



## Artery Research

ISSN (Online): 1876-4401

ISSN (Print): 1872-9312

Journal Home Page: <https://www.atlantis-press.com/journals/artres>

---

### **P46: ELONGATION OF THE PROXIMAL AORTA DURING THE CARDIAC CYCLE PLAYS AN IMPORTANT ROLE IN THE ESTIMATION OF AORTIC COMPLIANCE**

Stamatia Pagoulatou, Mauro Ferraro, Bram Trachet, Vasiliki Bikia, Dionysios Adamopoulos, Nikolaos Stergiopoulos

**To cite this article:** Stamatia Pagoulatou, Mauro Ferraro, Bram Trachet, Vasiliki Bikia, Dionysios Adamopoulos, Nikolaos Stergiopoulos (2018) P46: ELONGATION OF THE PROXIMAL AORTA DURING THE CARDIAC CYCLE PLAYS AN IMPORTANT ROLE IN THE ESTIMATION OF AORTIC COMPLIANCE, Artery Research 24:C, 91–91, DOI: <https://doi.org/10.1016/j.artres.2018.10.099>

**To link to this article:** <https://doi.org/10.1016/j.artres.2018.10.099>

Published online: 7 December 2019

<sup>2</sup>South African Medical Research Council, Unit for Hypertension and Cardiovascular Disease, North-West University, Potchefstroom, South Africa  
<sup>3</sup>Department of Biomedical Engineering and Technomathematics, Aachen University of Applied Sciences, Juelich, Germany

**Background:** Masked hypertension (MH) is prevalent in young adults and is associated with similar vascular complications as sustained hypertension, but whether this is already evident in young adults is unclear. We therefore compared retinal vessel calibres and function in response to flicker light induced provocation (FLIP) in young healthy adults stratified by MH status and explored associations between these parameters.

**Methods:** We used data from the first 566 participants (aged 20–30 years) taking part in the African-PREDICT study. Participants were clinically normotensive (70% valid readings) were measured and MH status determined. The central retinal artery (CRAE) and vein equivalent (CRVE) were calculated from fundus images and retinal vessel dilation responses to FLIP determined. **Results:** MH showed a prevalence of 16%. MHs had a lower CRAE ( $155 \pm 10$  MU vs.  $160 \pm 12$  MU,  $p = 0.002$ ), but similar CRVE and vessel dilation in response to FLIP when compared to normotensives. The latter findings remained consistent upon adjustment for sex, ethnicity, age and body mass index. Multivariate regression analysis demonstrated an independent association between CRAE and the presence of MH ( $R^2 = 0.07$ ,  $\beta = -0.10$  (-0.20; -0.01)). No further associations existed between retinal vessel parameters and MH status.

**Conclusion:** Already at a young age, healthy adults with MH show slight adverse changes in the retinal microvasculature. Considering the prevalence of MH in young adults, and the predictive value of reduced CRAE, our data emphasize the early identification of altered 24 hr blood pressure patterns.

#### P45 IMPEDANCE CARDIOGRAPHY EVALUATION IN ELDERLY HYPERTENSIVE PATIENTS

Francisco Ferreira da Silva <sup>1</sup>, Pedro Marques da Silva <sup>2</sup>

<sup>1</sup>Hospital CUF Descobertas, Lisboa, Portugal

<sup>2</sup>Hospital de Santa Marta - Centro Hospitalar de Lisboa Central, Lisboa, Portugal

**Objectives:** Vascular aging results from endothelial dysfunction and increased arterial stiffness, a independent determinant of cardiovascular (CV) events, that is amplified by the presence and progression of arterial hypertension (AH). Age related changes in hemodynamic variables<sup>1</sup> may predict negative vascular outcomes.<sup>2</sup> In this study, we evaluate hemodynamic variables in elderly hypertensive patients with impedance cardiography (IC) in order to infer opportunities for therapeutic optimization.

**Methods:** We retrospectively analysed hypertensive patients that were purposed for IC evaluation. The selected 75 patients were divided into two groups, above or below 65 years old, matched by anthropometric and blood pressure (BP) values. (Table 1) Antihypertensive therapy wasn't considered. For each group the mean of IC variables was obtained, and statistical analysis was performed by a T-student test.

**Results:** From the patients included, 25 have  $\geq 65$  years and 50  $< 65$  years. In the elderly group mean age was 71 years, 52% were female and mean BMI  $28,6$  Kg/m<sup>2</sup>. Mean BP was 142 mmHg vs 135 mmHg for systolic and 74 mmHg vs 83 mmHg for diastolic BP, heart rate 63 bpm vs 69 bpm in elderly and younger group respectively. Mean IC results showed statistically significance differences for cardiac output, cardiac index, systemic compliance, left ventricular ejection time, velocity index and acceleration index between the groups. (Table 2)

**Conclusions:** BP determination and control may not signify adequate hemodynamic state. With this study, elderly hypertensive patients present different hemodynamic behaviour, compared with younger ones, in variables of blood flow, resistance and contractility. These data could have potential implications on the pharmacological optimization of BP treatment.

