The correlations changes of regional visual cortical thickness with optic radiation tract in anisometropic amblyopia

Poster No.: C-0632
Congress: ECR 2011
Type: Scientific Paper
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Keywords: Neuroradiology brain, Eyes, Neuroradiology peripheral nerve, MR, MR-Functional imaging, Neural networks, Imaging sequences, Segmentation, Technology assessment, Occupational / Environmental hazards, Neoplasia, Chronic obstructive airways disease
DOI: 10.1594/ecr2011/C-0632

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Purpose

Previous studies have indicated that regional changes in the white matter and grey matter, detected by diffusion tensor imaging and high-resolution magnetic resonance imaging, are present in amblyopia. However, the exact relationships between the depths of the visual cortex integrity changes in optic radiations fibres in anisometropic amblyopia are still unclear. The purpose of this study was to determine whether the changes of the visual cortex associate with integrity changes in the Optic radiations fibres in amblyopia. Structural MRI and DTI data were collected from 15 anisometric amblyopic patients and 15 age and gender matched normal controls. The fractional anisotropy value was used to evaluate Optic radiations white matter integrity, and FreeSurfer software was employed to find the significant changes of the cortical thickness accurately between the two groups. Moreover, the relationships between cortical thickness and FA values in the Optic radiations were studied to determine whether changes in cortical thickness associate with the integrity changes of Optic radiations white matter in amblyopia. The results from this study indicate that the fractional anisotropy value and voxel numbers reduced significantly in the Optic radiations of patients with amblyopia relative to the controls; the cortical thickness decreased in the following sub-regions: lingual cortex, lateral occipito-temporal gyrus, cuneus, occipital lobe, inferior parietal lobe, temporal lobe. There was a cortical thickness increase in the calcarine gyrus relative to the controls. A reduction of fractional anisotropy value correlated with the decreased cortical thickness in only the following sub-regions: lateral occipito-temporal gyrus, occipital-middle-and-lunatus, occipital-superior, occipito-temporal-medial-and-lingual, calcarine cortex, and med-lingual. These results provide key information on the complex damage of internal brain network in anisometric amblyopia.

Methods and Materials

Twenty amblyopic patients, recruited from Xijing Hospital of Fourth Military Medical University, participated in the MRI scan. Of these patients, fifteen patients underwent high-resolution T1-weighted and T2-weighted and DTI scans. All of the subjects went through a detailed ophthalmologic exam. The controls were required to have the best-corrected visual acuity with at least 1.0 and have no visual disorder history. All of the amblyopia subjects underwent MRI scanning before amblyopia treatment was initiated. All patients were right-handed.

Results
There was a significant reduction in FA value and voxel number of ORs in patients with amblyopia relative to the controls (Fig 1.A1 and A2). The number of ORs was not significantly different between the two groups, and there was no significant difference in FA value and voxel numbers between the bilateral ORs.

There was significant reduction in cortical thickness in the patients with amblyopia compared with the controls in the bilateral med-lingual, lateral occipito-temporal lobe, lateral occip, cuneus, occipital-superior, inferior parietal lobule, occipital middle and lunatus. The calcarine gyrus was thicker in the patients with amblyopia than the controls (Fig. 2).

**Conclusion**

In this study, we report the anomalous development of ORs and cortical thickness reduction within the visual cortex in the brain of amblyopia. The cortical thickness reduction is correlated with damage to the ORs fibres' integrity. These findings indicate that developmental changes occur in both ORs and visual cortex at the same time. The method combining the white matter FA value and gray matter thickness to analyse the structure network opens a new avenue to further study the complicated microstructure in the brain.

**References**


Personal Information