

ARAŞTIRMA / RESEARCH ARTICLE

The impact of delayed ventilation tube insertion in otitis media with effusion on children's development

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Effüzyonlu otitis mediada gecikmiş ventilasyon tüpü uygulamasının çocuk gelişimi üzerindeki etkisi

Amaç: Bu çalışmada effüzyonlu otitis medianın çocuklardaki dil, konuşma ve kognitif gelişim üzerine etkilerini araştırmıştır.

Yöntem: Effüzyonlu otitis media tanısı ile 9 ay veya daha uzun süre sonunda ventilasyon tüpü uygulanan 22 çocuk ve kontrol grubu olarak tanıdan sonraki 9 ay içinde ventilasyon tüpü tatbik ettiğimiz 22 çocuk randomize kontrollü bu çalışmaya alınmıştır. Bu iki gruba Wechsler çocuklar için zeka ölçeği ve Peobody Resim kelime testi uygulanmıştır.

Bulgular: İki grup arasında toplam zeka, sözel zeka, alıcı dil, genel bilgi, yargılama, aritmetik, benzerlik, sözcük dağarcığı, resim tanımlama ve resim düzenleme gibi parametrelerde istatistiksel olarak anlamlı farklılıklar bulunmuştur. Erken tüp takılan çocuk grubu, 9 aydan daha geç tüp takılan gruba göre bu testlerde daha başarılı bulunmuştur. Küplerle desen, şifre alt testleri ve parça birleştirme parametrelerinde ise her iki grup arasında anlamlı fark bulunamamıştır.

Sonuç: Effüzyonlu otitis media tanısı konulduktan sonra çocuklardaki işitme kaybı odyolojik testlerle aralıklı olarak takip edilmeli, işitme kaybı düzelmeyorsa dil, konuşma ve bilişsel gelişim üzerine etkilerini azaltmak amacıyla ventilasyon tüpü tatbik edilmelidir.

Anahtar Sözcükler: Effüzyonlu otitis media, ventilasyon tüpü, çocuk gelişimi.

Abstract

Objectives: The effect of delayed ventilation tube insertion in children concerning linguistic, speech and cognitive development with otitis media with effusion (OME) were examined in this study.

Methods: Randomized controlled trial. Wechsler Intelligence Scale for Children - Revised and Peabody Picture Vocabulary Tests were applied two groups of children. Study group consists of the children with OME who had ventilation tube insertion delayed for nine or more months control group with OME who had ventilation tube insertion before nine months.

Results: Significant statistical difference have been found out between these two groups in the parameters such as total intelligence, verbal intelligence, receptive language, general information, comprehension, arithmetic, similarity, vocabulary, picture completion and picture arrangement. The control group has been found more successful in these tests according to the group with children who had OME surgery after nine months. However, in the parameters of design with cubes, coding and object assembling, no significant difference has been found out between the two groups.

Conclusion: Delayed tube insertion in OME has a permanent negative effect on children's articulation, linguistic and cognitive development. For this reason, following OME diagnosis, hearing loss in children should be followed at regular intervals by audiological tests and if hearing loss is not improving for more than nine months ventilation tube should be inserted immediately.

Key Words: Otitis media with effusion, ventilation tube, children development.

Türk Arch Otolaryngol, 2006; 44(3): 151-155

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Türk Otolarengoloji Arşivi, 2006; 44(3): 151-155

Introduction

Otitis media with effusion (OME) is characterized by the fluid collecting behind the partially healthy-seemingly tympanic membrane without the symptoms of any systemic and local infection and findings. Generally the only complaint is hearing loss. As the hearing loss in bilateral cases is increased it is easier to diagnose. During the routine examination of a child this can be found incidentally. For this reason, otoscopic evaluation is utmost importance. In otoscopic examination the tympanic membrane is generally transparent and in some cases the air-fluid level can be seen. In persistent effusions the colour of the tympanic membrane becomes reddish-brown. In some cases peripheral hyperaemia and engorgement in capillaries can also be seen.

