Women Show Earlier Age-related Changes Than Men in Cortical Thickness and Brain Volumes

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INTRODUCTION

- Normal aging is associated with changes in the brain cortex structures (e.g., Raz, 2000).
- Recent studies have shown that age-related changes in cortical thickness and cortical volumes are not limited to association areas and may be more widespread than previously thought (Raz et al., 2004; Salat et al., 2004).
- One suggestion is that age-related changes are not unidirectional and include increases, as well as decreases, in cortical thickness and cortical volumes.
- It remains unclear whether such structural changes are limited to the older population.
- It is also unclear whether women and men are showing similar age-related changes in cortical measurements.

Thus, we asked three questions:
1) How early in life do structural changes occur?
2) Do women and men exhibit different patterns of cortical thickness and cortical volume change?
3) Do young adults and older adults show similar sex differences?

AIMS

- To investigate age-related regional changes in cortical thickness and cortical volume in healthy young adults.
- To examine sex differences between YA and OA in cortical thickness and cortical volume

METHODS

Participants

N = 33, YA (14 women, 19 men) aged 18 - 26 years (M = 22.1 ± 2.32 years) and with 14.82 ± 1.6 years of education (range 13 - 19 years).
N = 35, OA (19 women, 16 men) aged 60 - 87 years (M = 70.13 ± 7.15 years) and with 16.66 ± 2.0 years of education (range 14 - 22 years).

Imaging Parameters

- We acquired 2 MPRIHC scans on a Siemens 1.5 Tesla Sonata scanner (Siemens, Erlangen); voxel size: 1mm x 1mm x 1.33 mm; TR = 2530; TE = 2.6; TI = 1100; FA = 7.

Scans were motion corrected and averaged before reconstruction.

- Image volumes were reconstructed and parcellated into 52 regions of interest using FreeSurfer software (Fischl & Dale, 2000).
- We calculated thickness and volume measures were calculated for each region and mapped them onto the reconstructed, inflated brain of each participant.
- Age-related and sex-related differences were examined using correlations between age and cortical measures (thickness and volume).

CORRELATIONS BETWEEN AGE AND CORTICAL MEASURES

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Women and men showed markedly different patterns.

- YA women: negative correlations between age and cortical volumes (i.e., volume decrease) in the L parietal, frontal, temporal, and occipital cortices bilaterally, and the R precuneus, and a small portion of the R prefrontal cortices.
- OA women: significant positive correlations with age (i.e., volume increase) in the L parietal, frontal, temporal, and occipital cortices, more frequently in the L hemisphere; volume decreases in somatosensory cortices bilaterally.
- YA men: cortical thinning in the orbitofrontal, medial frontal, and temporal regions, more frequently in women than men. These associations were present in somatosensory, occipital, and medial temporal cortices.
- OA men: cortical thinning in the L parietal and medial temporal regions; positive correlations with age (i.e., thickness) in R frontal and auditory cortices.

CONCLUSIONS

- Significant associations between cortical measures and age were more frequent in women than men. These associations were present regardless of the age group, but tended to go in opposite directions in YA (negative) and OA (positive).
- Our results indicated that cortical thinning and decrease in cortical volumes were taking place in healthy individuals in their third decade of life. In older individuals, increases were also observed in cortical thickness and volumes.
- Confirming previous results, we found changes in association cortices. We also found changes in primary cortical areas (somatosensory, occipital, and auditory cortices). Thus, these regions appeared to be vulnerable to age-related changes as well.
- The cortical reductions in YA women may reflect a greater impact of sex hormones on cortical thickness, as shown in animal studies (Kawata, 1995). There is also suggestion of earlier and more pronounced pruning of redundant collateral connections among and within neural networks in younger women compared to men.
- The positive correlations between age and cortical measures in OA women are not fully explained. We are in the process of investigating associations between measures of brain integrity and cognitive test performance in our participants.

Our findings underline the importance of conducting sex-specific analyses. These allowed us to uncover relations that would have otherwise been obscured.

REFERENCES


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IMAGING Parameters

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