Quantitative Complexity Theory (QCT) in prediction of head-up tilt testing outcome.

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INTRODUCTION

Vasovagal syncope (VVS) is a form of neutrally mediated reflex syncope, caused by a sudden decrease in blood pressure (BP) and/or heart rate (HR). Head-up tilt testing (HUTT), a well-established tool in the diagnosis of VVS, is time-consuming and every provoked vasovagal reaction, even presyncopal, may result in consolidating its reflex mechanism. The identification of parameters that could shorten the duration of HUTT and prevent from final fainting is desirable. Quantitative Complexity Theory (QCT) can provide quantitative and holistic information on the cardiovascular reaction in HUTT by merging multiple streams of hemodynamic data.

The aim of the present study has been to evaluate the prognostic value of complexity in comparison with traditional hemodynamic parameters (HR and BP) in prediction of the HUTT outcome.

METHODS

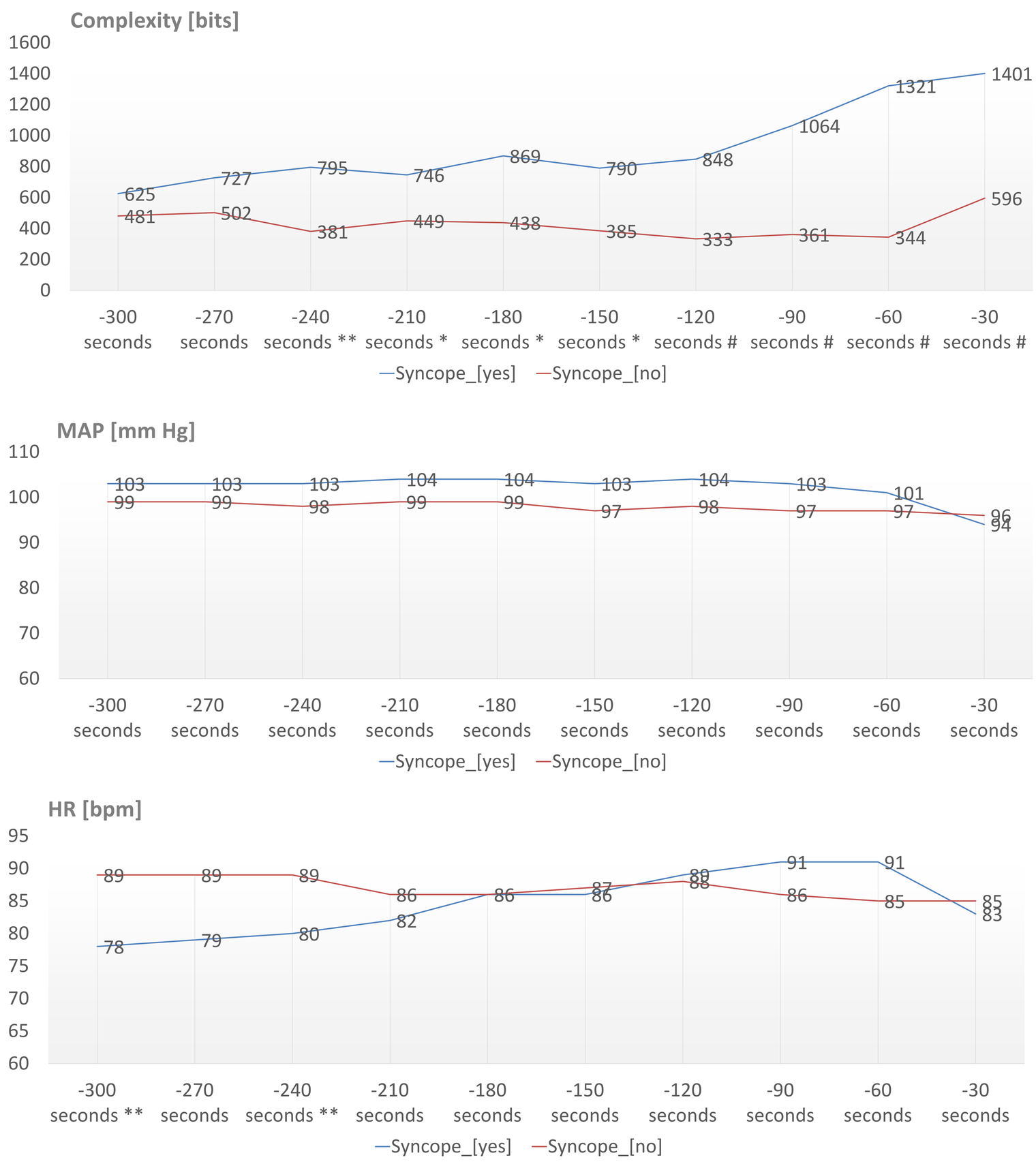
81 healthy volunteers (74 men; mean age of 37.8 ± 4.7 years) were included in this retrospective analysis. The subjects underwent HUTT according to the Italian Protocol. Test termination (supine restored) was made when the protocol was completed in the absence of symptoms, or there was the occurrence of syncope/presyncope. In 54 cases (66.7%) the HUTT was positive and resulted in VVS (pre)syncope.

