# The pattern of hearing impairment among schoolboys in an Institute for deaf subjects

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## ABSTRACT

**Objective:** The aim of this study was to study the pattern of deafness among boys of Al-Amal Institutes for the Deaf in Abha, the capital city of Asir Region, Southwestern Saudi Arabia.

**Methods:** All students (n=155) were subjected to full otoscopic and audiometric examinations, and the type and degree of deafness were graded according to the recommendation of the British Society of Audiology. Computerized tomography scan was carried out to exclude congenital inner ear deformity, and specific Igm antibodies assay for TORCHS was carried out when the history of intrauterine infection was positive or suggestive.

**Results:** More than 97% of students had sensori-neural hearing loss of various grades (55% profound, 28% severe and 14.5% moderate), while congenital conductive deafness constituted 3% of all cases. Residual hearing was reported for 43% of cases. There was delayed identification of deafness with an inverse relation between the age of identification of deafness and its severity ($F = 227.66$, $P < 0.001$). Prematurity (30%), intrauterine infection (17%) and heredity (15.5%) were the most frequently encountered causes of deafness. Postnatal causes accounted for only 20%, mostly due to meningitis 12%, other childhood fevers 5% and trauma 2.5%. Deafness of unknown cause constituted 12% of all cases.

**Conclusion:** The preventable causes of deafness in the region has not yet been overcome, a finding that will necessitate more efforts to upgrade the prenatal and perinatal health care. Late identification of hearing impairment will make the improvement in the audiology screening for infants the priority need.

**Keywords:** Deafness, hearing impairment/loss, sensorineural hearing loss, congenital deafness, prematurity, meningitis.

**Saudi Medical Journal 2000; Vol. 21 (9): 873-876**

Deafness and profound impairment of hearing affect an individual's ability to communicate with his fellow beings. The economic impact of deafness involves the cost of identification and rehabilitation.[1] Identifying the causes of deafness in an area will give vital data in planning preventive measures to eliminate avoidable deafness and help educational planning for the deaf. El-Sayed and Zakzouk[2] reported that sensori-neural hearing loss (SNHL) was more prevalent in Saudi Arabia than in most of the developed and developing countries. They reported the heredofamilial factors as the most frequent causative factors for such handicap.

In Asir region, studies have been made on the hearing impairment in normal ordinary schools[3], but no such studies have been made in schools for the deaf, and therefore data on the pattern of deafness in the region are unavailable.

The aim of the present study was to study the pattern of deafness among boys of Al-Amal Institutes

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Received 22nd April 2000. Accepted for publication in final form 5th June 2000.

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for the deaf in Abha, Asir region, Southwestern Saudi Arabia through the following: i) determination of the type and degree of deafness; ii) determination of the age of identification of different degrees of deafness, and iii) identification of the possible causes of deafness.

**Methods.** All boys of the two Al-Amal Institutes for the deaf in Abha (n=155), constitute the target subjects for the present study.

Individual records for each student were examined and an interview with the parents was conducted to collect the following data; 1) Data related to the handicap such as: hearing impairment, any consanguinity of the parents and any family history of deafness, and 2) Prenatal and perinatal history: such as history of infection, specifically (TORCHS), ototoxic drug ingestion during pregnancy, prematurity, severe hypoxia or kernicterus during neonatal period.

During a period of 6 months, from February to July 1997, each child was subjected to the following techinques: 1) Otoscopic examination was carried out by one ear, nose and throat specialist where external and middle ears were examined and any associated congenital deformity was identified; 2) Full audiological assessment by tympanogram including acoustic reflex, pure tone audiogram, and auditory brain stem response (ABR); 3) Specific Igm antibodies assay for TORCHS in some patients with positive or suggestive history of intrauterine infection, and 4) CT scan to exclude congenital inner ear deformity. The degree of deafness suffered by the students were classified according to the recommendation of the British Society of Audiology.[4]

The etiology of deafness was specified for each child based on all such previous investigations: Genetically determined deafness was considered when positive history of deafness in a parental sibling of direct parental ancestors is evident, regardless of the parental hearing status.[2] Perinatal complications were considered if the birth weight was less 2500 gms, or if there was any history indicating that the condition at birth required resuscitation such as: birth asphyxia, hyperbilirubinaemia, etc. Acquired hearing loss was only specified if there was a definite clinical association between the illness and the onset of deafness.[5]

Data were analyzed using the EPI Info software program (version 6.02) for comparison of the rates of different causes of deafness. One-way ANOVA was applied to compare the mean age of identification of different degrees of deafness.

