Subcortical Atrophy in Cognitive Impairment and Dementia

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Abstract

Background: Cortical atrophy is a key neuroimaging feature of dementia. However, the role of subcortical gray matter reduction in cognitive impairment has not been explored extensively.

Objectives: We examined the risk factors of subcortical structures on neuroimaging and their association with cognitive impairment and dementia.

Methods: Data from two studies were used: a subsample from the Epidemiology of Dementia in Singapore (EDIS) study of non-demented community-dwelling subjects (n=550) and a case-control study. Subjects underwent similar neuropsychological tests and brain MRI. Subcortical volumes of accumbens, amygdala, caudate, pallidum, putamen, thalamus, hippocampus, and brainstem were measured. Cognitive impairment no dementia (CIND), dementia and its subtypes, vascular cognitive impairment (VCI), were defined using accepted criteria. Cognitive function was also expressed as both composite and domain-specific Z-scores.

Results: In the EDIS study, age, female gender, Malay ethnicity, diabetes, lacunar-infarcts, and white matter lesions were the most important risk factors for subcortical atrophy. Moreover, smaller volumes of accumbens, amygdala, caudate, thalamus, and brainstem were significantly associated with lower cognitive composite Z-scores. With respect to clinical outcomes in the case-control study, structures such as the accumbens, caudate, putamen, and hippocampus were related to both CIND and dementia. Smaller caudate and pallidum volumes were related to VCI whereas amygdalar atrophy was only associated with non-VCI. Furthermore, subcortical atrophy was related to both VCI and non-VCI.

Conclusion: Subcortical gray matter atrophy is not only observed in dementia, but also in the preclinical stages of cognitive impairment. Furthermore, besides VCI, subcortical structures were also related to non-VCI.

Keywords: Cognitive impairment, magnetic resonance imaging, risk factors, subcortical atrophy

INTRODUCTION

Loss of neuronal cell bodies and their connections, referred to as atrophy, is a hallmark of dementia, in particular Alzheimer’s disease (AD). AD is characterized by neurodegeneration of the cortex and subcortical structures including hippocampus. These changes are...