Beat-to-beat hemodynamic cardiovascular response to tilting was evaluated by impedance cardiography with use of the Niccomo™ device integrated with Tensoscreen™ module (Medis, Ilmenau, Germany). The collected data was analysed with use of QCT (OntoNet™).

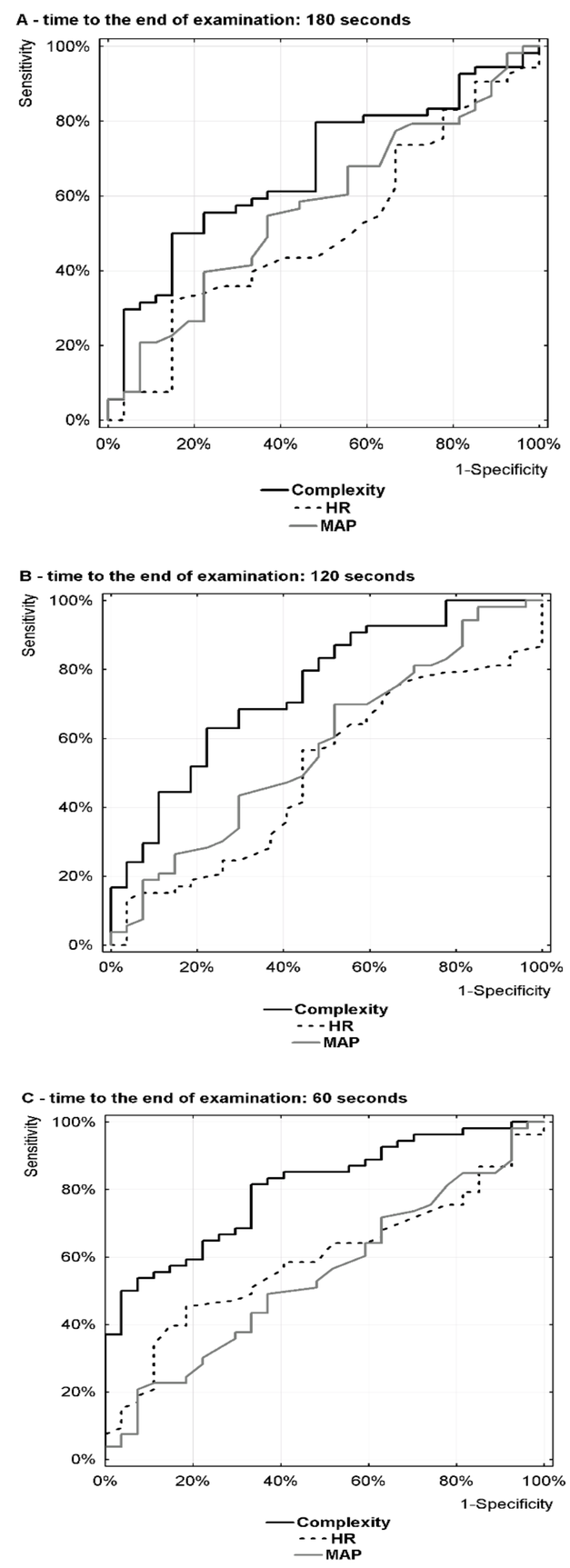
RESULTS

The values of complexity were higher in fainting subjects already 300 seconds before HUTT termination with significant upward trend starting 150 seconds before (pre)syncope. No clinically relevant intergroup differences and trends were observed for heart rate and mean arterial pressure.

The AUC over 0.700 was observed for complexity since 120 seconds before HUTT termination. The best complexity performance in predicting syncope at 120 seconds was expressed by sensitivity of 63% and specificity of 78%. Assuming clinically acceptable sensitivity (>80%) 120 seconds before HUTT termination, complexity revealed specificity of 52%. The prognostic value of heart rate and mean arterial pressure was poor.



*The intergroup comparison of complexity, MAP and HR values within last 300 seconds before the termination of HUTT (*p<0.05, **p<0.01, #p<0.001)*



The comparison of ROC curves of complexity, MAP and HR for chosen time points before the termination of HUTT

CONCLUSIONS

Complexity has been shown to be a sensitive marker of cardiovascular hemodynamic response to orthostatic stress and proved its superiority over HR and BP in predicting HUTT outcome. The predictive performance of complexity even 2 minutes before syncope (sensitivity>80%, specificity>50%) appears to be clinically acceptable. Beat-to-beat complexity analysis may be used to terminate HUTT before triggering symptomatic vasovagal reflex with high probability of correct diagnosis.

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