Artery Research
Vol. 25(S1); 2019, p. S111
DOI: https://doi.org/10.2991/artres.k.191224.098; ISSN 1872-9312; eISSN 1876-4401
https://www.atlantis-press.com/journals/artres

P67 Detecting Preload Reduction with Machine Learning on Arterial Waveform Parameters

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ABSTRACT

Background: Hemodynamic optimization of unstable patients by means of fluid resuscitation improves patient outcome, but choosing the correct amount of fluid can be difficult. Too little fluid may not ensure adequate perfusion whereas too much fluid is associated with increased mortality. Static parameters are not sufficiently sensitive to detect a reduction in preload, and dynamic parameters rely on changes induced by mechanical ventilation. We hypothesized that the arterial wave form contains parameters that can be used as model input to identify patients that benefit from fluid administration.

Methods: Radial artery waveform parameters were extracted in patients after they had undergone a coronary artery bypass graft surgery ($n = 20$, all male). Three classes were defined: unchanged preload, preload reduction induced by positive end-expiratory breath holds (PEEP), and preload increase following fluid administration. A leave-one-out multinomial logistic regression was performed to train and evaluate the model. Model performance is reported as accuracy, sensitivity and specificity.

Results: In univariate analysis, left ventricular ejection time, augmentation index, dPdtmax and stroke volume showed the largest variation between the classes and were selected as model inputs. Following leave-one-out cross-validation the final model detected decreased preload with an accuracy, sensitivity and specificity of 87.5%, 85% and 90% respectively. Fluid administration did not give enough stimulus for modelling.

Conclusion: Arterial waveform parameters adequately distinguish unchanged from artificially reduced preload; preload increase could not be reliably detected. Since PEEP influences arterial compliance, future studies need to evaluate this effect, and also the applicability of the model in other populations.

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