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Measuring changes in the autonomic nervous system in real-time: development of a novel real-time ANS monitoring tool that works by continuous non-linear geometrical heart rate variability analysis

Maddalena Ardissino, Nicoletta Nicolaou and **Marcela Paola Vizcaychipi**
Imperial College London, UK

Heart rate variability (HRV) is a powerful means of non-invasively assessing autonomic nervous system (ANS) function and tone. The aim of this study was to develop a novel, non-invasive, and real-time tool for autonomic monitoring that uses continuous Poincaré quantification of HRV dynamics to assess autonomic tone. The datasets for analysis included continuous LiDCO monitoring data of 18 young (<45 y) and 7 old patients (>65 y) from before propofol induction to after extubation. HRV was analysed in real-time over the length of the recordings using Poincaré plot quantification. Young patients had greater baseline HRV than old patients (SD2:p=0.0003). Propofol, an autonomic suppressant, induced a significant decrease in HRV (SD1:p=0.019; SD2:p=0.0002) in young patients, and this could be graphically visualized real-time. Furthermore, there was a positive correlation between old patients' resting HRV and their mean arterial pressure (MAP) during surgery. In conclusion, we successfully developed a method of visualizing autonomic tone in real-time and non-invasively, using HRV analysis by Poincaré quantification. The measures of SD1 and SD2 could furthermore be used to selectively sub-analyse sympathetic and parasympathetic function. Furthermore, we found that a low resting HRV was correlated with low MAP during surgery, suggesting that there is a potential further use for baseline HRV monitoring in old patients for hypotension risk assessment.

ma5713@ic.ac.uk