

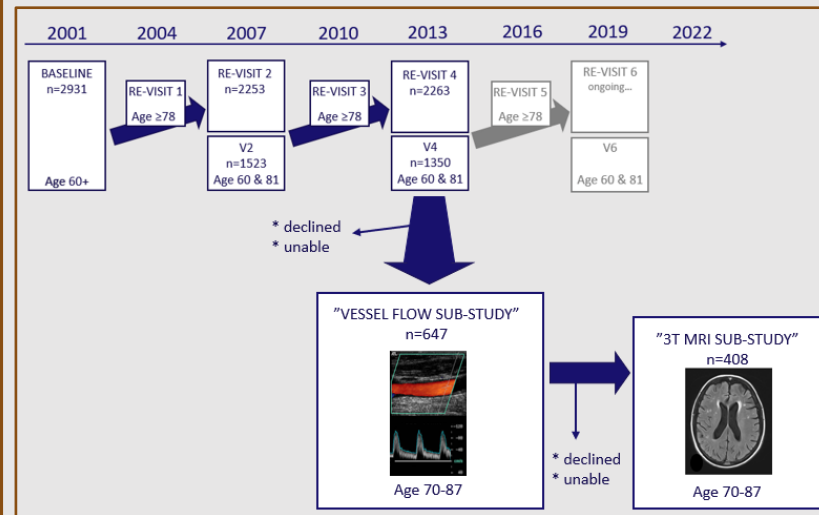


Low Carotid End Diastolic Velocity is Associated with White Matter Hyperintensities and Cortical Atrophy in the Swedish "Good Aging in Skane" Study

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AIM The relationship between hemodynamic properties of the larger arteries and cerebral small vessel disease (CSVD) is not yet fully understood. Our aim was to study the prevalence and interrelations between magnetic resonance (MR) markers of CSVD and specific brain atrophies, and their association to carotid artery Duplex flow parameters.

METHOD The Good Aging in Skåne Study is a longitudinal randomized population study of older adults, still ongoing. Revisits occur every 3rd or 6th year depending on age, and new subjects are recruited every 6th year. In conjunction with the 4th revisit, subjects were offered participation in the Vessel Flow and MRI sub studies. **Peak Systolic Velocity (PSV)** and **End Diastolic Velocity (EDV)** were assessed by carotid Duplex, and **Resistivity Index (RI)** and **Pulsatility Index (PI)** were calculated using the Pourcelot and Goslin formula. Exclusion criteria was Peak Systolic Velocity ≥ 120 cm/s. Nine MRI findings were investigated by visual rating scales: **white matter hyperintensities (WMH)** using Fazekas' scale, **pontine white matter changes (PMC)**, **microbleeds (MB)** ($<2-5$ mm), **lacunar infarctions (LAC)** (<10 mm), **medial temporal lobe atrophy (MTA)** according to Schelten's scale, **global cortical atrophy (GCA)** according to Pasquier's scale, **parietal atrophy (KPA)** according to Koedam's scale, **precuneus atrophy (PA)** and **central atrophy (CA)**. Hierarchical cluster analysis was performed to investigate CSVD covariance, and regression models were used to test for associations to carotid flow parameters.



Resistivity Index
 Pourcelot formula

$$\frac{PSV - EDV}{PSV}$$

Pulsatility Index
 Goslin's index

$$\frac{PSV - EDV}{V(\text{mean})}$$

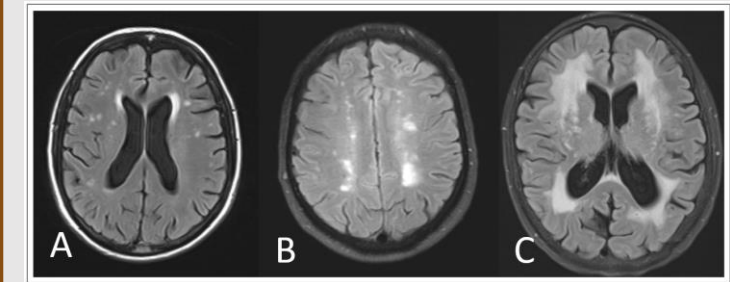
$$V(\text{mean}) = \frac{PSV - EDV}{3} + EDV$$

