Abstract 18715: Impact of Cardiovascular Risk Factors on Cerebrovascular Structure and Perfusion in Young Adults

Wilby Williamson, **Nils Forkert**, **Adam J Lewandowski**,**Renzo Phellan**, **Henry Boardman**, **Ashley Verburg**, **Odaro Huckstep**, **Thomas Okell**, **Charlie Foster**, and **Paul Leeson**

Originally published14 Nov 2017Circulation. 2017;136:A18715

Abstract

Introduction: Cardiovascular risk factors during young adulthood predict risk of stroke and cerebrovascular atrophy in later life. If brain vasculature is already remodelling in young adulthood, in response to cardiovascular risk factor exposure, early intervention may be needed to reduce long-term risk.

Hypothesis: Cardiovascular risk factors in young adults are associated with adverse changes in cerebrovascular structure and function.

Methods: 115 young adults (mean age 24 yrs, 57 female) with detailed characterisation of cardiovascular risk factors and comprehensive blood pressure measurements underwent detailed cerebrovascular phenotyping. Brain MRI (3.0 Tesla, Siemens TIM Trio scanner) included Time of Flight (ToF-MRA), T1 structural and, in a subgroup (n=57) arterial spin labelling (ASL). ToF images were analysed with advanced multistep segmentation frameworks. ASL images were analysed with an adapted FSL BASIL pipeline and T1 images with FSL T1_anat to generate grey matter masks to calculate perfusion.

Results: In multivariate analysis, increased systolic blood pressure (ß -0.38, $p<0.0001$) was associated with reduced brain vessel calibre. Density of brain vessels also reduced with increasing systolic blood pressure (ß -0.30, $p=0.007$) and body mass index (ß -0.20, $p=0.04$). However, smokers (ß 0.30 $p=0.003$) and those under treatment for hypertension (ß 0.24, $p=0.02$) had a relative preservation of vessel density. Cerebral perfusion was proportional to vessel density (ß=0.57, $p<0.0001$) but there was an additional negative impact on perfusion of increasing cardiovascular risk score (QRISK 2017) (ß= -0.48, $p<0.0001$) so that young adults requiring hypertensive treatment (n=10) had 12.5ml/min/100g lower perfusion compared to the study group ($p=0.009$, adjusted for age and sex).

Conclusions: Brain vessel calibre and density in young adults varies with modifiable cardiovascular risks typically seen in this age group. Cerebral perfusion is highly dependent on brain vessel density and is additionally negatively impacted by high QRISK scores. Early prevention trials are needed to determine whether these changes are reversible.