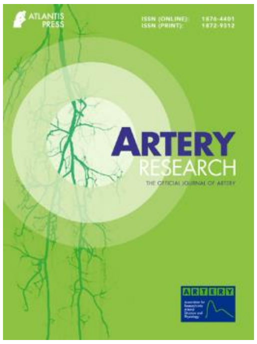

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P8.02: LARGE DIFFERENCES IN CENTRAL PRESSURE ESTIMATION BETWEEN SPHYGMOCOR AND OMRON HEM 9000AI

J. Kips, A. Schutte, S.J. Vermeersch, H. Huisman, L. Van Bortel, P. Segers

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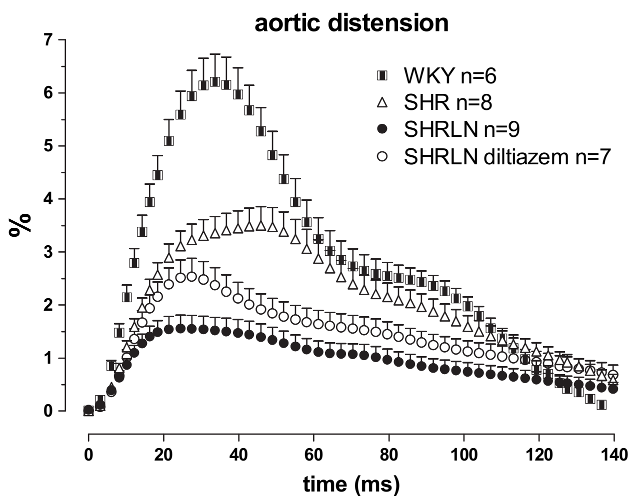


P7.05

AORTIC STENT IMPLANTATION IN THE ISTHMIC REGION IN AN ANIMAL MODEL

L. Semplicini, H. Poser, I. Iacopetti, N. Maschietto, E. Valerio, G. Ceolotto, T. Pilla, G. M. De Benedictis, G. Gerardi, F. Stella, D. Bernardini, S. Basso, L. Aresu, O. Milanesi, A. Semplicini
University of Padua, Padua, Italy

Background: Balloon dilation with stent implantation is a novel technique of aortic coarctation treatment. Residual arterial hypertension is a frequent finding (50% of treated patients), leading to major cardiovascular events and reducing life expectancy, even in the presence of stenosis resolution,

Aim of This Study: To determine feasibility of stent implantation in the aortic isthmus of an ovine model for the study of pressor, haemodynamic and hormonal changes induced in the growing animal.

Materials and Methods: Platinum-iridium stent was implanted in the aortic isthmus of 6 females sheep through vascular catheterization (STENT group). Vascular catheterization and angiographic study was performed in 6 control sheep (SHAM). All subjects had direct aortic pressure measurement during catheterization as well as echocardiographic and blood pressure measurements (through auricular artery catheterization) every 90 days. Twelve months after intervention the animals were sacrificed.

Results: Stent implantation did not affect growth and quality of life of the animals. Aortic pressure measurements performed during catheterization revealed a pressure wave morphology compatible with acute *augmentation index* alteration after stenting implantation. Auricular blood pressure did not differ among groups. One subject died after surgery for vascular access haemorrhage. Another subject died a few days after intervention. One subject developed aortic insufficiency after catheterization.

Conclusions: Stent implantation is feasible and well tolerated. This animal model can be useful to study the hemodynamic impact and the aortic stiffness induced by stent implantation and their consequences on the left ventricle and the vasculature.

Methodology

P8.01

REFERENCE VALUES FOR CAROTID STIFFNESS AND IMT

L. Engelen [1], P. Boutouyrie [2], I. Ferreira [1], C. D. A. Stehouwer [1], S. Laurent [2]
[1]*Maastricht University Medical Centre, Maastricht, Netherlands*
[2]*Hopital Europeen Georges Pompidou, Paris, France*

Arterial properties, such as carotid distention and intima-media thickness (IMT) are important markers of arterial stiffness and atherosclerotic disease and have been shown to predict cardiovascular events. However, the application of these measurements in clinical practice has been hampered by the absence of reference values. The aim of the present study is to establish reference and normal values for carotid stiffness and IMT.