OME is the most frequent ear disease following acute otitis media in the early childhood. In the studies held in the USA it is stated the cumulative incidence in children aged 6-12 is 22%.¹

In these cases, hearing loss can be determined by conventional audiological tests (pure-tone audiometry, speech audiometry). In older children, it is possible to find out a conductive type of hearing loss by diapason tests. Effusion in the middle ear results in a conductive type of hearing loss between 25-40 dB.¹

OME is generally diagnosed in winter months. Having the first acute otitis media attack before sixth months of age, being male gender, early stopping breast-feeding, going to child-care unit at an earlier age, a low socio-economic level, genetic tendency, allergy and passive smoking are considered among risk factors.²

OME is an early childhood disease and it often recurs in spite of the fact that all treatment methods are carried out to get rid of the disease. OME sequels can be divided into two groups as intratemporal and intracranial. Nearly all intracranial complications may lead to neurological sequela which may persist for a long time. One of the most important sequela which was emphasized currently is the effect on the child's speech, linguistic and cognitive development. In our study, we tried to determine these sorts of impacts of persistent OME.³

Materials and Methods

Two groups of children took part in this study. One group including sick children who were diagnosed as bilateral otitis media with effusion by means of otoscopic examination and audiological tests and who had a late surgical operation due to patient-related factors. We accepted the term "delayed surgical operation" as an operation which is performed nine or more months after the diagnosis.¹⁹ A control group including sick children who were diagnosed as having bilateral OME and had early operation before nine months. In each group, there were 22 children, 11 girls and 11 boys, aged between 6-11. Audiologic tests were performed for both ears in preoperative period and postoperative controls.

In both groups, the socio-economic level has been found out by asking the job of breadwinner, his/her education, monthly income and the location of their living place. In order to ensure homogeneity, children who were on the upper level socio-economically were excluded from the study. The groups were compared by using t test for independent sample groups. Two different tests have been applied to each of the children in the groups 1 month after operation. These were as follows:

Wechsler Intelligent Scale for Children-Revised (WISC-R)

This test has been developed to be applied to individuals aged between 6-16 by Wechsler⁴ and its revised copy was published in 1974. The Turkish standardisation, reliability and validity of the tests were performed by Savaşır and Şahin.⁵

WISC-R includes total 13 subtests. It is divided into two main parts as verbal and performance. At the end of the application, verbal, performance and total intelligence scores have been obtained. In our study, in addition to total scores, subtest scores are also used to show the differences between the groups. Especially WISC-R Vocabulary subtest has been used as the measurement of expressive aspect of language development and verbal understanding factor.

Peabody Picture Vocabulary Test (PPVT)

L.M. Dunn developed this test to measure intelligence, linguistic and receptive language in 1959. Katz and his colleagues in Turkey obtained receptive language norms of city, slums and village for children aged between 2.5 and 11 in 1974.⁶ It has often used in publications as a linguistic scale. Since this test has Turkish norms and it enables a comparison with the publications, it has been used to determine the receptive aspect of linguistic development of the groups.

Results

Forty four children who were operated due to OME were included in this study. Twenty two children were operated in the nine-month period after the diagnosis while the other group after nine months after diagnosis. Both groups consisted of 11 girls and 11 boys each. In terms of gender there were no difference in each group. Mean age was 8 years in the study group and 7.8 years in the control group.

The socio-economical level in both groups was either medium or low. It was similar in both groups. Thirteen children from study group, 11 children from control group had families with medium socio-economic level; 9 from the study group and 11 from control group had families with low socio-economic level.

The time period from diagnosis of OME to the operation was 12.52 ± 5.43 months in study group (range 9-24 months) and 4.05 ± 1.9 months for the control group (range 1-7 months).

Statistical analysis for preoperative and postoperative pure tone audiometry results for right and left ears were performed by using repeated measure factorial ANNOVA test. Although preoperative and postoperative hearing levels results were different statistically ($p < .05$); no difference was found between right and left ears and in both groups ($s: 0.12, p > .05$).

The groups were compared by using t test for independent sample groups. Besides, the correlation between duration of the disease and these measurements were examined (Table 1).

Despite of having better hearing levels after the operation, in the parameters of total intelligence, performance intelligence, receptive language, general knowledge, picture completion and picture arrangement, the group with OME who had a ventilation tube

insertion after 9 months, was found worse significantly in comparison with the control group. No significant difference was found in the parameters of design with cubes, coding and object assembling.

