4.5: A SYSTEMATIC REVIEW AND META-ANALYSIS OF CENTRAL TO BRACHIAL BLOOD PRESSURE AMPLIFICATION IN PATIENTS TYPE 2 DIABETES MELLITUS

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Methods: Aortic pressure and flow were measured in anesthetized, open-chest dogs (n = 5). Wave reflections were modified with i.v. infusion of methoxamine (iMTX) to increase reflections and nitroprusside (iNPTP) to decrease reflections. In a group of 27 dogs, central pressure and flow were measured using carotid tonometry and phase-contrast MRI, respectively.

Results: Under conditions of baseline and increased reflections in both dogs and humans, peak of the forward wave (FWA) consistently occurred after time of peak flow (P < 0.001). FWA was systematically greater than peak flow multiplied by aortic characteristic impedance (QmaxZc) in dogs (P < 0.01) and humans (P < 0.01). Only when wave reflections were abolished vasoactively (iNPTP) in dogs was time of FWA and peak flow the same, leading to significant differences in FWA and QmaxZc (P = 0.59).

Conclusion: In steady-state, wave reflections set up in previous cardiac cycles, wave re-reflections at the aortic root, and proximal reflections contribute to both the Pi and P0 waves, even during early-systole. Most importantly, peak aortic flow is also determined by aortic input impedance, which includes effects from properties distal of the proximal aorta. Under steady-state conditions, forward wave amplitude and morphology cannot be attributed solely to the LV and proximal aorta.

4.5 A SYSTEMATIC REVIEW AND META-ANALYSIS OF CENTRAL TO BRACHIAL BLOOD PRESSURE AMPLIFICATION IN PATIENTS TYPE 2 DIABETES MELLITUS

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Background: Brachial blood pressure (BP) may not reflect central BP due to systemic arterial compliance (aortic BP amplification). Patients with type 2 diabetes mellitus (T2DM) elicit vascular irregularities that may affect SBP amplification or other central BP indices (including pulse pressure [PP], augmentation pressure [AP] and augmentation index [AIx]). By systematic review and meta-analysis, this study aimed to determine the magnitude and variation of central-to-brachial SBP and PP amplification, AIx and AP in T2DM compared to non-diabetic controls.

Methods: Online databases were searched for published studies reporting invasive or non-invasive central and brachial SBP in T2DM and non-diabetic controls. Random effects meta-analyses and meta-regression were used to analyse the studies.

Results: We identified 17 studies with a total of 2,711 T2DM and 10,460 non-diabetic controls. There was no significant difference in SBP amplification between groups (T2DM = 10.8, non-diabetic = 10.2 mmHg; pooled estimate = 0.6 mmHg, 95% CI = -0.3, 1.5, p = 0.21), but large variation in both (T2DM range = 2.0–16.6 mmHg, non-diabetic range = 1.0–16.1 mmHg). In the meta-regression, duration of T2DM explained 16.3% of the variance in the pooled data (P<0.001). C0 and humans (P<0.001), left ventricular mass index (LVMI; beta = 0.258, p<0.001), E/e' index (ratio of early mitral wave velocity to E-ES) and early diastolic mitral annular velocity:e'-ES = 0.266, p = 0.001), augmentation index (AI); beta = 0.143, p = 0.008) and body mass index (BMI; beta = 0.132, p = 0.017). No correlations between indexed LA volume and IMT were found.

Conclusion: There is a significant relationship of carotid arterial stiffness but not intima-media thickness to LA volume in patients with untreated hypertension.

5.1 INERTIAL-VISCOElastic MINIMAL MODEL OF THE ARTERIAL SYSTEM RECONCILES ARTERIAL COMPLIANCE ESTIMATIONS

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Background: The arterial system is viscoelastic rather than purely elastic. There exist various methods to characterize the purely elastic nature of arterial compliance, each method yielding different values. The pulse pressure method (C0), estimating compliance by matching the pulse pressure (PP) of a two-element Windkessel to measured PP, yields consistently lower values than the pressure decay time method (CIVEMM) and diastolic area method (CIVEMM). An alternative inertial-viscoelastic model (IVEMM) that is viscoelastic and frequency-dependent rather than purely elastic and constant has been shown in dogs to reconcile the various compliance estimation methods. We assessed the presumed merits of IVEMM compliance estimates in a clinically diverse human sample.

Methods: Central pressure and flow were measured using carotid tonometry and phase-contrast MRI, respectively, in 226 subjects. Arterial compliance was estimated using (1) C0; (2) CIVEMM; (3) CAREA; (4) CIVEMM(P=0). Results: C0 was nearly perfectly correlated with CIVEMM evaluated at frequency of heart rate (Pearson coefficient (r) = 0.99; slope (b) = 1.00; P < 0.001). C0 was (r = 0.979; B = 0.928; P < 0.001) and CIVEMM (r = 0.974; B = 0.954; P < 0.001) were very strongly correlated with CIVEMM evaluated at 0 hertz (static compliance). Conclusion: C0 is fit to PP defined in systole, when fast-acting phenomena are likely to elicit viscoelasticity of the arterial system. Its consistently lower values compared to CAREA and CIVEMM are clarified by IVEMM to be the result of estimating viscoelastic compliance at frequency of heart rate. CAREA and CIVEMM are estimates of static compliance. Consistent with dog studies, IVEMM appears to reconcile the three popular compliance estimation techniques.

5.2 SOLUBLE RECEPTOR FOR ADVANCED GLYCATION END-PRODUCTS AND AORTIC STIFFNESS IN GENERAL POPULATION

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It has been suggested that accumulation of advanced glycation end-products (AGE) is involved in several pathophysiological processes in the vessel wall. Soluble isoform of receptor for AGE (sRAGE) acts as a decoy for capturing circulating AGE, prevents them from binding to the cell-surface receptor and protects against the RAGE-AGE axis-elicited processes. We hypothesized that low sRAGE levels might be associated with increased arterial stiffness.