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LANGUAGE DEFICITS IN BOYS WITH ADHD

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SUMMARY

ADHD (Attention deficit hyperactivity disorder) is a common neurodevelopmental disorder. Children with ADHD have many cognitive and behavioral problems, associated with poor inhibition mechanisms, impulsivity, ineffective attention processes, and poor motor control. The aim of this study was to assess language deficits in a group of 60 boys with ADHD, compared to 30 healthy controls. The results suggest mild or moderate language problems, consisting in failed word choice and selection, lack of inhibition of inadequate memories, and increased susceptibility to interference, related to ADHD.

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a common neurodevelopmental disorder. An estimated 3-5% of American pupils, 8% of Puerto Rican children, and 6% of Polish children have symptoms of this disorder (APA, 1994; Canino et al., 2004; Kashala et al., 2005).

ADHD is characterized by three main group of symptoms – inattention, hyperactivity, and impulsivity, which are developmentally inappropriate. (Inoue et al., 1996; Barkley, 1997).

Tannock (2005) called attention to the language manifestation of this syndrome. Sustained attention disturbances cause inappropriate verbal responses, frequent changes of topic, problems with listening, and noncompliance with non verbal conversation rules. Also characteristic for the speech of ADHD children are overly quick responses and difficulties in dealing with pauses.

The etiology of this disorder remains unclear, but there is evidence for a significant genetic factor (Faraone et al., 2000; Slaats-Willemse et al., 2003; Knutsi & Stevenson, 2001).

Children with symptoms of ADHD present a diverse group of behavioral problems, lower school achievement, frequent mood disorders, and lower re-

sults on quality of life questionnaires (Rodriguez et al., 2007; McGough et al., 2005; Varni & Burnwikle, 2006). The co-occurrence of hyperkinetic disorders and reading disability is often observed, ranging from 15% to 45% (Biederman et al., 1991; Semrud-Clickeman et al., 1992). The lack of inhibitory mechanisms is a key symptom the in ADHD model created by Barkley (1997), with a negative impact on working memory, self-regulation of affect-motivation-arousal, internalization of speech, and reconstitution processes.

Many researches have described language disturbances among ADHD children. Difficulties in sentence imitation, word articulation, speaking ratio, and overall speech and language efficiency have been mentioned. Barkley et al. (1998) specified several symptoms, such as delayed onset of language, speech impairment, poor discourse organization, impaired verbal problem solving, coexistence of central auditory processing disorder, poor rule-governed behavior, and delayed speech internalization. A disproportion has been observed between pragmatic behavior during conversation and pragmatic knowledge (Kim & Kaiser, 2000), as well as problems with organized forms of discourse, including especially incoherence and chaos in spoken and written forms (Munir et al., 1987; Kołakowski et al., 2007). The syntactic problems displayed by ADHD children have been described by other authors (Oram et al., 1999). More impulsive children have a tendency to build simpler syntactic constructions and use inappropriate words. Some researchers have described difficulties in differential diagnosis between ADHD and aother neurodevelopment disorders, such as CAPD (Central Auditory Processing Disorders) (Borkowska, 2000; Riccio et al., 1994).

Other studies, which were concentrated on the inhibition processes underlying hyperkinetic disorder, found some relationships between ADHD and the phonological difficulties characteristic of children with reading disorders (Purvis & Tannock, 2000; Hynd et al., 1995).

The relationship between ADHD and various language impairments is under discussion. Various authors have described comorbidity of language disorders and symptoms of hyperkinetic disorders (Tentnowski, 2004; Ricci, 1993; Borkowska, 2000). Some authors underline working memory problems as the origin of language deficits among ADHD patients (Wolańczyk, Kołakowski, Skotnicka, 1999; Oram et al., 1998).

The purpose of my research was to study neuropsychological deficits among boys suffering from ADHD; the present paper will be concentrated on their language deficits.

