Language Deficit With Attention-Deficit Disorder: A Prevalent Comorbidity

Emanuel Tirosh and Ayala Cohen

J Child Neurol 1998 13: 493
DOI: 10.1177/088307389801301005

Original Article

Language Deficit With Attention-Deficit Disorder: A Prevalent Comorbidity

Emanuel Tirosh, MD; Ayala Cohen, PhD

ABSTRACT

The aim of this study was to delineate the prevalence and behavioral patterns of children with attention-deficit and language problems as compared to children with attention-deficit hyperactivity disorder (ADHD) only. Out of a cohort of 3208 children 6 to 11 years old, 5.2% were identified as having a primary ADHD. A teacher's behavioral questionnaire, pediatric interview and assessment, IQ, attention tests, and language evaluation were employed. A 45% rate of language problems was identified. This comorbidity is more prevalent among girls ($P = .02$). Sequencing and short-term memory were significantly related to attention-deficit and language problems, but the attention scores were not. Language performance was the best predictor of group assignment and was superior to IQ in that regard. Correlation analysis revealed a different behavioral pattern for the two groups. It appears that a significant proportion of children with ADHD have a language comorbidity not reflected by IQ assessments; therefore, language tests should be considered as part of their routine assessment. Children with attention-deficit and language problems appear to have a different neurocognitive pattern underlying their problems as compared with their peers with ADHD only. (*J Child Neurol* 1998;13:493–497).

Attention-deficit hyperactivity disorder (ADHD) is the most prevalent behavioral disorder in childhood.[1] Comorbidities such as conduct disorder, oppositional-defiant disorder, anxiety, and depressive and mood disorders as well as learning disabilities are well acknowledged.[2,3] The association of attention deficit and language deficits also has been documented. Psychiatric problems among children with a primary language disorder[4–11] and, conversely, language deficits among children with psychiatric disorders[12–16] were repeatedly reported. However, as previously suggested, most of the literature concerns biased clinical samples and fails to control for intervening factors such as intelligence.[17] The scope of the present study was therefore to investigate children with ADHD and no other behavioral comorbidities.

It has been suggested that in intellectually normal individuals, inferior language abilities may relate more to neurocognitive functions other than language (eg, short-term memory and processing speed).[18] However, when children with attention deficit were compared with children with attention deficit and reading disability, IQ was not found to have a main effect.[19] It was suggested that memory was related both to attention[14,20–22] and language functions.[22,23–26]

The hypotheses for the present research were the following:

1. Children with ADHD (with no other behavioral comorbidity) have a high prevalence of attention-deficit and language problems.
2. This association is not necessarily mediated by IQ.
3. Children with attention-deficit and language difficulties present a different behavioral pattern than children with attention deficit and no language difficulty.
4. Short-term memory is less optimal among children with both attention-deficit and language difficulty, as compared to children with attention deficit only.

METHOD

Sample

Stage 1: Between October 1992 and September 1993, teachers of three primary regular schools in Haifa, located in three different socioeconomic regions, were approached. Each teacher was requested to identify children with attention deficit (with or with-

Received August 7, 1997. Accepted for publication Sept 3, 1997.

From the Hannah Khoushy Child Development Center, Bnai Zion Medical Center, and the Bruce Rappaport Faculty of Medicine (Dr Tirosh) and the Faculty of Industrial Engineering and Management and the Statistical Laboratory, Technion Israel Institute of Technology (Dr Cohen), Haifa, Israel.

Address correspondence to Dr Emanuel Tirosh, the Hannah Khoushy Child Development Center, Bnai Zion Medical Center, PO Box 4940, Haifa, Israel.

out comorbidities), employing a questionnaire designed for the study (see measurements). Only children who met the *Diagnostic and Statistical Manual of Mental Disorders-III-Revised* (*DSM-III-R*) criteria for ADHD were included; their parents were approached.

Stage 2: Out of 3208 students between the ages of 6 years and 11 years, 166 (5.2%) were identified by the teachers as having primary attention problems with no other behavioral comorbidities. Data concerning 148 (4.6%) children with other identified physical or psychiatric comorbidities were not accessible for ethical reasons. Of the 166 children, 27 (16.2%) were already medicated and 5 of these participated in the study. The 22 medicated children who were excluded (81.8% were boys) were followed and treated with different medications for different periods of time, and therefore discontinuation of treatment was not advised by their parents or physicians. The other five medicated children were treated with short-acting methylphenidate and their parents were asked to discontinue their medication for the assessments and to participate in the study. Parents of 24 (14%) children did not give consent for their children to participate in the study.

