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# Research Paper

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*For further information about this article or if you need reprints, please contact:*

Dr. Kim Kah Hwi  
Department of Physiology  
Faculty of Medicine  
University of Malay  
50603 Kuala Lumpur, Malaysia

Tel: +603 79674923  
Fax: +603 79674775  
E-mail: kimkh@ummc.edu.my

## 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 T<sub>2</sub>-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 was recorded with a band-pass filter of 0.01-120 c s<sup>-1</sup>. 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 State Test (MMST), asymptomatic cerebral infarction

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Department of Physiology, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia

**INTRODUCTION**

Event Related Potentials (ERPs) can be use to evaluate the mental state and interlectual performance. Therefore, ERPs have been widely accepted as physiological parameter 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 report exist concerning the correlation between P300 latency or amplitude and changes in intellectual function noted by various mental test<sup>[1-4]</sup>. In Perkinson disease, numerous investigations have reported that some cognitive declines does occur. Goodin and Aminoff<sup>[5]</sup>, Hansch *et al.*<sup>[6]</sup> and Tachibana *et al.*<sup>[7]</sup> have been shown abnormal ERPs in Perkinson disease with cognitive decline or dementia. However, such correlation remain controversial. There have been no detail 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 T<sub>2</sub>-weight image, as Group 2 (Fig. 2). We compared these two group 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<sup>-1</sup>. ERPs were derived from the Fz, Cz and Pz (the international 10-20 system)<sup>[8]</sup> 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±13.5 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.*<sup>[9]</sup> 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

	Control (n=13)	Group 1 (n=10)	Group 2 (n=13)
Average age	65.3±4.30	70.1±01.3	68.6±02.8
MMST	28.3±2.30	25.3±03.3	23.5±02.5
N100			
ms	90.6±8.90	91.6±06.8	92.3±10.8
µV	7.8±2.60	6.8±03.3	6.3±02.4
P200			
ms	170.3±14.60	172.6±06.8	178.3±13.8
µV	6.4±01.60	5.9±02.4	6.8±02.6
N200			
ms	240.9±18.20	251.6±16.3	246.5±21.5
µV	3.8±02.65	3.3±02.3	4.3±02.6
P300			
ms	338.6±13.50	378.8±33.6*	388.3±03.6*
µV	10.5±04.30	10.3±05.3	12.6±06.3

\*Statistically significant

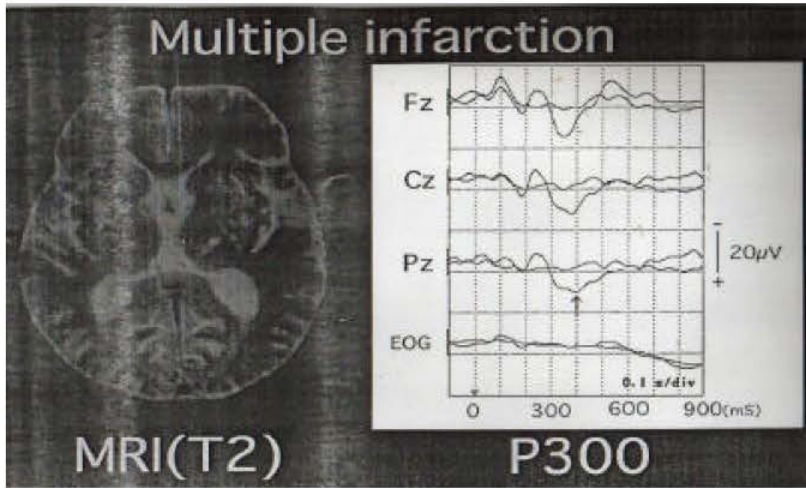


Fig. 1: The MRI of multiple lacunar infarction in T2-weight image with prolonged P300 average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm

