Artery Research
Vol. **26**(**S1**); 2020, *p.* S23
DOI: https://doi.org/10.2991/artres.k.201209.017; ISSN 1872-9312; eISSN 1876-4401
https://www.atlantis-press.com/journals/artres

Conference Abstract

P.03 Local Pulse Wave Velocity Estimation using a Double Gaussian Propagation Model

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Keywords

Local pulse wave velocity

ABSTRACT

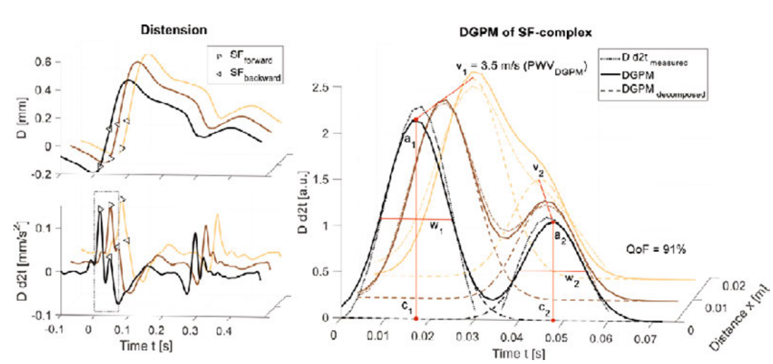
Background: Pulse wave velocity (PWV) is an established marker of arterial stiffness [1]. Local PWV estimates, however, are affected by confluence of incident and reflected waves, biasing the spatiotemporal propagation of the systolic foot (SF) in the distension waveform [2,3]. We, therefore, propose a Double Gaussian Propagation Model (DGPM) to estimate PWV in consideration of local wave dynamics.

Methods: Ten subjects (38 ± 10 years) were measured in rest for 2 minutes, repeatedly in 3 sessions over 3 weeks. From carotid ultrasonography (*Vantage64, VerasonicsInc.*,USA), we acquired 32 distension waveforms over a 19 mm wide arterial segment, simultaneously with noninvasive continuous blood pressure (*NOVA, FinapresMedicalSystemsB.V.*, NL). The DGPM, fitted to the detrended second derivative (of the SF-complex, was defined as:

with time t[s], segment distance x[m] and 8 parameters modelling all 32 waveforms, i.e. a(mplitude)[a.u.], c(entroid)[s], w(idth)[s] and v(elocity)[m/s] of the forward (1) and backward (2) propagating wave, respectively (see Figure). Quality of fitting (QoF) was assessed as percentage of the waveform accounted by DGPM relative to the mean amplitude. Per cardiac cycle, PWV_{DGPM} (= v_1), spatiotemporal PWV(PWV_{ST}) from linear regression of SF distances and timings, and Bramwell-Hill PWV (PWV_{BH}) were computed [4]. Pearson correlation coefficients were computed between session means of local PWV measures and PWV_{BH}.

Results: The DGPM adequately models the SF-complex (mean QoF = 85% for >20.000 cardiac cycles). For PWV_{BH}, PWV_{DGPM} shows a significantly higher predictive utility compared to PWV_{ST} (*r*: 0.64 vs. 0.10).

Conclusion: The proposed DGPM demonstrates significant predictive utility for PWV by accounting for wave confluence. This may facilitate the clinical practicality of local arterial stiffness estimation.



Figure

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