Abnormal cognitive dysfunction in patients with restless legs syndrome: An event-related potential study

Ki-Young Jung[a,b], Deokwon Ko[a,b], Gwan-Taek Lee[a], Yong-Seo Koo[a]
[a] Department of Neurology, Korea University College of Medicine, Seoul, Korea
[b] BK21 Program for Biomedical Science, Korea University College of Medicine, Seoul, Korea

Introduction

Recent study reported that patients with restless legs syndrome (RLS) may have cognitive deficit, particularly prefrontal lobe dysfunction (Pearson et al., 2006).

The cognitive dysfunction may be attributed to either secondary to daytime sleepiness and/or attention deficit due to RLS symptoms, or primary to intrinsic brain dysfunction underneath RLS syndrome.

Event-related potential (ERP), which offers high temporal resolution, provides information about the precise timing of dynamic neural mechanisms of different cognitive processes. ERP involved in stimulus categorization, probability sequence, attention resource allocation, and memory processing .

To identify cognitive dysfunction in patients with RLS, event-related potential (ERP) study was performed. Daytime sleepiness and RLS symptoms were checked to delineate underlying mechanism of cognitive dysfunction in RLS.

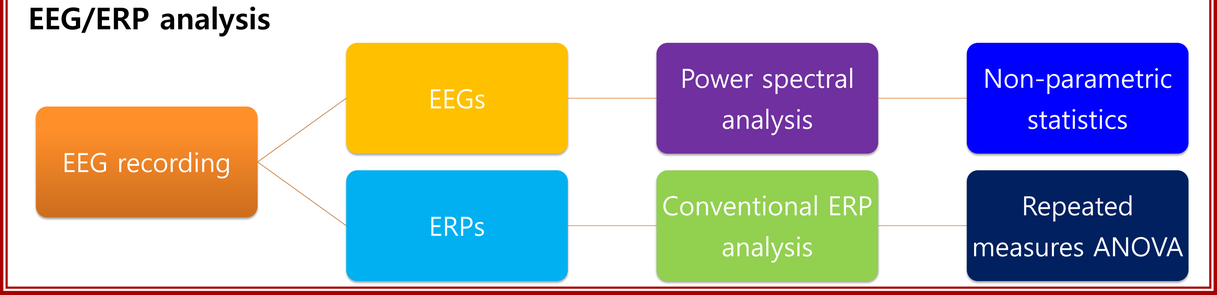
Methods

Subjects
- *Patient* : Female who newly primary diagnosed as RLS in Korea University Medical Center.
- *Control* : age matched normal healthy female.

Stimuli presentation
- Oddball paradigm with visual stimuli.
- Paradigm consisted of 80% of triangle stimuli (non-target) and 20% of rectangle stimuli (target).
- Inter stimuli Interval(ISI) : 1.2 sec
- Subjects were press button when target stimuli were presented

EEG recording
- EEG recorded at 11 am
- 32-channel digital EEG machine with 27 electrode that are placed on the scalp
- International 10-20 system, with extended coverage of the lower temporal region (F9, F10, T9, T10, P9, P10)
- The reference electrode : linked ears (A1, A2)
- Band pass filter : 0.1Hz ~ 100Hz
- Sampling rate : 400Hz

EEG/ERP analysis



Results

Table 1. **Demographic data**

Group		RLS	CON
N		17	13
Age		53.7±9.6	54.6±7.6
Educatioin (years)		12.1±3.3	9.8±3.2
IRLSS score		21.1±7.4	-
ERP test			
Stanford sleepiness scale		3.2±1.6	2.2±1.0
Bothersomeness (VAS)*		6.1±3.2	0.2±0.6
Response	RT (ms)*	425.3±40.1	382.7±32.6
	Hit rate (%)	98.2±2.1	99.1±1.3

