CORRELATION BETWEEN TOTAL SMALL VESSEL DISEASE BURDEN ON MRI AND IMPAIRMENTS IN STRUCTURAL BRAIN NETWORKS IN PATIENTS WITH CEREBRAL AMYLOID ANGIOPATHY

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BACKGROUND AND OBJECTIVES

Cerebral amyloid angiopathy (CAA), a common cause of lobar intracerebral hemorrhage (ICH) and cognitive impairment in the elderly, is associated with hemorrhagic and nonhemorrhagic markers small vessel disease (SVD). A composite score to quantify the total burden of SVD on MRI specifically for CAA patients was recently developed [1]. Brain network alterations related to individual MRI markers of SVD in CAA were demonstrated [2]. Considering diffusion based network measures sensitive to detect different relevant SVD-related brain injury, we investigated if increased overall SVD injury on MRI corresponds to worse global brain connectivity in CAA.

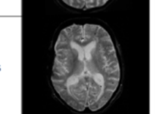
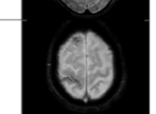
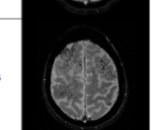
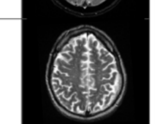
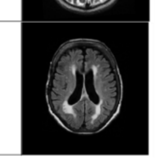
METHODS

Seventy-three patients with probable or possible CAA (according to Boston criteria) [3] and diffusion weighted sequence on MRI from an ongoing single-center cohort study were considered.
The score, ranging from 0 to 6, considered 4 MRI features:

- lobar microbleeds
- focal or disseminated cortical superficial siderosis
- moderate-severe white matter hyperintensities
- centrum semiovale-enlarged perivascular spaces

Diffusion imaging based network reconstruction was made. The associations between *total MRI SVD score* and global network efficiency (GNE) were analyzed.

CAA total small vessel disease score: MRI signatures, categories and points

MRI marker	Visual assessment	Definition	Score	MRI example
Lobar CMBs	International consensus definition[10, 21]	2-4 CMBs	1 point	
		≥ 5CMBs	2 points	
cSS	Visual rating scale[7, 23]	Focal cSS (≤3 sulci)	1 point	
		Disseminated cSS (≥4 sulci).	2 points	
CSO-PVS	International consensus definition[21]	Moderate-to-severe, i.e. ≥20 CSO-PVS	1 point	
WMH	Fazekas scale[25]	Confluent deep WMH (Fazekas score 2 or 3) and/or irregular periventricular WMH extending into the deep white matter (Fazekas score 3)	1 point	

RESULTS

- The study sample consisted of 73 patients (79.5% male, mean age 70.58±8.22y).
- The total MRI SVD score was normally distributed (mean±SD: 3.9±1.40) range (1-6).
- Figure 1 shows the association between total MRI SVD score and GNE. For each point increase in total MRI SVD score, global network efficiency decreased with -0.185(-0.329;-0.041) SD (p=0.013; R2=0.07). Adjustment for normalized TBV did not change the results (p=0.030).
- Of the individual SVD components of the total MRI SVD score, presence of cSS and moderate-severe WMHs were negatively associated with global network efficiency (adjusted mean differences ± SEM: -0.013 ± 0.005 p=0.021 and -0.010 ± 0.005 p=0.046, respectively).

Figure 1. Total MRI small vessel disease score

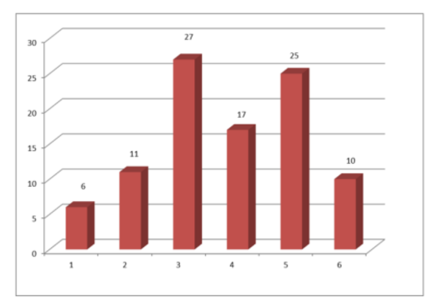
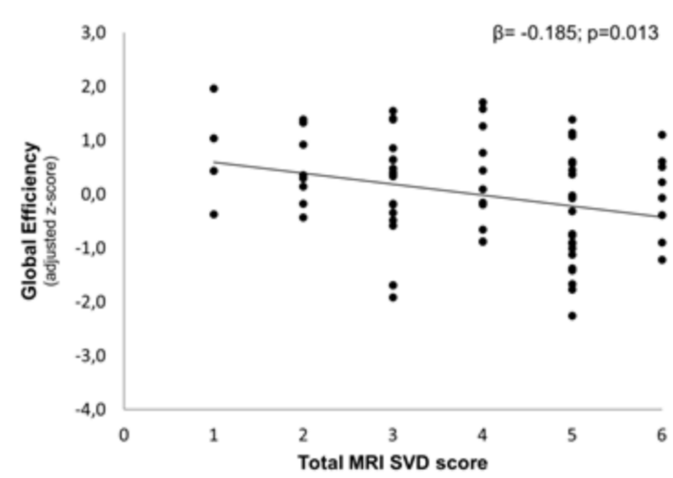


Figure 2. Scatterplot of the association between total MRI SVD score and global network efficiency



DISCUSSION

An increased burden of SVD neuroimaging markers corresponds to more reductions in global brain connectivity, implying a possible cumulative effect of overall SVD markers on disrupted physiology. Some SVD components of the total MRI SVD score (cSS and moderate-severe WMHs) seemed to significantly contribute to the reduction in GNE.

References:

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