

Mean diffusivity measurement in gray matter: a potential image-based biomarker of MCI and AD

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PURPOSE

The potential of mean diffusivity as a biomarker for detecting the early stage of the neurodegenerative process has been of great interest. The current study therefore investigated the changes of mean diffusivity (MD) in cortical gray matter in normal subjects and patients with mild cognitive impairment (MCI) and AD.

METHODS

The study was approved by the institution review board. Subjects from 3 age-matched groups were recruited: 35 normal control subjects (NC, aged 65.7 ± 6.4 year old), 27 AD patients (aged 69.4 ± 8.2 year old) and 59 MCI patients (aged 68.2 ± 6.4 year old). Both diffusion weighted images and T1-weighted MP RAGE were acquired on a 3T MR scanner (TIM-Trio, Siemens, Germany). The imaging parameters of the diffusion weighted images included TR/TE=7324ms/83ms, 64 axial slices of voxel size=2x2x2mm³, 64 gradient directions and the b-value 1000 sec/mm². The MD was parcellated followed the procedure by Lo et al.¹ The changes in mean diffusivity were subsequently calculated.

RESULTS

Increased mean diffusivity was noticed in patients with AD when compared to MCI (Figure A, blue), which was located in rostral temporal and frontal lobe. In contrast, when comparing MCI with NC (Figure A, green), increased MD was found in ventral temporal and occipital lobes. Color of light blue indicated the overlapping regions. Figure B showed the regions with significantly increased MD in patients with AD when compared to NC, which was consistent with the regions identified in Figure A. The percentage changes of MD in frontal (Figure C) and temporal (Figure D) lobes showed that the difference of MD between AD and NC is approximately equal to the sum of the MD changes in AD with MCI and MCI with NC.

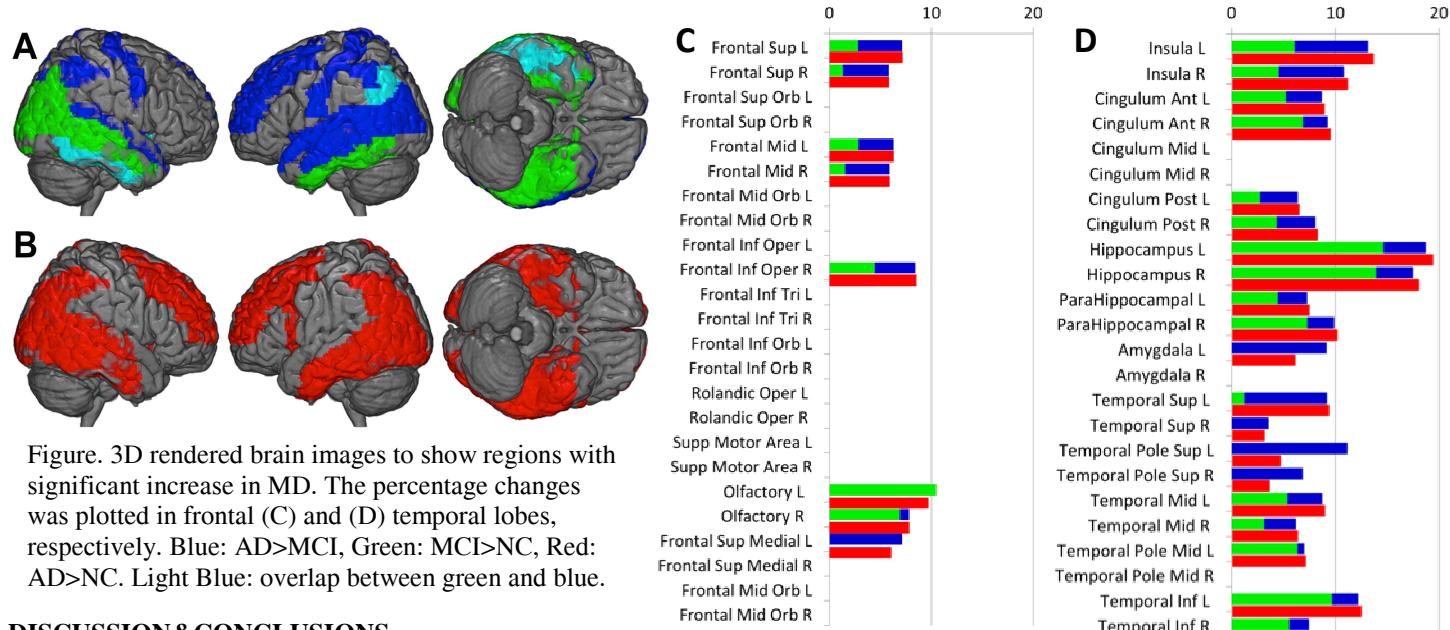


Figure. 3D rendered brain images to show regions with significant increase in MD. The percentage changes was plotted in frontal (C) and (D) temporal lobes, respectively. Blue: AD>MCI, Green: MCI>NC, Red: AD>NC. Light Blue: overlap between green and blue.

DISCUSSION&CONCLUSIONS

Our study showed that significant increase of MD in patients of AD when compared to normal control can be noticed in both frontal and temporal lobes, which is consistent with the clinical observations related to cognitive impairment and dementia.² Both the percentage changes of MD and the involved regions might suggest that MCI is a transition stage between NC and AD. The current study therefore demonstrated that MD in cortical gray matter could be a potential image-based biomarker of MCI and AD.

REFERENCES

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