MRI as research tool for cuff-based physiological measurements

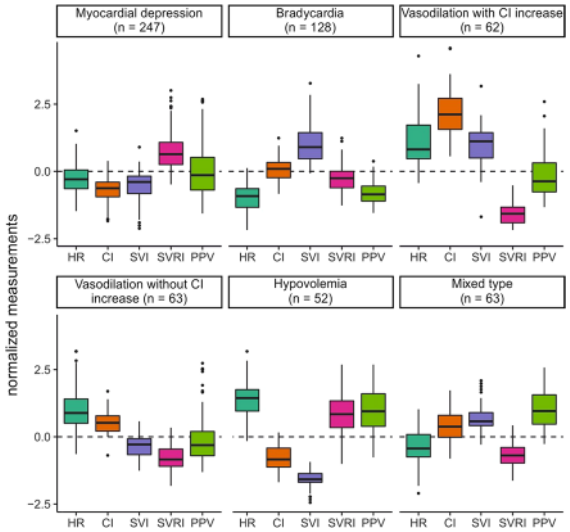

Fig. 1 (abstract P026) Boxplots showing the normalized mean and standard deviation of stroke volume index (SVI), heart rate (HR), cardiac index (CI), systemic vascular resistance index (SVRI), and pulse pressure variation (PPV) for each phenotype. Data are normalized to a mean of zero (dashed horizontal line) and a standard deviation of one. Boxes represent 25th and 75th percentiles and the range between them is the interquartile range. Inside the boxes, bold horizontal lines represent medians. The whiskers (extensions from the box) indicate the lowest and highest value no further than 1.5 times the interquartile range. Outliers are shown as dots.

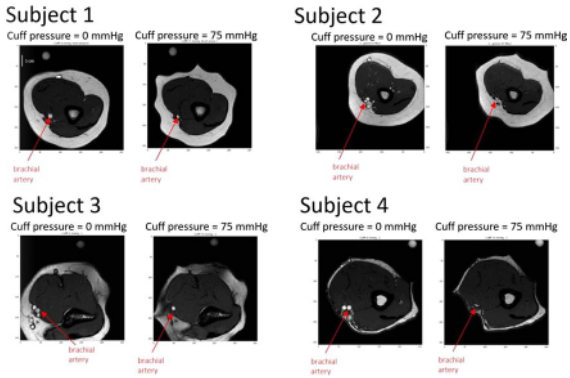

Fig. 1 (abstract P027) Cross-sectional view of the upper arm during cuff inflation.

P027

MRI as research tool for cuff-based physiological measurements

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Introduction: Cuff devices offer ample possibilities to modulate blood flow and pulse propagation. Vasculature response to occlusion perturbations may enable measurement of arterial compliance, peripheral resistance, and beat-to-beat BP calibration [1]. However, in standard practice the cuff is still only used for intermittent, largely inaccurate BP measurements. Strong assumptions are required to explain vascular occlusion mechanisms. Additional research modalities are needed for further development of cuff measurements.
Methods: In this study, we employed MRI to provide new insights over the influence of the cuff on arterial pulsations. We performed MRI scans on 10 healthy participants to observe vasculature, tissue, cuff interaction. Written informed consent was obtained from the participants.
Results: The images provide insights into several assumptions. Unpredictable cuff folding occurs during inflation; compression of the arm is not isotropic (Fig. 1). This effect possibly hinders accurate modulation of arterial transmural pressure. The artery location is subject dependent; oscillations of superficial arteries are likely expressed differently than oscillations of arteries located within subcutaneous fat. Complex tissue compression/displacement occurs under the cuff; arterial volume pulsations might not be equivalent to arm volume pulsations. Artery size is quantified revealing nonlinear collapse characteristics and non-uniform collapse across the length of the cuff. No significant changes in arterial properties were detected during two consecutive inflations.
Conclusions: These results are useful for improving existing BP measurements and enabling measurement of arterial compliance, peripheral resistance and beat-to-beat BP. The cuff interaction with the vasculature is oversimplified by existing models. MRI is an essential research tool for further development of cuff-based physiological measurements.
Acknowledgement: The data collection was registered with MEC-U as nWMO W20.090.

Reference

1. Bogatu et al. Sensors 21:5593, 2021

P028

Norepinephrine infusion titration at the early phase of septic shock: relevance of a transcranial Doppler based protocol

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Introduction: In septic shock, the surviving sepsis Campaign (SSC) guidelines give clear recommendations about the initial mean arterial pressure (MAP) goals but remain incomplete regarding further goals. The cerebral circulation is concerned by the blood flow redistribution during shock and can be assessed by transcranial Doppler (TCD). The purpose of this study was to assess the contribution of TCD in hemodynamic management during the early phase of septic shock by comparing a personalized TCD-guided hemodynamic goals to the SSC recommendations.
Methods: Fifty patients meeting the Sepsis-3 consensus criteria were enrolled and equally randomized into 2 groups. Concerning norepinephrine infusion, we aimed in the standard group to maintain a MAP ≥ 65 mmHg with negative blood lactate level during 72 h after shock onset. For the TCD-guided group, MAP goals and Norepinephrine infusion rate were determined according to TCD measurements to achieve a pulsatility index (PI) < 1.3. Sepsis associated encephalopathy (SAE) was diagnosed using CAM-ICU score > 3 or a GCS deterioration. The main outcome was 28 days mortality.
Results: The 2 groups were comparable regarding demographic and initial severity scores. We noticed an increased mortality ($p = 0.031$),