09.04: A UNIFYING EXPLANATION OF THE AORTIC PULSE WAVEFORM IN HUMANS

J.E. Davies*, J. Aguado-Sierra, D.P. Francis, A.D. Hughes, K.H. Parker, J. Mayet

To cite this article: J.E. Davies*, J. Aguado-Sierra, D.P. Francis, A.D. Hughes, K.H. Parker, J. Mayet (2006) 09.04: A UNIFYING EXPLANATION OF THE AORTIC PULSE WAVEFORM IN HUMANS, Artery Research 1:S1, S26–S26, DOI: https://doi.org/10.1016/S1872-9312(07)70018-2

To link to this article: https://doi.org/10.1016/S1872-9312(07)70018-2

Published online: 21 December 2019
with rheumatoid arthritis (RA). The aim of this study was to investigate the effect of simvastatin and ezetimibe on inflammation, disease activity, arterial stiffness and endothelial function in patients with RA and to test our hypothesis that cholesterol lowering per se can improve arterial stiffness and reduce inflammation.

Methods: 20 RA patients received simvastatin 20 mg and ezetimibe 10 mg in a double-blind cross over study. Blood pressure, arterial pulse wave velocity (PWV) and flow mediated dilatation response (FMD) were measured before and after each treatment. Serum inflammatory markers and disease activity were also determined. Data are mean changes ± SEM, and significance was determined using 2-way repeated measures ANOVA.

Results: As expected both ezetimibe and simvastatin significantly reduced total cholesterol (–0.62 ± 0.12 and –1.28 ± 0.11 mmol/L, respectively; \( P < 0.0001 \)). Both drugs significantly reduced CRP (–5.35 ± 0.26 and –0.71 ± 0.16 m/l; \( P = 0.0012 \)) and concomitantly, FMD was significantly improved (1.37 ± 0.26 and 2.51 ± 0.48%; \( P = 0.0001 \)). Importantly, only the effect on total cholesterol differed significantly between the drugs (\( P = 0.001 \)).

Conclusion: The present study shows, that both ezetimibe and simvastatin reduce inflammatory markers and disease activity to a similar extent in patients with RA. Moreover, aortic PWV was reduced with both drugs and concomitantly, endothelial function was improved. This suggests that cholesterol lowering per se has anti-inflammatory effects and improves vascular function.

**09.02**

**RELATIONSHIP BETWEEN GROWTH AND AORTIC STIFFNESS IN EARLY YEARS OF LIFE**

M.E. Phitidis1, N. Bansal, A. Koudsi, M. Banerjee, A. Vyas, I. Gemmell, O. Ayoola, P. Clayton, J.K. Cruickshank. Manchester University, Manchester, United Kingdom

Introduction: The exact course of aortic stiffness in early years of life is not known. This study was designed to test the relationship between aortic pulse wave velocity (aPWV) and the parameters of growth amongst children aged between 0 and 2 years. Our hypothesis was that aPWV is influenced by pulse pressure at birth, 1 and 2 years of age as shown in the table. aPWV was determined using 2-way repeated measures ANOVA.

Methods: Data was obtained from 517 baby-visits between 0 to 24 months of age. Weight, length, blood pressure (BP) and BMI were also determined. Data are mean changes ± SEM, and significance was determined using 2-way repeated measures ANOVA.

Results: As expected both ezetimibe and simvastatin significantly reduced total cholesterol (–0.62 ± 0.12 and –1.28 ± 0.11 mmol/L, respectively; \( P < 0.0001 \)). Both drugs significantly reduced CRP (–5.35 ± 0.26 and –0.71 ± 0.16 m/l; \( P = 0.0012 \)) and concomitantly, FMD was significantly improved (1.37 ± 0.26 and 2.51 ± 0.48%; \( P = 0.0001 \)). Importantly, only the effect on total cholesterol differed significantly between the drugs (\( P = 0.001 \)).

Conclusion: The present study shows, that both ezetimibe and simvastatin reduce inflammatory markers and disease activity to a similar extend in patients with RA. Moreover, aortic PWV was reduced with both drugs and concomitantly, endothelial function was improved. This suggests that cholesterol lowering per se has anti-inflammatory effects and improves vascular function.

**09.04**

**A UNIFYING EXPLANATION OF THE AORTIC PULSE WAVES IN HUMANS**

J.E. Davies1, J. Agudo-Siesta, D.P. Francis, A.D. Hughes, K.H. Parker, J. Mayet. International Centre for Circulatory Health, St Mary’s Hospital & Imperial College, London, United Kingdom

Introduction: Despite more than 200 years of research, no model has been able to fit all the aortic pressure waveform with physiologically interpretable parameters. We propose that the arterial waveform is composed of two components: (1) an arterial windkessel which capacatively discharges pressure from the Windkessel at systole and discharges it during diastole and (2) waves originating from the left ventricle and distal reflective sites.

Method: In 19 subjects (age 54 ± 13 years) we measured simultaneous pressure and velocity in the aorta. The windkessel component of the pressure wave was calculated, and forward and backward waves were identified as previously described [1]. The peak contribution of each component was calculated after subtraction of the diastolic pressure.

Result: In the human aorta, the initial rise in pressure was due to a wave arising from the left ventricle (Figure 1). This wave was responsible for 20 mmHg (29%) of the total rise in pressure. Windkessel pressure was responsible for 40 mmHg (57%) of the total pressure rise. Reflected waves were responsible for 10 mmHg (14%) of the total rise in pressure.

Fig. 1. Conclusions: Using this new approach we have shown that the aortic pressure wave consists of three principal components. The systolic rise in pressure in the aorta is largely determined by a windkessel and waves arising from the left ventricle. Reflected waves make only a minor contribution. Waves do not contribute to the pressure and flow in diastole. Diastolic pressure is due to capacitative discharge of pressure from the Windkessel.

References