Attentional and Perceptual Disturbances in Children With Tourette’s Syndrome, Attention Deficit Disorder, and Epilepsy

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Abstract

Perceptual, motor, and neuromaturational competence were assessed using a battery of tasks with three groups of children with diagnosed disorders of Tourette’s syndrome (TS), attentional deficit with no known organic substrate (Constitutional ADD), and attentional deficit disorder in children with epilepsy (E-ADD). The purpose was to determine how the three groups related to each other on these measures and to establish clinical validation of the test battery. As predicted, the control and the TS groups did much better than the ADD and seizure groups. The TS group differed from the controls on only a handful of measures, whereas the constitutional ADD and E-ADD children were far more deviant than the TS children. The E-ADD children as a group suffered difficulties in virtually every area.

A spectrum of attentional, perceptual-motor, coordination, and neuromaturational difficulties are found in children with diverse psychiatric, learning, and behavioral disorders. Because dysfunctions in basic psychological systems such as attention are hypothesized to underlie particular psychiatric disorders, children with a constellation of behavioral difficulties (impulsivity, inattention, poor concentration) have been characterized as suffering from “attention deficit disorders” (Alpert et al. 1981). A similar constellation can be found in children with severe, pervasive developmental disturbances such as autism, as well as in normal children who are responding to temporary situational or developmental upsets and in younger children. Recent clinical and epidemiological studies of children with Tourette’s syndrome (Cohen et al. 1980; Jagger et al. 1982) have suggested that a large percentage have attentional and learning difficulties which may interfere with academic achievement. Finally, children with disorders involving the integrity of central nervous system (CNS) functioning—such as epilepsy—have an increased frequency of learning and attentional problems which may, at times, be compounded by medications, such as anticonvulsants (Rutter, Graham, and Yule 1970; Rutter 1977).

In this study, we assessed perceptual, motor, and neuromaturational competence using a battery of tasks with three groups of children with diagnosed disorders: Tourette’s syndrome (TS), attention deficit disorder with no known organic substrate (constitutional ADD), and attention deficit disorder in children with epilepsy (E-ADD). The purpose of the study was to compare these three groups on multiple measures that have been used clinically to assess psychological processes, as well as to provide clinical validation for this battery of measures. The tasks used have been described previously and developmental trends in normal children defined (Harcherik, Carbonari, and Cohen 1982). We hypothesized that these clinical groups and normal children would fall in a spectrum of dysfunction in the following order: normal, TS, ADD, E-ADD.

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Population

The clinical populations all received thorough psychological, psychiatric, and neurological evaluations, as described previously (Cohen 1976; Cohen et al. 1979; Shaywitz, Cohen, and Shaywitz 1979; Young et al. 1982). Diagnoses conformed to the criteria of DSM-III (American Psychiatric Association 1980).

The 15 children with TS (14 male, 1 female) ranged in age from 7 to 15 years (mean = 11 years) and had characteristic multiple motor and phonic symptoms with waxing and waning intensity, changing morphology, and temporary suppressibility. None of them were on medication at the time of testing. The 11 children with constitutional ADD (10 boys, 1 girl), aged 5–14 years (mean = 9.5 years), exhibited impulsivity, short attention, poor concentration, frustration intolerance, and restless overactivity. Only one ADD child was on medication, an antihistamine for treatment of eczema. The 15 children with seizure disorder (9 male, 6 female) were 4 to 13 years old (mean = 8.9 years) and had grand mal and mixed seizure disorders. Four epileptic children were on no medication, five were receiving phenobarbital, one was receiving Dilantin, and five were on a combination of drugs (generally including Dilantin and/or phenobarbital). The normal control population consisted of 90 psychologically and medically healthy school children (50 boys, 40 girls) between the ages of 4 and 14 years (mean = 8 years, 3 months), reported previously (Harcherik, Carbonari, and Cohen 1982).

Method

The test battery consisted of 37 tasks to assess functioning in the following areas: fine motor, gross motor, perceptual-motor, vigilance, neuromaturation, and cognition. Tasks consisted of frequently used clinical procedures, standardized tests (subtests from the Wechsler Intelligence Scale for Children: WISC-R), and especially designed, game-like laboratory tasks, as previously described (Harcherik, Carbonari, and Cohen 1982). The entire battery took 40 to 70 minutes to administer to the clinical groups and approximately 40 minutes for the normal children. The clinical groups were tested in a quiet room in the Yale Child Study Center. After several minutes of familiarization, children were presented with the tasks as "games" and were encouraged to "do their best." Details of the tasks and developmental patterns have been presented.

Statistical Analysis

As previously shown, performance on all tasks improved with age (Harcherik, Carbonari, and Cohen 1982). The developmental trend was also observed with clinical groups (between-groups analysis of variance by age, p = .01). Therefore, analysis of variance statistics were covaried by age (ANCOVA) for all tasks. If the results of the ANCOVA were significant, Scheffe's contrast procedure for corrected treatments was used to determine which contrasts were significantly different from zero or between which diagnostic groups there was a difference. Scheffe's S-method did not indicate significant differences on some of the ANCOVAs which had significant F ratios. This was due to the single range Scheffe's method used, resulting in a more robust test. In data analysis, these results were considered nonsignificant, giving further strength to the significant results achieved.

