

## P300

### Event-related Potentials of Pre- and Post-Hemodialysis in Patients with Chronic Renal Failure

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#### - Abstract -

**Background** : Nervous system dysfunction is a major complication of end stage renal disease. Although severe neurologic symptoms are partially or completely reversed by adequate hemodialysis, even optimally dialyzed patients will usually not return to normal neurocognitive function. To investigate the influence of chronic renal failure and hemodialysis on higher cognitive function electrophysiologically, we studied auditory P300 event-related potentials in 14 hemodialysis patients and 14 age- and sex-matched normal healthy controls.

**Methods** : The subjects consisted of 14 patients(M: 6, F: 8) with chronic renal failure(CRF) for 1 to 10 years and 14 age- and sex-matched healthy controls(M: 5, F: 9). For the reliability of study, patients with diabetes mellitus, abnormal brain CT findings, or low mini-mental state score(below 20) were excluded. Event related potentials(ERPs) for hemodialysis patients were performed at pre- and post-hemodialysis. To obtain ERPs, subjects underwent 2-tone auditory discrimination test(oddball paradigm).

**Results** : Although the age(control: 48.79±10.31 years, CRF: 51.21±7.61 years) and mini-mental state score(control: 27.00±1.71 points, predialysis CRF: 25.07±3.58 points) were not different in normal control and CRF groups significantly(P>0.05), P300 latencies at Cz(control: 288.11±17.36 msec, predialysis CRF: 332.35±42.34 msec) were significantly delayed(P<0.05)and the duration of Trail making test A was significantly prolonged(control: 64.2±24.2 sec, CRF: 118.9±101 sec) in CRF group. P300 latencies between pre- and post-hemodialysis CRF patients(predialysis CRF: 332.35 ± 42.34 msec, postdialysis CRF: 325.82±38.69 msec) were not significantly different. The P300 latency was not related with the duration of CRF(Spearman's correlation test, r=0.25, P>0.05) and the frequency of hemodialysis(Spearman's correlation test, r=0.28, P>0.05).

**Conclusions** : From these results, we suggest that P300 latency is valuable in evaluating cognitive brain dysfunction in patients with CRF and hemodialysis does not have a significant effect on cognitive brain dysfunction in patients with CRF.

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**Key Words** : P300 event related potential, CRF(chronic renal failure), Hemodialysis

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가, <sup>1,2</sup>

가, <sup>3,4</sup>

가, <sup>5,6</sup>

가, <sup>7,8</sup>

P300

1965 Sutton <sup>9</sup>

300

msec 가

가

P300

가

P300

가

<sup>10</sup> P300

가

P300

(generator)

(medial temporal lobe)

(basal gan-  
glia) (mul-  
tiple generator) 가 <sup>11,12</sup>

(Alzheimer's disease)

(dementia), (Parkinson's  
disease), (Huntington's disease),  
(chronic alcohol abuse)

P300 <sup>13-19</sup>

mini-mental state exam

P300

making test A

trail

1.

14

( 6 , 8 )

41 69 ( ± , 51.2±7.6)

1 ~ 10

2 ~ 3 /

14 ( 6 , 8 )

37 62 (48.78±

10.3)

가

mini-mental state exam 20

(Hb, BUN,  
albumin) 가

2.

mini-mental  
state exam MMSE-K(mini-mental status  
examination-korea)

12 가 30

가 20 <sup>20</sup>

trail making test A

B A 가

(Fig. 1). B A 가

가

가

3. P300( )

Nicolet Pathfinder plus  
'odd-ball paradigm'

Cz, Fz, A1 A2

5 K 가

0.7 / 100

1000 Hz 2000 Hz

, 1000 Hz 80%(80 : frequent tone), 2000 Hz 20%(20 : infrequent tone), 2000 Hz

50 msec, rise and fall time 10 msec, 80 dB, plateau time 40 msec가

low filter: 0.1 Hz, high filter: 70 Hz, analysis time: 500 ~ 700 msec, artifact

Frequent tone(1000 Hz) infrequent tone(2000 Hz)

가 infrequent tone(2000 Hz) (20 )

