P51: NON-CONTACT MEASUREMENT OF LOCAL CAROTID AND CAROTID-FEMORAL PULSE WAVE VELOCITY BY LASER DOPPLER VIBROMETRY: VALIDATION OF A NEW DEVICE AGAINST REFERENCE TECHNIQUES IN HYPERTENSIVE PATIENTS

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Methods: DIS-LDV against reference techniques.

Laser Doppler vibrometer (CARDIS-LDV). Our objective is to validate CARDIS-LDV in the detection of skin movements induced by arterial pulses through a computer model. Several studies showed that arterial stiffness is prone to artefacts, thus limiting the measurement of arterial stiffness in hypertensive patients.

Objective: PWV measurement devices are technically demanding, expensive and prone to artefacts, thus limiting the measurement of arterial stiffness in hypertensive patients.

Results: Measurements by CARDIS-LDV are easy and fast to perform. A simple palpation of pulse is enough to position the device and obtain good signals thanks to the 6-beam array. Figure 1 shows an example of a carotid-femoral recording on a healthy volunteer (age 28). PWV is 5.88 ± 0.30 m/s using the maximum of 1st derivative method, compared with 5.96 ± 0.40 m/s with tonometry. Data on larger sample size will be presented at the meeting.

Conclusion: CARDIS-LDV is a promising technique to assess arterial stiffness; we expect to demonstrate its good agreement with reference techniques and that it improves the screening of cardiovascular risk in large populations.

References

PS1
NON-CONTACT MEASUREMENT OF LOCAL CAROTID AND CAROTID-FEMORAL PULSE WAVE VELOCITY BY LASER DOPPLER VIBROMETRY: VALIDATION OF A NEW DEVICE AGAINST REFERENCE TECHNIQUES IN HYPERTENSIVE PATIENTS

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Objective: PWV measurement devices are technically demanding, expensive and prone to artefacts, thus limiting the measurement of arterial stiffness in primary care. The CARDIS consortium developed a non-contact device based on the detection of skin movements induced by arterial pulses through a laser Doppler vibrometer (CARDIS-LDV). Our objective is to validate CARDIS-LDV against reference techniques.

Methods: This study sponsored by INSERM will include 100 essential hypertensive patients of grade I-III, aged 18-80. The CARDIS-LDV comprises two rows of 6 laser beams spaced 5 mm (2.5 cm wide). These rows are either situated 2.5 cm apart for local PWV measurement or can be split in tensives, males and females, grade I-III, aged 18-80. The CARDIS-LDV comprises two rows of 6 laser beams spaced 5 mm (2.5 cm wide). These rows are either situated 2.5 cm apart for local PWV measurement or can be split in

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Conclusion: CARDIS-LDV is a promising technique to assess arterial stiffness; we expect to demonstrate its good agreement with reference techniques and that it improves the screening of cardiovascular risk in large populations.

References

Table 1. MRI and US measurements of D, U and PWV. Data are means ± standard deviations (n=8).

<table>
<thead>
<tr>
<th></th>
<th>Min D (cm)</th>
<th>Max D (cm)</th>
<th>Min U (m/s)</th>
<th>Max U (m/s)</th>
<th>PWV (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI</td>
<td>2.5±0.4</td>
<td>3.0±0.3</td>
<td>0.1±0.0</td>
<td>0.9±0.2</td>
<td>3.5±0.8</td>
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<tr>
<td>US</td>
<td>2.4±0.2</td>
<td>2.8±0.2</td>
<td>0.3±0.1</td>
<td>1.1±0.2</td>
<td>3.6±1.0</td>
</tr>
</tbody>
</table>

PS2
ESTIMATING CENTRAL BLOOD PRESSURE FROM MRI DATA USING REDUCED-ORDER COMPUTATIONAL MODELS

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Purpose: Central Blood Pressure (CBP) is a better cardiovascular risk indicator than brachial pressure [1]. However, gold standard CBP measurements require an invasive catheter. We propose an approach to estimate CBP non-invasively from Magnetic Resonance Imaging (MRI) data coupled with a non-invasive brachial pressure measurement, using reduced-order (0-D/1-D) computational models. Our objectives were: identifying optimum model parameter estimation methods and comparing the performance of 0-D/1-D models for estimating CBP.

Methods: Populations of virtual (simulated) healthy subjects were generated based on [2]. Pressure and flow waveforms from these populations were used to develop and test Methods: for estimating model parameters. Two common clinical scenarios were considered: when a brachial pressure waveform is available; and when only systolic and diastolic blood pressures are available. Optimal parameter estimation Methods: were identified for each scenario and used with two 0-D Windkessel models and a 1-D aortic model. Results were compared with invasive CBP in a post-coarctation repair population (n = 10).

Results: Model parameters were best estimated by: fitting an exponential to the pressure waveform to estimate compliance and outflow pressure; using the least-squares method to estimate pulse wave velocity from flow data; assuming characteristic impedance was 5% of arterial resistance; and estimating end-systolic time from the second derivative of the pressure waveform. Average pulse and systolic CBP errors were <5 mmHg and <2 mmHg, respectively.

Conclusions: We have demonstrated the feasibility of estimating CBP from MRI and brachial pressure. Different reduced-order models provided similar performance, although the 1-D model reproduced pressure waveform morphology more accurately.

References