**Results.** Table 1 shows the distribution of hearing impaired students according to certain characteristics. The mean age of those boys are 12.3 $\pm$ 3.4 years. In about one-fourth of such students, deafness had been discovered during infancy. On the other hand, 71% had been diagnosed during the first three years of life, and 2% at the age of more than 3 years. About one-half of such students (49%) have consanguineous parents and one-fourth (24.5%) showed a positive family history of deafness, mostly in the first degree relatives (16%).

Table 2 shows the distribution of hearing impaired students according to different types and degrees of hearing loss and the corresponding mean age of identification. More than one-half of students (55%) had profound sensori-neural hearing loss, and about one-fourth (28%) severe SNHL, while those with moderate SNHL were only 15%. Congenital conductive deafness constituted 3% of all cases. The table shows an inverse correlation between the age of identification of deafness and its severity. The mean age of identification for children with moderate hearing loss (HL) was 61.2 months ($\pm$ 14.2). This has been significantly reduced to 24.4 months ($\pm$ 9.6) for those with severe HL, with further significant reduction to 15.7 months ($\pm$ 6.8) for those with profound HL ($F = 227.66$, $P<0.001$). Residual hearing was reported for 43% of cases.

Table 3 shows causes of hearing loss among the boys of the Al-Amal Institute for the Deaf in Abha. About two-thirds of all cases were found to be congenital in origin (68%). Prematurity was found to

**Table 1 -** Distribution of students of Al-Amal Institutes for the Deaf according to certain characteristics.

| Characteristics | Number (%) |
|---|---|
| **Age (years)** | |
| 6-11 | 49 (32) |
| 12-17 | 93 (60) |
| 18 + | 13 (8) |
| **Total** | **155 (100)** |
| **Mean SD** | **12.3 $\pm$ 3.4** |
| **Age of discovery (years)** | |
| 0 | 39 (25) |
| 1-3 | 110 (72) |
| 4-6 | 2 (1) |
| > 6 | 3 (2) |
| **Total** | **154 (100)** |
| **Parental consanguinity** | |
| Close relation | 66 (43) |
| Far relation | 10 (6) |
| None | 79 (51) |
| **Total** | **155 (100)** |
| **Family History of Deafness** | |
| Positive FH | 38 (24.5) |
| First degree relative | 25 (16) |
| Second degree relative | 10 (6.5) |
| Far relative | 3 (2) |
| Negative FH | 117 (75.5) |
| **Total** | **155 (100.0)** |

**Table 2 -** Age of identification of deafness according to type and degree of HL among students Al-Amal Institutes for the Deaf, Abha.

| Type and degree of HL | Number (%) | Age of Indentification (month) | |
|---|---|---|---|
| | | X | SD |
| Moderate SNHL (41-70 dB) | 23 (15) | 61* | 14 |
| Severe SNHL (71-95 dB) | 43 (27) | 24* | 9. |
| Profound SNHL ( 95 dB) | 85 (55) | 16* | 7 |
| Congenital conductive HL | 4 (3) | 11§ | 6 |
| **Total** | **155 (100)** | **21** | **5** |

F = 227.66, P < 0.001
X = mean, SD = standard deviation,% = percentage
SNHL = sensorineural hearng loss
HL = hearng loss
* = only cases of moderate, severe and profound SNHL were included when applying the variance analysis.
§ = the mean age of identification for only 3 cases of 4, with one case whose data was missing.

**Table 3 -** Causes of hearing impairment among students of the Al-Amal Institutes for the Deaf in Abha.

| Causes of hearing impairment | Number (%) |
|---|---|
| Congenital | 105 (68) |
| Genetic | 24 (16) |
| Intrauterine infection | 27 (17) |
| Prematurity | 47 (30) |
| Kernicterus | 3 (2) |
| Hypoxia | 2 (1.5) |
| Ototoxic drugs | 2 (1.5) |
| Meningitis | 19 (12) |
| Other childhood fevers | 8 (5) |
| Trauma | 4 (3) |
| Unknown | 19 (12) |
| **Total** | **155 (100)** |

be the leading cause of congenital deafness (47/105, 45%) constituting 30% of all cases, followed by intrauterine infection (27, 17%). Heredity came the third most common cause of congenital deafness (24/105, 23%) and was responsible for 15.5% of all cases of deafness. Other causes of congenital deafness include: kernicterus (2%), hypoxia and drugs (1% each).