RESULTS Pathologies were found in 80% of subjects. In hierarchical cluster analysis, average distance between clusters was high indicating a heterogenic distribution of CSVD: After adjustment for age and sex, EDV in common carotid arteries (CCA) was associated with "moderate/severe WMH" (OR:0.92; $p=0.004$), KPA (OR:0.94; $p=0.022$), PA (OR:0.94; $p=0.022$), GCA (OR:0.90; $p=0.013$), and "number of MRI pathologies" ($\beta=0.07$; $p<0.001$). The latter two were also associated with pulsatility and resistivity indexes. There was no association between PSV and MRI markers of CSVD or brain atrophy.

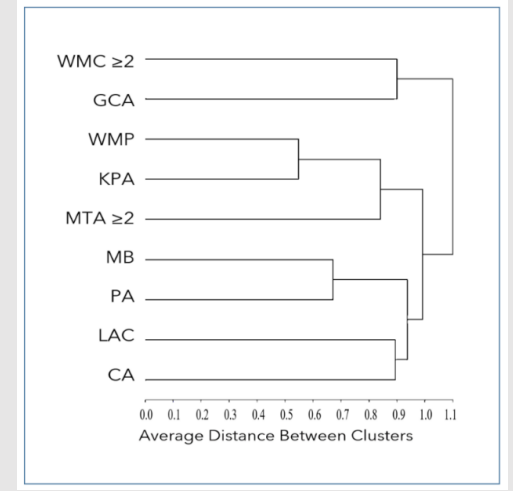
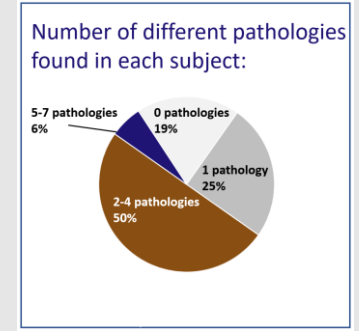
	Total cohort	No other lesions*	WMH ≥ 2	MB	LAC	GCA	CA	MTA ≥ 2
WMH ≥ 2	122	18 (15%)	-	44 (36%)	17 (14%)	17 (14%)	31 (25%)	34 (28%)
MB	105	24 (23%)	44 (42%)	-	9 (9%)	12 (12%)	19 (18%)	26 (25%)
LAC	32	3 (9%)	17 (53%)	9 (28%)	-	8 (25%)	6 (19%)	9 (28%)
GCA	48	4 (8%)	17 (35%)	12 (25%)	8 (17%)	-	12 (25%)	13 (27%)
CA	65	4 (6%)	31 (48%)	19 (29%)	6 (9%)	12 (19%)	-	38 (59%)
MTA ≥ 2	75	4 (5%)	34 (45%)	26 (35%)	9 (12%)	13 (17%)	38 (51%)	-

←Co-occurrence of MRI-pathologies expressed as number of mutual cases and percentage within the variable expressed in the horizontal rows. Individuals with data missing are excluded test wise, percentage is based on valid percentage. Red boxes express significant association between variables according to Pearson's chi squared.

*WMH Fazekas grade 1 and MTA Scheltens grade 1 are coded as "no lesions".



MRI exams of three different patients: Axial FLAIR-images show three different degrees of white matter hyperintensities, classified into mild grade 1 (A), moderate grade 2 (B) and severe grade 3 (C) according to Fazekas grading



Hierarchical Clustering of MRI-findings displayed as a dendrogram, where a higher degree of co-occurrence is illustrated by a sooner point of convergence.

CONCLUSION In a cross-sectional randomized population based study of older adults, low common carotid end-diastolic flow velocity, a proposed marker of arteriosclerosis, have been associated with MRI signs of cerebral small vessel disease (CSVD), indicating a link between large vessel hemodynamic properties and cerebral microcirculation.

