

# Prospective study of hearing loss in schools for deaf children in Assir region, Saudi Arabia

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## Summary

In this prospective study, various types and etiology of hearing loss among children attending public schools for the deaf were examined. One hundred students from two schools below the age of 15 years were enrolled in the study. Questionnaire was sent to all parents. Multiple modalities of investigations of hearing impairment in the children were performed. Out of the 100 students 78 (78%) had sensorineural hearing loss (SNHL) which was congenital in origin while in (22%) SNHL was acquired as a result of infancy or childhood infection. Forty one cases (41%) were born as a result of consanguineous marriages. Thirty two cases (32%) had a family history of deafness. Ninety (90%) of the students were found to have moderate to severe SNHL. The majority of these children were found to have no hearing aids and some of them were using non-functional hearing aids. Preventive methods through education of the public remain mandatory to minimize the incidence of SNHL. We recommend continuous monitoring and evaluation in association with appropriate care and rehabilitation for these children in order to achieve an acceptable level of speech and literacy.

**Keywords:** *Sensorineural Hearing Loss, Hearing Aids*

## Résumé

Dan cet étude en perspective, des types diverses et l'étiologie de la perte de l'ouïe parmi des enfants qui vont à l'École Publique pour les Sourds ont été étudiés. Cent étudiants venant de deux écoles en moins de l'âge de 15 ans ont été inscrit en matière de cet étude. Questionnaire était envoyé aux tous les parents. Modalités multiples des investigations sur l'affaiblissement de l'ouïe chez des enfants ont été opérées. Parmi les 100 étudiants, 78 soit 78% avaient la perte de l'ouïe sensorineurale (SNHL) qui était de l'origine congénitale tandis que 22%, SNHL était acquis en conséquence de l'infection d'enfance. Quarante et un cas soit 41% étaient nés en conséquences des mariages consanguineux. Trente deux cas soit 32% avaient une histoire des sourds dans la famille. Quarante dix soit 90% des étudiants étaient notés d'avoir le SNHL du moyen au sévère. On a remarqué que le plus grand nombre de ces enfants n'avaient pas des audiophones et certains d'entre eux utilisent les audiophones non fonctionnels.

Des méthodes preventives à travers l'éducation de la publique reste toujours obligatoire afin de réduire l'incidence du SNHL. Nous recommandons la surveillance continue et une évaluation associée aux soins plus appropriés et centre de rééducation pour ces enfants afin de réaliser un niveau acceptable de la parole et de l'alphabétisation.

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## Introduction

In the upbringing of a deaf child, there are many pitfalls and parents need the benefit of all the skills and experience that a good teacher can place at their disposal<sup>1</sup>. Borgstein and Raglan<sup>2</sup> found that the greater the hearing loss, the more difficult it will be for a child to acquire language through the auditory channel. Moderate to severe sensorineural deafness is a major disability and permanent hearing impairment is a major cause of delay in speech and language development. Parental observations have been found to play an important role as a part of the screening programme for the detection of hearing impairment at an early age<sup>3</sup>. The average age of identification of a congenital hearing impairment was reported by Northern and Epstein<sup>4</sup> to be 30 months. Early auditory stimulation is necessary for the normal development of communication skills. Maximal language function can be obtained if hearing is restored by 18 months of age<sup>5</sup>. Recent studies have shown that if hearing is restored by 6 months of age, hearing impaired infants can catch up with normal hearing infants in the development of speech and language<sup>6</sup>. Heredity and environmental factors continue to be important etiological factors in hearing loss in children<sup>7</sup>. Scientific and clinical evidence show that individuals with hearing loss do benefit from the treatment provided by audiologist and speech pathologists. This evidence was documented and clearly seen through the improvement of children literacy skills as well as their overall educational achievement in language<sup>8,9</sup>. Audiologists generally agree that individuals have normal hearing if their ability to detect sound falls within 0 and 20 dB<sup>11,12</sup>. Mild SNHL is defined as hearing loss that falls between 20 and 40 dB, moderate to severe between 40-80dB and profound hearing loss more than 80db. Profound, early onset deafness is present in 4-11 per 10,000 children and is attributable to genetic causes in at least 50% of cases<sup>12</sup>.