Discussion

Speech and linguistic development in a child is a process that starts immediately after birth. One of the prerequisites that are important for speech and linguistic development is normal hearing. The degree and the period of onset of hearing loss effects linguistic development in different ways. A negative effect on hearing in a child can be put under four main groups:

1. It causes delays in the development of receptive and expressive communicative skills.
2. Linguistic disorder leads to learning difficulty. Every field of academic life, especially reading and arithmetic skills is affected.
3. It causes communicative difficulties and it leads to social isolation and lack of self-confidence.
4. It has a negative impact on the opportunities of vocational choices.⁷

A hearing loss changing from very mild to medium is also seen in OME in early childhood.^{8,9} In a number of researches it has been examined whether hearing loss with a continuously changing level was responsible for the developmental difficulties encountered in the later periods of life.

While some of these researches showed that there would be insufficiency in the speech, linguistic and cognitive development of children with OME, some emphasized on the fact that there was not any correlation between OME and the speed of mental development.

Teele and his colleagues examined the linguistic and speech development of 207 patients, aged 7, with the duration of OME. As a result of this study, they found out that the longer the length of OME was, the lower the cognitive, linguistic development and school success became. It was also found out that the scores of arithmetic and reading, articulation and morphological markers determined through verbal, performance intelligence IQ and Metropolitan tests were low.¹⁰ Studies with the aim of supporting these findings performed by Friel-Patti and his colleagues on 35 patients

and as a result, they argued that the rate of linguistic development delay in those who had OME is 71.5% and 21.4% in the normal group.¹¹ Likewise in another study with 16 children it was emphasized that in the case of persisting OME, the linguistic disorder ratio was 20% for children aged under 5 and 33% for children aged 6.¹²

The correlation between persisting OME, speech sound sensitivity (Carrow elicited language inventory), and articulation (Goldman Friestoe Articulation) were showed in a study performed with 294 children. It was believed that linguistic and speech disorders of these children could be prevented by speech stimulations at home.¹³ However, Wright and his colleagues showed linguistic development was normal in 156 children, aged 2, suffering from mild and medium hearing loss with OME. Thitysix of these children was retested at the age of 3-4 years and it was concluded that hearing and linguistic development was normal and no significant correlations between the middle ear problem and linguistic development were found.⁹ The study of Roberts and his colleagues also backs up this in the study including 30 children with medium socio-economic levels and 33 children with low socio-economic levels. No correlations were found between the duration of OME of children between the age 0-3 and linguistic development of children while they were at age 4, 5-6.¹⁴

In the current study, we measured the cognitive, mental and linguistic development in children objectively by 14 parameters. Linguistic, speech and cognitive development in children with OME longer time was found lower (Table 1).

Patients in study group had lower test scores in general information, comprehension, arithmetic, similarity, vocabulary and picture completion tests when compared with the control group. The low scores obtained from these tests might have affected the total, verbal and performance intelligence scores. According to these measurements there was a significant difference between two groups. Likewise fluent language score obtained by PPVT was significantly different between the two study groups. Our data shows that OME effects the language development in children. General information, comprehension, arithmetic, similarity and vocabulary test measure the language development and learned information. According to these findings further

control studies are required.

Picture completion and picture arrangement tests considerably measure the performance, object definition, attention, integration and organisation skills and the child is expected to recognise and to comprehend the visual material or organise it in order to create a story. For these skills, the effect of receptive language cannot be neglected. However, in the parameters of design with cubes, coding and object assembling, no significant difference has been found out (Table 1).

Still, there is no unanimity regarding the treatment of OME, treatment time and its length. 70% of OME is culture positive, however; the growth of *S.pneumonia*, *H.influenzae*, *M.cattharalis* is 50%. Although recovery to some extent is possible with the antibiotic, recurrence is seen.¹⁵

The role of decongestants and antihistaminics has not yet been determined and there have been conflicting results regarding the use of steroids.

Although in some studies steroids treatment was found useful, but there is still controversies.^{16,17} The Valsalva manoeuvre, weekly politzeration and in an allergy-diagnosed patient allergy treatment and immunotherapy may be useful in OME for a short period of time.

