Gender differences in brain iron level

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Introduction

Iron-induced oxidative injury is a major factor of ageing and age-related diseases. Recently, Bartzokis et al reported for the first time that women had lower brain iron level than man in some region including the caudate, thalamus, and frontal white matter [1]. Such gender-related differences in iron status may be responsible for the fact that women have a lower risk of developing neurodegenerative disease. However, no further data confirm their finding. Due to the fact that higher iron content will lead to a greater negative phase relative to the surrounding parenchyma, phase images of GRE sequence are sensitive to detect minor iron concentration differences in the brain [2]. In this study, we utilized phase image to measure brain iron level in vivo and tried to explore the gender differences in the iron level of the human brain.

Materials and Methods

Seventy-seven healthy adult volunteers were studied with a GE 1.5T Signa EXCITE II scanner. The study population consisted of 40 male (range form 23 to 67 years old, mean=41.5, SD=11.9) and 37 female (range form 21 to 78 years old, mean=44.6 SD=15.8). All subjects were imaged with the following 3D GRE sequence: TR = 51ms, TE =38ms, FA = 20°, slice thickness = 2mm, FOV = 24cm, and matrix size = 256×256. The slab contained 28 continuous slices, and the slab center was superposed on the anterior and posterior commissure line (AC-PC line). A spatial high-pass filter was applied to the initial phase image to remove slowly varying phase shifts caused by background static field gradients. The phase shifts were measured on the "corrected" phase images in six subcortical structures. The third and fourth slices above the AC-PC line were used to obtain the data of the globus pallidus (GP), putamen (PU), caudate (CA), thalamus (TH) and frontal white matter (FWM), and the second and third slice inferior to the AC-PC line were used to obtain the data of the substantia nigra (SN) and red nucleus (RN). All the data were obtained from contiguous pairs of slice. In each region, covariance model was used to analysis the age and gender effect on the brain iron level, with gender as the independent variable, controlling for linear effects of age.

Results

	d	F	*P*
FWM	-0.00424	1.447	0.233
TH	0.00048	0.088	0.768
PU	-0.00274	0.153	0.697
CA	-0.01058	1.818	0.182
SN	0.00252	0.310	0.580
RN	0.00468	0.483	0.489
GP	-0.01168	4.199	0.044

Table 1. Gender effect on iron level in healthy subject. *d*: difference of phase shifts between men and women. Negative value indicating greater phase shifts for women.

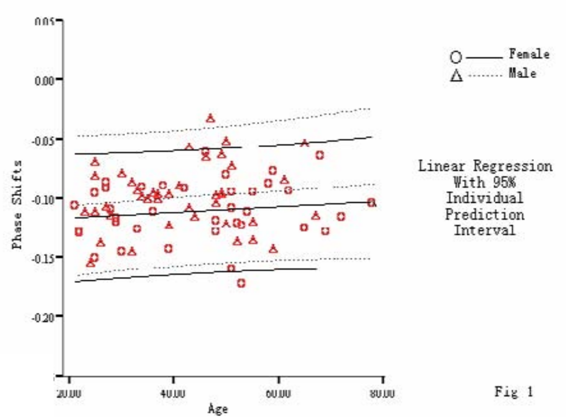

Fig 1. Scatter plots of phase shifts vs. age subdivided by gender difference.

In the FWM, PU, CA, and GP, greater phase shifts were observed in women as compared to men, which indicated more iron content. Contrastly, women had lower iron level in the TH, SN, and RN than men. After controlling the linear effect of age, only the difference in the GP was significant (*P*=0.044).

Discussion

In the present study, we found that women had significant higher iron level than men in the globus pallidus. There was no gender difference in iron level in other subcortical regions. Different study population and technique may be used to explain the divergent finding of our study and Bartzokis's. Therefore, more data is needed on the gender differences in the iron level of the human brain.

Reference

[1]. Bartzokis G et al. Neurobiol Aging 2006:

[2]. Abduljalil AM et al. J Magn Reson Imaging 2003; 18: 284-290.

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