I9 Study on P300 and P50 and Cognitive Disorder of Patients After Brain Trauma

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After attending this presentation, attendees will learn about the application of Event Related Potentials (ERP) in forensic science in mainland China.

This presentation will impact the forensic science community by discussing the new study results of the ERP application for cognitive dysfunction patients.

Background: The assessment of cognitive function in patients with brain trauma in forensic psychiatry was mainly depended on psychiatric interview, inquiry materials and medical history. Although some items of neuropsychological testing, the relatively objective indicators, were applied in the disability evaluation after brain trauma, the reliability and veracity of the tests were influenced by the cooperation of experimenters and the qualification of evaluators. In recent years, the Event Related Potentials (ERP) have received more attention as more objective indicators for cognition. Some studies had proved that the latent period of P300 (a component of ERP) was extended, the amplitude was declined, and the amplitude of P50 (another component of ERP) was significantly different form the normals. However, these existing studies were mostly grouped and contrasted by the degrees of primary injury, the relationship between cognitive dysfunction caused by brain trauma and ERP was explored very little. Therefore, it is necessary to determine the relationship and to provide more objective auxiliary indicators for the disability evaluation after brain trauma.

Aim: The goals of this research are to: (1) to explore the application of neuropsychological tests during the evaluation of cognitive disorder in brain trauma patients; and, (2) to analyze characteristics and differences of waveforms of P300 and P50 of brain trauma patients with different degrees of cognitive disorder respectively,

in order to provide more scientific and objectives auxiliary indicators for the identification of cognitive disorder of patients after brain trauma.

Method: (1) the subjects were the interviewed in the Institute of Forensic Science from July 1, 2009 to December, 31, 2009. The subjects were selected based on the following criteria: six months after brain trauma, dextromanuality, and could coordinate the test, excluding those with neuropsychiatric disease existing before the trauma and those with psychotic symptoms after the trauma; (2) the following neuropsychological tests were conducted on the subjects: the items of block design, picture completion and similarities in the Wechsler Intelligence Scale for Adult-China Revised (WAIS-RC), the items of long-term memory (LTM) and short-term memory (STM) in the Wechsler Memory Scale – China Revised (WMS-RC), and the visual retention, simple visual reaction time, length discrimination and digit cancel in the fourth set of Computer – administered Neurobehavioral Evaluation System (NES-4). The P300 and P50 were examined by the BrainMaster, and the sites of electrode was according to the international 10-20 electrode system; and, (3) the subjects were grouped into mild- injury, moderate-injury and severe-injury groups according to the degrees of their primary injury and grouped into mild-cognitive dysfunction, moderate-cognitive dysfunction and severe-cognitive dysfunction groups according to the experts' opinion. Finally, the data were analyzed using analytical software: one-way ANOVA for differences among groups and the Least-Significant Difference (LSD) method for advanced pairwise contrast.

Results: (1) No significant difference was discovered in the tests of block design, information, similarities, length discrimination and digit cancel among the mild-injury, moderate-injury and severe-injury groups. The difference in the tests of picture completion, LTM, STM, visual retention and simple visual reaction time among groups were proved to be significant. The scores of LTM, STM, visual retention and simple visual reaction time in the mild-injury group were higher than that in the moderate and severe-injury groups ($p<0.05$). In the advanced pairwise contrast; however, no significant difference appeared between moderate and severe-injury groups. The scores of picture completion in the mild- injury groups were lower than the moderate and severe-injury groups ($p<0.05$). The above results suggest that part of the neuropsychological testing, especially the intelligence tests, could not reflect the correlation between the degree of primary injury and the cognitive dysfunction correctly.

(2) The scores of LTM, STM, visual retention, visual reaction, length discrimination, and digit cancel were decreased following the ingravescence of the cognitive dysfunction, and the differences in the LTM, STM, visual retention, and simple visual reaction time among the mild, moderate and severe-cognitive dysfunction were identified to be significant. The significant differences also proved to exist in the advanced pairwise contrast ($p<0.05$). The scores of block design, picture completion, information and similarities between the mild and severe- cognitive dysfunction group were similar and were lower than that in the

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moderate-cognitive dysfunction group. Significant differences existed in the picture completion, information and similarities tests. The indicators of neuropsychology, such as the memory, memory-visual, memory-neurobehavioral, psychomotor performance, and apparent reaction rate could reflect cognition effectively.

(3) No significant differences were discovered in the latent period and amplitude of N200 and P300 potential in the sites of Fz, Cz, Pz, T3 and T4 in the control group by one-way ANOVA analysis, so as the P50 potential examination.

(4) In the N200 potential, the latent period was extended and the amplitude was declined following the severity of cognitive dysfunction.

(5) The differences in the latent period and amplitude of P300 potential between the cognitive dysfunction group and the control group proved to be significant, and its latent period was previously prolonged in the moderate and severe-cognitive dysfunction group compared to the mild-cognitive dysfunction and control group ($p<0.05$). However, no significant differences proved to exist between the control and mild-

cognitive dysfunction group, or between the moderate and severe- cognitive dysfunction group. The differences in the amplitude of P300 potential between the cognitive dysfunction group and the control group were significant, and the amplitudes were lower in the moderate and severe-cognitive dysfunction group compared to the mild and control group ($p<0.05$). No significant differences were found between the mild and the control group or between the moderate and severe group.

(6) The correct rate of P300 in the control group and cognitive- dysfunction group was significantly different ($p<0.001$), and the significant differences also existed in the advanced pairwise contrast analysis ($p<0.05$).

(7) No significant differences in the latent period and amplitude of S1-P50 were discovered between the cognitive dysfunction group and the control group. The difference in the amplitude of S2-P50 proved to be significant; however, this difference was not discovered in the latent period performance of S2-P50. The amplitude of S2-P50 was higher in the moderate and severe-cognitive dysfunction groups compared to the mild and control groups ($p<0.05$). However, this difference between the mild and control groups, and between the moderate and the severe- cognitive dysfunction groups, was not significant.

(8) The differences in the inhibition rate of P50 potential between the cognitive dysfunction group proved to be significant, and it was higher in the moderate and severe-cognitive dysfunction groups compared the mild and control groups ($p<0.05$). No significant differences were found between the mild and the control group, or between the moderate and the severe-cognitive dysfunction group.

(9) The difference in the correct rate of P50 potential between the cognitive dysfunction group and the control group proved to be significant ($P<0.001$), and it was lower in the mild-cognitive dysfunction group compared to the moderate-cognitive dysfunction group ($p<0.05$). No significant difference was found between the mild and the severe- cognitive dysfunction group ot between the moderate and the severe- cognitive dysfunction group.

Conclusion: (1) The degree of primary brain trauma was not absolutely parallel with the degree of cognitive dysfunction: The patients with mild-cognitive dysfunction were more likely to exaggerate or feign dysfunction in the neuropsychological tests; (2) the P300 potential could be used as an objective indicator to reflect the degree of cognitive dysfunction, while the latent period of P50 potential could not measure the degree of cognitive dysfunction effectively; and, (3) the P300 and P50 potentials all could act as objective indicators for the identification of feigning symptoms, especially in the mild-cognitive dysfunction patients.

Forensic Psychiatry, Event Related Potential, Brain Injuries

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