2

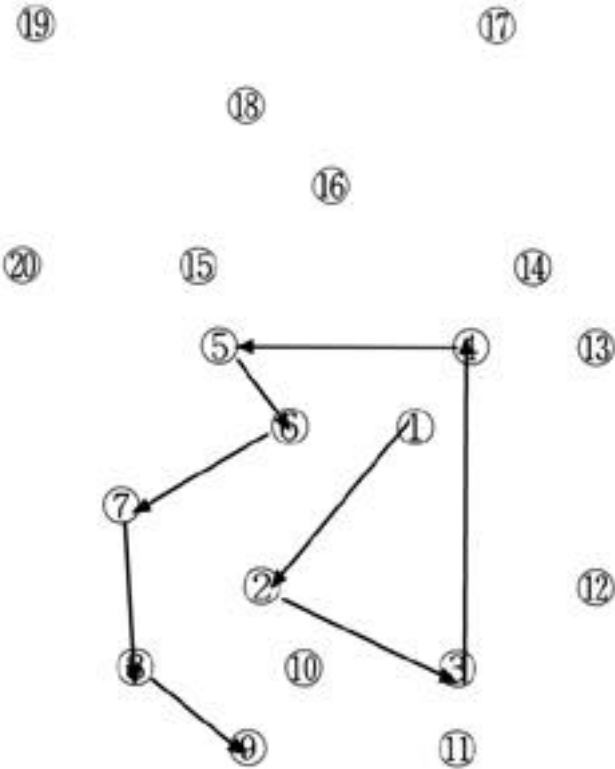


Figure 1. Trail making test A.

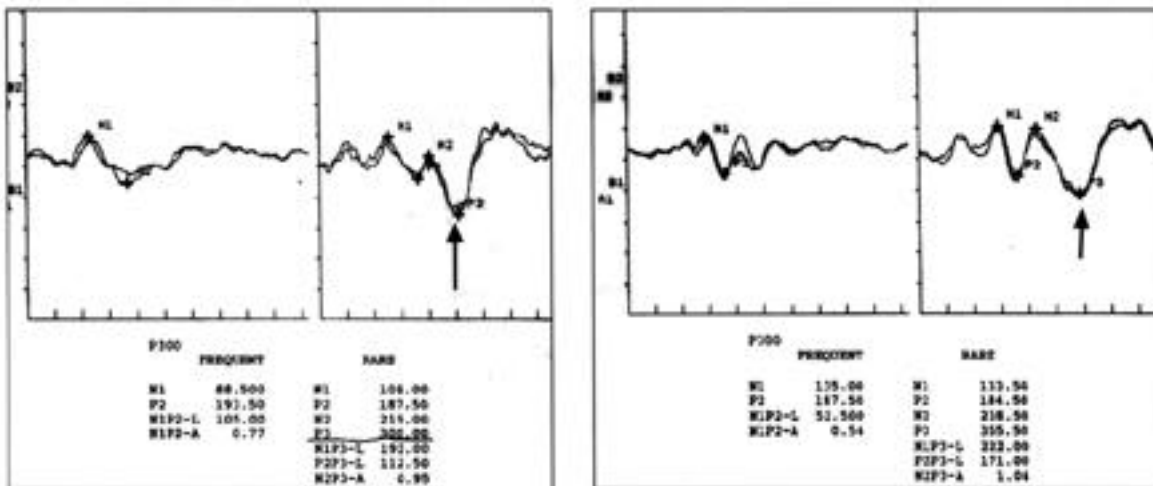
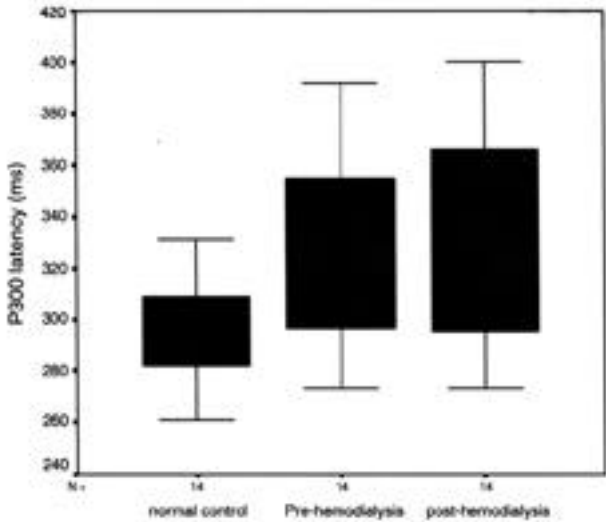


Figure 2. Event-related potential waveforms in response to frequent tones(left) and infrequent tones(right) in a normal control(A) and a patient with chronic renal failure(B). Arrows indicate the P300 potentials.

**Table 1.** Demographic data of fourteen chronic renal failure patients with neuropsychometric test scores and P300 values

Pt. No.	Age/Sex	duration of CRF(month)	total dialysis frequency	mini-mental state(score)	trail making test A(sec)	P300(msec), pre-dialysis	P300(msec), post-dialysis
1	50/F	12	96	25	90	319.5	319.5
2	69/F	36	288	26	65	385.0	366.0
3	60/M	48	432	23	117	315.0	297.0
4	44/M	10	40	28	50	297.0	313.5
5	66/M	36	360	23	112	392.0	400.5
6	41/M	24	288	25	45	355.5	340.5
7	58/F	120	480	20	395	300.0	300.0
8	51/M	36	288	28	55	312.0	295.5
9	43/M	48	576	28	85	288.0	292.5
10	44/F	84	1008	28	120	273.0	273.0
11	46/F	132	720	30	95	282.0	276.0
12	53/M	108	1296	28	80	373.7	375.0
13	44/M	36	576	30	75	344.8	330.0
14	53/F	60	192	22	240	342.0	367.5



**Figure 3.** P300 latency in normal control, prehemodialysis and posthemodialysis of patients with chronic renal failure: a box plot. Outer limits of the box represent the 25th and 75th percentiles. The line inside the box represents the median.

correlation test

( 6 , 8 ; ± , 51.2±7.6) ( 6 , 8 ; ± , 48.8±10.3)

. Mini-mental state score 27.0±1.7 , 26.0±3.08 (P>0.05, by independent t-test)(Table 1).

