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A Database for the Development of Pulse Wave Analysis Algorithms

P. H. Charlton[1], J. Mariscal Harana [1], S. Vennin [1, 2], P. Chowienczyk [2], J. Alastruey [1]

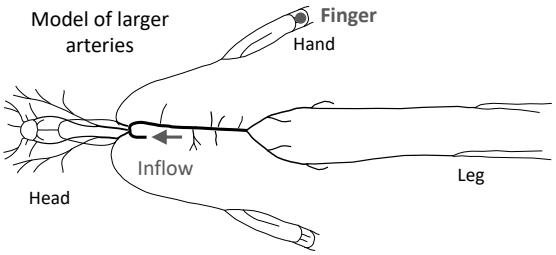
[1] *Department of Biomedical Engineering, King's College London, King's Health Partners, London, SE1 7EH.*
[2]*Department of Clinical Pharmacology, King's College London, King's Health Partners, London, SE1 7EH.*

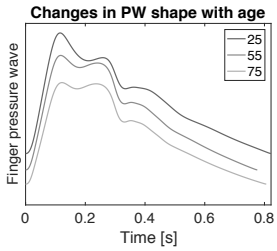
Introduction

The shape of the arterial pulse wave (PW) is a rich source of information on cardiovascular (CV) health, since it is influenced by both the heart and the vasculature. Consequently, many algorithms have been proposed to estimate clinical parameters from PWs. However, it is difficult and costly to acquire comprehensive datasets with which to assess their performance. Our aim was to create a database of simulated PWs under a range of CV conditions, representative of a healthy population.

Methods

Baseline PWs were simulated using 1D computational modelling [1]. CV model parameters were varied across normal healthy ranges to simulate a sample of subjects for each age decade from 25 to 75 years. The model was extended to simulate photoplethysmographic PWs at common measurement sites, in addition to the pressure, flow and diameter PWs produced by the model.





Results & Discussion

The database was verified by comparing simulated PWs with in vivo PWs. Good agreement was observed, with age-related changes in blood pressure and wave morphology well reproduced. The utility of the database was demonstrated by applying algorithms to estimate arterial stiffness, cardiac output and left ventricular ejection time to PWs. The relative performances of several algorithms were compared, and CV factors which reduced algorithm performance were identified.

Conclusion

The database is a valuable resource for development and pre-clinical assessment of PW analysis algorithms [2, 3]. It is particularly useful because it contains several types of PWs at multiple measurement sites, and the exact CV conditions which generated each PW are known.

References

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