P143: VALIDITY OF PULSE WAVE VELOCITY AND AUGMENTATION INDEX MEASUREMENTS IN PATIENTS WITH ATRIAL FIBRILLATION

Rogier Caluwe, An S. De Vriese, Bruno Van Vlem, Francis Verbeke

To cite this article: Rogier Caluwe, An S. De Vriese, Bruno Van Vlem, Francis Verbeke (2017) P143: VALIDITY OF PULSE WAVE VELOCITY AND AUGMENTATION INDEX MEASUREMENTS IN PATIENTS WITH ATRIAL FIBRILLATION, Artery Research 20:C, 96–97, DOI: https://doi.org/10.1016/j.artres.2017.10.155

To link to this article: https://doi.org/10.1016/j.artres.2017.10.155

Published online: 7 December 2019
Methods: In the present study, we enrolled 12 normotensive subjects and 8 hypertensive patients undergoing an election surgical intervention; (11/20 were severely obese). All patients underwent a biopsy of subcutaneous fat during surgery. Subcutaneous small resistance artery structure was assessed by wire microscopy and the M/L was calculated. WLR of retinal arterioles was obtained by SLDF and AO (SLDF, Heidelberg Engineering, Heidelberg, Germany and RTX-1, Imagine Eyes, Orsay, France). Functional (basal) and structural (total) microvascular density were evaluated by capillaroscopy before and after venous congestion.

Results: The results are summarized in the Table (slope of the relation: p < 0.01 RTX-1 vs. SLDF).

<table>
<thead>
<tr>
<th></th>
<th>Basal capillary density in the nailfold / M/L</th>
<th>Total capillary density in the forearm / M/L</th>
<th>Basal capillary density in the dorsum of the finger / M/L</th>
<th>Total capillary density in the dorsum of the finger / M/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation coefficients</td>
<td>0.53, r² = 0.28, p &lt; 0.05</td>
<td>0.50, r² = 0.25, p &lt; 0.05</td>
<td>0.17, r² = 0.29, p = NS</td>
<td>0.34, r² = 0.12, p = NS</td>
</tr>
<tr>
<td>(n = 20)</td>
<td>W/L retinal arterioles (SLDF)/ M/L</td>
<td>W/L retinal arterioles (RTX-1)/M/L</td>
<td>W/L retinal arterioles (SLDF)/ W/L</td>
<td>W/L retinal arterioles (RTX-1)</td>
</tr>
<tr>
<td>Correlation coefficients</td>
<td>0.54, r² = 0.29, p &lt; 0.01</td>
<td>0.90, r² = 0.81, p &lt; 0.001</td>
<td>0.71, r² = 0.50, p &lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>(n = 20)</td>
<td>W/L retinal arterioles (RTX-1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions: Our data suggest that AO has a substantial advantage over SLDF in terms of evaluation of microvascular morphology, since it is more closely correlated with the M/L of subcutaneous small arteries, considered a gold-standard approach.

P142
AORTIC ROOT STIFFNESS AND MECHANICAL PROPERTIES OF HEALTHY ADULTS

Madalina Negoita 1, Alan D. Hughes 2, Kim H. Parker 3, Ashraf W. Khir 1
1Brunel Institute of Bioengineering, Brunel University London, UK
2Institute of Cardiovascular Science, University College London, UK
3Department of Bioengineering, Imperial College London, UK

Background: Arterial stiffness, often expressed in terms of pulse wave velocity (PWV), is an important risk factor for cardiovascular disease. PWV can be determined locally and non-invasively, by means of ultrasound.

Aim: To assess PWV, local compliance (Cs), distensibility (Ds) and Young’s modulus of the aortic root using non-invasive ultrasound measurements.

