Association of Motor Function With Cognitive Trajectories and Structural Brain Differences

A Community-Based Cohort Study

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Study Question
Do individuals with age-related motor impairments have faster cognitive decline and structural brain changes?

What Is Known and What This Article Adds
Age-related motor impairments—including diminished dexterity, slower gait speed, poor coordination, and decreased muscle strength—are common and associated with poorer quality of life and a higher risk of all-cause mortality. However, the association between motor function and cognitive decline remains controversial, and the mechanisms underlying such an association are unclear. The results of this study show that age-related motor impairment is associated with accelerated decline in global and domain-specific cognitive functions. Low motor function is also associated with smaller total brain, total white matter, and cortical white matter volumes, but a larger volume of white matter hyperintensities (WMH).

Methods
Within the Memory and Aging Project, a cohort study from the communities in northeastern Illinois, 1,618 dementia- and disability-free participants (mean age: 79.45 ± 7.32 years) were followed for up to 22 years to observe cognitive function changes. At baseline, global motor function was assessed using the averaged z-scores of 10 motor tests covering dexterity, gait, and hand strength. Global and domain-specific cognitive functions—including episodic memory, semantic memory, working memory, visuospatial ability, and perceptual speed—were measured annually through 19 cognitive tests. A sub-sample of 344 participants underwent brain MRI scans, and structural brain volumes (including total brain, gray matter, white matter, hippocampus, and WMH) were measured. Data were analyzed using linear mixed-effects models and linear regressions with adjustments for potential confounders.

Results and Study Limitations
We found that low global motor function and its subcomponents were significantly related to faster declines in global cognitive function ($\beta = -0.005$, 95% CI $-0.006$ to $-0.005$) and in the 5 cognitive domains (Figure). In the MRI data analysis, we found that low motor function was associated with smaller total brain ($\beta = -25.848$, 95% CI $-44.902$ to $-6.795$), total white matter ($\beta = -18.252$, 95% CI $-33.277$ to $-3.226$), and cortical white matter ($\beta = -17.503$, 95% CI $-32.215$ to $-2.792$) volumes, but a larger volume of WMH ($\beta = 0.257$, 95% CI $0.118$ to $0.397$). This study has several limitations. The participants were volunteers who were healthier than the general populations. This might have contributed to an underestimation of the strength of the association between motor function and cognitive function. In addition, the relationship between motor function and structural brain volumes was cross-sectional, thus the temporality of this association is unclear.

Study Funding and Competing Interests
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Model adjusted for age, sex, education, body mass index, ApoE epsilon 4, alcohol consumption, smoking, physical activity, social activity, hypertension, diabetes, heart disease, stroke, and depression.
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