Evaluation of hearing and speech-language in preschool children: how important, why we should perform?

Suna Tokgöz-Yılmaz[1], Esra Özcebe[2], Meral Didem Türkyılmaz[2], Aysen Köse[3], Gonca Sennaroğlu[2], Filiz Orhon[4], Betül Ulukol[4]

[1]Department of Audiology , Ankara University Faculty of Health Science, [2]Department of Audiology, Hacettepe University Faculty of Health Science, [3]Ankara University Vocational School of Health, and [4]Department of Pediatrics, Ankara University Faculty of Medicine, Ankara, Turkey. E-mail: eozcebe@gmail.com

SUMMARY: Tokgöz-Yılmaz S, Özcebe, E, Türkyılmaz MD, Köse A, Sennaroğlu G, Orhon F, Ulukol B. Evaluation of hearing and speech-language in preschool children: how important, why we should perform? Turk J Pediatr 2013; 55: 606-611.

The aim of the study was to present the hearing and speech-language findings of preschool children. The children in this study were aged 3-5 years. Sixty-seven of 239 children (28.0%) had been referred to a physician because of possible middle ear problems, and 25 of the 67 children had slight and mild conduction type hearing loss with air-bone gaps. One of 239 children had profound sensorineural hearing loss. Speech-language problems were found in 70 of 239 children (29.3%). Necessary attention should be paid to the evaluation of hearing and speech-language skills in preschool-aged children to avoid delayed detection and to give these children the opportunity for timely intervention for hearing and speech-language problems.

Key words: preschool, hearing, evaluation, speech-language.

It is well known that hearing and speech-language development is a useful indicator of a child's overall development and cognitive ability[1-4]. Deficits in communication functions adversely affect a child's educational process during the early years and in all school years that follow. Early and/or timely identification and intervention in hearing loss and speech-language problems increase a child's potential language skills, literacy, academic achievement, and emotional/social development. Early detection of permanent hearing loss has improved greatly through the availability of newborn hearing screening programs; however, not all cases of hearing loss in early childhood are detected due to the following factors: 1) universal newborn hearing screening (UNHS) programs utilize screening devices primarily designed to target hearing loss averaging from 30 to 40 dB or more; 2) all infants not passing their newborn hearing screening do not necessarily receive or have access to the appropriate diagnostic services; and 3) the UNHS does not identify late-onset, acquired, or many other additional cases of progressive loss[5]. The prevalence of hearing loss is 1-2 infants per 1,300 live births, and this number increases five times when the children reach 5 years of age both in Turkey and worldwide[6]. Even if the hearing loss is mild, it may cause delay in speech and language development, cognitive, social and emotional development, and in the academic performance of the child[1,2]. The European Consensus Statement on Hearing Screening of Preschool and School-age Children declared 13 position statements. They mentioned the importance of preschool hearing screening and the negative impact of untreated hearing loss on speech, language and cognitive development and subsequently on academic achievements[7].

Speech and language development problems are the most common problems observed in preschool children, which means that early detection of those children with speech and language abnormalities at an early age is critical. Speech and/or language development problems will impact a child's emotional and social interactions with his/her family and friends and his/her overall social well-being. At school age, these speech and language development abnormalities will affect the

child's academic performance and intellectual development. Some speech-language difficulties are not generally identified until the child enters primary school. The Speech Pathology Association of Australia stated that attention should be given to screening children of preschool age to minimize the impact of oral language difficulties on literacy acquisition[8]. In one article, the percentage of untreated speech and language delay in preschool children was reported as 40% to 60%[9]. Evaluating preschool children for speech and language delay and disorders can include different approaches, although there is no uniformly accepted screening technique in the primary care setting[10]. Milestones for speech and language development in young children are generally determined[11]. Parent questionnaires and parent concern are often used to detect speech-language delay[9]. When evaluating those children with probable speech and language development deficiencies, the degree of speech-language delay, multiple language capabilities (receptive and expressive language development), family functions, and general social communications levels must be identified and taken into consideration. Other clinical conditions (mental retardation, loss of hearing, autism, etc.) that may accompany speech-language development deficiencies need to be identified and eliminated to obtain an accurate assessment of the child's speech and language development. Consequently, identifying and treating speech and language deficiencies in children require an interdisciplinary approach.

In this study, we aimed to evaluate the hearing and speech-language skills of 239 preschool children, aged 3-5 years old, with an emphasis on the importance of timely detection and intervention in hearing loss and speech-language problems.

Material and Methods

General Procedure

The subjects participating in this study were a group of 3-5-year-old children seen between 2009 and 2012. The children were initially seen in the Social Pediatrics Child Follow-up Clinic of Ankara University. All otoscopic examinations were performed by a pediatrician using a standard otoscope. After a pediatric examination, 239 children were referred to the Department of Pediatrics, Audiology and Speech Pathology Unit for an assessment of their hearing and speech-language skills. The study was approved by the Ethics Committee of Ankara University, and an informed consent form was signed by the parents of each child. This study was conducted in accordance with the principles of Helsinki Declaration 2008 (http://www.wma.net/en/30publicarions/10policies/b3/index.html).