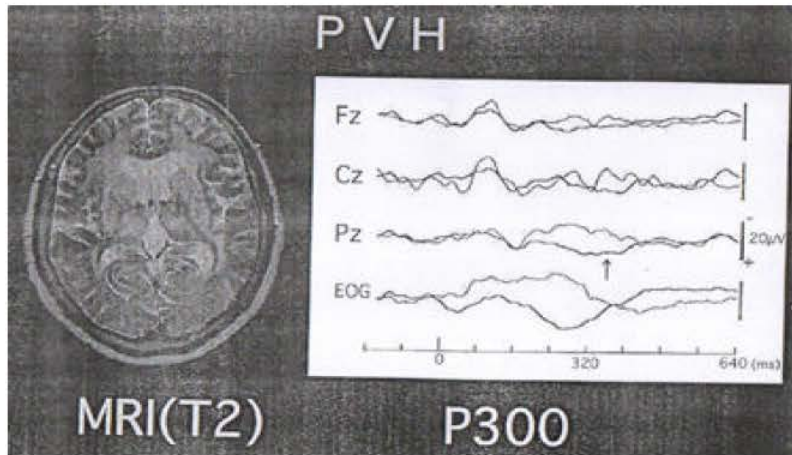


Fig. 2: The MRI of leuko-araiosis or periventricular high intensity without asymptomatic lacunar infarction in T2-weight image with prolonged P300 average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm

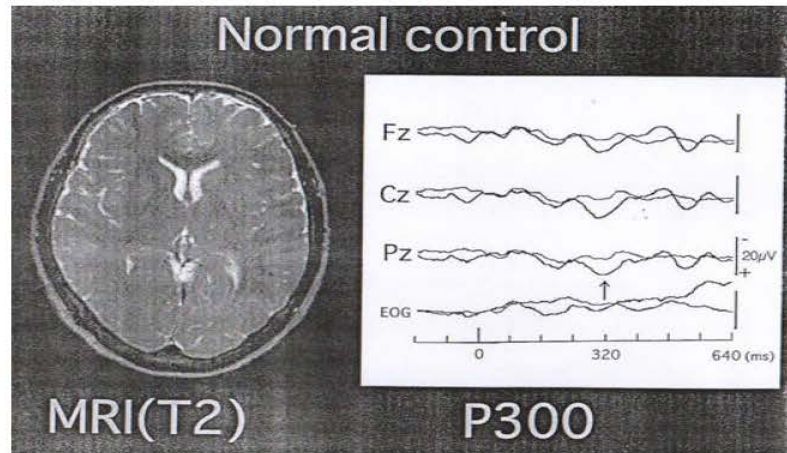


Fig. 3: The MRI of 65 age healthy adult with the normal average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm

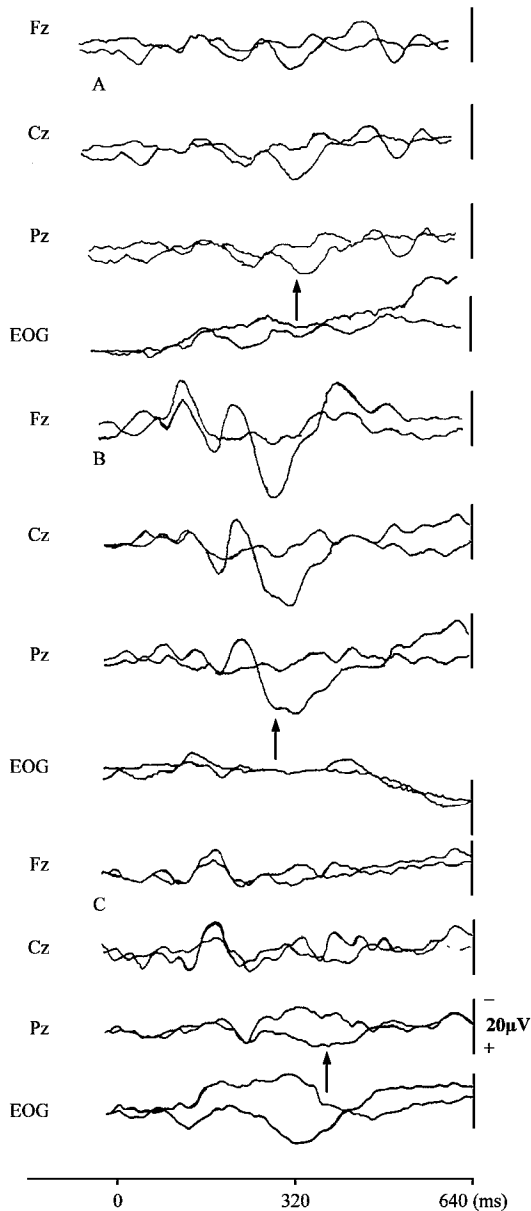


Fig. 4: The grand average waveforms of ERPs obtained from Fz, Cz, Pz and EOG in responses using a standard auditory oddball stimulus paradigm obtained from; A normal healthy person. B. Multiple Lacunar infarction patient and C. Leuko-araiosis patient

lacunar infarction with asymptomatic patients were significantly longer as compare to age-matched controls and they concluded that cognitive function was impaired in these patients. Yamashita *et al.*<sup>[10]</sup> examined 23 neurologically normal patients with asymptomatic lacunar infarction which confirm with MRI findings