#### Poster session I – Models, methodologies and imaging technology I

##### P46 ELONGATION OF THE PROXIMAL AORTA DURING THE CARDIAC CYCLE PLAYS AN IMPORTANT ROLE IN THE ESTIMATION OF AORTIC COMPLIANCE

Stamatia Pagoulatou <sup>1</sup>, Mauro Ferraro <sup>1</sup>, Bram Trachet <sup>1</sup>, Vasiliki Bikia <sup>1</sup>, Dionysios Adamopoulos <sup>2</sup>, Nikolaos Stergiopoulos <sup>1</sup>

<sup>1</sup>EPFL, Lausanne, Switzerland

<sup>2</sup>Geneva University Hospitals, Geneva, Switzerland

**Background and Aims:** Arterial volume compliance is a major determinant of cardiac afterload. More than 50% of the arterial volume compliance resides in the proximal aorta. Researchers often use area compliance for the estimation of volume compliance, assuming an invariant vessel length over pressure changes. Recent studies have provided evidence to question this simplification, showing that the extension of the proximal aorta along its long axis during systole produces significant longitudinal strain, which could lead to erroneous estimation of arterial stiffness. The aim of the present study was to test this hypothesis in a computational environment.

**Methods:** The 3-D proximal aortic geometry of a healthy young male was reconstructed and meshed and the original zero-pressure geometry was restored. Material behavior was approximated based on the model of (1). Viscoelastic support conditions were introduced along the aortic wall and aortic root motion, estimated from the cardiac-gated CT data of a healthy subject, was enforced at the proximal boundary. The simulation was run for an input pressure ranging from 80-110mmHg. Volume compliance of the vessel as obtained by integrating the area compliance over the centerline length (both variable and invariable) was subsequently compared to the ground truth (which was imposed by the material stiffness).

**Results:** Integration of the area compliance over an invariable centerline length led to an underestimated average distensibility by -68%. After taking into account the elongation, the error was improved to -25% (Figure 1).

**Conclusion:** The elongation of the aorta during cardiac cycle was found to affect significantly the estimation of arterial compliance.

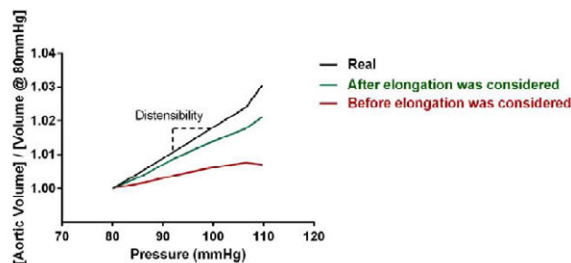


Figure 1. Relative volume, -normalized for the reference value at 80mmHg.- as a function of pressure during systole, calculated before and after considering the axial extension of the aorta.

#### References

1. Holzapfel GA, Gasser TC, Ogden RW. A New Constitutive Framework for Arterial Wall Mechanics and a Comparative Study of Material Models. *J Elast Phys Sci Solids*. 2000;61(1):1–48.

#### P47 ABNORMAL FLOW PATTERN IN MARFAN PATIENTS IS RELATED TO AORTIC GEOMETRIC FEATURES: A 4D FLOW MRI STUDY

Andrea Guala, Gisela Teixido-Tura, Jose Rodriguez-Palomares, Aroa Ruiz-Muñoz, David Garcia-Dorado, Artur Evangelista  
 Hospital Vall d'Hebron, Department of Cardiology, VHIR, Universitat Autònoma de Barcelona, Barcelona, Spain

**Introduction:** Ascending aorta aneurysm and dissection are the most common cardiovascular complications affecting Marfan syndrome patients (MFS). Recent large increase in life expectancy of MFS driven the growing prevalence of descending aorta (DAo) dilation and dissection. Despite local abnormal vortices in the proximal DAo were related to local dilation, their origins have never been explored. We investigated the link between aortic geometrical characteristics and abnormal flow pattern in the thoracic aorta of MFS.

**Methods:** Fifty-tree MFS without significant aortic valve disease and forty age-matched healthy volunteers (HV) were prospectively included in 4D flow-MRI study, obtaining flow field and angiography. Spatial distribution of flow (in-plane rotational flow (IRF) and systolic flow reversal ratio (SFRR))