4.8: INCREASED CARDIAC WORKLOAD IN THE UPRIGHT POSTURE IN MALE SUBJECTS: NON-INVASIVE HEMODYNAMICS IN MEN VERSUS WOMEN

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4.7 MEASUREMENT OF ARTERIAL STIFFNESS USING A CONNECTED BATHROOM SCALE: CALIBRATION AGAINST SPHYGMOCOR

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Background: Measurement of arterial stiffness (AS) is still considered difficult. We developed a non-invasive technique to assess AS from a connected bathroom scale, based on ballistocardiography (BCG) and impedance plethysmography (IPG).

Methods: We included 198 subjects and patients, 111 for calibration study (cal), 88 for validation study (val), 34% hypertensives, mean age 48±17 years, 50% women. The scale pulse transit time (WS-PTT) was calculated as the difference between BCG systolic signals and IPG blood flow in the foot. Distance was estimated from body height and PWV was calculated. Correlation between WS-PTT and CF-PTT was 0.83 (p<0.001), and correlation between WS-PWV and CF-PWV was 0.84 (p<0.001). These good correlations were non-trivial given the differences in wave paths, the fact that measurements are made in orthostatic position and totally investigator-free.

Conclusion: We show in two distinct populations that a simple user-oriented instrument such as a connected bathroom scale can estimate arterial stiffness with accuracy close to healthcare-oriented systems. Because these devices will be used by the general population, the availability of arterial stiffness data on very large, non-medicalized populations will change our management of well-being and health.

4.8 INCREASED CARDIAC WORKLOAD IN THE UPRIGHT POSTURE IN MALE SUBJECTS: NON-INVASIVE HEMODYNAMICS IN MEN VERSUS WOMEN

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Background: Men and women differ in the risk of cardiovascular disease, but the underlying mechanisms are not completely understood. We examined possible sex-related differences in supine and upright cardiovascular regulation.

Methods: Hemodynamics were recorded from 167 men and 167 women of matching age (±45 years) and body mass index (±26.5 kg/m²) during passive head-up tilt. None had diabetes, cardiovascular disease other than hypertension, or antihypertensive medication. Whole-body impedance cardiography, tonometric radial blood pressure, and heart rate variability were analyzed. Results were adjusted for height, smoking, alcohol intake, mean arterial pressure, plasma lipids and glucose.

Results: Supine hemodynamic differences were minor: lower heart rate (-4%) and higher stroke volume (+7.5%) in men than women (p<0.05 for both). Up-right systemic vascular resistance was lower (-10%), but stroke volume (+15%), cardiac output (+16%), and left cardiac work were clearly higher (+20%) in men than women (p<0.01 for all). Corresponding results were observed in a subgroup of men and postmenopausal women (n=76, age <55 years). Heart rate variability analyses showed higher low frequency to high frequency ratio in supine (p<0.001) and upright (p<0.003) positions in men.

Conclusions: The foremost difference in cardiovascular regulation between sexes was higher upright hemodynamic workload of the heart in men, a finding not explained by known cardiovascular risk factors or hormonal differences before menopause. Heart rate variability analyses indicated higher sympathovagal balance in men regardless of body position. The deviations in upright hemodynamics could play a role in the differences of cardiovascular risk between men and women.

4.9 PROPORTIONAL PRESSURE RELATIONS IN THE PULMONARY ARTERIAL SYSTEM

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Background – Objectives: The pulmonary arterial system can be characterized by:

1. A constant product of Pulmonary Vascular Resistance (PVR) and Total Arterial Compliance (TAC) with Tau=PVRxTAC=0.7 seconds (1).

2. A proportional relation exits between systolic and diastolic pulmonary artery pressure, sPAP, dPAP, with mean pulmonary artery pressure mPAP (2). Recently it was shown that the time constant Tau is affected by Pulmonary Arterial Wedge Pressure (PAWP), and thus not constant under all conditions (3).

We therefore questioned how the product PVRxTAC = Tau depends on PAWP.

Methods: We have studied proportionality of pressures in a group of patients (n=1054) and determined the contribution of Pulmonary Arterial Wedge Pressure.

Results: We found that sPAP = 1.61mPAP and dPAP = 0.62mPAP, for all PAWP between 1 and 31 mmHg. Calculating PVR and TAC in the standard way as PVR=(mPAP-PAWP)/CO and TAC=PSV/CO shows that for a certain PAWP and Heart Rate a linear relation exists between PAWP and mPAP and Heart Rate. A clinically measured low Tau could suggest a high PAWP.

References