Stage 3: The remaining 120 children and their parents were interviewed and assessed. Nineteen (15.5%) were diagnosed as having other behavioral comorbidities (n = 16; 13 boys; 3 girls) or data was missing (n = 3) and therefore were excluded from the final analysis. Of the remaining 101 children, 78 (91%) were boys and 23 (9%) were girls. No child had a hearing deficit.

Measurements

1. Teachers' questionnaires. A screening questionnaire based on *DSM-III-R* criteria for ADHD or undifferentiated type criteria was used.[27] The questionnaire also included exclusion criteria such as known emotional-behavioral comorbidities, such as conduct disorder, anxiety disorder (*DSM-III-R* criteria), diagnosed learning deficit, and hearing deficit.
2. For a more comprehensive characterization of behavioral emotional attributes, the Hebrew version of the Aggregate Neurobehavioral Student Health and Educational Review (ANSER) system teachers' questionnaire[28] was employed. The questionnaire was translated into Hebrew and back into English and was administered to 545 teachers. An average of 92% test/retest reliability was established in a sub-sample of 80 teachers. This commonly used questionnaire[29,30] consists of two checklists: a 20-item questionnaire pertaining to attention-distractibility, impulsivity, and hyperactivity, and a second, 24-item scale pertaining to associated behaviors, 18 of which are similar to the original Rutter's children's behavior questionnaire.[31] The items represent the factors of antisocial and neurotic behaviors. The validity of these factors has been reported previously.[31,32]
3. An open pediatric interview with both the child and the parents was conducted and the following assessments were administered in a standardized order:
4. First session. Intelligence tests consisting of the Wechsler Intelligence Scale for Children (Revised)[33] or Wechsler Preschool and Primary Scale of Intelligence.[34]
5. Second session. A complete pediatric evaluation, ie, physical and neurologic examinations.
6. Third session. Attention tests including the Porteus Maze test[35] and Matching Familiar Figures test.[36]
7. Language tests were administered, including a phonologic processing test modified from the Goldman-Fristoe Woodcock Auditory Skills Test battery,[37] an expressive vocabulary test adapted from the vocabulary usage test,[38] which is an expressive adaptation of the Peabody Picture Vocabulary Test, a sentence comprehension/syntax test modified from the TROG test,[40] and a reading fluency test of three age-appropriate stories, 65–100 words long (the score consisted of the number of correctly read words over a period of 60 seconds).
8. Verbal auditory sequential memory was evaluated with a test modified from the auditory attention span for unrelated words section of the Detroit Test of Learning Aptitude.[41] This test evaluates short-term auditory memory abilities for unrelated words. The digit span test was adapted from the Stanford-Binet Intelligence Scale.[42]
9. Text recall was tested using the three aforementioned texts. The score reflected the number of concepts recalled by the child out of the total number of the text concepts. Pragmatics were evaluated by the speech pathologist from a free speech sample and classified as a "yes" or "no" problem.

Analysis

The statistical analysis system[43] was used for data analysis. The following statistical tests were employed: For the analysis of normally distributed data, the t-test was used. As the Hebrew versions of the linguistic tests are not standardized, data were converted to standard scores.

Previous research indicates that the usual standardized approach for language deficit is associated with a high false negative identification rate (type-2 errors)[18] and as an intra-group analysis was employed, a group 1 SD below mean was used as a cut-off score. Chi-square was used for categorical data. The IQ, verbal sequencing, and attention test variables were subject to logistic regression procedures with the child's language status (yes/no problem) as the dependent variable. Each of the 44×56 pairs (one child of each of the study groups) was compared. If the fitted logistic model predicted a higher probability for the child with ADHD to be in this category, the pair is considered concordant. For the purpose of delineating a possible difference in behavioral patterns between the two language groups, ANSER behavioral items of the two groups were subject to Pearson product moment correlation and their results were compared. The relatively small number of girls and their disproportionate distribution in the two groups could bias the results. Therefore this analysis was employed for boys only.