Measurements of carotid wall thickness and function obtained by an echo tracking system (Walltrack and ArtLab, Esaote, Maastricht, Netherlands) are available for individuals from several combined European (*n* ~9000) and Chinese (*n* ~1500) cohort studies. After pooling, data will be analysed in order to obtain normal values of carotid stiffness and IMT as estimated in the 'normal population', which will be constituted from those selected individuals with no acquired cardiovascular risk factors (i.e. diabetes, use of antihypertensive and/or lipid lowering medication, dyslipidaemia, smoking) or overt cardiovascular disease *and* optimal blood pressure values. Other populations with one or more risk factors will serve to scale stiffness and IMT between populations and to obtain reference values. A special attention will be focused on bringing correspondence between echo tracking and image analysis techniques to allow for conversion, and carotid stiffness values calculated from central pressure and/or brachial pressure.

The study is currently ongoing, which enables presentation of the exact design. Definitive results are expected for Artery 2011.

P8.02

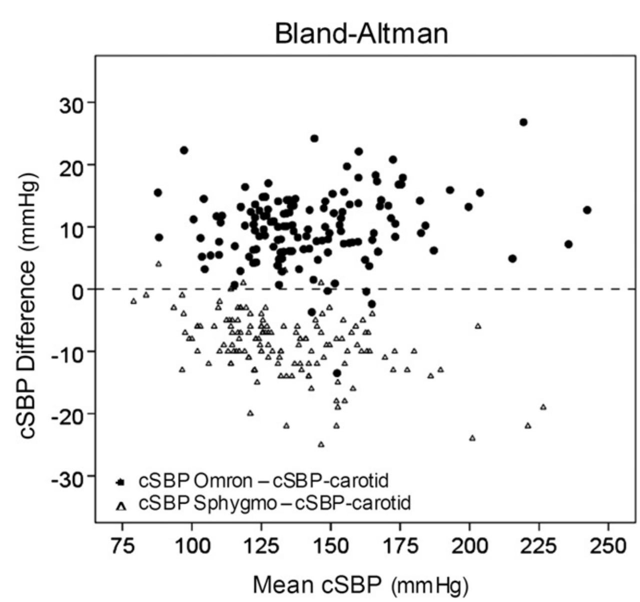
LARGE DIFFERENCES IN CENTRAL PRESSURE ESTIMATION BETWEEN SPHYGMOCOR AND OMRON HEM 9000AI

J. Kips [1,2], A. Schutte [3], S. J. Vermeersch [1,2], H. Huisman [3], L. Van Bortel [1], P. Segers [2]
[1]*Heymans Institute of Pharmacology, Gent University, Gent, Belgium*
[2]*IBiTech-bioMMeda, Gent University, Gent, Belgium*
[3]*Hypertension in Africa Research Team, North-West University, Potchefstroom, South Africa*

Introduction: Central systolic blood pressure (cSBP) has been shown to have a higher predictive value than brachial (cuff) pressure. Accurate cSBP, however, is difficult to obtain non-invasively and is often estimated from carotid or transformed peripheral pressures. In this study, the cSBP estimate from the Omron HEM 9000AI was compared to the SphygmoCor cSBP estimate and to carotid SBP. Whilst SphygmoCor uses a radial-to-aortic transfer function to calculate cSBP, the Omron HEM 9000 AI uses a regression equation which relies on the correlation between the second systolic peak of the radial pressure waveform and cSBP.

Methods: Radial applanation tonometry was performed in 251 rural black South Africans (aged 36-91 years) enrolled in the PURE study. Each subject was measured with an Omron HEM 9000AI and a SphygmoCor. Four different estimates of central pressure were calculated: (i) Omron device (cSBP-Omron); (ii) SphygmoCor, with calibration of the radial pressure by brachial SBP and DBP (cSBP-Sphygmo); (iii) SphygmoCor, with calibration of the radial pressure by brachial MAP and DBP obtained from brachial tonometry (cSBP-Sphygmo2, N=201) and (iv) carotid SBP obtained through carotid tonometry calibrated with brachial MAP and DBP (cSBP-carotid, N=143).

	Mean (SD) [mmHg]
cSBP-Omron	145.9 (25.5)
cSBP-Sphymo	127.4 (22.5)
cSBP-Sphymo2	131.2 (24.4)
cSBP-Carotid	138.0 (26.4)



Results: All four cSBP estimates were highly correlated (R>0.97).
Conclusion: When using both devices as advocated by their manufacturers, the mean difference in cSBP is 18.6 (4.5) mmHg. Carotid SBP is in the middle between the Omron and SphygmoCor estimates, indicating that the 'true' central cSBP should be sought between the Omron and SphygmoCor estimates.

