Title: A model for assessing impact of graded passive exercise on global hemodynamics, brain and heart perfusion in septic patients: feasibility and safety in healthy adults.

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Structured Abstract:

Introduction: Sepsis is a global problem associated with high mortality and long-term complications. Despite advances in our understanding of sepsis pathophysiology, specific therapies are still lacking. Passive exercise is one potential therapy that may improve survival and long-term outcomes via the modulation of skeletal muscle blood flow (1) and distal organ perfusion (2). However, the effect of passive exercise on organ perfusion in septic patients has never been measured. Furthermore, the dose of passive exercise required to affect distal organ perfusion will likely vary among septic patients given the heterogeneity of their baseline comorbidities, exercise tolerance, and illness severity. We developed a model of graded passive exercise that can be used to study global hemodynamics, brain and cardiac perfusion in septic patients, and tested its feasibility and safety in a cohort of healthy adults.

Methods: We passively exercised 11 healthy volunteers using an in-bed cycle ergometer. After collecting resting baseline data, we increased the ergometer cadence from 5 rotations per minute (RPM) to 55 RPM, in 10 RPM intervals each lasting 5 minutes. During each interval, we recorded continuous global hemodynamics and cerebral blood flow using the Finapres® NOVA and Transcranial Doppler (TCD), respectively. We also measured global left ventricular (LV) function at each cadence level using speckle tracking analysis, a sensitive technique to detect changes in LV contractility. Mean values were calculated for all measured parameters during the last 2 minutes of each experimental stage, and ANOVA was used to determine differences between experimental stages both within and between volunteers.

Results: Graded passive exercise has no effect on global hemodynamics, except for a 7.5% increase in mean arterial pressure (MAP) at peak exercise intensity. There were no changes in cerebral blood flow or cardiac function. The graded passive exercise model was well tolerated by all participants.

Conclusion: In our cohort of healthy adults, our model of graded passive exercise is feasible, safe and has no clinically significant impact on global hemodynamics, cerebral blood flow or cardiac function. This model can now be safely applied to septic patients.

References: (1) Mortensen S.P., et al. 2012. (2) Doering T.J., et al. 1998.