Linear and non-linear heart rate metrics for the assessment of anaesthetists' workload during general anaesthesia.

Abstract: Excessive workload may impact the anaesthetists’ ability to adequately process information during clinical practice in the operation room and may result in inaccurate situational awareness and performance. This exploratory study investigated heart rate (HR), linear and non-linear heart rate variability (HRV) metrics and subjective ratings scales for the assessment of workload associated with the anaesthesia stages induction, maintenance and emergence. HR and HRV metrics were calculated based on five min segments from each of the three anaesthesia stages. The area under the receiver operating characteristics curve (AUC) of the investigated metrics was calculated to assess their ability to discriminate between the stages of anaesthesia. Additionally, a multiparametric approach based on logistic regression models was performed to further evaluate whether linear or non-linear heart rate metrics are suitable for the assessment of workload. Mean HR and several linear and non-linear HRV metrics including subjective workload ratings differed significantly between stages of anaesthesia. Permutation Entropy (PeEn, AUC=0.828) and mean HR (AUC=0.826) discriminated best between the anaesthesia stages induction and maintenance. In the multiparametric approach using logistic regression models, the model based on non-linear heart rate metrics provided a higher AUC compared with
the models based on linear metrics. In this exploratory study based on short ECG segment analysis, PeEn and HR seem to be promising to separate workload levels between different stages of anaesthesia. The multiparametric analysis of the regression models favours non-linear heart rate metrics over linear metrics.

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