Results

As predicted, the normal and TS groups did much better on many of the tasks than the ADD and seizure-disordered children. On several tests, the TS group deviated significantly from the normal children.

Cognitive Functioning. The four WISC-R subtests provided a general profile of cognitive competence in the clinical groups and normal children. The normal children scored higher than all clinical groups on the digit symbol (B version), higher than the seizure-disordered children on the mazes and block design, and higher than both the ADD and seizures group on similarities.

Fine Motor. There were no differences among the four subgroups on the size of letters when children were asked to write the alphabet as quickly as possible. However, the normal children wrote significantly more letters than the three clinical groups in the 20-second allotted period. In the pegboard tasks, children were instructed to place either round or square pegs into randomly arranged holes; when finished, they were instructed to remove the pegs as quickly as possible. The normal children and TS patients...
were faster than the E-ADD children on all trials, and the normal children were also faster than the ADD children in inserting pegs in the round holes using their dominant hand. The E-ADD children were slower than all other groups in removing the pegs in all trials.

**Gross Motor.** The normal children and TS group walked backward on their heels faster than the E-ADD children. There were no differences among the groups in walking forward on the 4-inch balance beam. The normal children were able to place more marbles in color-coded holes than the ADD and E-ADD children; on this task, the TS children were also faster than the E-ADD children.

**Perceptual-Motor Vigilance.** On the road-tracking task, children were instructed to keep a felt-tipped pen in the middle of a printed roadway which moved at slow, medium, and fast speeds. On all three speeds, the E-ADD children went off the track significantly more often than any of the other groups. On the medium speed, the TS and ADD children also veered off the track more often than the normal children.

**Neuromaturational Measures.** The TS children were able to hold out their tongues and arms with their eyes closed for the allotted 20 seconds; in contrast, 44 percent of the ADD and 39 percent of the E-ADD children had trouble holding out their tongues, and 38 percent and 18 percent, respectively, had trouble holding out their arms with their eyes closed. The normal children were able to stand on their right feet with their eyes closed significantly longer than the ADD and E-ADD children, a further measure of the motor impersistence of these two clinical groups.

**Discussion**

Formal assessment of motor skills, cognitive performance, and neuromaturation are standard aspects of the child psychiatric examination. Individual differences, and unusual profiles of competence and dysfunction, are essential to the understanding of a particular child's disorder. In this report, however, we focus only on group differences, as a way of approaching the clinical validity of this battery of measures and major differences among three groups of clinical disorders in which attentional and motor difficulties are prominent features. Based on this study, there is a spectrum of attentional, motor, and neuromaturational difficulty in which, as a group, TS children are closest to normal, and children with definite CNS dysfunction (epilepsy) and behavioral signs of ADD are most deviant.

While clinical assessment and epidemiological evidence suggest that, as a population, TS patients have a high percentage of attentional and learning difficulties, on this battery they differed from normal children on only a handful of measures. For example, they did not adapt so quickly as normal children to changes in speed of the road-tracking task, and their coding (digit symbol B) was significantly impaired. It is our impression that TS children, as a group, can perform at a much improved level on tasks such as the ones we have employed, when the situation is highly structured and distractions are minimized. In the classroom or when alone at home doing homework, behavior deteriorates, as the children's attention drifts and they are more preoccupied with either the suppression (in school) or expression (at home) of motor and phonic symptoms. The clinically frequent symptomatic difficulty with writing was observed in this study as well: TS patients wrote fewer letters than normal children in the short time allotted. The TS children in this study were not so severely impaired as some whom we have studied in other projects. The results indicate that, with sufficient structure, TS patients can be expected to perform well as a group.

The children with constitutional ADD and ADD associated with epilepsy were far more deviant than the TS children, as would be expected from the selection criteria. The ADD and E-ADD children all satisfied criteria for attentional disturbances, and many had clinical findings of nonlocalizing motor dysfunction; only a subgroup of the TS patients satisfied the criteria for ADD. Most impressive, the E-ADD children as a group suffered from difficulties in virtually every area investigated. The multiple tasks revealed the difficulties which the epileptic children experience in organizing their motor performance and in cognitive tasks. The degree to which these differences reflect the underlying brain dysfunction, as such, the medication (particularly phenobarbital), or a combination of factors could not be determined from this study. Careful documentation of the difficulties of the E-ADD children, however, proved of clinical value in guiding families and suggesting interventions in relation to schooling. Rigorous measurement
of attentional, motor, and neuromaturational findings adds increased persuasiveness to medical recommendations in relation to school interventions; in addition, such measurement may provide useful yardsticks for assessing developmental changes, the impact of improved or worsened control, or the results of medication changes. In the clinical evaluation of children with attentional and motor performance difficulties, clinicians require simple, easy to administer tests which can provide standardized scores. The results of this study, along with others using similar approaches, suggest that this is an opportune time for clinical application of behavioral measures which previously have been used extensively in clinical investigation.

References


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