Otitis Media: Precursor of Delayed Reading

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Objective: To investigate the connection between otitis media in the language acquisition years and the occurrence of delayed reading between the ages of 8 and 10.

Method: Participants were 40 children, half of whom had a history of otitis media between the ages of birth and three years and half who were free of the disease. These children, now ages 8–10, were tested with the WISC-R and a variety of reading measures.

Results: Children with a history of otitis media scored over a year below grade level in reading and significantly below controls on a variety of literacy measures as well as on the Verbal Comprehension factor on the WISC-R.

Conclusions: Children with early onset otitis media (birth to three years) tend to be at greater risk for delayed reading than age-matched controls.

Key words: otitis media; language acquisition; literacy; reading.

Otitis media (OME), an infection of the middle ear cavity, is one of the most common afflictions of childhood. OME is caused by an accumulation of fluid in the middle ear, and sound traveling through the ear canal is impeded. Most young patients experience a mild-to-moderate hearing loss during OME episodes, especially in the decibel range critical for discriminating speech sounds (Feagans, Sanyal, Henderson, Collier, & Applebaum, 1987; Friel-Patti, 1990). Hearing loss is usually temporary, but periods of impairment often persist for 6 to 24 months.

Lengthy periods of fluctuating sensitivity to speech sounds can delay early language development and impair the formation of linguistic categories (Berko-Gleason, 1983; Friel-Patti, Finitzo, Formby, & Brown, 1987). The stable auditory basis for constructing the rules and vocabulary of language is interrupted as well (Menyuk, 1989). Finitzo, Gunnarson, and Clark (1990) found that mild, fluctuating hearing loss during infancy disrupted both expressive and receptive language acquisition.

Auditory processing and language deficits resulting from early OME episodes can persist into the elementary school years, and children with a history of OME have been found to produce lower verbal than performance scores on the WISC-R (Zinkus, Gottlieb, & Schapiro, 1978; Zinkus & Gottlieb, 1980). Thus, language deficits are common among children who suffer repeated episodes of OME during early language acquisition (Bergstrom, 1980). Because learning to read draws heavily on language skills (Vellutino, 1987), repeated early OME episodes during early language acquisition might well be a precursor of delayed reading. Thus, we posed the following hypothesis.

Children who experienced multiple OME episodes during primary language acquisition will find learning to read more difficult than age-matched peers who were free of this disorder. That is, children with a history of OME should perform worse
on measures of basic reading skills—phonology and verbal comprehension—than nonotitic age-mates.

Method

Participants

Participants were 40 second, third, fourth, and fifth graders, 28 boys and 12 girls, between the ages of eight and ten. The children were mostly (98%) Caucasian, and all lived in suburban and rural neighborhoods near the University of Virginia. Half had a history of repeated episodes of OME before age three; the others served as matched controls.

Measures

Wechsler Intelligence Scale for Children-Revised. The Wechsler Intelligence Scale for Children-Revised (WISC-R) was used to assess the overall intellectual strengths and weaknesses of the participants (Wechsler, 1974; the WISC-III was unavailable at the time of testing). In addition to a full scale IQ score, the WISC-R yields three factor-analytically distinct scores: Verbal Comprehension (VC), Perceptual Organization (PO), and Freedom from Distractibility (FFD).

Word Recognition in Isolation. To assess word recognition in isolation (WRI), the child is presented with word lists, each containing words at a common grade level. The primer level list is shown first, then progressively more difficult word lists are presented until the child fails to recognize 25% of the words on the list. Two WRI scores are generated, one timed (for about 1/4 second), the other untimed. In practice, the timed and untimed scales are highly correlated and will, in this study, be combined into a single WRI scale.

Word Recognition in Context. Word recognition in context (WRC) is assessed by instructing respondents to read aloud from a series of graded passages. The child is given progressively more difficult word lists until more than 10% of the words are read incorrectly (Stauffer, Abrams, & Pikulski, 1978). The WRC score represents the highest grade level passage the child is able to read in context with at least 90% accuracy.

Hearing Capacity. Hearing capacity (HC) refers to the highest grade level a child can comprehend when freed from the constraints of print. The examiner reads passages aloud rather than requiring the child to do so. Passages of progressively more advanced grade levels are read, and each is scored for comprehension accuracy. The HC score represents the highest grade level the child comprehends with more than 70% accuracy.

Diagnostic Test of Phonic Skills. The Diagnostic Test of Phonic Skills (DTPS) was used to assess phonetic capability (Bryant, 1963). Respondents were asked to pronounce nonsense words constructed according to commonly understood rules of English phonics. Because DTPS items are not in anyone’s sight vocabulary, they assess tacit phonetic knowledge. Monosyllabic and polysyllabic word scores were combined into a single score representing the number of words correctly pronounced.

