

Alertness: Vigilance and Wakefulness in Developmental Disorders of Reading and Attention

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Wakefulness in adults is associated with stable ocular pupil size that may be quickly assessed quantitatively by pupillometry.¹ Some developmental disorders are speculated to be associated with disordered vigilance.² We have previously shown in a large pool of developmentally disabled students of elementary through college age a high frequency of pupillary instability.³ This study investigates the relationship between attention/reading disorder, daytime wakefulness, and behavioral as well as physiologic measures of vigilance.

Fifty children (41M/9F) between 10 and 15 years of age (mean 12; SD 1.84) met DSM-III-R diagnosis of attention deficit hyperactivity disorder (ADHD) and/or developmental disorder of reading (RD). In addition to psychometric evaluation, a routine EEG supplemented by computer-assisted topographic mapping and auditory N-100/P-300 evoked potential studies (Bio-Logic Systems Corp., Mundelein, Illinois), all subjects underwent quantitative measurements of pupil size and stability utilizing monocular pupillometer (Micromesurments, Farmington, Connecticut). Subjects were initially drug free. After three minutes of dark adaptation, a 10-minute recording was performed between noon and 4:00 p.m.

Moderate or severe pupillary instability assessed semiquantitatively was observed in 11 of 32 ADHD only (34%), 8 of 15 ADHD+RD (53%), and 1 of 3 RD only (33%). Daytime drowsiness, despite adequate nocturnal rest, correlated moderately with cognitive impairment on the Letter Cancellation Task and prolonged N-100/P-300 latency.

The N-100/P-300 latencies in the 50 patients diagnosed as ADHD and/or RD were contrasted with 20 control subjects between ages 9 and 15 years of age (mean 12; SD 1.9) without personal or family history of developmental disorder. Study subjects displayed significantly longer P-300 latency (mean = 329.3 ms; SD = 32.96; Mann-Whitney U P < 0.001) compared to the controls (mean 292.3 ms; SD = 14.13). Additionally, these patients displayed longer N-100 latency (mean 108.8 ms; SD = 24.60; Mann-Whitney U P < 0.001) compared to the control group (mean 87.0 ms; SD = 8.35). Among the study subjects, the most common alteration was a prolonged (>320 ms) P-300 latency, which was observed in 31, followed by prolonged (>100 ms) N-100 latency, noted in 25 of the 50 subjects.

Baseline cognitive and pupillary observations were contrasted with cognitive performance and pupillary stability following protocol acute dosages of alerting compounds. Improved wakefulness marked by improved pupillary stability was commonly but not invariably

associated with improved cognitive performance, This paradigm permits accurate prediction of clinical response to pharmacologic intervention.

Overall, these studies suggest that a common feature of developmental disorders of attention is cognitive impairment if vigilance with which there is not uncommon correlate of impaired alertness and a common correlate of prolonged physiologic latency. These observations are consistent with the conference theme of disordered temporal processing in developmental disorders.

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References:

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