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ORIGINAL RESEARCH

UNILATERAL SENSORIONEURAL HEARING LOSS AND COMMUNICATION DISORDERS

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Abstract

The aim of study is to verify the association with oral communication disorders and unilateral sensorioneural hearing loss. Based on a preliminary cross-sectional study including 20 subjects, both females and males between seven and 19 years old (mean 10.8) with varying degrees of unilateral sensorineural hearing loss who attended a speech and language therapy service in São Paulo, Brazil. All patients underwent anamnesis, auditory evaluation, and a standard structured interview to collect information about their language, communication and auditory performance. In general subjects were diagnosed with hearing loss at mean age of 6.3 years. Five (25%) of these subjects had a history of school failure and hearing loss in the left ear. The most common communication disorders reported were associated to oral communication. Language, communication and auditory performance was affected by varying degrees of unilateral hearing loss and comorbidities as lack of attention, irritability and agitation are associated to communication disorders resulting from unilateral hearing loss in this sample.

Key words: sensorioneural hearing loss; hearing disorders; unilateral; speech and language pathology; communication disorders.

INTRODUCTION

Hearing is a major resource for building language and speech skills in normal individuals. The ear is the only sensory organ with representation in the two cerebral hemispheres as the auditory system has ipsilateral and contralateral pathways.

From 1960s specialists in otorhinolaryngology and speech and language pathology have directed their attention to the investigation of individuals with several types of hearing deficits including unilateral hearing loss.

The prevalence of unilateral hearing loss among schoolchildren varies from 3.0% to 6.3% depending on the case definition[1,2]. Many investigators have studied the etiology of unilateral hearing loss [3,4] and the most frequent causes of hearing loss are complications of viral infections and meningitis, especially in developing countries where these diseases are still very common. Cochlear nerve aplasia also appears to be commonly related do unilateral sensorioneural hearing loss [5].

Hearing problems experienced by individuals with unilateral hearing loss are in part due to the phenomenon of binaural hearing, which includes binaural summation, sound localization and threshold change by masking noise [4,6-8].

Health specialists have point out that a great deal of children with unilateral hearing loss has behavioral and/or school problems compared to those with normal hearing [4,6,7]. They also report that these children experience emotional disorders such as embarrassment, confusion, annoyance, and call

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attention to the fact that these deficiencies usually go unseen[4,6,7].

The aim of the present study was to verify the association between unilateral hearing loss, communication disorders and related comorbities in a sample of children.

METHODS

There were selected to participate in this preliminary study 20 subjects undergoing speech and language evaluation at the Speech and Language Evaluation and Diagnosis Clinic (LIDAL) and the Childhood/Adolescence Hearing Deficiency Center of the Department of Otorhinolaryngology at Universidade Federal de São Paulo, in São Paulo, Brazil.

The study was approved by the Research Ethics Committee of Universidade Federal de São Paulo, Protocol No. 0701/05 and follow best human research practice rules.

Inclusion criteria were: unilateral hearing loss; normal pure tone audiometry and logoaudiometry in one ear; tympanometry with normal or type A curve in both ear; no evidence of neurological, motor, visual, and/or emotional impairments; age between seven and 20 years; and signed informed consent to participate in the study.

For those meeting the inclusion criteria, a complete medical history was taken from the subject's caregiver (family member or not) and the subject him/herself and then they underwent evaluation using pure tone audiometry, logoaudiometry and acoustic immitance.

Using a standardized questionnaire [8] there were collected information about the history of hearing loss including risk factors for peripheral or central hearing loss; age when hearing loss was detected; details of detection and diagnosis of hearing loss; aspects related to the indication and adaptation of auditory prostheses; schooling; school difficulties; speech and language development; and communication disorders.

ABFW´s Vocabulary Test was used to assess the lexical competence of the subject, as from five years of age children´s vocabulary quantitatively similar to that of an ordinary adult[9]. The assessments were categorized as normal or altered.

Information on patient history and complementary tests were analyzed and statistically treated using a test for the equality of two proportions. The descriptive analysis also included the estimation of confidence intervals at a 5% level of significance.

RESULTS

The preliminary study sample comprised 10 (50%) females´ subjects, with varying degrees of unilateral sensorineural hearing loss. The subjects mean age was 10.8 years, with aged between seven and 19 years (SD = 3.14). Of all subjects studied, 12 (60%) had hearing loss in the left ear and all of them were right hand.

Based on mean speech frequencies (500 Hz, 1000 Hz, and 2000 Hz), hearing loss was categorized by severity: one (5%) of the subjects studied had mild loss, four (20%) moderate, two (10%) severe and 13 (65%) profound.

As for individual characteristics of hearing loss, five (25%) had stable loss, two (10%) sudden, one (5%) progressive, and the remaining 12 (60%) reported not knowing whether their loss was congenital or acquired.

Hearing loss was suspected around the age 4.3 years, mostly noticed by close relatives, especially the child's mother. The medical diagnosis was made around the age of 6.3 years.

