Longitudinal decline in cortical thickness is associated with elevated dopamine synthesis capacity in aging


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Introduction

Aging is associated with declines in executive function (Buckner, 2004) and altered dopamine function (Bäckman et al., 2006). Many components of the dopamine system decrease with age, but dopamine synthesis appears to increase (Braskie et al., 2008). Upregulation in synthesis may compensate for declines elsewhere in the system.

We examined relationships between dopamine synthesis capacity, retrospective longitudinal working memory, and retrospective longitudinal change in cortical thickness.

Methods

Participants
38 healthy older adults (mean age = 75, 22 F) with no history of neurological, psychiatric, or major medical illness.

Listening Span (Daneman & Carpenter, 1980)
A working memory measure in which participants hear sentences and must recall the final word of each sentence. A working memory measure in which participants hear sentences and must recall the final word of each sentence.

Dopamine synthesis capacity
The PET tracer \([18F]\)fluoro-L-m-tyrosine (FMT) measured dopamine synthesis capacity in the striatum. FMT is a substrate of the aromatic amino acid decarboxylase, an enzyme in the dopamine synthesis pathway.

Cortical thickness
Retrospective longitudinal change in gray matter was calculated using FreeSurfer (v.5.3) to analyze structural MR scans (2-5 scans per subject).

Conclusions

Supporting previous speculation that elevated dopamine synthesis in aging is compensatory, subjects with the highest dopamine synthesis were those with the greatest frontoparietal atrophy.

Higher levels of dopamine synthesis were not associated with better working memory maintenance overall, but did moderate atrophy’s negative impact on working memory.

These data suggest compensatory upregulation of dopamine synthesis is a neurobiological mechanism of cognitive resilience in aging.

Follow-up analyses

Average change in thickness in significant regions was plotted against FMT and Listening Span to visually check for outliers.

Average change in thickness in Listening Span regions was plotted against FMT, and average change in thickness in FMT regions was plotted against Listening Span.

Dopamine synthesis capacity moderate the negative effect of atrophy on cognitive decline.

References