

MRI as research tool for cuff-based physiological measurements

Citation for published version (APA):

Bogatu, L., Hoppenbrouwers, J., van den Bosch, H., Turco, S., Mischi, M., Muehlsteff, J., Schmitt, L., Woerlee, P. H., Korsten, H., & Bouwman, R. A. (2022). MRI as research tool for cuff-based physiological measurements. *Critical Care*, 26(Suppl. 1), 11. Article P027. <https://doi.org/10.1186/s13054-022-03927-z>

Document license:

CC BY

DOI:

[10.1186/s13054-022-03927-z](https://doi.org/10.1186/s13054-022-03927-z)

Document status and date:

Published: 25/03/2022

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

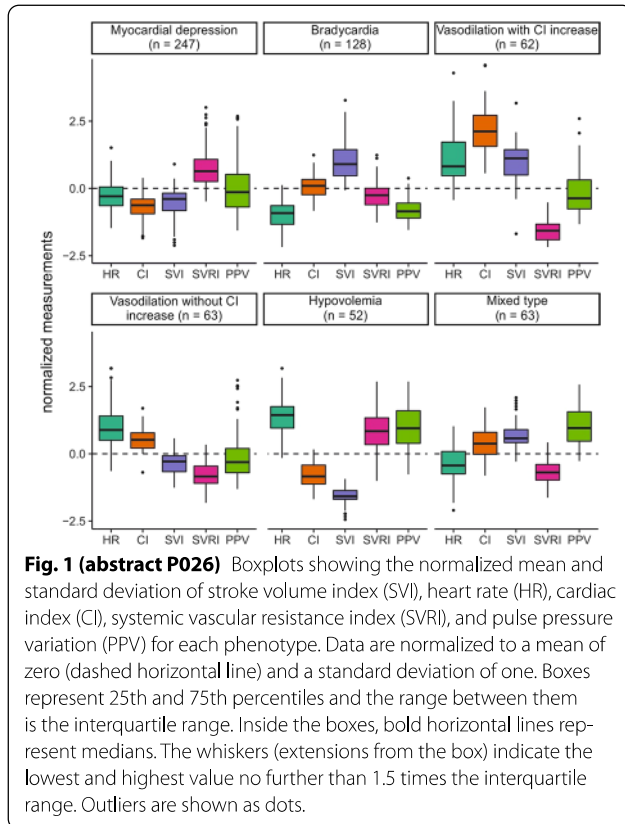


Fig. 1 (abstract P026) Boxplots showing the normalized mean and standard deviation of stroke volume index (SVI), heart rate (HR), cardiac index (CI), systemic vascular resistance index (SVRI), and pulse pressure variation (PPV) for each phenotype. Data are normalized to a mean of zero (dashed horizontal 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.

P027

MRI as research tool for cuff-based physiological measurements

L Bogatu¹, J Hoppenbrouwers², H van den Bosch², S Turco³, M Mischi³, J Muehlsteff⁴, L Schmitt⁴, P Woerlee³, H Korsten², RA Bouwman²
¹Eindhoven University of Technology, Philips Research, Biomedical Diagnostics, Patient Care and Measurements, Eindhoven, Netherlands, ²Catharina Ziekenhuis, Eindhoven, Netherlands, ³Eindhoven University of Technology, Eindhoven, Netherlands, ⁴Philips Research, Eindhoven, Netherlands

Critical Care 2022, **26(Suppl 1)**: P027

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



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

under the cuff; arterial volume pulsations might not be equivalent to arm volume pulsations. Artery size is quantified revealing non-linear 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

C Ben Miled¹, A Ben Souissi¹, M Sboui¹, E Langar¹, W Fguiri¹, S Yamoun¹, A Gharbi¹, I Sadedd¹, J Hafedh¹, MS Mebazaa²
¹Mongi Slim University Hospital, Anesthesiology and ICU Department, La Marsa, Tunisia, ²Mongi Slim University Hospital, Anesthesiology and ICU, La Marsa, Tunisia

Critical Care 2022, **26(Suppl 1)**: P028

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 ($p = 0.031$),