MATERIAL AND METHODS

Sixty previously untreated boys with newly diagnosed ADHD (clinical group) and 30 healthy controls, all aged between 8 and 16 years of age, were enrolled. All of them were native Polish speakers. None had an IQ below 79 points (WISC-R).

In the clinical group, the diagnosis of ADHD was confirmed with a structured parental interview (ICD 10 and DSM IV criteria) and teacher reports. Boys with a history of traumatic brain injury, structural brain malformation, central nervous system illness, symptoms of Asperger or Tourrete syndrome, PTSD, psychosis, severe language delay (ICD 10 F 80 criteria), deafness, blindness, or severe somatic disorders were excluded..

The clinical group was divided in two subgroups: ADHD combined type (called ADHD-C) - 46 boys, ADHD inattentive type (called ADHD-I) – 13 boys. Only one person had hyperactive type ADHD.

Coexisting oppositional defiant disorder (ODD) was diagnosed in 19 boys with ADHD-C, but only in 2 from the ADHD-I group (Fig. 1).

The control group consisted of 30 healthy boys, with no symptoms of ADHD according to ICD 10 and DSM IV criteria.

All these boys were tested individually in one session. (lasting 1.3-2 hours). We used several methods, making up an experimental test battery:

1. Full scale WISC-R: Arithmetic, Comprehension, Similarities, Vocabulary, Digit Recall, Picture Completion, Picture Arrangement, Digit Symbols, Block Design, Labyrinths (Wechsler 1974; Matczak, Piotrowska & Ciarkowka 1997);
2. An experimental memory test - a short story from the Łucki Battery for the Diagnosis of Brain Damaged Patients (Łucki 1995);
3. The writing sentence from the Łucki Battery for the Diagnosis of Brain Damaged Patients (Łucki 1995);
4. An experimental Polish version of Stroop test (prepared by Szymańska, Stroop – Victoria Modification, Regard, 1981 by Strauss, Shermann & Spreen 2006);
5. A modified version of the Verbal Fluency Test (semantic category: animals, combined semantic and phonological category: objects beginning with K").
6. Narration (the "Cowboy" story from the Picture Arrangement subtest of the WAIS-R).

The test results were evaluated on quantitatively and qualitatively. The scores for all WISC-R subtests (Vocabulary, Similarities, Comprehension, Arithmetic) were estimated with the traditional shift, and the total number of errors and omissions was assessed. The performance time for each set and the number of errors was estimated for th eStroop Test. On the Fluency test, we assessed the number of correct nouns in the first 30 seconds, the total

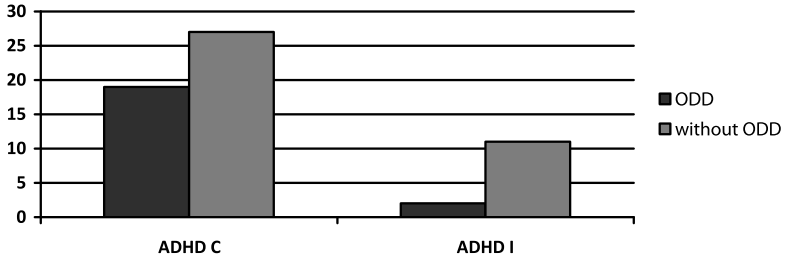

Fig. 1. Coexistence of ADHD and ODD symptoms in the various subgroups

number of correct nouns in 60 seconds, the number of errors, and the number of repetitions. The parameters used to calculate the score for short story recall included the number of correct responses, and the number and types of errors (omission, substitution, perseveration, contamination, translocation, confabulation). The presence or absence of discourse planning, the identification of the hero, the number of sentences, and grammatical errors were described in discourse analysis ("Cowboy Story").

RESULTS

Substantial differences between the control and ADHD groups, as a whole, were confirmed for global IQ ($t = 3.8$; $p = 0.000$), verbal IQ ($t = 5.2$; $p = 0.000$) and nonverbal IQ ($t = 3.3$; $p = 0.000$; Fig. 2).

