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Original article

Schooling of hearing-impaired children and benefit of early diagnosis

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ABSTRACT

Objective: To assess the impact of moderate-to-severe bilateral hearing loss on schooling and the factors influencing this impact, and to evaluate special schooling needs in addition to speech therapy.
Material and methods: Retrospective study including children with moderate-to-severe bilateral hearing loss, born between 1992 and 2006, diagnosed and managed in our institution. The age and degree of hearing loss in the better ear, the type of schooling and the level of schooling at the time of the last visit were recorded for each patient.
Results: Two hundred and twenty-five hearing-impaired children were included: 161 attended a regular school (58% of the 55 children with severe hearing loss and 76% of the 170 children with moderate hearing loss). The percentage of children with moderate hearing loss attending a regular school increased over time. This study did not demonstrate any difference in terms of grade retention according to the age at diagnosis for children with moderate hearing loss. No child with comorbidity affecting intellectual capacities attended a regular school.
Conclusion: This study confirms that moderate-to-severe congenital bilateral hearing loss has an impact on the child's schooling, with grade retention that depends, but not exclusively, on the degree of hearing loss. A growing number of children with moderate bilateral hearing loss fitted with a hearing aid now attend a regular school.

1. Introduction

Prelingual bilateral sensorineural hearing loss is responsible for numerous medical, developmental, social and economic consequences. At an early stage of development, auditory deprivation or impaired hearing impacts on oral language acquisition and intelligibility.

Diagnostic tests (auditory-evoked potentials) and screening (evoked otoacoustic emissions, automated auditory-evoked potentials) of hearing loss in newborns or infants have been developed over recent years. Information campaigns about the consequences of hearing loss targeting the general public and the medical profession have been conducted. Neonatal screening programmes, initially targeted to infants presenting risk factors for hearing loss [1], following by universal screening [2,3] have been developed. These programmes are designed to ensure earlier diagnosis and therefore earlier management of children with moderate, severe or profound bilateral sensorineural hearing loss.

Several studies have demonstrated the benefit of early management of prelingual hearing loss on language and articulation, but these studies were generally based on limited follow-up and only concerned infants or preschool children [4–7], with unilateral or mild hearing loss [8–10] or children who had been fitted with one or two cochlear implants [11,12].

The purpose of this study was to assess the impact of moderate-to-severe bilateral hearing loss on the schooling of these hearing-impaired children and the factors able to influence this impact. We tried to quantify the need for any type of special schooling in these children with moderate-to-severe hearing loss in order to determine the probability that these children can continue to attend a regular school.

2. Material and methods

We conducted a descriptive observational study on children born between 1992 and 2006, in whom bilateral hearing loss was diagnosed in the Robert-Debré hospital ENT department, in Paris.

Patients included in this study presented moderate-to-severe bilateral hearing loss in the better ear, were between the ages of 4 and 18 years and attended school in France at the time of their last visit. A hearing-screening test at birth did not constitute an inclusion criterion. Children with unilateral hearing loss or mild hearing loss in the better ear were excluded from the study.

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The age at diagnosis was considered to be the child's age at the time of confirmation of the hearing loss by auditory-evoked potentials (AEP).

The degree of hearing loss was that observed on the first audiogram performed with headphones. It was based on the mean hearing loss (MHL), corresponding to the mean of air conduction hearing thresholds observed at 500 Hz, 1 kHz, 2 kHz and 4 kHz. Hearing loss was classified according to the criteria established by the International Bureau for Audiophonology (BIAP) (www.biap.org): moderate hearing loss corresponds to an MHL of 40 to 70 dB, and severe hearing loss corresponds to an MHL between 70 and 90 dB. For patients with evolving hearing loss (deterioration, or exceptionally improvement of hearing over time), hearing loss was determined according to the thresholds observed at the time of the first pure tone audiogram on separate ears. Various factors able to influence the child's development such as the social environment and comorbidities were also recorded.

The level and type of schooling were recorded at the last visit in the department by clinical interview of the parents or the patient. Children were divided into two groups: children who were fully integrated in a regular school, with or without speech therapy, and those requiring schooling in a specialized institution.

