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11 Heart Rate Variability as a Marker of Surgeon’s Stress and Cognitive Load Within Vascular Surgery

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Aim: Surgeons experience significant stress levels in theatre. Acute stress can cause cognitive overload, worsening surgical performance. Chronic stress poses a substantial risk to surgeons’ health. Effectively identifying intraoperative stress may allow for preventative strategies that reduce surgeons’ stress and improve patient outcomes. Here, the feasibility of using heart rate variability (HRV) as a marker of stress during vascular surgery was assessed.
Method: 11 senior surgeons were evaluated performing 3 distinct vascular surgery procedures. HRV metrics (low-frequency/high-frequency ratio and standard deviation of the normal-normal interval) were determined from single-lead ECG traces at pre-determined procedural performance points. Surgeon-reported stress was assessed using the State-Trait Anxiety Inventory-6 (STAI-6), a validated clinical stress tool. Subjective reports of procedural difficulty were also collected. One-way ANOVA compared HRV at key performance points to baseline. Pearson’s coefficient assessed correlation between HRV and subjective stress.

Results: Data was collected for 6 carotid endarterectomies, 6 open abdominal aortic aneurysm repairs, and 5 lower limb bypasses. HRV metrics indicating significantly greater stress were observed at key performance points in all procedures. Peaks in stress were consistent across different surgeons performing the same procedure. A significant correlation was observed between HRV metrics and subjective STAI-6 stress reports ($r = 0.7680, p = 0.0003$). HRV metrics displaying the greatest stress corresponded with the most difficult procedural steps reported.

Conclusions: HRV may present a feasible method to assess intraoperative stress and cognitive load in vascular surgery and could be used to evaluate whether a theatre intervention (e.g., timeout) could reduce stress in areas of surgical difficulty.