P8.03
ASSESSMENT OF CAROTID ELASTICITY IN EXERCISE: A REPRODUCIBILITY STUDY

E. Bianchini [1], A. I. Corciu [1], R. M. Bruno [2], F. Faita [1], M. Demi [1], L. Ghiadoni [2], R. Sicari [1], V. Gemignani [1]
[1]*Institute of Clinical Physiology-CNR, Pisa, Italy*
[2]*Department of Internal Medicine, University of Pisa, Pisa, Italy*

Arterial stiffness may vary with physiological stimulus and therefore, its quantification in dynamic conditions could enhance the characterization of vascular elastic properties. The aim of this study was to evaluate the feasibility of the assessment of carotid artery's elasticity during exercise in terms of reproducibility.
Eighteen healthy volunteers (9 men, 34±3 years) underwent a maximal exercise testing on a graded semi-supine cycle ergometer. Ultrasound B-mode image sequences (DICOM format, high frame-rate) of right common carotid arteries were acquired at different steps (60%, 70%, 80% and 85% of maximal heart rate), and analysed by an automatic system (Carotid Studio, IFC-CNR) for the measurement of arterial diastolic diameter (D) and distension (ΔD). In addition, central pulse pressure (PPa) was estimated by tonometry (radial-aortic transfer function, Sphygmocor, AtcorMedical). Cross-sectional compliance (CC) and distensibility (DC) coefficients were then obtained for each step of the examination. Subjects were analysed in two different sessions 7 days apart, in order to evaluate intersession reproducibility of the measurements; variability was expressed as coefficient of variation (CV) for each step of the examination. At rest CVs were 3%±3% for D, 8%±6% for ΔD, 8%±6% for PPa, 9%±8% for CC and 10%±6% for DC.
During exercise maximal variability was found at peak: 7%±5% for D, 12%±8% for ΔD, 11%±7% for PPa, 19%±6% for CC and 24%±15% DC.
The reproducibility of carotid parameters, which is excellent at rest, remains more than satisfactory during exercise. Hence, the proposed approach might be used for investigating the dynamic behaviour of arterial elasticity.

P8.04
CAROTID INTIMA-MEDIA THICKNESS: COMPARISONS BETWEEN SEMI-AUTOMATIC EDGE DETECTION METHOD VERSUS A NEW AUTOMATIC ECHO TRACKING SYSTEM

G. P. N. Leftheriotis [1], R. Hamza [1], B. Levy [2], A. Taquet [5], L. Bressolette [4], M. Dauzat [6], P. Boutouyrie [3]
[1]*UMR CNRS 6214-Inserm 771 - CHU Angers, Angers, France*
[2]*Unité Inserm 689 - Cardiovascular Research Centre - Hop. Lariboisière, Paris, France*
[3]*UMRS 872 - Équipe 1 - HEGP, Paris, France*
[4]*Service de Médecine Interne - CHU Brest, Brest, France*
[5]*Cabinet Angiologie - Prévention, Paris, France*
[6]*EA 2992 Univ Montpellier 1 - CHU Nimes, Nimes, France*

Rationale: The intima-media thickness (IMT) of the common carotid artery is a widely used clinical marker of cardiovascular diseases. To date, IMT is measured from longitudinal B-mode ultrasound images using manual or imaging analysis methods. Real-time automatic tracking of the lumen-intima and media-adventitia echoes using multi-echotracking technology could overcome some limits of manual and imaging analysis methods.
Material and methods: Common carotid intima-media thickness measured with a new multi-echotracking system (QIMT — Esaote - Italy) was compared to a semi-automatic edge detection imaging analysis method (IMT@televasc, www.televasc.fr, France) from B-mode ultrasound images.
Results: 93 scans were analyzed with both techniques on the same scans and from both carotids in 57 patients (age 55 +/- 17, 34 males). Mean QIMT was higher than IMT@televasc (690+/-173 vs 662+/-135, p<0.0001). Coefficient of variability for QIMT was 5% and 16 % for the IMT@televasc without significant inter-observer differences. Correlation coefficient were r= 0.657 (p<0.001, QIMT = IMT@televasc . 0.84 (+/-0.09) + 134+/-66 μm). Bland Altman plot did not showed systematic bias.
Discussion: QMIT gives more reproducible values of IMT than IMT@televasc with a significant correlation between the 2 methods. There was a systematic difference in absolute value between both techniques, values provided being higher with QIMT than with IMT@televasc. Conversion tables are needed for comparisons between echotracking technology and edge detection imaging analysis method for the routine use and follow up of the patients.

