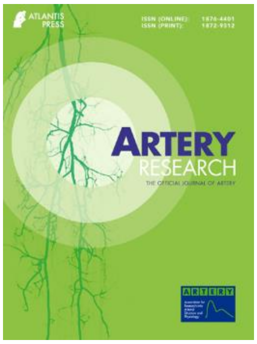

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P6.01: IMPLANTABLE PULSE WAVE VELOCITY SENSOR

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Conclusions: In the present study reverse dipping status is associated with lower levels of HRQOL.

P6 Methods and Modelling

P6.01
IMPLANTABLE PULSE WAVE VELOCITY SENSOR

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In case of vascular weakness or thrombosis stents are implanted and brace vessels from the inside to assure the proper blood flow. A widespread method to monitor the state of blood vessels in terms of their stiffness and diameter is to measure the pulse wave velocity (PWV). The stiffer or the narrower a vessel is the higher is the pulse wave velocity. At present no diagnosis method exists to determine the state of the implanted stent directly and non-invasive. In case of a reasonable suspicion catheterization for precise diagnosis is required. The new approach developed at Fraunhofer IPA allows measuring the PWV locally, so it can be applied in shorter intervals. This approach is based on inductive coupling. It consists of two passive units integrated into the stent and an extra-corporal detection unit. The passive units consist of a capacitive pressure sensor and an air-coil (Fig.1). They form an oscillating circuit, the resonance frequency of which functionally depends on the local blood pressure. The extra-corporal detection unit consists of an excitation coil which generates an alternating magnetic field and a circuit for signal detection. The spreading pulse wave changes the resonance frequency of the passive oscillating circuits inside the vessel in such a way, that it crosses the frequency of the externally applied field while the pulse wave passes by (Fig. 2). The short resonance leads to a shift in the impedance measured at the excitation coil. As the distance between the two sensors is known the PWV can be determined.

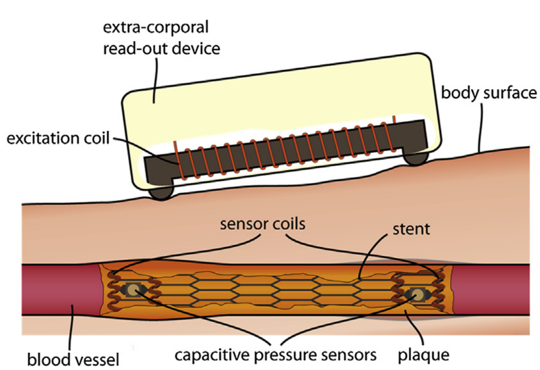

Figure 1 Scheme of functional principle

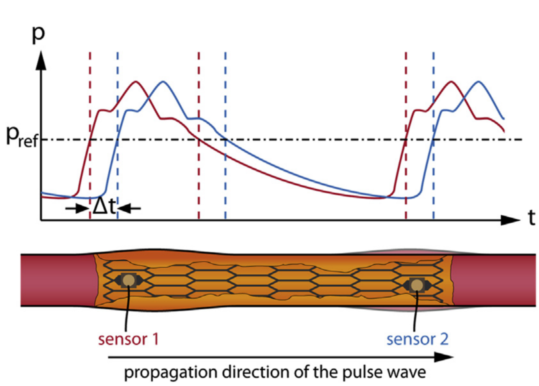

Figure 2 Schematic pulse wave propagation

P6.02
TOTAL ARTERIAL COMPLIANCE ESTIMATED BY A NOVEL METHOD AND ALL-CAUSE MORTALITY IN THE ELDERLY: THE PROTEGER STUDY

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Aortic stiffness assessed by carotid-to-femoral pulse wave velocity (PWV) often fails to predict cardiovascular (CV) risk and mortality in the very elderly. This may be due to the non-linear association between PWV and compliance, or to blood pressure decrease in the frailest subjects. Moreover, total arterial compliance (C_T) is the most relevant arterial property regarding cardiac function and ventriculo-arterial coupling. A new method for C_T estimation, based on PWV, was recently proposed. We aimed to investigate the value of this method to predict all-cause mortality at the elderly.
Methods: PWV was estimated (Complior) in 279 elderly subjects (85.5±7.0 years) who were followed-up for a mean period of 1 year. C_T was estimated by the formula $C_T = k \times PWV^{-2}$; coefficient *k* is body-size dependent based on previous *in silico* simulations. In this study, *k* was adjusted for body mass index (BMI) with a 10% change in BMI corresponding to almost 11% change in *k*. For a reference BMI = 26.2 kg/m^2, k = 37.
Results: Survivors (n = 185) and non-survivors (n = 94) had similar PWV (14.2±3.6 versus 14.9±3.8 m/s, respectively; p = 0.139). In contrast, non-survivors had significantly lower C_T than survivors (0.221±0.1 versus 0.198±0.128 ml/mmHg; p = 0.018). Cox-regression analysis showed that C_T was a significant predictor of mortality (p = 0.022, odds ratio = 0.326), while PWV was not (p = 0.202). Interestingly, age was an independent determinant of C_T (p = 0.016), but not of PWV.
Conclusions: It was demonstrated that C_T, estimated by a novel method, can predict all-cause mortality in the elderly. C_T could be a more sensitive arterial biomarker than PWV regarding CV risk assessment.

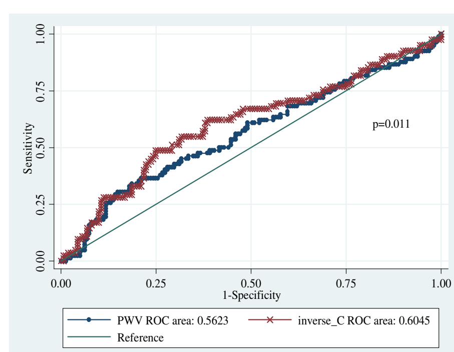

Figure. Receiver-operator-curve analysis of carotid-to-femoral pulse wave velocity (PWV) and total arterial compliance (inversed values) for the prediction of

Figure Receiver-opertor-curve analysis of carotid-to-femoral pulse wave velocity (PWV) and total arterial compliance (inversed values) for the prediction of

P6.03
A FSI MODEL OF CAROTID ARTERIES WITH VISCOELASTIC WALL BEHAVIOUR

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Objectives: Human carotid arteries exhibit viscoelastic behaviour characterised by hysteresis of the pressure-diameter relation and longitudinal wall motion[1]. Ultrasound techniques have been used to measure vessel wall displacements, as well as pressure and diameter waveforms, from which viscoelastic properties can be derived[2]. The aim of this study is to develop a fully-coupled numerical model for pulsatile flow in human arteries with viscoelastic wall behaviour.