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Conference Abstract

YI 1.1 Aortic Impedance and Total Arterial Compliance from Regional Pulse Wave Velocities

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ABSTRACT

Background: *In-vivo* assessment of aortic characteristic impedance (Z_{ao}) and total arterial compliance (C_T) has been hampered by the need for invasive methods to access simultaneous recordings of aortic pressure and flow, wall thickness, and cross-sectional area. In contrast, regional pulse wave velocity (PWV) measurements are noninvasive and clinically available. Given that PWV is strongly related to aortic stiffness (1), we assume that carotid-to-femoral PWV (cfPWV) and carotid-to-radial PWV (crPWV) may contain sufficient information to evaluate the elasticity of the ascending aorta. Concretely, here, we present a noninvasive regression method for estimating Z_{ao} and C_T using cuff pressure, cfPWV, and crPWV.

Methods: Gradient Boosting is employed for predicting Z_{ao}, and C_T. The regressors are trained/tested using a pool of virtual subjects (n = 4833) generated from a previously validated in-silico model (2). The cross validation is performed using a 10-fold cross-validation (3).The population used has been previously generated (4) and reflects a wide range of hemodynamical properties and states.

Results: Predictions had a high accuracy (Figure) achieving a normalized-RMSE equal to 6.24 ± 1.19% (r = 0.85, p < 0.001) for Z_{ao}, and 4.38 ± 0.36% (r = 0.97, p < 0.001) for C_T, respectively. High errors were reported for high values of Z_{ao} due to the limited amount of similar data.

Conclusion: The proposed approach constitutes a step forward to noninvasive screening of elastic vascular properties in human by exploiting easily obtained measurements. This study could introduce a valuable tool for assessing aortic stiffness reducing the cost and the complexity of the required measuring techniques. Clinical evaluation is required to validate the method *in-vivo*.

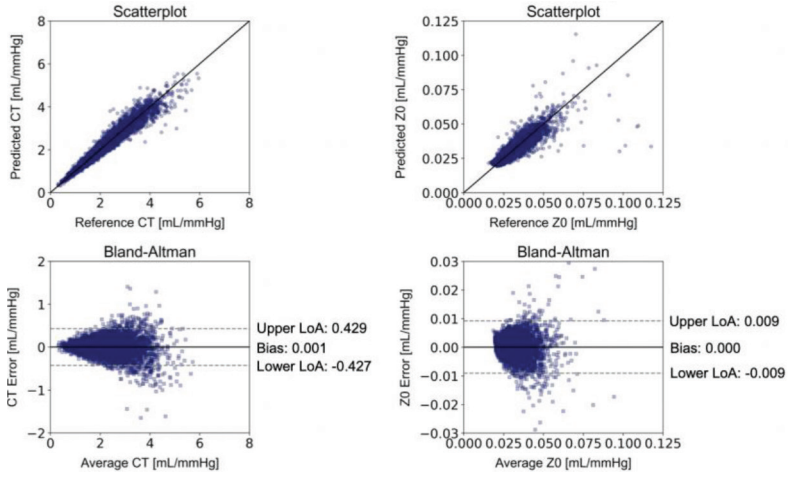

Figure | Comparison of the estimated values with the reference values. Scatterplot and Bland-Altman plot for the predicted Z_{ao} (left panel). Scatterplot and Bland-Altman plot for the predicted C_T (right panel). Solid line represents equality. Limits of agreement (LoA), within which 95% of errors are expected to lie, are defined by the two horizontal dashed lines.

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