RESULTS

Forty-five percent of the students participating in the project were identified as having at least one compromised language function (Table 1). The gender distribution indicates that the relative proportion of girls with attention-deficit and language problems was significantly higher than that for boys (Table 2). At the time of referral, the children in the attention-deficit and language problems group were older than the children of the ADHD group (9 years, 1.4 SD, and 8.2 years, 1.4 SD, respectively; $T = 2.4$, $P = .01$).

Table 1. Type and Rate of Different Language Deficits*

Type	*%*
Vocabulary	10
Syntax	26
Phonetic	
Expressive	4
Receptive	11
Reading fluency	29
Text recall	27
Pragmatic	16

(N = 101).
*Individual children may have more than one deficit.

Table 3. Summary of Regression Analysis for Diagnostic Category* (for Attention-Deficit Hyperactivity Disorder/Attention-Deficit with Language Deficit)

Item (1 SD or more below mean)	*Wald Statistics*	*P*	*Odds Ratio*
Reading fluency	16.7	< .001	136.5
Text recall	13.7	< .001	98.5
Pragmatic	8.7	.003	57.4

*IQ and language variables included in the procedure.
Odds ratio of those for whom the binary independent variable is 1 SD or more below mean, to be in the ADLAD group is "OR" times higher than for the others.
Predicted probability and observed responses: concordant 94.9%; discordant 4%.

Wechsler Full-Scale IQ was found to be statistically lower in the attention-deficit and language problems group as compared to the ADHD-only group (104.9, 6.1 SD, and 107.6, 5.7 SD, respectively, $P = .02$). Similarly, Wechsler Verbal IQ was lower among attention-deficit and language problem children (101.0, 6.1 SD) as compared to ADHD children (106.9, 5.9 SD; $P < .001$). Yet these differences were not considered of clinical significance. No difference was found for Wechsler Performance IQ (107.5, 7.1 SD, and 108.9, 7.9 SD, for attention-deficit and language problem and ADHD children, respectively). The identification rate of language problems as detected by Verbal IQ of 1 SD or more below mean and employing language tests as a gold standard reveals a high false negative rate (positive predictive value 39%, negative predictive value 66%).

Short-term memory appears to be lower among students with attention-deficit and language problems as compared to their ADHD peers, ie, verbal sequential recall was significantly compromised among children with attention-deficit and language problems (31 of 45 scored 1 SD or more below the mean, as compared to 15 of 56 among the ADHD children; χ^2 17 $P < .001$). Text recall also was lower (26 of 45 and 1 of 55 scored 1 SD or more below the mean among attention-deficit and language problem and ADHD children, respectively; χ^2 39.3, $P = .001$). The comparison of the attention test results of the two groups revealed no significant statistical differences ($\chi^2 = 0.85$, P = NS). However, more children with ADHD failed the Matching Familiar Figures test (25 of 56), as compared to the attention-deficit and language problems group (16 of 45). This test also revealed no significant difference between the two groups both for the errors and for the latency percentile rank.

The behavioral characterization of the boys with and without language problems was subject to correlation analysis. The comparison of the behavioral patterns in the two groups reveals significant differences, for example, significant correlations were found between "is slow to take up new tasks" and "has much variation in mood" ($r = 0.4$, $P = .006$), "stares for long periods" ($r = 0.5$, $P < .001$) and "seems underactive" ($r = 0.7$, $P < .001$) among the attention-deficit and language problem but not the ADHD children. Significant correlations between "seems to have too much energy" and "seems to do things without thinking" ($r = 0.4$, $P < .001$) and "learns best on one-to-one basis" ($r = 0.4$, $P < .001$) were found among children with ADHD but not among those with attention-deficit and language problems. The logistic regression procedure including IQ and the six language variables revealed that IQ variables were not statistically significant (Table 3).

Table 2. Diagnostic Category as Related to Gender*

	Gender		
Category	*Boys N (%)*	*Girls N (%)*	*Total N (%)*
ADHD	48 (85.8)	8 (14.2)	56 (100)
ADLAD	30 (66.6)	15 (33.3)	45 (100)
Total	78 (77.2)	23 (22.8)	101 (100)

*χ^2 4.9, $P = .02$.
ADHD = attention-deficit hyperactivity disorder; ADLAD = attention-deficit with language deficit.

