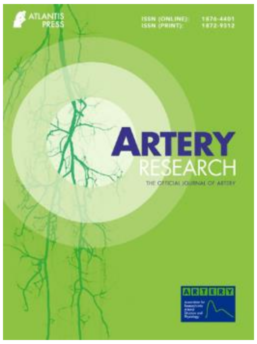


Artery Research

ISSN (Online): 1876-4401 ISSN (Print): 1872-9312
Journal Home Page: https://www.atlantis-press.com/journals/artres

1.1: COMPARISON OF VARIOUS METHODS FOR THE ESTIMATION FOR AORTIC CHARACTERISTIC IMPEDANCE IN TIME DOMAIN FROM VELOCITY-ENCODED MAGNETIC RESONANCE AND APPLANATION TONOMETRY DATA

E. Bollache, N. Kachenoura, I. Bargiotas, A. de Cesare, M. Bensalah, A. Redheuil, E. Mousseaux

To cite this article: E. Bollache, N. Kachenoura, I. Bargiotas, A. de Cesare, M. Bensalah, A. Redheuil, E. Mousseaux (2013) 1.1: COMPARISON OF VARIOUS METHODS FOR THE ESTIMATION FOR AORTIC CHARACTERISTIC IMPEDANCE IN TIME DOMAIN FROM VELOCITY-ENCODED MAGNETIC RESONANCE AND APPLANATION TONOMETRY DATA, Artery Research 7:3_4, 161–161, DOI: https://doi.org/10.1016/j.artres.2013.10.002

To link to this article: https://doi.org/10.1016/j.artres.2013.10.002

Published online: 14 December 2019

Artery Research (2013) 7, 161–170

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/artres

Oral Presentation Abstracts

Oral Session 1

Young Investigator Oral Presentations

In association with the ESC Working Group on Peripheral Circulation

1.1

COMPARISON OF VARIOUS METHODS FOR THE ESTIMATION FOR AORTIC CHARACTERISTIC IMPEDANCE IN TIME DOMAIN FROM VELOCITY-ENCODED MAGNETIC RESONANCE AND APPLANATION TONOMETRY DATA

E. Bollache [1,3], N. Kachenoura [1], I. Bargiotas [1], A. de Cesare [1], M. Bensalah [1], A. Redheuil [1,2], E. Mousseaux [1,2]

[1]*Laboratoire d'Imagerie Fonctionnelle Inserm U678/UPMC, Paris, France*

[2]*Cardiovascular Imaging Department, European Hospital Georges Pompidou, Paris, France*

[3]*Institut Jean Le Rond d'Alembert, CNRS 7190/UPMC, Paris, France*

Objectives. To combine cardiovascular magnetic resonance (CMR), which provides accurate and non-invasive evaluation of flow, with applanation tonometry to assess aortic characteristic impedance (Zc) in time domain while comparing six different methods.
Methods. We studied 72 healthy volunteers (31women, age: 42.1 ± 15.3years) who underwent aortic velocity-encoded CMR and carotid applanation tonometry. We developed a method for the superimposition of flow and pressure waveforms as well as semi-automated estimation of temporal Zc based either on magnitude, derivative peaks and early systolic up-slopes ratios or pressure-flow loop. All Zc indices were used to calculate reflection magnitude (RM) as the ratio between backward and forward pressures.
Results. For all methods, Zc was in good agreement with the reference Zc provided in frequency domain and with the theoretical water-hammer Zc, which combines aortic pulse wave velocity and area, and with carotid pulse pressure (table) with a slight superiority for methods based on derivatives peaks and early systolic up-slopes. In addition, only these latter two methods were significantly related to arterial stiffness indices such as tonometric carotid-femoral pulse wave velocity ($r = 0.27$ and $r = 0.25$; $p < 0.03$) and CMR ascending aorta distensibility ($r = -0.30$ and $r = -0.25$; $p < 0.03$). Again these two methods were slightly superior when comparing the derived RM against age ($r = 0.68$, $r = 0.65$; $p < 0.0001$).
Conclusions. The time derivative and up-slopes straightforward computation methods that can be easily integrated in a clinical workflow provides reliable characteristic impedance and reflection magnitude that might enhance CMR usefulness in evaluating aortic left ventricular (LV) pulsatile load and help for further understanding in LV-aortic coupling.