In the assessment of causes of hearing loss, we found that 11 (55%) were of unknown cause, six (30%) were under investigation, and three (15%) had a known cause such as mumps, trauma, meningitis, and middle ear malformation.

The assessment of school performance showed that five (25%) subjects had failed at least once at school. The majority of the children studied had low socioeconomic condition and 18 (95%) subjects attended public elementary school.

About the history of difficulties, we found that 11 (55%) experienced behavioral problems at home and/or school with lack of attention, irritability, and agitation the most common problems mentioned by the subject and caregiver/familiar. In addition, 11 (55%) dos subjects attended after-school learning programs.

The most frequently seen communication difficulties were regarding sound localization, group and classroom talk, and difficulty to focus attention during classes. The major hearing-related impairments experienced by the children were concerning peer relationship, as well as lack of support in the classroom to improve the communication.

In regard to hearing devices, six (30%) subjects had undergone selection and adaptation of auditory prostheses, of which only three (15%) used them regularly.

DISCUSSION

Regarding sociodemographic characteristics and occurrence unilateral hearing loss, did not find any statistically significant differences between the affected ear and gender, like reported in other studies[10,11].

The age hearing loss was first suspected was around 4.3 years old, mostly the child's mother and the medical diagnosis was usually made at the age of 6 years, similar data to those reported in other studies[1,2,5,12].

Although has a neonatal hearing screening program in Brazil, late detection of hearing

problems, usually during preschool age, is still common, especially in case children at risk to hearing loss[5,13].

A good neonatal hearing screening program provides an opportunity for early detection and intervention in children allowing parents to anticipate potential difficulties during language development and at school. The earlier the diagnosis, the more effective is intervention and rehabilitation, reducing hearing-related impairments [4,7].

The main impact of the symptoms of hearing impairment reported by parents and/or caregivers were those associated to school activities, especially for the learning of reading and/or writing and on the patient behavior. Many studies have reported that, compared to children with normal hearing, those with hearing loss experience more difficulties at school and have a 10-fold increased risk of school failure[4,12,13]. A study with children with unilateral hearing loss showed that 35% failed one grade and 20% had behavioral problems in the classroom[13].

Hearing problems experienced by individuals with unilateral hearing loss are in part due to the phenomenon of binaural hearing, which includes[14]:

A) Binaural summation: phenomenon that allows increasing thresholds of audibility by 2–3 dB when both ears are sound stimulated. The differences between frequency and intensity thresholds obtained binaurally are around two-thirds of that obtained monoaurally.

B) Sound localization: it is an essentially binaural auditory function. Interaural time difference (ITD) and interaural intensity difference (IID) in the horizontal plane are two main acoustic cues for appropriate sound localization.

ITD is produced when a source emits a sound, let's say, from the head's left side. The sound arrives first on the left ear and then soon after on the right ear, producing an arrival-time difference. The direction of the sound source will be localized by the ear that was first stimulated.

C) Threshold change by masking noise: elevation of an acoustically detectable signal under binaural hearing conditions. This effect is seen when a normal listener can hear someone talking in a noisy room.

It has been recognized the importance of binaural hearing supporting the indication of electronic devices for sound amplification and codification. Several studies have demonstrated that patients using personal sound amplification devices in both ears can have considerable benefits in different daily life situations of communication[7,11,16].

The most frequent communication difficulties were regarding sound localization, difficulty understands when group and classroom talks, as well as difficulty to focus attention during classes. Studies show that the use hearing aids for speech in noise was significantly improved understanding, as well as with asymmetric bilateral hearing loss[7,11].

The rate of school failure was around 25% for subject in these study, which is a higher data than that seen among children with normal hearing [4,15]. Children with mild to moderate hearing loss bilaterally or even with unilateral hearing loss are at risk for school difficulties when compared with children normal hearing. Furthermore, economic condition and difficulty of access rehabilitation service and difficulty for support in the classroom, added auditory difficulties, are responsible to school difficulty[16,17].

Some authors[4,6,12,16,17] have verified that these individuals have communications problems and are prone to express negative feelings associated to their hearing loss and in situations where they experience communication difficulties. They also underscore that individuals with unilateral hearing loss require professional help to understand their hearing loss and to adjust to daily life situations[4,6,12,16-18]. The hearing loss influences aspects how social and emotional relationship[17.]

Unilateral hearing loss has been diagnosed during preschool age and is associated school failure to 25% for subject, as well as school difficulty to 33% for subject.

In addition, the most frequent communication difficulties were regarding sound localization, group and classroom talk as well as difficulty to focus attention during classes. Communication and auditory performance was affected by varying degrees of unilateral hearing loss and this comorbities seems to be an important challenge that requires individual amplification to reestablish binaural hearing, so that the subjects can have suitable conditions to restore their communication skills and social interaction by auditory path, which contributes to a better relation to the environment.

Therefore is important that family keep closer with children in childhood and has attention in the first sign associated hearing impairment, especially about difficulties understanding when speech in noise and difficulties sound localization.

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