Trail making test A

. Trail making test A (14 ) 45 -395 ( ± :116.0±93.65(sec)), (14 ) 45 -124 ( ± : 62.5±22.7(sec))

trail making test A

2

(P<0.05, by independent t-test).

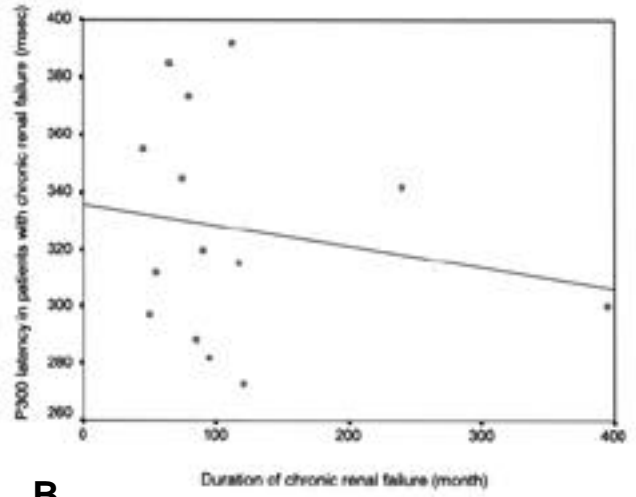
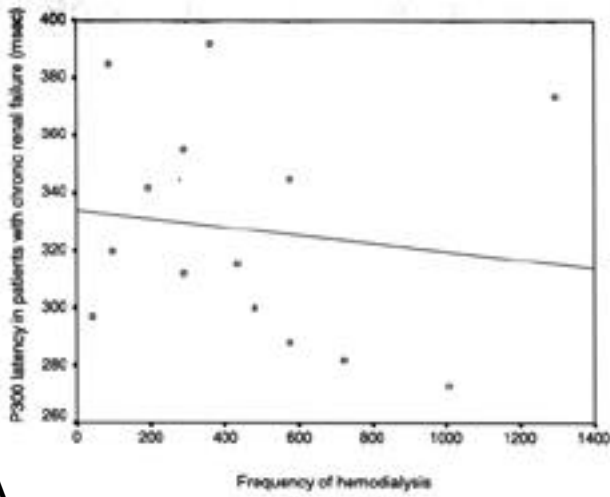
infrequent tone(2000 Hz) 250 msec 가 P300 가 P300 가 P300 P300 24 (Fig. 2).

P300 327.07 ± 38.84(msec), 288.1 ± 17.4(msec) (independent t-test, P<0.05), P300 327.07±38.84(msec), 324.75±39.76(msec) 가 (paired sample t-test. P>0.05)(Fig. 3, Table 1).

P300

(spearman's correlation test,

± , unpaired t-test, paired t-test, Spearman's



A

B

**Figure 4A.** Correlation between P300 latency and frequency of hemodialysis(B) Correlation between P300 latency and duration of chronic renal failure

**Table 2.** Mean±SD in patients with CRF and normal control

	CRF group(n=14)	Normal control(n=14)
Age(year)	51.2±7.6	48.8±10.3
Mini mental state(score)	25.1±3.5	27.0±1.7
Trail making test(sec)	118.9±101.3	62.5±22.7
P300(msec), pre-hemodialysis	332.4±32.3	288.1±17.4
P300(msec), post-hemodialysis	325.8±28.7	

Values are mean±standard deviation.  
CRF, chronic renal failure

r = 0.28, P>0.05). P300

22-26

(Spearman's correlation test, r = 0.25, P>0.05)(Fig. 4).

가

27-29

trail making test

1946

Armitage가

A

가

가

1

2

3

20

가

가

B

1

A

2

B,

3

C

4,21 P300

가

mini-mental state exam trail making test A

가 , ,  
 가 , ,  
 A 가  
 trail making test A  
 2  
 (speed of information processing)가  
 가  
 . 1983 Cohen <sup>25</sup> 22  
 10  
 가 1986 Marsh <sup>23</sup>  
 1986 Rosenberg <sup>24</sup> 4  
 가  
 14 가 6  
 가

P300 가 가  
 P300  
 trail making  
 2  
 test A  
 가  
 , P300  
 , P300  
 P300  
 가  
 P300  
 가  
 P300  
 가

가 <sup>21</sup>  
 Creatinine 가, CO<sub>2</sub>  
 가  
 14 P300  
 14

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