

Electrophysiological and Psychometric Assessment of Cognitive Functions in Normal Aging

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بسم الله الرحمن الرحيم

﴿قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا

إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ﴾

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ABSTRACT

Aging and Age-related Changes (ARCs) refer to the declines in component biologic processes occurring with senescence that result in impaired brain structure, cognitive performance and behavior. In the present study we aimed to assess cognitive functions in normal elderly subjects using psychometric cognitive assessment scales and electrophysiological studies including power of brain activity and late cortical responses.

Method: Forty seven healthy elderly subjects were assessed with electrophysiological studies and psychometric scales. Electrophysiological studies include P300 and CNV studies and QEEG recording.

Results: The results of P300 showed a significant positive correlation was found between age and reaction time. A significant negative correlation was found between reaction time and the total score of the performance scale. The results of CNV revealed a significant negative correlation was noted between latency of N2 and total score of the verbal scale. Regarding relative power of EEG frequencies, a significant positive correlation was found between relative power alpha frequency and the total score of performance scale. No significant correlation was revealed between P300, CNV parameters and relative power of EEG frequencies and scores of WMS subtests and parameters of WCST.

Conclusion: Results suggest that the psychiatric scales do not provide a substitute for electro-physiological tests in evaluating the cognitive changes which occur with normal aging. Also, it revealed that P300 parameters are more sensitive than CNV parameters in detecting such changes.

Key words: cognitive, electrophysiological, psychometric, aging.

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List of ABBREVIATIONS

| | |
|----------------|--|
| AD | Alzheimer's disease |
| ADHD | Attention deficit hyperactivity disorder |
| ADLs | Activities of daily living |
| AIDS | Auto-Immune Deficiency Syndrome |
| AP | Absolute power |
| ARCs | Age-related Changes |
| ATP | Adenosine triphosphate |
| BOLD | Blood oxygenation level–dependent |
| CLOX | Clock Drawing Task |
| CNV | Contingent negative variation |
| Cr | Creatine |
| CT | Computed tomography |
| dB | Decibel |
| DLPFC | Dorsolateral prefrontal cortex |
| DNA | Deoxyribonucleic acid |
| EEG | Electroencephalogram |
| E-wave | Expectancy wave |
| EXIT-25 | Executive Interview |
| fMRI | Functional magnetic resonance imaging |
| Gln | Glutamine |
| Glu | Glutamate |

List of ABBREVIATIONS (continued)

| | |
|---------------|--------------------------------|
| HPA | Hypothalamic-pituitary-adrenal |
| 5-HT | 5-hydroxytryptamine |
| Hz | Hertz |
| IQ | Intelligence Quotient |
| ISIs | Inter-stimulus intervals |
| Khz | Kilo-Hertz |
| LC | Locus coeruleus |
| MEG | Magnetoencephalography |
| mm | Millimeter |
| MMN | Mismatch Negativity |
| MMSE | Mini-Mental State Examination |
| MRI | Magnetic resonance imaging |
| msec | Milliseconds |
| mtDNA | Mitochondrial DNA |
| μV | Microvolts |
| NAA | N-acetyl aspartate |
| NBM | Nucleus Basalis of Meynert |
| NE | Norepinephrine |
| O-wave | Orienting wave |
| OXPHOS | Oxidative phosphorylation |
| PET | Positron emission tomography |
| PFC | Prefrontal cortex |

List of ABBREVIATIONS (continued)

| | |
|----------------|---|
| PLEDs | Periodic lateralized epileptiform discharges |
| QEEG | Quantitative Electroencephalography |
| RMS | Root-mean-square |
| RP | Relative power |
| SD | Standard deviation |
| sLORETA | Standardized Low Resolution Electromagnetic Tomography |
| VTA | Ventral tegmental area |
| WAIS | Wechsler Adult Intelligence Scale |
| WCST | Wisconsin Card Sorting Test |
| WMS | Wechsler Memory Scale |

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INTRODUCTION

and

AIM OF WORK

INTRODUCTION

The aging of the world's population has profound implications for medical care and health care systems. Aging spares no organ or system, and in due course affects everything, from cell to thought (**Raz and Rodrigue, 2006**).

There is a generalized, proportional decline in mental processing speed among elderly adults that affects all elements of mentation equally (**Bashore *et al.*, 1989**). Numerous investigators have reported changes in the pattern of brain electrical activity (electroencephalogram, EEG) associated with aging and noted a relationship between specific changes in the EEG and clinical deterioration (**Prichep *et al.*, 2006**).

The P300 event-related potential (ERP) is thought to reflect neuroelectric activity related to cognitive processes such as attention allocation and activation of immediate memory. However, studies have provided evidence that the P300 also is influenced by biological processes such as fluctuations in the arousal state of subjects (**Polich and Kok, 1995**).

The contingent negative variation (CNV) can be recorded in the serial conditions of habituation—reinforcement—motor extinction (free attention)—reinforcement—motor extinction (forced attention). The mean CNV amplitude under the reinforcement and motor extinction (free attention) conditions decreases prominently with aging (**Verleger *et al.*, 1999**).

AIM OF WORK

To assess cognitive functions in normal elderly subjects using psychometric cognitive assessment scales and electrophysiological studies including power of brain activity and late cortical responses.

**REVIEW
OF
LITERATURE**

Chapter 1

Theories of Normal Aging