This was also true for the number of errors in the Stroop test (Fig. 3). The ADHD group performed significantly worse across all three crucial sets:

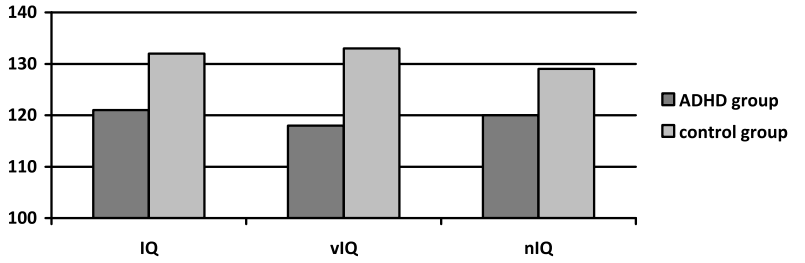

Fig. 2. WISC R results in ADHD boys

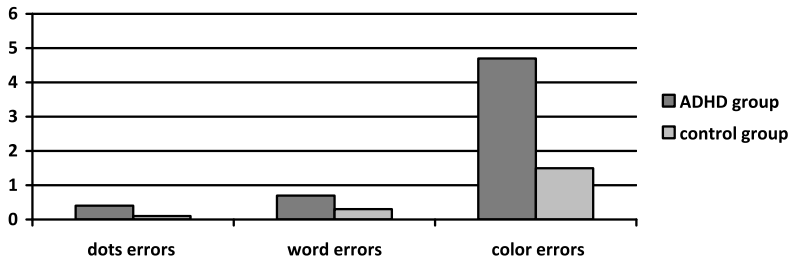

Fig. 3. Error analysis in the Stroop subtests

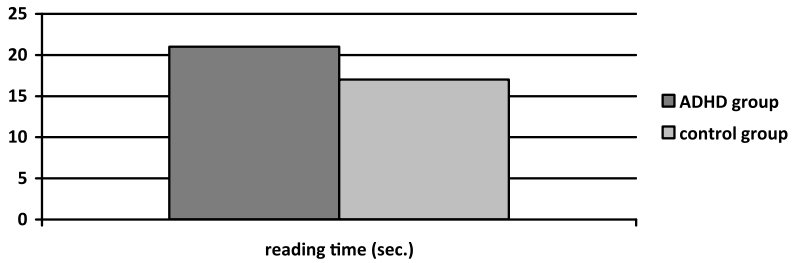

Fig. 4. Reading subtest of the Stroop Test – time differences

- naming the color of dots (t = 2.2; p = 0.027);
- naming the color of simple words (t = 2.3; p = 0.024);
- naming the color of color-words (t = 4.9; p = 0.000).

There were no statistically significant differences for the number of errors between the control and ADHD group in the reading item set, but the performance time differed significantly: the hyperactive boys were slower than the controls (t = 2.0; p = 0.040; Fig. 4).

The ADHD group had poorer results in the verbal fluency tests, especially on semantic category (t = 1.0; p = 0.030) and in the first 30 seconds (t = 3.5; p = 0.000; Fig. 5).

They also gave more wrong answers in the Similarities and Comprehension subtests of the WISC -R (t = 3.3; p = 0.001; t = 3.3; p = 0.001) and fewer two-point answers in Vocabulary and Comprehension (t = 2.3; p = 0.020; t = 2.2; p = 0.030) than controls.

The ADHD group also performed worse on the Digits Span, both forward and backward (t = 3.0; p = 0.003; t = 3.7; p = 0.003), but there were no statistically significant differences between groups in the story recall item and narration (Fig. 6).

Statistical analyses of both the two ADHD subgroups and the controls indicated significant age differences among them. The ADHD-I group turned out to be older than controls and ADHD-C group (t = 2.3; p = 0.020; t = 2.1; p = 0.036), therefore it was excluded from further analyses (Fig. 7).