Methods: 10 healthy volunteers aged 21 – 39, 1 male, were scanned using ultrasound (GE, Vivid E9) with a phased array transducer 1.5-4.5MHz. DICOM images were recorded from the parasternal long axis: M-mode for diameter measurements, and apical 5- chamber view for blood Doppler velocity, sequentially. Each measurement was repeated 3 times for 20s. Velocity and diameter waveforms were extracted off-line in Matlab based on grey-scale thresholding. PWV was determined using the (nD) U- loop method [1]. Wall thickness was extracted from the B-mode images used to measure the diameter. Distensibility and compliance were calculated as Ds = 1/ (p * PWV²), Cs = dA/dp = Ds, A where p = 1050kg/m³ blood density, A is the cross- sectional area, and Young’s modulus was calculated as previously described [2] using the Bramwell-Hill and Moens-Kortweg equations. 

Results: Across all patients mean PWV was 3 ± 0.8m/s, mean distensibility was 1.3 ± 0.61 10⁻⁴ Pa⁻¹, and mean compliance was 0.6 ± 0.31m²Pa⁻¹. The average wall thickness was 0.4 ± 0.06cm while Young’s modulus was 63.6 ± 40.4kPa. These results are comparable to corresponding values reported in the literature using other techniques.

Conclusions: Aortic root PWV, distensibility, compliance and Young’s modulus can be determined using ultrasound measurements of diameter and velocity. Further studies are required to investigate the potential clinical utility of aortic root parameters.

References

P143
VALIDITY OF PULSE WAVE VELOCITY AND AUGMENTATION INDEX MEASUREMENTS IN PATIENTS WITH ATRIAL FIBRILLATION

Rogier Caluwe 1, An S. De Vriese 2, Bruno Van Vliem 3, Francis Verbeken 3
1Department of Nephrology, Dialysis and Hypertension, OLV Hospital Aalst, Belgium
2Department of Nephrology and Infectious Diseases, St.-Jan Hospital Brugge, Belgium
3Department of Nephrology, University Hospital Gent, Belgium

Background: Individualized weighing of the risk-benefit of anticoagulation is recommended in patients with atrial fibrillation (AF) that have low established risk scores or, conversely, are at increased risk for bleeding 1. Parameters of arterial stiffness and wave reflection could improve risk stratification, but their use has not been validated in arrhythmia 2.

Methods: We measured carotid-femoral pulse wave velocity (PWV), central augmentation index (Al) and central pulse pressure (CPP) using the Sphygmocor (AlCor Medical, Sydney, Australia) system in 34 patients (53 to 85 years; 25 males) with AF before and after elective electrical cardioversion. Agreement was assessed using the intraclass correlation coefficient (ICC) and the coefficient of variation, completed with Bland-Altman plots.

Results: Following cardioversion, mean arterial blood pressure (MAP) and heart rate (HR) decreased significantly by 7 mmHg and 18 bpm respectively. PWV decreased from 11.8 m/s to 10.7 m/s, AI increased from 24% to 29%, and CPP rose from 45 mmHg to 50 mmHg. The decrease in PWV was related to the decrease in MAP (beta = 0.57; R² = 0.33; P < 0.001) whereas changes in AI and CPP were related to the decrease in HR (AI: beta = −0.59; R² = 0.35; P < 0.001; CPP: beta = −0.52; R² = 0.26; P = 0.001). After adjustment for changes in MAP and HR, reliability analysis showed an excellent agreement for PWV (ICC = 0.89; 95% CI: 0.79–0.95) but moderate agreement for AI (ICC = 0.59; 95% CI: 0.17–0.80). Excellent agreement was also found for CPP (ICC = 0.89; 95% CI: 0.78–0.94).

Figure 1. A. Scatter plot showing PWV before (PWV₀) and after (PWV₁) cardioversion. The solid line is the line of identity, the broken line the regression line for PWV₁ vs PWV₀ (Passini & Bablok regression). B. Bland-Altman plot showing the proportional difference (%) between PWV₀ and PWV₁ cardioversion. The solid line represents the mean value of PWV and the dotted lines mean ± 2 SD.
Conclusions: Measurement of PWV and CPP is reliable in patients with AF, as they appear unaffected by the presence of arrhythmia.

References