It is advised that for persisting OME, a hearing test should be done. And in case of hearing loss a ventilation tube should be inserted. There are a number of opposing ideas regarding the time of tube insertion. Some authors advise that for incidences lasting more than 3 months a tube should be inserted according to the test results.¹ In addition to this, the adenoidectomy for patients with ventilation tube insertion gives positive results.¹⁸

In a study no difference were found considering the improvement of patients who had tubes at an earlier or late. In this study including children aged 3, three different tests were used. These were follows:

1. Number of Different Word test for word diversity;
2. Cognitive Index of McCarthy scale for receptive language, the length of vocabulary, grammatical complexity, parent-child stress;
3. Percentage of Consonants Correct-Revised test for articulation and sound production.¹⁹

Conclusion

Patients included in our study group with delayed tube insertion are affected in their speech and cognitive development because of the hearing loss. Retardation of linguistic, speech and cognitive development in our study group can be attributed to the delay in tube insertion. Hearing loss should be followed by audiological tests at regular intervals after the diagnosis of OME and if hearing loss does not improve ventilation tubes should be applied immediately and in selected cases amplification and rehabilitative advices should be given.

References

1. **Akyıldız N, Kemalöglü YK.** Otitis media. 1st ed. Ankara: Bilimsel Tıp Yayınevi; 2000.
2. **Moriniere S, Soın C, Lescanne E, Ployet MJ.** Epidemiology of otitis media with effusion. *Rev Prat* 1998; 48: 838-42.
3. **Bailey BJ.** Head & neck surgery - otolaryngology. 3rd ed. Philadelphia: J.B. Lippincott Company; 1993. p. 1600-1601.
4. **Wecshler D.** WISC. Wecshler intelligence scale for children. New York: The Psychological Corporation; 1949.
5. **Savaşır I, Şahin N.** The factorial structure of WISC-R in Turkish standardization. Presented in Cross Cultural Psychology Conference. Istanbul: Bosphorus University; 1986.
6. **Katz J, Önen F.** A Turkish peabody picture vocabulary test. *Hacettepe Bulletin Social Sciences Humanities* 1974; 6: 129-42.
7. **Sennaroğlu G.** İşitme kaybına bağlı konuşma bozuklukları. *Türk ORL Klinikleri* 2002; 1: 123-30.
8. **Roberts JE, Burchinal MR, Koch MA, Footo MM, Henderson FW.** Otitis media in early childhood and its relationship to later phonological development. *J Speech Hear Disord* 1988; 53: 424-32.
9. **Wright PF, Sell SH, McConnel KB, et al.** Impact of recurrent otitis media on middle ear function, hearing and language. *J Pediatr* 1988; 113: 581-7.
10. **Teele DW, Klein JO, Chase C, Menyuk P, Rosner BA.** Otitis media in infancy and intellectual ability school achievement, speech, and language at age 7 years. Greater Boston Otitis Media Study Group. *J Infect Dis* 1990; 162: 685-94
11. **Friel-Patti S, Finitzo-Hieber T, Conti G, Brown KC.** Language delay in infants associated with middle ear disease and mild, fluctuating hearing impairment. *Pediatr Infect Dis* 1982; 1: 104-9.
12. **Biurrun Unzue O, Vilacorta Labairu B, Herrera Gonzalez E, Biurrun Unzue A, Llansa Ribas G.** Impact of chronic seromucous otitis on child linguistic development. *An Otorrinolaringol Ibero Am* 2001; 28: 501-11.
13. **McCormick DP, Baldwin CD, Klecan-Aker JS, Swank PR, Johnson DL.** Association of early bilateral middle ear effusion with language at age 5 years. *Ambul Pediatr* 2001; 1: 87-90.
14. **Roberts JE, Burchinal MR, Davis BP, Collier AM, Henderson FW.** Otitis media in early childhood and later language. *J Speech Hear Res* 1991; 34: 1158-68.
15. **Daly KA, Hunter LL, Gienbink GS.** Chronic otitis media with effusion. *Pediatr Rev* 1999; 20: 85-93.
16. **Podoshin I, Fradis M, Ben-David Y, Faraggi D.** The efficacy of oral steroids in the treatment of persistent otitis media with effusion. *Arch Otolaryngol Head Neck Surg* 1990; 116: 1404-6.
17. **Macknin ML, Jones PK.** Oral dexamethasone treatment of persistent middle ear effusion. *Pediatrics* 1985; 75: 329-35.
18. **Gates GA, Avery CA, Prihoda TJ, Cooper JC Jr.** Effectiveness of adenoidectomy and tympanostomy tubes in the treatment of chronic otitis media with effusion. *N Engl J Med* 1987; 317: 1444-51.
19. **Paradise JL, Feldman HM, Campbell TF, et al.** Effect of early and delayed insertion of tympanostomy tubes for persistent otitis media on developmental outcomes at the age of three years. *N Engl J Med* 2001; 344: 1179-87.

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