The results can be summarized as follows:

- The ADHD-C group performed worse than controls across all the verbal subtests of WISC-R: Similarities (t = 2.5; p = 0.016), Arithmetic (t = 2.5;

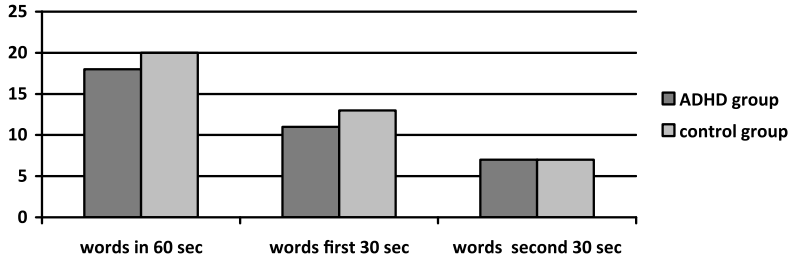

Fig. 5. Semantic category, verbal fluency test: differences between groups

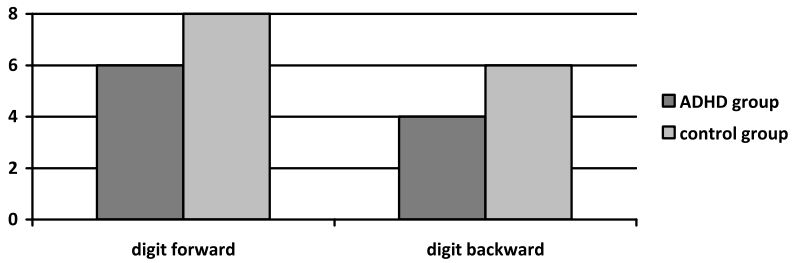

Fig. 6. Digit Span differences

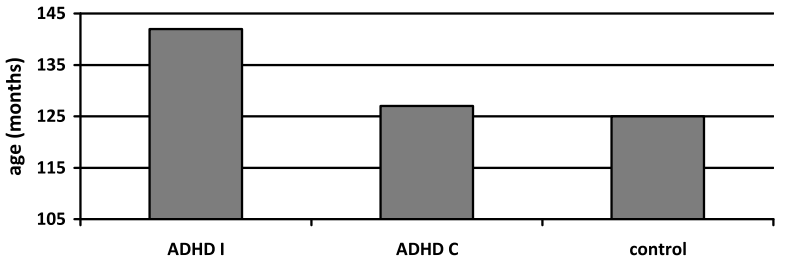

Fig. 7. Differences in age between the ADHD subgroups and the control group

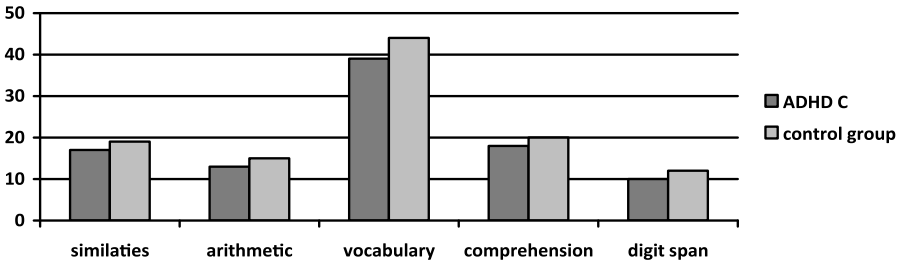

Fig. 8. Raw score differences on the WISC-R verbal subtests among groups

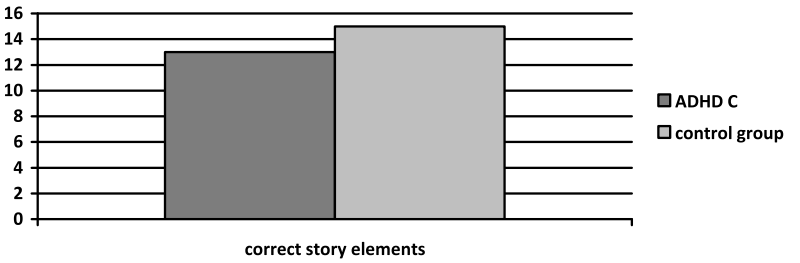

Fig. 9. Correct story recall elements, group differences

p = 0.010); Vocabulary (t = 2.2; p = 0.030), Comprehension (t = 2.5; p = 0.014), Digit Span forward and backward (t = 2.5; p = 0.010; t = 3.4; p = 0.001; Fig. 8).

- The ADHD-C group gave more wrong answers in Similarities (t = 3.2; p = 0.001) and Comprehension (t = 2.5; p = 0.014).
- The ADHD-C group gave fewer two-point answers in both the Vocabulary and Comprehension subtests (t = 2.9; p = 0.050; t = 2.5; p = 0.014).
- The ADHD-C group obtained worse results on short-story recall (t = 2.02, p=0.04) and made more omission errors (t = 2.2; p = 0.020; Fig. 9).

DISCUSSION

This study confirmed the presence of various language disturbances in ADHD children. The ADHD boys can be less communicative, have more difficulties in finding appropriate words and planning their utterances. They

answered more quickly, often impulsively, and made more errors than their healthy colleagues. These difficulties may be one of the reasons for their social problems. Conversation failure can be due to inappropriate compensatory strategies (Bruce, Thernlund & Netterbladt, 2005; Westby & Cutler, 1994).

Language deficits are correlated with poor inhibitory processes. The boys with ADHD-C in our sample did worse overall on the neuropsychological test-battery than did controls (ADHD-I boys achieved results almost like those of the control group).These findings confirm Barkley's model of how the inhibitory process affects the development of an appropriate internalization of speech, self-regulation and reconstitution of reality, and social rules (Barkley, 1997). Boys with clinical inhibitory deficits have more problems in many of their