

Long-term Consequences of Early life Otitis Media on Language Development

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Our study regarding the long-term effects of early life Otitis Media on language development in Dutch school-aged children will be presented, as it has been published in *Audiology and Neurotology*¹ and the *Journal of Speech, Language and Hearing research*².

Otitis Media (OM) is highly prevalent in children and has its highest incidence in the first years of life. Periods of OM have generally duration of about 10 days and can result into a hearing loss up to 40 dB. Chronic OM with concurrent hearing loss can consequently result into a constantly fluctuating auditory input; at a time when language development is generally assumed to have its sensitive period³. During the first two years of life, when basic language skills are acquired, imprinting plays an important role: words and phonemes which are perceived repeatedly become stored in the child's mental lexicon. A frequent change of the auditory input due to Otitis Media is has a negative effect of on language development in young children, as demonstrated by several authors, e.g.⁴. However, it is still debated whether negative consequences of a temporary reduction of the auditory signal on language and auditory skills can be compensated on the long term. In a prospective study, we examined the effect of early life Otitis Media and its underlying hearing loss on general language development and speech perception in background noise at school age.

Sixty-five Dutch children, 34 boys and 31 girls, with the mean age of seven years (age range = 6.6–7.10 years; M=7.3; SD = 0.4) were included in the present study. These children form a subset of the MOMES study of Anteunis and Engel⁵, conducted at the Maastricht University medical Centre, Maastricht, The Netherlands. In this prospective study, the middle ear status and hearing loss of 250 children was documented in 3-monthly visits in their first two years of life. All 65 included children in the present study were born without complications, had a normal cognitive development and visited a mainstream elementary basic school. To assess their language skills with 27 months, the 'mean length of utterances', conducted from speech samples of spontaneous speech, were calculated. At age seven, two subtests from the Dutch 'Language Tests for Children'⁶ were used to test the children's general language ability: the Word Forms Production (WFP) test and the Concealed Meaning (CM) test. WFP is a test of morphological expressive language skills and addresses knowledge of irregular word forms.

The CM test is receptive in nature, focusing on the child's understanding of the nonexplicit content of sentences.

When analyzing the relation between early life OM related hearing loss and language abilities at 27 months, we found a statistically significant correlation between these two variables. Likewise, there was a strong correlation between language scores at 27 month and seven years. In contrast, no significant correlation between early life OM and its underlying hearing loss and language skills at school age was present. Neither language production nor comprehension scores were affected by early life Otitis Media; indicating that the earlier drawback in language abilities as a consequence of OM a had been resolved by school age ¹.

In a second study, we examined the relation between the performance on speech perception in background noise at school age to the number of early life OM incidents and their underlying hearing loss ². In this way, we aimed to determine whether the middle ear status at early life affects speech perception up to school age. In 55 of the earlier tested children, the speech-in noise (SPiN) test ⁷ was conducted at age seven. This test measures speech perception in a condition which is comparable to mostly all daily situations, as speech has generally to be perceived in accompanied background noise. The SPiN test gives a better insight in auditory functioning in a 'natural noisy condition' than an audiogram, where hearing is evaluated by the ability to perceive tones in silence. Even when a pure tone audiogram reveals normal hearing thresholds, a person's language perception in background noise may be weak. The SPiN test requires both language and auditory skills. Children were asked to repeat short sentences, presented congruently with background noise, as correctly as possible. After a correct response, the level of the sentences is reduced by 2dB, and after an incorrect response, the speech level is increased by 2dB. In this way, the speech-to-noise (S/N) ratio becomes estimated: this is the distance between speech and noise at which 50% of the sentences are repeated correctly. Therefore, absolute volume level is less important than the S/N ratio, as the latter determines the degree of difficulty.

The mean S/N was -2.7, meaning that 50% of the sentences were repeated correctly when the speech was on average 2.7dB softer than the background noise. The weakest S/N ratio was -0.3dB, which resembles an almost an equal level of speech and background noise. When calculating the correlations between early life middle ear conditions and speech perception at school age, both the number of OM incidents and its underlying hearing loss at early life were statistically significant related to the S/N ratio in children at seven years. These results show that early life OM and its underlying hearing loss affect speech perception in difficult listening conditions negatively on the long term.

Overall, the findings of the present study indicate that long-term consequences of early life OM and its underlying hearing loss may not apply for general language comprehension and production skills. Detrimental effects may be restricted to lower-order auditory processing tasks in which language is less redundant, such as speech perception in difficult auditory conditions. Weak language perception skills can have negative consequences for example for the situation in the school

class when complex instructions have to be understood in background noise. Further research is required to examine whether children with inconsistent auditory input at early life also have problems in other conditions when the redundancy of language is reduced; for example in the differentiation between minimally distinctive pairs like ‘bear’-‘pear’ which may cause misunderstanding of the perceived message.

Another aspect which has to be considered in interpreting the results of the present study is that all included children were born without complications, had a normal cognitive development and no language problems and may therefore to a certain level be able to compensate for shortfalls. Further research is required with children having cognitive developmental delays; neurological disorders, or language problems, where early life OM related hearing loss may even have a stronger negative long-term effect on speech perception.

References

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