* P < 0.01

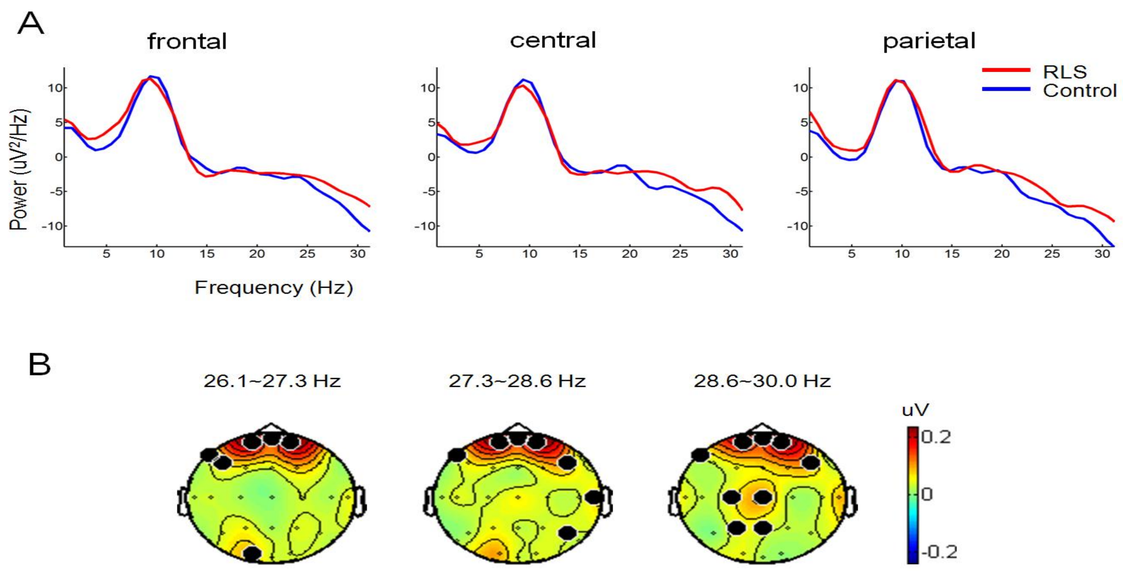


Figure 1. (A) Averaged power spectra of both groups at the different recording sites. (B) The topography of the difference of EEG spectral power (spectral power of RLS patients minus that of controls) in high beta frequency band. Red denotes a positive and blue denotes a negative potential. Black dots are electrodes which have statistical significance by cluster-based statistical nonparametric test (p <0.05).

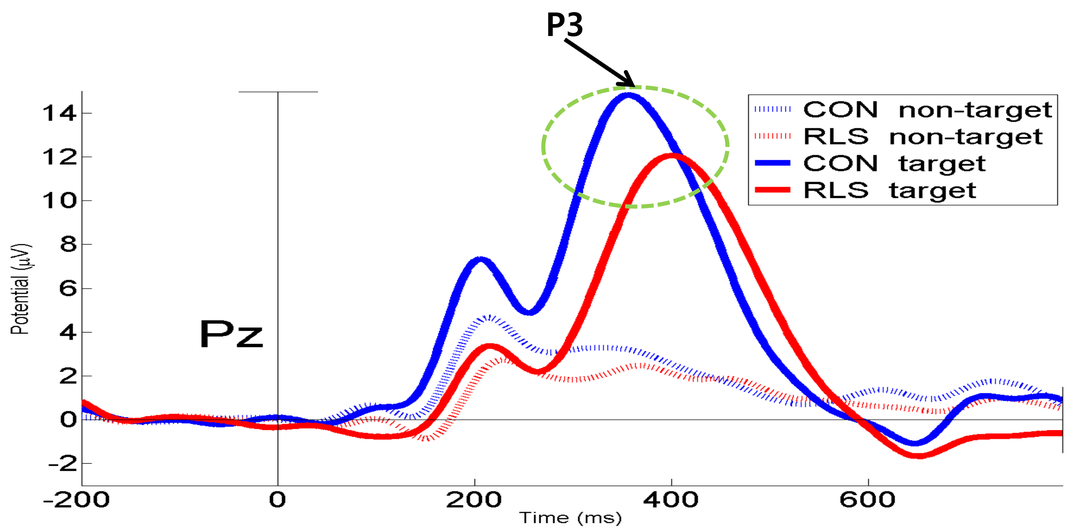


Figure 2. Grand average ERP responses to standard and target visual stimuli. RLS patients show P3 amplitudes are lower and P3 latencies are longer than those of controls (P<0.05).

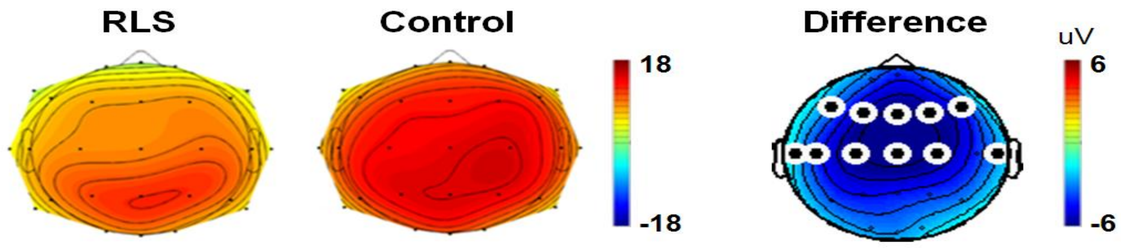


Figure 3. Voltage topographic scalp maps of P300 (left and middle panels) and of ERP difference (right panel) between groups (ERP of RLS patients minus that of controls). Red denotes a positive and blue denotes a negative potential. Significant electrodes are highlighted by cluster-based statistical nonparametric test (p < 0.05).

Conclusion

Our study supports that RLS patients have cognitive dysfunction.

The significant correlation found between P300 latency and bothersomeness, the lack of sleepiness observed during the ERP test, and the increased beta activity observed in resting state EEG suggest that a combination of inattention and cortical dysfunction underlie cognitive dysfunction in RLS.