

# Tilt Test Outcome Early Perdition using ECG, Pressure and Impedance Parameters using Support Vector Machine Nonlinear Classifier

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The tilt test is a valuable clinical tool for Vasovagal Syncope diagnostic. Given its relatively long duration (up to 40 minutes), early prediction of the tilt test outcome has been extensively analyzed in the literature, and the use of simple ECG and pressure based parameters have been pointed to have significant predictive value. However, no practical system has ever been created allowing to predict the tilt test outcome at the beginning in the clinical setting, and moreover, some recent studies raised the question about the actual predictive value of the proposed parameters. Our objectives were: (1) To evaluate and benchmark, over a single large database, the predictive performance of the proposed parameters in the literature. (2) To evaluate the incremental predictive performance, if any, when applying machine learning. (3) And additionally to evaluate when jointly and nonlinearly combined. We analyzed a database of 727 consecutive cases of tilt test. Previously proposed features were measured from heart rate and systolic/diastolic pressure, in several representative signal segments. A nonlinear classifier (support vector machine) was used to predict the test outcome with the available features. Also the inclusion of additional physiological signals (impedance) was intended to improve the performance. The predictive performance of the nonlinearly combined previously proposed features was limited ( $p$ -values  $> 0,03$  and area under ROC curve  $0.57 \pm 0.12$ ), especially in the beginning of the test, which is the most clinically relevant period, and the improvement with additional available physiological information and SVM classification was limited (area under ROC curve  $0,59 \pm 0.22$ ). In conclusion, the use of a system for tilt test outcome prediction with current knowledge should be considered with caution.