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ORIGINAL ARTICLE

Correlation between clinical manifestations of nocturnal enuresis and attentional performance in children with attention deficit hyperactivity disorder (ADHD)

Teng-Kai Yang [a,†], Kuo-How Huang [b,†], Shyh-Chyan Chen [b], Hong-Chiang Chang [b], Hung-Ju Yang [a], Ya-Jun Guo [c,d,*]

[a] *Division of Urology, Department of Surgery, Cardinal Tien Hospital, Yong he Branch, New Taipei City, Taiwan*
[b] *Department of Urology, National Taiwan University Hospital, Taipei, Taiwan*
[c] *Department of Psychiatrics, Taipei City Hospital, Heping Fuyou Branch, Taipei, Taiwan*
[d] *Institute of Neuroscience, National Chengchi University, Taipei, Taiwan*

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Background/Purpose: Children with attention deficit hyperactivity disorder (ADHD) tend to be more vulnerable to various forms of voiding dysfunction and nocturnal enuresis (NE). We attempt to compare the clinical manifestations and attentional performance between ADHD children with NE and those without NE.
Methods: We consecutively enrolled children diagnosed with ADHD in child and adolescent psychiatric clinics. The questionnaires for evaluation of ADHD symptoms and voiding dysfunction symptoms were administered to all study participants. All participants also received the Test Battery for Attention Performance (TAP) for assessment of attentional function.
Results: A total of 53 children were enrolled in this study, comprising 47 boys and six girls. The prevalence rate of NE was 28.3%. Children in the NE group had statistically significant higher dysfunctional voiding symptom score (5.40 $\pm$ 3.66 vs.3.16 $\pm$ 2.74; $p = 0.018$) and two subscales of "When I wet myself, my underwear is soaked" ($p < 0.001$) and "I miss having a bowel movement every day" ($p = 0.047$). There were no significant differences with regard to all psychiatric evaluations between the NE and non-NE groups. In the TAP test, the NE group showed a significantly shorter reaction time in the domain of inhibitory control, working memory, and auditory sustained attention than the non-NE group.

* Corresponding author. Department of Psychiatrics, Taipei City Hospital, Heping Fuyou Branch, No. 33, Section 2, Zhonghua Road, Zhongzheng District, Taipei City 100, Taiwan.
E-mail address: guogina@hotmail.com (Y.-J. Guo).
† These authors contributed equally to this work.

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Conclusion: Children with ADHD have a high prevalence of NE. ADHD children with NE had a significantly higher dysfunctional voiding symptom score and shorter reaction time in most domains of the TAP test. Further study is needed to discern the impact of NE on the neuropsychological function of ADHD children.

Introduction

Attention deficit hyperactivity disorder (ADHD) is a common problem in child and adolescent psychiatric clinics.[1] It represents a syndromic diagnosis with three symptom domains: inattention, hyperactivity, and impulsivity.[2] Although there are effective treatments for ADHD, no established objective "test" can conclusively diagnose ADHD.[3] Test Battery for Attention Performance (TAP) is a neuropsychological testing used for the evaluation of inhibitory control and attentional performance in children with ADHD.[4,5]

The association between nocturnal enuresis (NE) and ADHD has been investigated in several previous studies.[6–11] Children with ADHD tend to be more vulnerable to various forms of urinary problems, such as NE, voiding dysfunction (VD), and diurnal incontinence.[9–13] The etiology of NE has been reported to be associated with neurological maturation. Previous studies have demonstrated that children with NE had higher incidence of delayed language and gross motor development.[14] However, surveys with neuropsychological attention tests in ADHD children with NE are lacking. Therefore, we conducted our study using TAP to evaluate neuropsychological function and attentional performance in children with ADHD. Moreover, our aim was to investigate the correlation between NE and attentional performance in children with ADHD.

Materials and methods

After obtaining approval from the institutional research ethics committee, informed consent was obtained from each participant before any evaluations or sample collections were conducted. Between January 2005 and December 2007, we consecutively enrolled 53 children, aged 6 to 10 years, diagnosed as having ADHD who first sought medical help without previous medications in the Child and Adolescent Psychiatric Clinics of Taipei Municipal Hospital. The diagnosis of ADHD was confirmed by experienced child and adolescent psychiatrist according to *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* criteria. Children with other mental disorders such as mental retardation, pervasive developmental disorder and psychosis, and organic brain diseases such as seizure were excluded from the study. Details on demographic data, perinatal history, medical history, the presence of sleep disorder, and developmental history were collected from parents or medical records. Sleep disorders including obstructive sleep apnea, nightmares, and sleepwalking were recorded and compared between the two groups.

The psychiatric interviews of these children were obtained from their parents using the validated, Chinese version of the Kiddi Schedule for Affective Disorders and Schizophrenia-Epidemiologic version (K-SADS-E).[15] Data on behavior problems such as ADHD, oppositional defiant disorder symptoms, conduct disorder, depression, mania, and anxiety disorders were also collected. The IQ of all study participants was assessed using the Chinese version of Wechsler intelligence Scale for Children,[16] which was conducted with the assistance of an experienced child psychologist. NE was defined as nighttime wetting with or without daytime incontinence, at least twice a week over a period of 3 months or longer, but without anatomical abnormalities. The evaluation of NE and VD was examined by urinalysis, renal echo, and structured questionnaire of NE and dysfunctional voiding symptom score (DVSS) questionnaire, Chinese-language version, which has been validated for quantification of voiding symptoms in children.[17,18] The DVSS consists of 10 questions that assess daytime incontinence, NE, constipation, urgency, voiding frequency, and dysuria, each was scored from 0 to 3 (0 = almost never,1 = less than half the time, 2 = about half the time, 3 = almost every time) for a maximum total score of 30 (most severe symptoms). An additional 11th question assesses recent stressful events within the family. Scores for the NE and non-NE groups were compared for each subscale and in aggregate. The diagnosis of VD was based on DVSS with a threshold score of 6 for females and 9 for males, and abnormal uroflowmetry curve shapes during micturition.

Each of the questionnaires used in this study was explained to the parent(s) of the participants and handed to them for completion. Participants ordinarily participated with their parents in responding to the questionnaires.

Test of attentional performance test

TAP test is a computer-driven test battery for the assessment of attentional function and inhibitory control.[4,5] All participants completed the TAP test in the morning with the assistance of a well-trained personnel. TAP test is a valid tool for the clinical assessment of attention function of children. Our study adopted the following five components:

(1) Alertness

There are two conditions in this test. For condition A, the children were instructed to press a button as fast as possible when a cross appeared (×). Under condition B, the children heard an arousal signal (60 dBA) first, then they were to press a button when a cross (×) appears.