cognitive processes, and achieve lower results on intelligence scales (Crosbie & Schachar 2001). An interesting complement to Barkley's concept was proposed by Herba and colleagues (2006), who described three domains of inhibitory processes: motor, language and cognitive (interference control). Deficits due to problems with appropriate self-control of behavior are typical for ADHD and oppositional defiant behavior.

Additional results confirmed the hypothesis of an attention, but not inhibitory etiology for ADHD cognitive deficits (Martinussen & Tannock, 2006). Even though the ADHD-I group was the oldest, boys with inattention symptoms (ADHD-I) performed all verbal tests comparable to controls. Although in this study the ADHD boys as a group did not significantly differ from the controls in the narrative task, there were some boys with severe discourse disturbances. One presented a telegraphic style: "Cowboy. Cowboy. Storekeeper. Cowboy.", "A man come. A man give him. A man take some money." These narrative difficulties among the ADHD group confirm earlier findings about discourse deficits in ADHD (Munir et al., 1987; Kaiser & Kim, 2000).

Some authors underline the important role of language impairment on therapy, and suggest the necessity to perform a language competence evaluation before therapy is undertaken (Cohen et al. 2000).

Another line for future research could be similarities between ADHD language disturbances and deficits in persons with right hemisphere damage. (Łojek, Skotnicka & Bryan, 1999; Kolałkowski et al., 2007).

CONCLUSIONS

The assessment and recognition of verbal dysfunctions due to ADHD, including both pragmatic and narrative aspects of language processing, should be an important aim for future studies: first of all, to establish the underlying mechanisms of ADHD disorders (inhibitory or attention deficits); secondly, to create an appropriate algorithm of treatment for children manifesting both language deficits and hyperactivity.

Contemporary therapeutic methods, based on normal verbal abilities of clients, may be less effective for persons with verbal deficits. This suggests the

necessity of verbal skill training or rehabilitation in some persons with ADHD, to improve not only the efficacy of the treatment, but the quality of life as well.

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