P.041: VALIDATION OF SPHYGMOCOR-PROCESSED AUGMENTATION INDEX USING CAROTID ARTERY DISTENSION WAVEFORM

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A modified Augmentation Index (mAIx) using wave intensity analysis

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Poster Presentations S37

Poster Presentations S37

Augmentation index (Alx) is widely used as a measure of wave reflection in clinical studies. The validity of Alx results rests on the ability to quantify the magnitude of the reflected pressure wave (P) in relation to the pressure pulse (PP). This is traditionally carried out by determining the inflection point (ip) on the pressure waveform. In this study, we investigate the results of Alx and propose a modified augmentation index (mAIX) that is more sensitive to loading conditions.

In 11 anaesthetised dogs, total sequential occlusions were produced at 3 aortic sites (thoracic, diaphragm, abdominal) and at the left iliac artery. Pressure and flow were measured in the ascending aorta before and during the occlusion at each site, and ip was ascertained using the 4th derivative of the pressure waveform allowing for the determination of Alx. Magnitude of P was calculated using wave intensity analysis (WIA), and divided by PP giving a modified Augmentation index (mAIX = P/PP).

Alx during control were surprisingly not different from those determined during proximal occlusions. Peak systolic P increased significantly during occlusions; resulting in a significant increase in mAIX by 165% during thoracic, 48% during diaphragm and 20% during abdominal occlusions, all compared to control.

The ip is not an accurate method for determining P. This can result in significant errors in the estimation of Alx. The mAIX, derived from pressure-flow relationship in the wave intensity analysis is more sensitive to the determination of P, than Alx which uses only the pressure waveform.

In conclusion, wave reflections can be assessed from distension waveforms with good accuracy. Future work is needed to investigate the application ofessa parameters to humans and its ability to modify with loading conditions.

P.042 MULTIAXIAL MECHANICAL CHARACTERISTICS OF CAROTID PLAQUE: ANALYSIS BY MULTI-ARRAY ECHOTRACKING SYSTEM.

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Carotid plaque rupture depends on the various types of mechanical stresses. Our objective was to determine the multiaxial mechanical characteristics of atherosclerotic plaque and adjacent segment of the common carotid artery (CCA).

A novel non-invasive echotracking system was used to measure intima-media thickness, diameter, pulsatile strain, and distensibility at 128 sites on a 4 cm long CCA segment. The study included 62 patients with recent cerebrovascular ischemic event and either a plaque on the far wall of CCA (n = 25) or no plaque (n = 37). We investigated the mechanical characteristics of a high risk carotid segment devoid of plaque did not differ between the two groups. Among patients with plaque, 16 had a larger radial strain at the level of plaque than at the level of adjacent CCA (pattern A: outward bending strain). The 8 patients who had an opposite pattern (inward bending strain) were more often dyslipidemic (100% vs 56% P = 0.03) and type 2 diabetic (63% vs 12%, P = 0.04) than pattern A patients. Strain gradient significantly decreased in parallel with the presence of dyslipidemia and/or type 2 diabetes. Longitudinal gradients of distensibility and Young’s elastic modulus were consistent with strain gradients.

In conclusion, type 2 diabetes and dyslipidemia were associated with a stiffer carotid at the level of the plaque than in adjacent CCA, leading to an inward bending stress. The analysis of plaque mechanics along the longitudinal axis may afford useful information, since repetitive bending strain of an atherosclerotic plaque may fatigue the wall material and result in plaque rupture.