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# The Degree of Hearing Loss and Presumed Etiologies in Children and Adults in Béni Mellal, Morocco

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## Introduction

Deafness is a sensory disability most frequently encountered in children at a rate of 1/1000 at birth, 5% of the population aged less than 45 years and 30% of the subjects over 70 years.

5.12% of the Moroccan population was identified as being in a situation of disability in September 2004. That is around 1,530,000 people including 14.3% with hearing impairment [1].

Hearing deficits can be classified into two broad categories: Transmission Deafness and Perception Deafness. For the first, the least frequent, surgical treatments can be prescribed. For the second one, the perception deafness - featured by loss of hearing cells of the organ of Corti and auditory neurons of the spiral ganglion, there are at present, aside from substitute of auditory function techniques (speech therapy, hearing aids, cochlear implants or brain stem) no alternative [2].

Children's deafness differs from that of adults by various aspects. Hearing is essential to the young child's harmonious development of oral language. Therefore its etiologies are different from those of the adult [3].

In adults, the presbycusis is undoubtedly the most frequent cause with a hereditary predisposition. 2/3 of "deep" or "severe" children's deafness cases are associated with a genetic cause. They can be part of a syndrome (30% of cases) or occur separately (70% of cases). Recent advances have been made in the knowledge of genetic deafness, through the identification of an increasingly number of implied genes and the development of some "performing" molecular diagnostic tools [4].

## Patients and Methods

The study presented in this paper refers to a population of 210 patients with perceived hearing impairment problems. The study was conducted during 2010.

The survey were type face to face, deafness levels were evaluated in a law audiologist in the presence by a specialist doctor in Otorhinolaryngology.

The etiological diagnosis of patient's sensorineural deafness was based on clinical, radiological and audiometric data confrontation (a clinical review shows a loss compared to the normal ear, expressed in decibels (dB HL, I.S.O Standard). Recommendation 02 of the International Office of Audiophonology (B.I.A.P) used for 25 years, has been clarified (October 26, 1996) to take into account the recent clinical observations. An average loss is calculated in decibels from the loss measured at 500 Hz, 1000 Hz and 2000 Hz 4000 Hz frequency. Any frequency not collected is rated 120 dB. Their sum is divided by 4 and rounded off to the upper unit).

This calculation provides an average tonal loss as a basis for the following audiometric classification:

- Normal and subnormal, hearing the average tonal loss is less than 20 dB.
- Mild hearing impairment, the average tonal loss is between 21 and 40 dB.
- Hearing impairment average, the average tonal loss is between 41 and 70 dB.
- Severe hearing impairment, the average tonal loss is between 71 and 90 dB.
- Profound (or "deep") hearing loss, the average tonal loss is between 91 and 119 dB.
- Total hearing impairment: cophosis the average loss is 120 dB.

Possibly supplemented by a family survey that included questions on the mother's health status during pregnancy and childbirth, any information on the person with a disability such as age, sex, birth place, schooling level…. Analysis and processing of the results were made by statistical software (Sphinx 2 plus). The test used is that of chi2 which is a statistical hypothesis test based on a statistical probability law. Comparing the effective distribution of a sample on various items crossed with what it should theoretically be given the structure of the sample distribution, it highlights the differences that are more significantly positive and those significantly lower.

## Results and Discussion

For our study we have used a sample of 210 patients (according to our criteria). We noted a female predominance: 114 cases (say 54.3%) compared to 96 cases of male (say 45.7%). The age of our patients ranged from 3 years to 95 years, the population aged less than 30 years accounted for 62.4% of the overall sample.

 

## Degree of deafness or deafness scale

All 210 patients were examined by a specialist in oro- rhino-laryngology, and the degree of deafness has been evaluated by a qualified audiologist, except for some children the use of the PEA was mandatory.

Almost all 210 cases had a bilateral sensorineural hearing loss. 85 cases had a profound deafness or 40.5% of the study population. 67 cases had a severe deafness or 31.9% of the study population. 34 cases had an average hearing loss or 16.2% of the population studied. 18 cases had a cophosis or 8.6% of the population. 4 cases had a slight deafness or 1.9% of the study population. Unilateral sensorineural hearing loss was observed in only in two cases.

In 51% of the population the patient had bilateral deafness of degree of the same level for both ears, and in the 49% of the population, the left ear had a degree of deafness more severe than the right ear.