The child's schooling in a local regular school started in the 1st section of kindergarten (class 14) to the final year of high school (class 0). "Specialized institutions" comprised all available modalities of management of these children, requiring notification by the *Commission des droits et de l'autonomie des personnes handicapées* (Disabled persons' rights and autonomy commission [CDAPH]) of the *Maison départementale des personnes handicapées* (Departmental disabled persons home [MDPH]), such as:

- special education institutes, and specialized institutions for deaf children, proposing *Sections d'enseignement et d'éducation spécialisées* (Specialized teaching and education sections [SEES]) and/or *Sections pour enfants avec handicaps associés* (Sections for children with multiple disabilities [SEHA]);
- *Service d'éducation spécialisée et de soins à domicile* (Specialized education and home care services [SESSAD]), equivalent to specialized institutions that provide services at the child's home;
- *Classes pour l'inclusion scolaire* (School inclusion classes [CLIS]), small elementary classes with less than 12 pupils;
- *Unités locales d'intégration scolaire* (Local school integration units [ULIS]), college or high school classes with specialized educators and teachers.

Children attending a SEGPA (*Sections d'enseignement général et professionnel adapté* [Adapted general and professional teaching sections]) were also grouped under the label "specialized institution", although placement in these college classes is decided by the regional director of education rather than the CDAPH.

Children were then divided into three groups according to their year of birth (1992–1996; 1997–2001; 2002–2006). Age at diagnosis was compared between the various groups and according to the degree of hearing loss.

Schooling of children with moderate-to-severe hearing loss in a regular class or in a specialized institution was studied according to their year of birth.

For children with moderate hearing loss attending a regular school, the presence and degree of grade retention were studied according to the child's age at the time of diagnosis by entering data (age and level of schooling at the time of the last visit in the department) with Excel software and plotting a point cloud for each age-group at the time of diagnosis. Linear regression lines for each group of patients studied were calculated from these point clouds. These regression lines were used to predict the child's theoretical age for a given class and, in particular, evaluate the child's estimated age in the final year of high school.

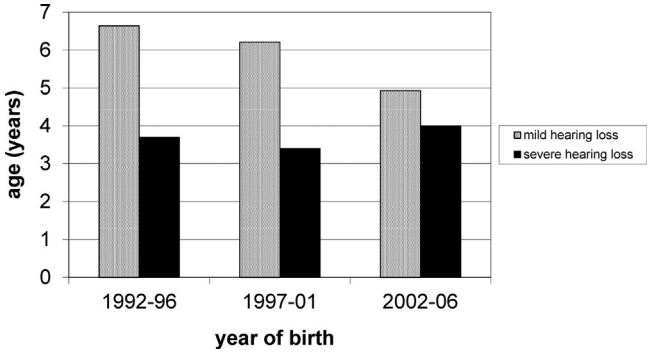

Fig. 1. Age at diagnosis as a function of severity of hearing loss and year of birth.

3. Results

3.1. Population

A total of 225 of the 998 children born between 1992 and 2006 in whom hearing loss was diagnosed in Robert-Debré hospital satisfied the inclusion criteria. The main reasons for exclusion were children under the age of 4 years at the last examination, profound bilateral hearing loss, mild bilateral hearing loss or asymmetrical hearing loss with hearing loss less than 40 dB in the better ear at the time of the first audiogram on separate ears. One hundred and seventy (76%) of the patients included had moderate hearing loss in the better ear and 55 had severe hearing loss.

Certain comorbidities were able to directly impair the child's capacities or contribute to grade retention due to their chronic nature and their impact on intellectual capacities. Forty (18%) of the 225 patients presented this type of comorbidity: 1 case of autism, 4 cases of mental retardation, 2 cases of cerebral palsy, 3 cases of Down syndrome, and 2 cases of Charge syndrome. Twenty-eight children (12%) were derived from a very underprivileged family and social background, with 14 children derived from refugee families (either French-speaking or non-French-speaking, but always faced with difficulties obtaining residency status, housing and employment).

Thirty-two (14%) of the 225 patients presented sudden or progressive deterioration of their hearing loss, over a very variable interval following the diagnosis of bilateral sensorineural hearing loss, which was at least moderate in the better ear.

3.2. Age at diagnosis

The mean age at diagnosis was 5.5 years ± 3.2 (median: 5.4 years) for moderately hearing-impaired children born between 1992 and 2006. It decreased from 5.8 years ± 3.8 (median: 5.9 years) for children born between 1992 and 1996 to 4.9 years ± 2.2 (median: 4.9 years) for children born between 2001 and 2006 (Fig. 1). Statistical analysis did not reveal any significant difference between these 3 groups. The mean age at diagnosis for severely hearing-impaired children was 4 years ± 2.5 (median: 3.3 years), with little variation between 1992 and 2006.

3.3. Type of schooling

No child with a comorbid condition affecting intellectual capacities attended a regular school. Almost one half of severely hearing-impaired children attended special schools (special education institutes), regardless of their year of birth (Table 1).