSC, from which HRV and repolarization features were calculated. A cross-validated, linear support vector machine with feature selection was developed to predict rearrest type.

Results: There were no differences between groups in gender, race, ethnicity, bystander CPR, AED use, epinephrine given, or time from arrest to initial ROSC. Machine learning using HRV features was able to predict PEA and VT/VF. Moreover, addition of repolarization features improved model area under the receiver operating curve (65% to 72%), accuracy (68% to 71%), and specificity (49% to 58%). Finally, repolarization features were among the most important used by the model, supporting their improvement of prediction of rearrest type over HRV alone.

Conclusion: We developed a novel machine learning model to predict both PEA and VT/VF rearrest in EMS patients. Repolarization features enhanced the prediction accuracy of PEA and VT/VF rearrest when used with HRV. If rearrest type can be predicted using machine learning during resuscitation, this would potentially allow targeted treatments to be initiated to prevent rearrest and thereby improve cardiac arrest outcomes.