The aim of this study was to investigate the etiology of the SNHL in schools for deaf children. It was important to determine the age at which SNHL was diagnosed and to assess the influence of late diagnosis on the children speech.

## Materials and methods

This prospective audit, diagnostic assessment of hearing status of one hundred children below the age of 15 years from two different schools for the deaf children in Abha, Saudi Arabia was carried out over a period of one year. Questionnaires were sent to all parents. The questionnaire contained the history of antenatal, perinatal and postnatal periods as well as information on the use of medications during pregnancy, admission of the babies to a pediatric intensive care unit for a period more than ten days, jaundice, meningitis, measles, mumps, and any history of febrile convulsions. Family history of hearing loss, and history of consanguinity were also documented.

One day per week was organized to see 3-5 children at a time

in order to complete the whole work up. At the time of their first visit to the clinic, the questionnaire was reviewed and a complete physical examination performed which included examination of ears, throat, nose, head and neck and a neurological examination in all the children. Depending upon the children's age, audiological examinations consisting of pure tone auditory and otoacoustic emissions (OAE) were assessed by an audiologist in all the children. Speech evaluation was conducted by a speech pathologist that assessed their vocabularies and ability to communicate using lip reading. Laboratory work up included; immunoglobulin assays for Toxoplasmosis, Rubella, and Cytomegalovirus (CMV) and Herpes virus. High resolution Computerized tomography scan (HRCT scan) of the temporal bone was done which allowed good visualization of the anatomy of the bones including ossicles and the inner ear. Consultations with other specialties such as ophthalmology, neurology, pediatrics and urology were done where indicated.

## Results

The mean age of the children was 7.5 years. Eighty six of the parents 86% returned completely answered questionnaires. The mean age at diagnosis of hearing impairment was 2 years. All the children were first noticed to have hearing loss by their parents. Sixty -three cases (63%) were females and 37(37%) were males (m:f=1:1.7). Thirty-eight children (38%) were born as a result of consanguineous marriages. Thirty-two students (32%) had a family history of deafness. In seventy-four students (74%), SNHL was congenital in origin while in 26 children (26%) it was acquired mainly through illness during early infancy (Table I).

Four mothers (4%) reported history of fever during early pregnancy, but no history of drug intake. Ninety-seven children (97%) were born at full term gestation and only 3 children (3%) were born prematurely. Six children (6%) had a history of admission to the neonatal intensive care unit (NICU) for a period exceeding ten days, 5 of these children (5%) had a history of severe jaundice. Ninety-eight cases (98%) had SNHL. The SNHL was found to be mild bilateral in 10 children (10%), moderate to severe bilateral in sixty-four children (64%) while 22 children (22%) had profound bilateral SNHL. One 7-year old female was found surprisingly to have normal hearing and another found to have moderate to severe mixed hearing loss secondary to chronic suppurative otitis media. Acoustic emissions

showed a wave response of more than 70% in both ears for only 12 of the children, and the rest of the children the wave response was less than 15%.

Five children (5%) had elevated IgG antibodies for rubella which was detected by enzyme-linked immunosorbent assay (ELISA) and 3 of the children had moderate to severe bilateral SNHL and 2 had bilateral SNHL. Of four children (4%) who had a history of meningitis, 3 children had severe SNHL and 1 had profound bilateral SNHL. Three children (3%) tested positive for Toxoplasmosis and all of them had severe bilateral SNHL. None had positive IgM. Two children (2%) had a history of encephalitis during their early childhood of whom one had severe bilateral SNHL and the other had bilateral profound SNHL. CT-scan in five cases showed the presence of Mondini deformity. Only twenty-one of the children (21%) were found using single hearing aid and most of these hearing aids were found to be non-functional thus the children were not happy to use them. Speech evaluation indicated that 61% of the children had some vocabularies and could easily communicate, while 17% had the ability to communicate using lip reading and 22% had no speech at all.