Spelling. To test for spelling proficiency, the Schlagal Spelling Inventory (Form A) was administered (Schlagal, 1982; Zutell, 1994). The inventory contains words culled from basal readers across grade levels that illustrate targeted orthographic features. When a child’s grade level score slips below 50%, the test is terminated. In this study, a score was obtained by counting the total number of correctly spelled words.

Reading Level. All the data collected from the literacy measures were given to three professionals in the field of reading: two reading professors and the senior author. Based on this information, each independently rated the overall reading level of the participants. There was high agreement among the judges (98%). After the initial ratings, the three met as a committee to assign a single set of reading level designations.

Procedures

Thirty children with four or more diagnosed episodes of OME before the age of three were identified by a pediatric otolaryngologist. The senior author contacted the parents of these children to enlist their child’s participation and collect information about occupation and level of education. Initially, 22 parents volunteered their children. One girl suffered from mild cerebral palsy and another had recently experienced a severe emotional trauma. Both were excluded from the study. Based on information about parental occupation and level of education, socioeconomic status (SES) was then assessed on the remaining 20 participants using procedures detailed by Hollingshead (1957).

Control participants were solicited by letter through the public schools. The letter explained the
nature of the study as well as criteria for inclusion and promised a free educational evaluation. To be included as a control, the child must have had only one (or no) OME episode before age three and must have met the matching criteria for gender, age, and SES. In the end, each control child was closely matched with an otitic counterpart.

All participants were brought to a university clinic for individual assessment. Ten examiners (three professors and seven graduate students), all experienced psychometricians and reading specialists, were trained by the senior author in the protocols of the study. To avoid criterion contamination, examiners were unaware of the child’s status (otic or control). Each child was tested over the course of a day in two sessions. Tests were administered in a fixed order: intelligence testing in the morning, the remaining assessments in the afternoon. Sessions lasted from 90 to 120 minutes.

Results

Participants were grouped according to OME history. For each group, means and standard deviations were computed on the five literacy measures and the reading level judgments, and t tests were conducted. To determine the extent to which the children were accelerated or delayed in reading, disparity scores were computed by subtracting actual grade in school from judged reading level. (e.g., a fourth grader reading at a second grade level would have a disparity score of –2.0.) Results are also shown in Table I. On every literacy task, otitic children scored significantly (p < .05) lower than controls. As for the disparity between reading level and grade in school, they scored nearly a standard deviation below their nonotitic counterparts (p < .01).

We conducted similar analyses on the three WISC-R subscales and full scale IQ. The results are again shown in Table I. Compared to controls, the otitic children scored nearly a full standard deviation lower on Verbal Comprehension (p < .01). There were no significant differences on any other subscale.

Finally, to control for Type I error, we conducted a two-group, multivariate analysis of variance using judged reading level and Verbal Comprehension scores as criteria. The difference between the mean vectors of otitic and control groups was significant, approximate $F(2, 37) = 4.16, p < .05$. When nonverbal IQs were controlled by covariance, the difference remained significant, approximate $F(2, 36) = 3.26, p < .05$.

Discussion

The results accorded well with the hypothesis of the study. Children with a history of OME underperformed their nonotic peers on all Verbal Comprehension and reading skill measures. They scored significantly lower, in most cases more than two thirds of a standard deviation lower, on every literacy indicator of the study. Moreover, the otitic children were, on average, more than a year ($M = 21.15$) below grade level in reading. Conversely, control children scored nearly a year above grade level ($M = 1.99$). It appears, then, that children with a history of repeated OME episodes during primary language acquisition find learning to read more difficult than those who have no such history. We found little evidence, however, that otitic children exhibit a similar disadvantage on nonverbal measures.

Although otitic children scored nearly a full standard deviation below their control peers on Verbal Comprehension, the clinical importance of this WISC-R trend may be limited for children like those in this study. Few participants in either group performed at substandard IQ levels. In fact, only four in the otitic group scored below 100 on the VC scale (the lowest score was a 93). Moreover, there were exceptions to the general finding. Four of the 20
otic children scored higher on verbal IQ than the control group mean ($M = 126.10$).

Because we selected children who were ethnically homogeneous and lived in an educationally favored community, our results may have limited generality. More research is needed to determine whether our findings can be applied to the general population. Nevertheless, it seems likely that early onset OME would affect the early reading of children in other circumstances. For those already at risk-those receiving inadequate medical attention, little exposure to literacy at home, inappropriate early reading instruction, or grappling with other cognitive, motivational, or social impairments-the added burden of otitis media could be substantial.

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