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<sup>[11]</sup> 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.*<sup>[12]</sup> 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.*<sup>[13]</sup> 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.*<sup>[14]</sup> 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.*<sup>[10]</sup> and Morota and Kaieda<sup>[11]</sup> that the P300 latency was significantly prolonged in neurologically normal patients with asymptomatic lunar infarction. Thus, we can conclude that cognitive function was impaired with asymptomatic cerebral infarction.

## REFERENCES

1. Goodin, D., K. Squires and A. Starr, 1978. Long latency event-related components of the auditory evoked potentials in dementia. *Brain*, 101: 635-648.
2. Gordon, E., C. Krauhin, A. Harris, R. Meares and A. Howson, 1986. The differential diagnosis of dementia using P300 latency. *Biol. Psychiatr.*, 21: 1123-1132.
3. Polich, J., C. Ehlers, S. Otis, A.J. Mandell and F.E. Bloom, 1986. P300 latency reflects the degree of cognitive decline in dementing illness. *Electroenceph. Clin. Neurophysiol.*, 63: 138-144.

4. Pfefferbaum, A., B.G. Wenegrat and J.M. Ford, 1984. Clinical application of the P<sub>3</sub> component of event related potentials. II. Dementia, depression and schizophrenia. *Electroenceph. Clin. Neurophysiol.*, 59: 104-124.
5. Goodin, D.S. and M.J. Aminoff, 1987. Electrophysiological differences between demented and non-demented patients with Parkinson's disease. *Ann. Neurol.*, 21: 90-94.
6. Hansch, E.C., K. Syndulko, S.N. Cohen, Z.I. Goldberg, A.R. Potvin and W.W. Tourtlotte, 1982. Cognition in Parkinson disease: An event related potentials perspective. *Ann. Neurol.*, 11: 599-607.
7. Tachibana, H., K. Toda and M. Sugita, 1992. Actively and passively evoked P<sub>3</sub> latency of event related potentials in Parkinson's disease. *J. Neurol. Sci.*, 111: 134-142.
8. Committee on Evoked Potential Examination Method, 1985. Japan Society of Electroencephalography and Electromyography. Guideline on evoked potential measurement. *Jpn. J. EEG. EMG.*, 13: 97-104.
9. Hara, M., Y. Tguchi, T. Okabe, O. Nohira, M. Fukuda and K. Hamaguchi, 1998. P300 in Patients with Asymptomatic Cerebra Infarction. In *Recent Advances in Huaman Neurophysiology*. Hashimoto and R. Kakiki (Eds.), Elsevier Science, pp: 740-743.
10. Yamashita, K., S. Kobayashi, H. Koide and S. Yamaguchi, 1995. Prolonged P300 latency in silent cerebral infarction with periventricular hyperintensity in normal adults. *Jpn. J. Applied Physiol.*, 25: 75-79.
11. Morota, H. and M. Kaieda, 1993. The relationship between silent stroke and cognitive function. *Nihon. Rinsyo.*, 51: 902-907.
12. Hunt, A.L., W.W. Orrison, R.A. Yeo, K.Y. Haaland, R.L. Rhyne, P.J. Garry and G.A. Rosenberg, 1992. *Neurology*, 39: 1470-1474.
13. Yamashita, K., S. Kobayashi, H. Fukuda, S. Yamaguchi and H. Koide H. *Gerontology*, 1992. 38: 233-240.
14. Boone, K.B., B.L. Miller, I.M. Lesser, C.M. Mehringer, E. Hill-Gtierrez, M.A. Goldberg and N.G. Berman, 1992. Neuropsychological correlates of white-matter lesions in hhealthy elderly subjects. *Arch. Neurol.*, 49: 549-554.