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Conference Abstract

P.05 Development and Validation of a Novel Centroid Method for Estimating Effective Reflection Time

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Keywords

Reflection-time
wave-tracking
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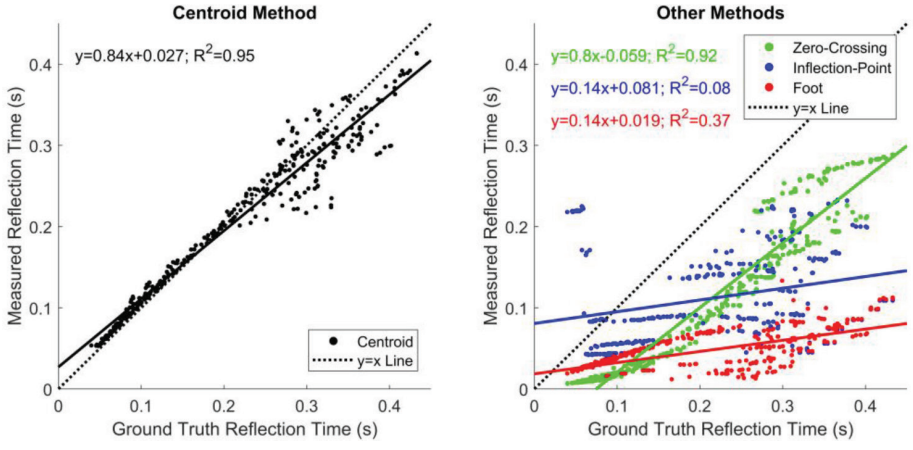
ABSTRACT

Background: The time at which reflected waves arrive at central arteries has an important influence on ventricular afterload. Current methods of estimating reflection time (RT), including zero-crossover [1], inflection-point [2], and foot methods [3], use only a single point on the pressure waveforms, and their accuracy is uncertain because no ground truth reflection time (GTRT) has been available. We here introduce a novel centroid method that accounts for the entire waveform and compare the accuracy of RT methods by comparison with a GTRT for the first time.

Methods: Using computational linear wave-tracking, we followed an impulse as it traversed through an anatomical model of the systemic arterial circulation; GTRT was calculated as the weighted mean arrival time of reflected waves at the inlet. Linear convolution of the resulting impulse response with a realistic input waveform (flow waveform multiplied by characteristic impedance) produced a pressure waveform that was separated into forward and backward components. The time difference between the centroids of the backward pressure and input waveforms was taken as RT in the centroid method. We also conducted a parameter sweep (n = 300) on the model to test the accuracy and robustness of the various methods.

Result: Compared to the zero-crossover, inflection-point, and foot methods, the centroid method estimated RT with the least mean difference to GTRT (104, 107, 171 vs. 8 ms; $p < 0.001$) and least standard deviation (34, 109, 97 vs. 28 ms).

Conclusion: The centroid method substantially improved accuracy and robustness for estimating RT compared with current methods.



Figure

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