Hearing Evaluation

Hearing tests were administered by audiologists to all children without the inclusion of any specific criteria (100 (41.8%) girls, 139 (58.2%) boys). The hearing tests were conducted by conventional tone audiometry using an Interacoustics AC-40 audiometer (Assens, Denmark). Hearing sensitivity of subjects was identified according to the pure tone average (PTA) of hearing thresholds at 500, 1000 and 2000 Hz and according to their audiometric configuration (hearing levels, air-bone gaps and immitancemetric measurements)[12]. In this study, 103 children were tested with conditioned play audiometry (CPA) using supra-aural earphones (46 children at age 3; 20 children at age 4; and 37 children at age 5)[13,14]. The remainder of the children (n=136) at 3 and 4 years of age who did not want to wear the headphones were tested with visual reinforced audiometry (VRA) using a loudspeaker[15].

Immitancemetric Measurements

Middle-ear pressure and acoustic stapedial reflex measurements (contralateral reflex at 500, 1000, 2000, and 4000 Hz) were performed using an interacoustics AZ-26 impedance audiometer. The tympanometry measurement was administered to children with a failure criteria; middle ear pressure peak of < -100 daPa was interpreted as high negative pressure[16,17].

Evaluation of Speech-Language Skills

A family interview was done, and a detailed case history was obtained to establish each child's speech-language developmental status. Milestones for speech and language development were taken into account in the study. The speech-language skills screening checklist and

Table I. Distribution of Hearing Configuration According to Gender

Type of hearing	Girl	Boy	Total
Normal hearing	74	97	171
Normal hearing with air-bone gap	14	28	42
Conductive hearing loss	11	14	25
Sensorineural hearing loss	1	-	1
Total	100	139	239

spontaneous language sample were obtained in order to evaluate speech-language performance of the children. Three parts of language including form, semantic and pragmatic skills were evaluated for receptive and expressive language skills. Speech intelligibility and speech fluency performance were also evaluated during the assessment. Speech-language evaluation in all children was conducted by experienced speech-language pathologists.

Results

Hearing Evaluation

A hearing evaluation of all 239 participants was performed in this study. The results of the hearing evaluation were as follows: 171 (71.6%) children showed normal hearing sensitivity with normal middle ear pressure; 42 (17.6%) children had normal hearing levels but had air-bone gaps; and 26 (10.9%) children had hearing loss (25 had conductive hearing loss, 1 had bilateral profound sensorineural hearing loss according to the pure tone averages and audiometric configuration) (Table I).

Immitancemetric Findings

All children's immitancemetric findings (ear volume, static compliance, pressure peak, and gradient values) according to the middle ear pressure peak are presented in Table II.

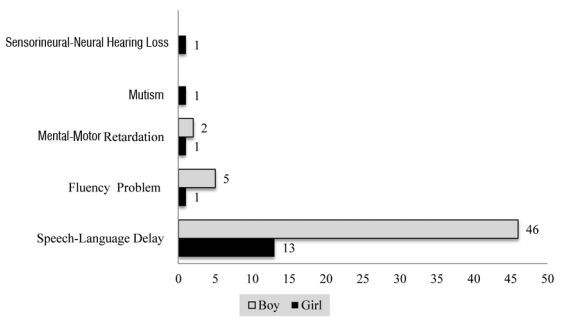

Fig. 1. Distribution of speech-language problems according to gender.

Middle ear pressure peak was found to be < -100 daPa in 67 children (27.1%). Pressure peak values < -100 daPa tended to be more prominently represented among those children with middle ear problems. Acoustic stapedial reflex measurements were performed in all the children. One hundred seventy-one children with normal hearing had normal contralateral acoustic stapedial reflexes.

Speech-Language Evaluation

The hospital files of all children who participated in this study were investigated, and all children were interviewed with a primary physician and their parents in attendance. The results of observations, interviews and a language checklist identified speech-language problems in 70 of 239 children. The results of the speech-language problems of 70 children were analyzed as follows: 59 children had some degree of speech-language delay, 6 children had fluency problems, 3 children had some level of mental motor retardation, and 1 child had mutism. Speech-language delay was found in 1 of 239 children because of profound sensorineural hearing loss. The etiological factors of hearing loss were linked with speech-language problems in 5 of 25 children with conductive hearing loss. The speech-language problems of 70 children are presented according to gender in Figure 1.