Meningitis was the leading cause of postnatal deafness and was responsible for 12% of all cases, followed by other childhood fevers (5%) and trauma (2.5%). Deafness of unknown causes was detected in 12% of cases.

Discussion. Childhood deafness is still a major public health problem in developing countries in general and in Saudi Arabia in particular.[2] The present study showed that out of the 155 deaf students in Al-Amal Institutes for the Deaf, 55% are with profound HL of 95 dB or greater, 28% with severe HL, and only 15% with moderate HL. Although most children with a HL greater than 90dB need the type of education provided in a school for the deaf, the educational needs rather than audiogram determine school placement.[6] The present study revealed that 43% of all students may have been able to make good use of their residual hearing in partially hearing units (PHU) which are often attached to normal schools. Unfortunately such units are not available in the Kingdom.

The age of identification of severe and profound deafness has a great implication upon the educational process.[5] The ideal age for detection is within the first few months of birth.[7] In the present study, however, although congenital deafness constituted about 68% of all cases, only one-fourth of all cases had been identified during infancy. In the UK, the mean ages of identification of moderate and severe bilateral deafness were 46 months and 19 months.[5] The corresponding ages in the present study were 61.4 months and 24.2 months ie. higher ages. Even, 4.5% of all cases of the present study were of school age before their deafness was recognized. This finding reflects the late detection of childhood deafness in the region, with its serious social educational, and habilitative implications.

When etiology of hearing loss is being considered, the age of the children being studied is critical to the outcome. In the present study, heredity was responsible for 15.5% of cases of deafness. Such genetically-determined deafness may be attributed to the high prevalence of consanguinity among the Saudi population[8,9] which increases the risk of transmission of both autosomal recessive and the polygenetic (multifactorial) inheritance. Boys of consanguineous parents in the present study constitute 49% of all children. In a genetic aetiological survey of childhood deafness, autosomal recessive deafness was prevalent among 92% of all the genetically determined cases.[10] Heredity was also manifested by presenting the same handicap among close members of the family (24.5%). However, the frequency of genetically determined deafness in the present study is much lower than the figure of 40-50% in developed countries[1], and even lower than the figure of 66% in Riyadh.[2] This might be attributed to the relatively lower level of medical care in Asir region, with the consequent higher frequency of deafness of acquired origin at the expense of the rate

of congenital deafness.

Maternal infection during pregnancy with rubella or cytomegalovirus may cause deafness alone or in association with other handicaps.[1] In the present study, such infection was responsible for 17% of all cases. This figure is relatively high, if compared with other studies[2,8] reflecting the lack of immunization service offered to women at the time when such children were born. Thus, it is hoped that such prevalence of infection be reduced by the effective immunization under the umbrella of the primary health care services distributed all over the Kingdom.

Perinatal events, singly or in combination, account for some cases of hearing defects. Prematurity was the leading perinatal factor in the present study, constituting 30% of all cases. It is probably the problems associated with prematurity rather than prematurity itself which account for undoubtedly increased incidence of hearing loss.[1] Earlier fears that incubator noise and the extensive use of gentamicine would damage the hearing do not seem to have been realized.

Bacterial meningitis is a leading cause of acquired SNHL. Several studies of school-age children have shown that it is the cause of 8-24% of all cases with sudden deafness.[1] In the present study, meningitis was responsible for 13% of all cases of deafness, and was the leading post-natal factor. This is consistent with most published studies.[11,12] Early identification and treatment of otitis media and early diagnosis and initiation of medical therapy in meningitis are important to decrease the incidence of post meningitic HL and neurological sequelae. However prevention of meningitis by vaccination was reported by others[2] as the only means of reducing this complication. Such strategy will be effective also in reducing the hearing loss due to other childhood fevers that were responsible for 5% of all cases of deafness in the present study.

The results of this study revealed that Saudi Arabia in general and the Asir region in particular have not yet overcome the preventable causes of deafness. This will necessitate more efforts to upgrade the prenatal and perinatal health care, with special emphasis to immunizations to prevent maternal infections.

Heredity is one of the main causes of hearing impairment and parental consanguinity may well play an important role. Thus, premarital counseling and examination and the discouragement of consanguineous marriages, especially in suspected cases of hereditary disorder in a family could be recommended.

The late detection of hearing impairment shown in this study, will make the improvement in audiology services the priority needs for early identification of deafness. Children suspected of having a hearing loss should be screened at ages seven to nine months. Such hearing screening should be focused on 'at risk' infants. Training for pediatricians, general practitioners and nurses at the primary health care setting in performing behavioural screening tests for detecting hearing loss in children is also recommended.

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