Table Comparison of aortic characteristic impedance using the 6 time domain methods against the frequency and theoretical references as well as carotid pulse pressure.

r (p)	Frequency Zc	Water-hammer Zc	Carotid pulse pressure
Peak Zc	0.59 ($p < 0.001$)	0.52 ($p < 0.001$)	0.46 ($p < 0.001$)
95% peak Zc	0.79 ($p < 0.001$)	0.54 ($p < 0.001$)	0.32 ($p = 0.01$)
Inflection point Zc	0.54 ($p < 0.001$)	0.53 ($p < 0.001$)	0.47 ($p < 0.001$)
Derivative peaks Zc	0.84 ($p < 0.001$)	0.55 ($p < 0.001$)	0.56 ($p < 0.001$)
Early systolic up-slopes Zc	0.91 ($p < 0.001$)	0.51 ($p < 0.001$)	0.57 ($p < 0.001$)
Pressure-flow loop Zc	0.76 ($p < 0.001$)	0.38 ($p = 0.001$)	0.39 ($p < 0.001$)

1.2

ASSESSMENT OF DIASTOLIC FUNCTION IN PAEDIATRIC PATIENTS BY MEANS OF WAVE INTENSITY ANALYSIS DERIVED FROM CARDIOVASCULAR MAGNETIC RESONANCE IMAGING

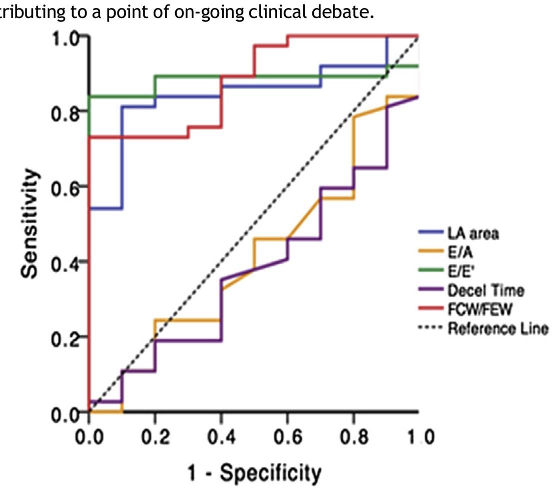
G. Biglino [1,2], H. Ntsinjana [1,2], R. Chung [2], S. Schievano [1,2], P. Ciliberti [2], K. H. Parker [3], A. M. Taylor [1,2]

[1]*Institute of Cardiovascular Science, University College London, London, United Kingdom*

[2]*Great Ormond Street Hospital for Children, London, United Kingdom*

[3]*Imperial College, London, United Kingdom*

Evaluating diastolic function in children remains a topic of clinical discussion and a gold standard measurement technique is still lacking. Wave intensity analysis can provide insight into ventricular filling mechanisms and ventriculo-vascular coupling, and it can be derived directly from cardiovascular magnetic resonance (CMR) imaging data, specifically from routine phase-contrast flow acquisitions, by defining wave intensity in terms of simultaneous changes of velocity and fractional changes of area. This method was applied to a group of 53 cases (12 healthy controls, 12 congenital aortic stenosis, 11 hypertrophic cardiomyopathy, 8 restrictive cardiomyopathy, 10 dilated cardiomyopathy). All patients also had full CMR and echocardiographic examinations. A new wave intensity parameter FCW/FEW was defined (=ratio of peak forward compression wave in early systole, typically associated with ventricular dP/dt, and peak forward expansion wave at end systole, associated with diastolic time constant τ) and compared with accepted indicators of diastolic dysfunction, i.e. left atrium area from CMR, E/A ratio, E/E' ratio and E-wave deceleration time (DT) from echo. Differences between cohorts were firstly appreciated in terms of ejection fraction and aortic distensibility. Receiver operating characteristic (ROC) curves then revealed that FCW/FEW, LA area and E/E' ratio were overall good, statistically significant discriminators between controls and patients with presumed compromised diastolic function, while E/A and DT failed to differentiate (Fig. 1, Table 1). This study proposes CMR-derived wave intensity analysis as an additional medium to non-invasively investigate diastolic function in children, contributing to a point of on-going clinical debate.



1872-9312/$ — see front matter .