DISCUSSION

The first hypothesis of this study pertained to the prevalence of language deficits among children with attention-deficit disorder. The high proportion of children (45%) who were identified as having a language deficit is probably also affected by a nonconservative criteria (ie, 1 SD or more below mean) and the employment of a multimeasure approach.

The rate of language deficit in the present cohort is in line with previously reported rates of language deficits among children with ADHD and other psychiatric morbidities.[12,15] However, these studies focused on a clinical population. Conversely, an increased risk of behavioral and emotional problems among children with language disorders was also repeatedly reported.[6,7] Both types of studies indicate a comorbidity prevalence of between 40% and 50%. The more specific link between attention deficit and language deficit among girls is in line with the finding reported by Berry et al.[13] However, the disproportionate number of boys excluded from the present study possibly has biased this result. Unlike a previous report of a predominant pragmatic deficit,[16] this study documented a high rate of syntactic lex-

ical deficit. A similar distribution of subtypes of language problems among children with ADHD was reported by Cohen et al.[15] It should be noted that children with other behavioral comorbidities were excluded from this cohort and thus the prevalence of language deficit is possibly under- or overpresented. It is also possible that a different methodology (ie, teacher-identified versus assessment) contributed to the difference in the results. In agreement with the results reported by Humphries et al,[16] a low rate of articulation problem was evident.

As hypothesized, the regression analysis demonstrates that language deficit is significantly related to attention deficit above and beyond the effect of IQ. This result corroborates previous reports of an identified subgroup of children with ADHD who also present with a deficit in vocabulary, word decoding, and short-term sequential memory[14] and reading disabilities[19] independent of their IQs. Research pertaining to the relationship between language and cognitive functions demonstrates that syntax, among other aspects of language, is dissociable from cognition, whereas semantics, pragmatics, and higher order language reasoning are not.[18] The link between different linguistic processes and short-term memory, as opposed to long-term memory, which is more specifically related to cognitive–semantic functions, has been previously suggested.[26] A neuropsychologic model integrating phonologic processing, attention, and memory also has been formulated.[44] Our results lend support to a more extensive model, including other language processes. The third hypothesis of two distinctly different behavioral patterns among children with ADHD, with and without language deficit, has been partly supported by the results of the present study. Whereas some of the characteristics, as delineated by the ANSER system, are similarly correlated in either group, a number of behaviors are typically interrelated in one diagnostic category, but not the other. This result should be treated with caution, as a child's sex and language deficit possibly have an interactive effect on behavioral outcome.

The difference in behavioral patterns between children with ADHD and those with attention-deficit and language problems has been demonstrated previously.[15,16] However, when only central auditory processing was employed for language classification, the difference in behavioral pattern was not observed.[10]

Furthermore, in this latter investigation the cohort under study was referred for different language problems; therefore, results of the two studies cannot be compared.

The heterogeneity in the clinical presentation of children with attention deficit has been demonstrated repeatedly in the literature[45–47] and extensively discussed.[48] These studies focused mainly on the difference in the behavioral and cognitive styles of the two groups. However, these cohorts were assembled mainly from clinical set-ups. In their extensive reviews, Shaywitz et al[49] discuss the diversity of children with attention deficit. It appears that the children with language deficit as defined in this investigation (not necessarily diagnosed as having a specific learning problem) show behavioral similarities with children identified as having attention deficit and learning disabilities.[48]

Finally, this study also provides some evidence for the validity of the ANSER system. The teachers' questionnaires appear to be sensitive enough to distinguish between the two types of attention-deficit children, those with and without language deficit.

In conclusion, the present study, by employing a representative sample of children and a multimeasure approach, provides further evidence to the not fully acknowledged subcategories of attention-deficit disorder. It is therefore advisable to carefully assess language functions in every child who is referred for attention problems and provide each child with proper intervention if deemed necessary. As externalizing behaviors appear to be less typical of these children, a special effort for early diagnosis might be needed.

Acknowledgment

We are indebted to the staff of the Hannah Khoushy Child Development Center and the Haifa Learning Remediation Center for their cooperation and involvement in this project. We are also indebted to Mrs Rivka Abiry for her help in the preparation of this manuscript.

