

fMRI in Systemic Lupus Erythematosus and Antiphospholipid Syndrome

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Introduction

Patients with systemic lupus erythematosus (SLE) have demonstrated cognitive dysfunction suggesting subtle but clinically important central nervous system involvement [1]. Antiphospholipid syndrome is another autoimmune disorder defined as the presence of arterial or venous thromboses and/or pregnancy morbidity with persistent antiphospholipid antibodies (APL). Diffusion tensor imaging (DTI) has been used to study the disease load in the brains of SLE patients [2-4]. SLE patients have also been investigated using functional magnetic resonance imaging (fMRI) [4-7]. The purpose of this study is to use both fMRI and DTI imaging to characterize the disease load in SLE and APL patients and compare these two groups.

Subjects and Methods

Three groups of subjects were studied: (1) fourteen SLE patients; (2) five APL patients; and (3) four normal controls. We acquired the MR images with a 3T clinical scanner. In addition to structural images, a 3D volumetric image set, diffusion tensor images including 5 b0 and 33 diffusion weighted images and functional MR images were acquired. The b-value in the DWIs was 800 s/mm². The DTI protocol included 60 slices of 2.6 mm thickness, FOV 240 mm, image matrix of 128x128 zero filled to 256x256 and 15 sec TR. After data acquisition, Dav (=Trace/3), FA maps were calculated. The fMRI protocol included FOV of 240 mm, 5mm slice thickness, imaging matrix of 64x64, pulse angle of 70 degrees and TR of 2 sec. Four fMRI paradigms, finger tapping, word generation, rhyming and N-back were used to evaluate the motor, language, working memory functions.

Results

The group difference of fMRI activation maps of control, APL, and SLE groups, finger tapping, word generation (Fig. 1), rhyming, and N-back paradigms (Fig. 2) were determined. Diffusion measurements were listed in the table below.

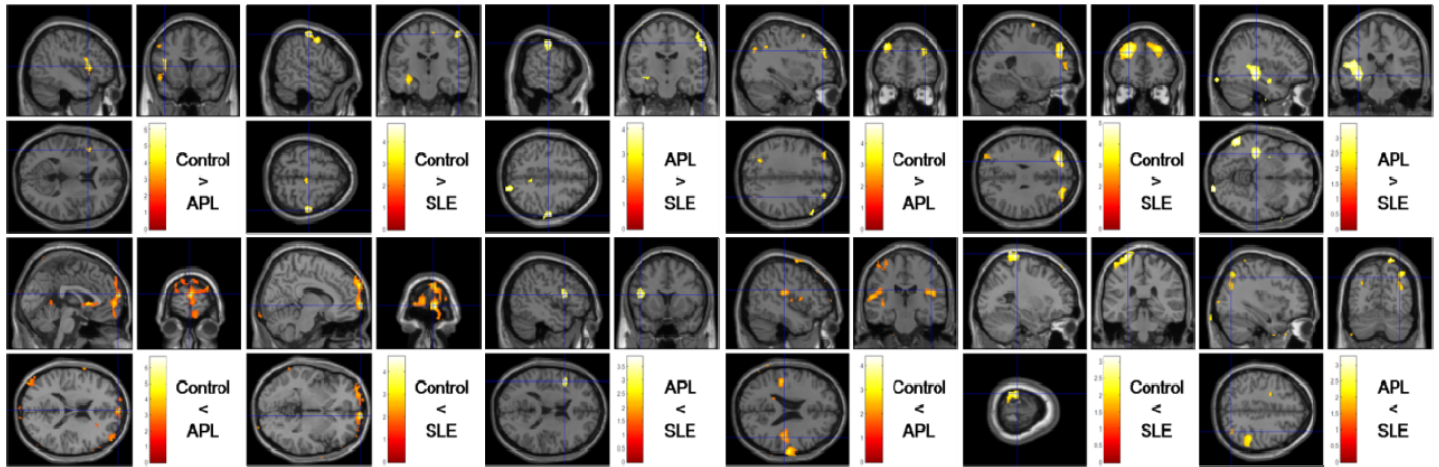


Figure 2: Group differences in word generation task

Figure 1: Group differences in N-back task

Discussion/Conclusions

The results show that there are considerable DTI and fMRI differences among three groups of subjects. We found the significant diffusion and fMRI activation changes in the frontal areas of the patients when compared to the controls. In both patient groups, word generation task shows abnormal activation patterns in the frontal areas suggestive of recruitment of these areas during these tasks. In the hippocampal area, there is a significant difference between APL and SLE groups during N-back, word generation and rhyming tasks. We found no difference during finger tapping among the groups. The fMRI determined regions activated during the tasks in SLE patients agreed with previously published results [4-6] using similar tasks. The diffusion changes agreed with the prior work [2-4]. In addition to regional differences, there is also whole brain diffusion (BDav) changes between the patient groups and controls. Considering that the diffusion and fMRI findings in APL are unknown, this comparative study provides novel information.

Acknowledgments

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		BD _{av}	Thalamus		Splenum CC		Frontal lobe		Genu CC	
			D _{av}	FA	D _{av}	FA	D _{av}	FA	D _{av}	FA
Control (n=4)	mean	0.78	0.81	0.31	0.87	0.63	0.84	0.39	0.91	0.73
	std	0.01	0.01	0.01	0.03	0.11	0.05	0.01	0.06	0.03
APL (n=5)	mean	0.82	0.86	0.31	0.92	0.61	0.89	0.35	0.96	0.67
	std	0.02	0.03	0.02	0.14	0.13	0.03	0.04	0.07	0.08
SLE (n=13)	mean	0.81	0.85	0.30	0.90	0.68	0.88	0.37	0.95	0.71
	std	0.02	0.05	0.02	0.13	0.10	0.04	0.04	0.17	0.07
Control vs APL	%incrs	4.6%	5.7%	-1.3%	5.8%	-3.8%	6.8%	-10.8%	6.2%	-9.2%
	p <	0.01	0.01	0.39	0.26	0.39	0.03	0.03	0.13	0.07
Control vs SLE	%incrs	2.9%	4.5%	-5.1%	4.1%	7.8%	5.0%	-5.1%	4.5%	-3.1%
	p <	0.03	0.07	0.11	0.31	0.20	0.05	0.17	0.32	0.26
APL vs SLE	%incrs	-1.6%	-1.1%	-3.8%	-1.6%	12.1%	-1.8%	6.4%	-1.6%	6.7%
	p <	0.10	0.34	0.17	0.42	0.11	0.22	0.15	0.42	0.12