P134: A COMPUTATIONAL INVESTIGATION OF CONFOUNDING FACTORS AFFECTING FLOW MEDIATED DILATION: TOWARDS IMPROVED ENDOTHELIAL FUNCTION ASSESSMENT

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Nowadays, the employment world is increasingly shifting towards service-related labour, changing focus from physiological to psychological loads for workers. Thus, a deeper psychological stress understanding arises, not only for jobs within extreme conditions (as astronauts or pilots) but also for regular jobs with high emphasis on mental stressors. With the intent of developing methods and technology able to detect psychological stress we perform this pilot laboratory study in 14 male volunteers under stress and relax situations. As a stressor and the relaxer were used a standardized cognitive Paced Auditory Serial Addition Test (PASAT) and a relaxing video, respectively. Galvanic Skin Response (GSR) and Heart Rate (HR) were continuously measured as golden standard techniques to indicate physiological stress levels. Before each stimulus intervention, a Braquial Blood Pressure were measured by standard Omron M6 apparatus. A continuous monitoring of Central Aortic Pressure (CAP) were assessed by non-invasive small WPL sensors and equipment, developed by NMT, S.A., which allowed on-line detection and long-term effect of stress evaluation. HR and GSR measurements showed high variations under stressor application, proving physiological stress among volunteers and validating PASAT suitability. From analysis of obtained data, were found the significant predictive value for mean ICP (p < 0.01, R² = 0.25), HR (p < 0.05), and mean aBP (p < 0.001), peak (p < 0.001), mean (p < 0.05) and minimum (p < 0.01) cBF had significant value for pulse ICP (R² = 0.35). The transfer function models showed potential to reproduce the ICP waveform (Root Mean Square Error (RASE): < 4 mmHg), being more accurate for mean aBP above 100 mmHg and mean ICP below 20 mmHg (RMSE < 0.5 mmHg).

Conclusions: The models developed from the comprehensive rat experiment demonstrated that systemic cardiovascular measures have predictive value in estimating the ICP magnitude and waveform, but other inputs may be necessary to improve accuracy in estimating ICP across the full physiological range.

P136 SIMULATING MYOCARDIAL OXYGEN BALANCE CHANGES DUE TO ANTI-HYPTERTENSIVE DRUGS
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Background: Hypertension clinical treatment largely relies on different drugs. Some of these drugs are thought to exhibit specific protective functions in addition to those resulting from blood pressure reduction per se. Through a validated multiscale mathematical model of the cardiovascular system, we studied the impact of commonly-used antihypertensive drugs on myocardial oxygen supply-consumption balance, which plays a crucial role in type 2 myocardial infarction.

Methods: Forty-two wash-out hypertensive patients were included in this study. Patients’ demographics, heart rate, brachial pressure, Left Ventricular (LV) volumes and carotid-femoral pulse wave velocity were used to set to patient specific condition a largely accepted benchmark data set, describing healthy subjects. Starting from literature data, drugs effects were modeled by means of six coefficients, describing LV function, heart rate, peripheral resistances and arterial stiffness. This was due to the concomitant reduction in LV work and increase in coronary flow. Similarly, RAAS blockers induced several positive changes, but to a reduced extent. In contrast, calcium channel blockers seem to induce some potentially negative effects on myocardial oxygen balance.

Results: Our results ascribed the well-known major cardioprotective efficiency of β blockers to a positive change of myocardial oxygen balance. This was due to the concomitant reduction in LV work and increase in coronary flow. Similarly, RAAS blockers induced several positive changes, but to a reduced extent. In contrast, calcium channel blockers seem to induce some potentially negative effects on myocardial oxygen balance.

Conclusions: Patient-specific multiscale mathematical model is able to reproduce clinically-relevant changes in coronary hemodynamics and ventricular function driven by anti-hypertensive drugs. Further studies are needed to evaluate eventual clinical usefulness of in-silico modeling of anti-hypertensive drugs.