Association of white matter hyperintensity with late-life parkinsonism

Shahram Oveisgharan, MD;[1,2] Lei Yu, PhD;[1,2] Victoria Poole, PhD;[1,3]; Konstantinos Arfanakis, PhD; [1,3,4] Julie A Schneider, MD;[1,2,5] David A. Bennett, MD;[1,2] Aron S Buchman, MD.[1,2]

[1]Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, IL, USA.
[2]Department of Neurological Sciences, Rush University Medical Center, Chicago, IL, USA.
[3]Department of Diagnostic Radiology and Nuclear Medicine, Rush University Medical Center, Chicago, IL, USA.
[4]Department of Biomedical Engineering, Illinois Institute of Technology, Chicago, IL, USA.
[5]Department of Pathology, Rush University Medical Center, Chicago, IL, USA.

Objective: Controversy exists about the underlying cause of late-life parkinsonism, a common phenotype of motor impairment in elderly. In this study, we examined the association of white matter hyperintesity (WMH) burden, as a manifestation of brain small vessel disease, with late-life parkinsonism and parkinsonism progression.

Methods: The analytic sample was 535 decedents participating in three community-based longitudinal studies of aging prior to death. Cerebral hemispheres were imaged with MRI ex vivo, and were also examined for neurodegenerative and cerebrovascular pathology indices. WMH burden was assessed using a modified Fazekas rating scale. Prior to death, participants were followed for up to 20 years, and parkinsonism was assessed annually using a modified motor portion of Unified Parkinson's Disease Rating Scale (UPDRS). Linear mixed effects models were used to examine the association of WMH and pathology indices with parkinsonism.

Results: Average age at death was 90.1 (SD = 6.4) years, and 70% of decedents were women. A higher WMH burden was associated with a faster rate of parkinsonism progression (estimate = 0.021, SE = 0.008, p = 0.005) and a more severe parkinsonism score proximate to death (estimate = 0.318, SE = 0.076, p<0.001). The association of WMH with faster parkinsonism progression did not change in the presence of neurodegenerative pathology indices, including Parkinson disease pathology index, while was attenuated, but still significant, in the presence of cerebrovascular pathology indices. Beyond age at death and sex, neurodegenerative pathology indices explained 7.9% and cerebrovascular pathology indices with WMH explained 9.4% of the variance of the rate of parkinsonism progression.

Conclusion: A higher WMH burden is associated with a faster rate of parkinsonism progression and more severe parkinsonism in late-life. Both neurodegenrative and cerebrovascular causes underlie late-life parkinsonism.