References

1. Szatmari P: The epidemiology of attention deficit hyperactivity disorder. *Child Adolesc Psychiatr Clin N Am* 1992;1:361–371.
2. Biederman J, Newcorn J, Sprich S: Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety and other disorders. *Am J Psychiatry* 1991;148:564–577.
3. Biederman J, Faraone SV, Lapey K: Comorbidity of diagnosis in attention-deficit hyperactivity disorder. *Child Adolesc Psychiatr Clin N Am* 1992;1:335–360.
4. Baker L, Cantwell DP: A clinical study of psychiatric problems in children with speech and language disorder, in Nelson KE (ed): *Children's Language.* London, Lawrence Erlbaum Assoc, 1982, pp 295–322.
5. Stevenson J, Richman N, Graham P: Behavior problems and language abilities at three years and behavioral deviance at eight years. *J Child Psychol Psychiatry* 1988;26:215–230.
6. Beitchman JH, Nair R, Clegg M, et al: Prevalence of psychiatric disorders in children with speech and language disorder. *J Am Acad Child Psychiatry* 1986;25:528–535.
7. Cantwell DP, Baker L: Prevalence and type of psychiatric disorders and developmental disorders in three speech and language groups. *J Commun Disord* 1987;20:151–160.
8. Silva PA, Williams S, McGee R: A longitudinal study of children with developmental language delay at age three: Later intelligence, reading and behaviour problems. *Dev Med Child Neurol* 1987;29:630–640.
9. Haines C, Naidoo S: Correlates of language impairment, in children with specific speech impairment. *Clin Dev Med* 1991;119: 181–205.
10. Riccio CA, Hynd GW, Cohen MJ, et al: Comorbidity of central auditory processing disorder and attention-deficit hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry* 1994;33:849–857.
11. Chess S: Clinical differentiation among children with initial language complaints. *J Autism Child Schizophr* 1974;4:99–109.
12. Gualtieri CT, Koriath U, Van Bourgondien M, Saleeby N: Comorbidity of central auditory processing disorder and attention-deficit hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry* 1983;22:165–171.
13. Berry CA, Shaywitz JE, Shaywitz B: Girls with attention deficit disorder: A silent minority? A report on behavioral and cognitive characteristics. *Pediatrics* 1985;76:801–809.