Discussion

It is well known that communication problems due to hearing impairment and speech-language problems have important negative effects on speech, language and cognitive development as well as on academic achievements in preschool age populations. Children with repeated or chronic otitis media with effusion (OME) are at high risk of acquiring some degree of hearing impairment and should be examined. Prolonged duration of OM contributes to the severity of the disease and can cause hearing

Table II. Immitancemetric Findings of All Children

	Peak pressure < -100 daPa			Peak pressure > -100 daPa		
	Median	Minimum	Maximum	Median	Minimum	Maximum
Ear volume (ml)	0.33	0.19	0.51	0.46	0.26	0.72
Compliance (ml)	0.45	0.12	1.60	0.43	0.20	1.00
Peak pressure (daPa)	-148	-320	-100	-10	-90	72
Gradient (ml)	0.06	0.04	0.51	0.15	0.07	0.45

loss[18,19]. Patient-specific treatment methods should be used, and these patients should be provided with regular follow-up assessment involving audiograms and immitancemetric measurements.

We found that the hearing levels of 213 children were normal, but 26 children (10.9%) in our study had hearing loss. Twenty-five of the children had slight and mild conductive hearing loss and one had profound sensorineural hearing loss. It was observed that hearing loss prevalence in this study was consistent with previous research results [20, 21]. Bess et al. [20] found that the prevalence of all types of hearing loss was 11.3% in the school-age population, and they proposed that this condition might have a negative effect on their educational state. Jacob et al.[21] reported that hearing impairment was seen in 11.9% and conductive hearing impairment was predominant in a rural primary school in their study.

As a result of the tympanometric measurements, it was found that the pressure peak in 67 of 239 children in our study was < -100 daPa. Twenty-five of 67 children had high negative middle ear pressure and also conductive hearing loss; however, the parents of these children had not realized there was any hearing impairment in their children. These children had not been treated before coming to the Social Pediatric Child Follow-up Clinic. Gultekin et al.[22] found the prevalence of persistent OME in their study to be 8.7%.

One of the 239 children was a three-year-old with bilateral profound sensorineural hearing loss. Her parents had not suspected that their child's hearing was impaired because she had passed the newborn hearing screening; only later did they realize her language was delayed. After they were admitted to Social Pediatrics for a general health check-up, the child's hearing loss was identified, and she was referred to the Otorhinolaryngology and Audiology Department for amplification and intervention. When the results of the speech and language evaluation were reviewed, we found that 70 of 239 children (29.3%) might have speech and language problems. In one study, the researchers investigated the prevalence of speech impairment in 4,983 4-to-5-year-old Australian children and reported that 25.2% of children had expressive speech-language impairment[23]. The prevalence results of this study were found to be consistent with the results obtained in our study. Law et al.[10] found prevalence ranged from 4.6% to 19% for speech and/or language delay.

In the present study, 75.7% of the children with speech-language problems were male and 25.3% were female. This 3:1 boy-to-girl ratio is consistent with the other results reported in the literature[24-26].

Speech-language problems were found in 5 of 25 children with conductive hearing loss. Profound hearing loss clearly affects speech and language development, but the effects of mild hearing loss are unclear. Several studies support the positive relationship between mild hearing loss and speech-language development while others do not[1,27,28]. Serbetcioglu et al.[27] stated that they could not find any correlation between hearing loss due to OM and the effusion and speech-language parameters in preschool children. Gell et al.[28] concluded that childhood hearing impairment (even mild) may have a detrimental effect upon linguistic and educational development. Depending on the early diagnosis, the treatment of mild hearing

loss plays an important role in a child's overall development[7].

Children are at risk of developing social, emotional, behavioral, and learning problems if hearing and speech-language problems are not identified early. Early intervention is critical for children with communication problems. Speech-language pathologists and audiologists should be involved in the prevention, identification and treatment of a child's speech, language and hearing disorders in partnership with parents, physicians, and educators because communication problems affect the whole family[29]. Widespread preschool/school-age hearing and speech-language skills screening programs will lead to improved communication abilities, lower educational costs and increased lifetime productivity. Speech and language skills must be screened in a preschool hearing screening program to counterbalance the possibility of parental ignorance of a child's speech and language problems. This availability of early screening would also allow for timely spontaneous recovery, thus reducing the necessity for professional help and duplication of resources.

Newborn hearing screening is widely used for the early detection of hearing loss and intervention in many countries around the world[30-33]. Depending on genetic causes, trauma or infections, children who have passed newborn hearing screening may still be at risk for hearing loss (progressive or acquired). However, not enough attention has been given to universalizing the preschool/school-age hearing and speech-language skills screening programs. Well-child care plays an important role in the quality of health care available to children; however, many children have far fewer well-child visits because of transportation problems, low maternal education and the insufficient number of available child follow-up clinics and audiologists.

In the present study, we evaluated hearing assessment and speech-language skills screening of 239 children, which is a very small population. However, our study suggests that a universal preschool screening program should be implemented for all preschool/school-aged children. Screening may be defined as a procedure that separates individuals with the high probability of such a disorder from the general population.

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