Latency Prolongation of P300 Event Related Potentials in Patients with and Without Asymptomatic Cerebral Infarction

Kim Kah Hwi and Chin Kah Chuan

In this study, we evaluate the changes on the Events-Related Potentials (ERPs) of P300 in patients with asymptomatic cerebral infarction which was detected by Magnetic Resonance Imaging (MRI). We examined 37 patients who visited University Hospital with complaint of headache or dizziness which had no episodes of stroke nor any neurological defect including obvious dementia between March 1988 to March 2000. MRI were performed and we found 23 cases of patients showed multiple lacunar infarction and 14 patients (8 male and 6 female) (with average age of 70) showed marked leuko-araiosis or periventricular high intensity with or without lacunar infarction in T2-weight image. We compared these two group with 13 healthy age-match (7 male and 6 female with average age of 68) as control group. ERPs were recorded with a band-pass filter of 0.01-120 c s\(^{-1}\). ERPs were derived from the Fz, Cz and Pz referenced to linked earlobe electrode and mini-mental test were performed in all subject. P300 ERPs were recorded by standard oddball paradigm with the subject seated in a reclined easy chair. In auditory paradigms, during the subject’s eyes were closed, 2,000 Hz tone were used as target and 1,000 Hz tone as none target through headphone. The target tone were presented in a random sequence at the rate of 20%. Then the subjects were instruct to count the number of target tone. Statistical analysis was performed using one factor ANOVA to determine inter-group differences. P300 latency in patients MRI showed multiple lacunar infarction (378.8±33.6 ms) and in patients MRI showed marked leuko-araiosis infarction (388.3±3.6 ms), were significantly prolonged as compare to normal healthy person (338.6±13.5 ms). However, the amplitude of P300 was remain unchanged. The scores obtained from Mini Mental State Test (MMST) were showed no significantly different between the normal elderly and patient with multiple lacunar infarction and in leuko-araiosis infarction patients Comparison the latency and amplitude of N100, P200 and N200 were also no significantly differences. The present finding, we found the P300 latency was significantly prolong in multiple lacunar infarction patients and in leuko-araiosis infarction patients. But there were no significant changes in the amplitude of P300. Thus, we can concluded that cognitive function was impaired with asymptomatic cerebral infarction.

**Key words:** Multiple lacunar infarction, leuko-araiosis infarction, P300 (ERP), Mini Mental Sate Test (MMST), asymptomatic cerebral infarction
INTRODUCTION

Event Related Potentials (ERPs) can be used to evaluate the mental state and intellectual performance. Therefore, ERPs have been widely accepted as a physiological parameter to reflect human processing or selective attention. In particular, the P300 component is a useful index of a certain cognitive process: attention, memorization, and discrimination of stimuli. Thus, P300 component is a useful index of impair intellectual functions in demented patients. Many reports exist concerning the correlation between P300 latency or amplitude and changes in intellectual function noted by various mental tests. In Parkinson disease, numerous investigations have reported that some cognitive declines do occur. Goodin and Aminoff, Hensch et al. and Tachibana et al. have been shown abnormal ERPs in Parkinson disease with cognitive decline or dementia. However, such correlation remain controversial. There have been no detailed studies concerning the interrelationships between ERPs and many clinical mental tests.

In this study, we evaluate the changes on the Events Related Potentials (ERPs) of P300 in patients with asymptomatic cerebral infarction which was detected by Magnetic Resonance Imaging (MRI).

MATERIALS AND METHODS

Patients: We examined 37 patients who visited University Hospital with complaint of headache or dizziness which had no episodes of stroke nor any neurological defect including obvious dementia between March 1988 to March 2000. MRI were performed and we found 23 cases of patients (13 male and 10 female with average age of 65) showed multiple lacunar infarction, as Group 1 (Fig. 1) and 14 patients (8 male and 6 female with average age of 70) showed marked leuko-araiosis or periventricular high intensity with or without lacunar infarction in T1-weight image, as Group 2 (Fig. 2). We compared these two groups with 13 healthy age-match (7 male and 6 female with average age of 68), as control group (Fig. 3).

Methods: ERPs was recorded with a band-pass filter of 0.01-120 c s⁻¹. ERPs were derived from the Fz, Cz and Pz (the international 10-20 system) referenced to linked earlobe electrode and mini-mental test were performed in all subject. Electro-oculogram (EOG) was also recorded by the sub-orbital electrodes. Trials with large EOG will be rejected. EEGs were amplified with settings of 0.1-50 Hz and average separately according to target and frequent tones. Thirty responses to target tones were average, P300 ERPs were recorded by standard oddball paradigm with the subject seated in a reclined easy chair. In auditory paradigms were performed during the subject's eyes were closed, 2,000 Hz tone were used as target and 1,000 Hz tone as none target through headphone. The target tone were presented in a random sequence at the rate of 20%. Then the subjects were instruct to count the number of target tone. Statistical analysis was performed using one factor ANOVA to determine inter-group differences.