14. August GJ, Garfinkel BC: Behavioral and cognitive subtypes of ADHD. *J Am Acad Child Adolesc Psychiatry* 1989;28:739–748.
15. Cohen NJ, Davine M, Meloche-Kerry M: Prevalence of unsuspected language disorders in a child psychiatric population. *J Am Acad Child Adolesc Psychiatry* 1989;28:107–111.
16. Humphries T, Kaltun H, Malone M, Roberts W: Teacher-identified oral language disabilities among boys with attention problems. *J Dev Behav Pediatr* 1994;15:92–98.
17. Baker L, Cantwell DP: Language acquisition, cognitive development and emotional disorder in childhood, in Nelson KE (ed): *Children's Language.* London, Lawrence Erlbaum Assoc, 1982, pp 286–321.
18. Montgomery JAW: Easily overlooked language disabilities during childhood and adolescence. A cognitive linguistic perspective, in Christophersen ER, Levine MD (eds): Developmental behavior: Older children and adolescents. *Pediatr Clin N Am* 1992;39: 513–529.
19. Dykman RA, Ackerman PT: Attention deficit disorder and specific reading disability: Separate but often overlapping disorders. *J Learn Disabil* 1991;24:96–103.
20. Silver LB: The relationship between learning disabilities, hyperactivity, distractibility and behavioral problems. *J Am Acad Child Adolesc Psychiatry* 1981;20:385–397.
21. Barkley RA: Evaluation of hyperactive children: Observational methods and psychological tests, in Barkley RA (ed): *Attention Deficit Hyperactivity Disorder. A Handbook for Diagnosis and Treatment.* New York, Guilford Press, 1992, pp 146–188.
22. Diamond A: The development and neural bases of higher cognitive functions. *Ann N Y Acad Sci* 1990;608.
23. Swisler LP, Sarno MT: Token test scores of three matched patient groups: Left brain damaged with asphasia, right brain damaged without aphasia, non brain damaged. *Cortex* 1969;5:264–273.
24. Conrad R: The developmental role of vocalizing in short-term memory. *J Veren Learn Verbal Behav* 1972;11:521–533.
25. Goldman PS: Development and plasticity of frontal associations in the infants human primates, in Ludlow CL, Doran-Quine E (eds): *The Neurological Basis of Language Disorders in Children: Methods and Directions for Research,* NINCP research monograph No 22. Baltimore, NIH Publications, 1979.
26. Wiig EH, Semel EM: The nature of language deficits in learning disabilities, in *Language Disabilities in Children and Adolescents.* Colombus, Charles E Marrill Publishing, 1976.
27. American Psychiatric Association: *Diagnostic and Statistical Manual of Mental Disorders,* 3rd ed. Washington, DC, American Psychiatric Association, 1980.
28. Levine MD: *The ANSER System (Aggregate Neurobehavioral Student Health and Educational Review).* Cambridge, MA, Educators Publishing Service, 1984.
29. Kelly DP, Aylword GP: Attention deficits in school-aged children and adolescents. Current issues and practice. *Pediatr Clin N Am* 1992;39:482–512.
30. Levine MD: Attention and dysfunction, in Levin MD, Carry WB, Crocker AC (eds): *Developmental-Behavioral Pediatrics,* 2nd ed. London, WB Saunders, 1992, pp 468–476.
31. Rutter M: A children's behavior questionnaire for completion by teachers: Preliminary findings. *J Child Psychol Psychiatry* 1967;8:1–11.
32. Venables PH, Fletcher RP, Palais JC, et al: Factor structure of the Rutter children's behavior questionnaire in a primary school population in a developing country. *J Child Psychol Psychiatry* 1983;24:213–222.
33. Wechsler D: *The Wechsler Intelligence Scale for Children,* revised. New York, Psychological Corp, 1974.
34. Wechsler D: *Wechsler Preschool and Primary Scale for Intelligence.* New York, Psychological Corp, 1967.
35. Porteus SD: *Porteus Maze Test: Fifty Years Application.* Palo Alto, Pacific Books, 1965.
36. Kagan J, Rosman BL, Day D, et al: Information processing in the child, significance of analytic and reflective attitudes. *Psychol Monographs* 1964;78.
37. Woodcock RW: *Goldman-Fristoe-Woodcock Auditory Skills Test Battery.* Circle Pines, MN, American Guidance Service, 1976.
38. Nation JEA: Vocabulary usage test. *J Psycholinguist Res* 1972;11: 221–231.
39. Dunn LM: *Peabody Picture Vocabulary Test Manual.* Circle Pines, MN, American Guidance Service, 1965.
40. Bishop D: *TROG-Test for Reception of Grammar.* Medical Research Council Oxford Chapel Press, 1982.
41. Hammill DD: *Detroit Test of Learning Aptitude.* Austin, Pro-Ed, 1985.
42. Binet A: *Stanford-Binet Intelligence Scale,* 3rd ed. Chicago, Rivereside, 1973.
43. SAS-Institute Inc: *SAS User's Guide Statistics,* version 5, revised. Cary, NC, SAS Institute, 1986.
44. Swanson HL: Phonological processes and other routes. *J Learn Disabil* 1989;22:493–497.
45. Lahey BB, Pelham WE, Schaghency EA, et al: Dimensions and types of attention deficit disorder. *J Am Acad Child Adolesc Psychiatry* 1988;3:330–335.
46. Hynd GW, Lorys AR, Semrud-Clikeman M, et al: Attention deficit disorder without hyperactivity: A distinct behavioral and neurocognitive syndrome. *J Child Neurol* 1991;6(Suppl):S37–S43.
47. Lahey PB, Carlson CL: Validity of the diagnostic category of attention deficit disorder without hyperactivity: A review of the literature. *J Learn Disabil* 1991;24:110–120.
48. Barkley RA: A critique of current diagnostic criteria for attention deficit hyperactivity disorder. A clinical and research implications. *J Dev Behav Pediatr* 1990;11:343–352.
49. Shaywitz BA, Fletcher JM, Shaywitz SE: Defining and classifying learning disabilities and attention-deficit/hyperactivity disorder. *J Child Neurol* 1995;10(Suppl 1):S50–S57.