Acknowledgements: Mr Martin D, Esaote company and V de Germain, Televasc

P8.05
INFLUENCE OF CENTRAL AND PERIPHERAL ARTERIAL STIFFNESS ON THE TIMING AND AMPLITUDE OF REFLECTED PRESSURE WAVE

J. Filipovsky, J. Seidlerova
Dept Internal MedII, Charles University Medical Faculty, Pilsen, Czech Republic

Background: Central stiffness is associated with increased pressure wave reflection. It is lower than peripheral in most subjects, but the reversal of central to peripheral stiffness gradient may occur at higher age and it may influence the mechanisms of wave reflection.
Objective: To evaluate the relationships of central and peripheral arterial stiffness to the parameters of wave reflection.
Methods: 528 untreated subjects, aged 25 to 74 years, selcted from general population, were examined. Pulse wave velocity on aorta (aoPWV) and on lower extremity (periphPWV) were measured by Sphygmocor. Wave reflections were assessed using carotid pulse waveform analysis.
Results: 46 subjects with the reversal of stiffness gradient (aoPWV > periphPWV). They had longer effective reflection distance (ERD; p<0.001 in both sexes); their carotid augmentation pressure (CAP) was higher in males (p<0.01), but not in females. We further studied the simultaneous influence of central and peripheral stiffness on parameters of wave reflection in the whole population in multiple linear regression. AoPWV predicted highly significantly (p<0.001) the parameters of wave reflection in both sexes, while periphPWV was only weakly positively associated with CAP in females (p<0.01) and ERD in males (p<0.05).
Conclusions: Reversal of stiffness gradient was uncommon in our sample. It was associated with prolongation of ERD, but the augmentation pressure was not decreased. These results do not confirm the previously published hypothesis that the reversal results in lower reflected wave and is therefore beneficial in older patients. The contribution of muscular-type artery stiffness to the timing and amplitude of reflected wave was small.

P8.06
DISCREPANCIES IN ESTIMATES OF LV ELASTANCE OBTAINED BY NON-INVASIVE METHODS

A. Sahlén [1], M. Norman [1], R. Winter [2], A. Manouras [2], L.Å. Brodin [2]
[1]*Karolinska Institutet, Stockholm, Sweden*
[2]*Royal Institute of Technology (KTH), Stockholm, Sweden*

LV elastance (Elv) denotes the slope of a line connecting a series of end-systolic pressure-volume relations during a load intervention. Non-invasive estimation is often done as LVESP/LVESV (simplified method, SM; smElv) which assumes that (A) intra-LV systolic blood pressure (smSBP) = 0.9 x brachial BP and (B) the Elv line intersects the volume axis (V_0) at zero. A more robust method exists which does not make assumption B (gold standard (GS) Elv: gsElv) but requires complex computation. We evaluated SM against GS in 22 consecutive patients (7 with heart failure, 32%; mean LVEF 43 ± 19%) attending our laboratory for echocardiography. Central pressure waveforms were obtained (radial artery tonometry; SphygmoCor, AtCor Medical, Sydney, Australia) and GS intra-LV SBP (gsSBP) was computed (aortic SBP + trans-aortic gradient; continuous-wave Doppler). gsElv was calculated as described previously.[1] smSBP and smElv were calculated as above. We found that intra-LV SBP was underestimated by SM (smSBP 117 ± 17 vs. gsSBP 126 ± 20 mmHg; p=0.002). The mean between-method difference was -8.4 ± 6.7 mmHg, range +6.5 to -17 mmHg). Nonetheless, SM overestimated Elv (smElv 3.4 ± 0.5 vs. gsElv 1.9 ± 0.8 mmHg/mL; p<0.001. The mean between-method difference (1.5 ± 0.7 mmHg/mL; range 0.6 to 2.7 mmHg/mL) was larger the more V_0 differed from zero (0.06 ± 0.03 mmHg/mL per 10 mL change in V_0; r=0.71, p<0.01). In conclusion, Elv obtained by SM differs markedly vs. GS, as a result of assumptions A and B.

Reference
1. Chen et al. JACC 2001;38:2028-34.

P8.07
CUTANEOUS LASER-DOPPLER FLUX RESPONSE TO PHYSIOLOGICAL STIMULI

Z. Melik, K. Cankar, N. Potocnik
Institute of Physiology, Medical Faculty, University of Ljubljana, Ljubljana, Slovenia

There is a predominance of sympathetic over parasympathetic activity in patients with developed essential hypertension. We were interested in