## Discussion

Consanguinity, poor antenatal care, home delivery and failure to complete childhood immunization appeared to contribute to the increase in incidence of hearing loss in our community. Poverty and lack of education was a common finding among the families of these children. Prevention and cure of hearing problems in our community should thus focus on parental education and counseling. Asian children have been reported to have a three-fold higher prevalence of SNHL hearing loss compared to non-Asian children<sup>13</sup>. Consanguineous marriages are very common among the Saudi people and this was found to be mainly between first cousins. Most of the children born with a history of hereditary SNHL were born to these families. This observation supports similar findings reported from Sudan and Pakistan. The three countries share the same religious and cultural backgrounds<sup>14</sup>.

In the two residential primary schools for the deaf, all children were found to have bilateral SNHL with the exception of one child that was surprisingly found to have normal hearing, but had speech delay. This child was recently registered in one of the schools, because some of her other siblings had SNHL. The school was altered and she was scheduled for intensive speech training.

In our study, only 21% of the children were fitted with hearing aids. These were fitted late at an average age of 5 years, this is not in conformity with the universal suggestion that hearing aids should be fitted as early as 6 months of age<sup>2, 15</sup>. Stelmachowicz<sup>16</sup> suggested that hearing aids should be selected for infants and young children as soon as their hearing loss was discovered. Studies done by Tye- Murray, et al<sup>17</sup>, indicated that children fitted with hearing aids before the age of 5 years had more accurate production of vowels and consonants. We found a moderately strong but significant correlation between perception and production performance in the population of children studied. All children fitted with hearing aids were found to use only one hearing aid and most of the hearing aids were either not working properly or were rarely used. There was no regular follow up of the children for hearing evaluation and the assessment of the status of their hearing aids.

Based on the findings of this study, all the children without hearing aids were recommended to undergo immediate hear-

**Table I** Distribution of 100 children with SNHL according to their etiology

| Etiology of SNHL         | No. of Children | %          |
|--------------------------|-----------------|------------|
| <b>Congenital</b>        |                 |            |
| Family history of SNHL   | 74              | 74         |
| Consanguinity            | 32              | 32         |
| Fever in Early Pregnancy | 38              | 38         |
| <b>Acquired SNHL</b>     | <b>26</b>       | <b>26</b>  |
| Rubella                  | 5               | 5          |
| Measles                  | 2               | 2          |
| Meningitis               | 4               | 4          |
| Toxoplasmosis            | 3               | 3          |
| Encephalitis             | 2               | 2          |
| Severe Jaundice          | 5               | 5          |
| <b>Total</b>             | <b>100</b>      | <b>100</b> |

SNHL: Sensorineural hearing loss

ing aid evaluation. Those children with unilateral hearing aids who had equal hearing loss in both ears were advised to have them changed to binaural ones. Most of the parents were unable to afford hearing aids for their children due to their high price. Children who had bilateral profound SNHL were recommended to undergo cochlear implantation. Only one family accepted to have cochlear implant for their child.

Despite the inadequate rehabilitation system in these two primary schools, the level of literacy skills was found to be acceptable. Few studies have shown discouragingly low literacy skills in the average deaf high school graduates with a plateau performance from 15-18 years of age. However Geer and Moong<sup>18</sup> found that deaf students in quality intervention programmes had a much higher potential for literacy than had been previously noted.

### Conclusion

Congenital SNHL was found to be the most common cause of hearing disability among children of schools for the deaf in Abha, Saudi Arabia. Consanguinity played a major role in the etiology of this problem. Regular, appropriate screening and adequate method of rehabilitation were found to be lacking in these schools.

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