RESULTS

P300 latency in patients MRI showed multiple lacunar infarction (378.8±33.6 ms) and in patients MRI showed marked leuko-araiosis infarction (388.3±3.6 ms) were significantly prolonged as compare to normal healthy person (338.6±3.5 ms) as shown in Table 1. However, the amplitude of P300 was not significantly different in comparison between the two groups of patients with the healthy person (Table 1).

The scores obtained from Mini Mental State Test (MMST) were showed no significantly different between the normal elderly and patient with multiple lacunar infarction and in leuko-araiosis infarction patients Comparison the latency and amplitude of N100, P200 and N200 were also no significantly differences (Table 1).

DISCUSSION

P300 of asymptomatic lacunar infarction and PVH: The present finding, we found the P300 latency was significantly prolong in multiple lacunar infarction patients and in leuko-araiosis infarction patients. But there were no significant changes in the amplitude of P300. Hara et al. found P300 latency in 26 multiple

Table 1: Mean and standard deviation of age, Mini Mental State Test (MMST) and ERPs in Group 1 and Group 2 patients with control healthy person

<table>
<thead>
<tr>
<th>Control (n=13)</th>
<th>Group 1 (n=10)</th>
<th>Group 2 (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average age</strong></td>
<td>65.3±4.30</td>
<td>70.1±01.3</td>
</tr>
<tr>
<td><strong>MMST</strong></td>
<td>28±2.30</td>
<td>25±0.33</td>
</tr>
<tr>
<td><strong>N100</strong></td>
<td>90.6±0.90</td>
<td>91.6±0.68</td>
</tr>
<tr>
<td><strong>µV</strong></td>
<td>7.8±2.60</td>
<td>6.8±0.33</td>
</tr>
<tr>
<td><strong>P200</strong></td>
<td>170±14.60</td>
<td>172±6.68</td>
</tr>
<tr>
<td><strong>µV</strong></td>
<td>6.4±0.60</td>
<td>5.9±02.4</td>
</tr>
<tr>
<td><strong>N200</strong></td>
<td>240±18.20</td>
<td>251±16.3</td>
</tr>
<tr>
<td><strong>µV</strong></td>
<td>3.8±02.65</td>
<td>3.3±0.23</td>
</tr>
<tr>
<td><strong>P300</strong></td>
<td>338±13.50</td>
<td>378±33.6*</td>
</tr>
<tr>
<td><strong>µV</strong></td>
<td>10.5±04.30</td>
<td>10.3±05.3</td>
</tr>
</tbody>
</table>

*Statistically significant
Fig. 1: The MRI of multiple lacunar infarction in T2-weight image with prolonged P300 average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm.

Fig. 2: The MRI of leuko-araiosis or periventricular high intensity without asymptomatic lacunar infarction in T2-weight image with prolonged P300 average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm.

Fig. 3: The MRI of 65 age healthy adult with the normal average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm.
and they found the P300 latency in these patients were significantly prolonged in the group of marked PVH with asymptomatic lacunar infarction compared with normal control. Morota and Kaieda examined 32 neurologically normal patients with asymptomatic lacunar infarction in MRI findings. They reported that P300 latency was significantly prolonged in asymptomatic lacunar infarction compared with a normal control.

**Cognitive function of PVH with asymptomatic lacunar infarction:** The relationship between cognitive impairments and PVH is controversial. Hunt et al. reported that 22% of normal elderly subjects had moderate lesions and 9% had severe lesions in MRI study. They concluded that the white-matter changes alone in the elderly were doubtful in clinical significance. Yamashita et al. reported that there was no significant correlation between the severity of PVH and P300 latency in normal aged subjects. On the other hand, Boone et al. reported that cognitive deficits were observed in the healthy elderly subjects with severe white-matter lesions detected by brain CT and MRI.

In the present study, the P300 latency was significantly longer in multiple lacunar infarction and PVH than that in age-matched controls. We concluded that cognitive function was impaired in patients with asymptomatic cerebral infarction.

The present finding, we found the P300 latency was significantly prolong in multiple lacunar infarction patients and in leuko-araiosis infarction patients (Fig. 4). But there were no significant changes in the amplitude of P300. Similar finding were reported by Yamashita et al. and Morota and Kaieda that the P300 latency was significantly prolonged in neurologically normal patients with asymptomatic lacunar infarction. Thus, we can conclude that cognitive function was impaired with asymptomatic cerebral infarction.

**REFERENCES**