## Deafness distribution by sex gender

The distribution of degree of deafness over sex is significant and there is a trend showing that men are more affected by the average hearing loss than women who are affected by deep and total deafness (Table 1).

**Table 1** Distribution of deafness by sex.

| Degree of deafness | Female | Male | Total | Chi2 | P value |
|---|---|---|---|---|---|
| Light | 1,0% | 1,0% | 1,9 % | chi2= 0,03 | p=0,8647 |
| Average | 5,2% | 11,0 % | 16,2 % | chi2= 5,63 | p=0, 0176 |
| Severe | 16,7 % | 15,7 % | 31,9 % | chi2= 0,16 | p=0,6858 |
| profound | 24,8 % | 16,2 % | 40,5 % | chi2= 0,95 | p=0,3308 |
| cophosis | 6,7% | 1,9% | 8,6 % | chi2= 3,72 | p=0,0539 |

**Notes:** Dependence is significant. Chi2 = 11.86, ddl = 4. 1-p = 98.15%.

Percentage of variance explained (Cramer's V): 5.65%

## Etiologies of bilateral sensorineural hearing loss

In our sample the etiologies of bilateral sensorineural hearing loss are:

- Recognised genetic cause (both syndromic and non-syndromic) represents 12.9%.
- Prenatal-perinatal-postnatal extrinsic cause accounts for 55.7%. Sporadic due to unknown cause represents 31.4%.

## Distribution of found etiologies of deafness

**Table 2** Distribution of found etiologies.

| Presumed Cause | Effective | Frequency |
|---|---|---|
| Unknown | 66 | 31,4% |
| Hereditary | 27 | 12,9% |
| Typhoïd | 25 | 11,9% |
| Meningitis | 8 | 3,8% |
| Presbycusis | 10 | 4,8% |
| Otitis media | 22 | 10,5% |
| Hyperthermia | 17 | 8,1% |
| Neonatal souffring | 6 | 2,9% |
| Noise | 4 | 1,9% |
| Trauma | 7 | 3,3% |
| Rubella | 2 | 1,0% |
| Perinatal souffring | 16 | 7,6% |
| Total | 210 | 100% |

## Etiology of genetic perception deafness

With scarce exception almost all hereditary forms of deafness analyzed so far correspond to monogenetic violations [5].

When hearing loss is associated with other diseases or defects, it is said to be syndromic. In non-syndromic deafness, autosomal recessive forms are the most frequent and deafness is usually congenital.

**The syndromic and nonsyndromic deafness:** The recessive form is the most common one. It is a transmissible genetic family deafness which can skip generations. This hereditary deafness represents 12.9% of the sample. 27 cases studied and are all congenital, evolutionary, and prelinguales in 11.9% cases. Only 1% of cases the hearing loss were postlingual. It was long thought that late forms of deafness hereditary yielded from a combination of genetic and environmental causes [5].

Syndromic deafness represented 1.9% or 4 female persons. Non-syndromic deafness was observed in 23 cases or 11% of the sample divided between 6% of male and 5% of female subjects. The degrees of deafness (for both syndromic and non syndromic) were as follows: average deafness (3.8%), severe deafness (2.9%), profound deafness (4.8%) and cophosis (1%); the left ear is more affected than the rightear in 7.2% of cases.

According to the survey of families of sufferers, the deafness was distinguished among the first generation (9%) and second generation (3.9%). Occurence of these hereditary deafness in families is significant (p0,05).

Of the 27 cases 4 individuals underwent postlingual progressive deafness which can be thought as a form of

dominant deafness. In the dominant forms, deafness is often progressive or delayed-onset during childhood or at the age adult [6].

## The extrinsic causes

**Table 3** Distribution of individuals by the causes of deafness.

| Presumed cause | Effective | Frequency |
|---|---|---|
| Unknown | 66 | 31.40% |
| Genetics | 27 | 12.90% |
| Postnatal | 93 | 44.30% |
| Perinatal | 22 | 10.50% |
| Prenatal | 2 | 1.00% |
| Total | 210 | 100% |

A quarter of children's deafness is of extrinsic causes. It is often difficult to certainly state that deafness is of extrinsic cause. A comprehensive review must be carried out in order to avoid a genetic form [7].

**Table 4** Distribution of the causes of the deafness according to age groups.

| Presumed cause / Age | less than 10 | De 10 à 20 | De 20 à 30 | De 30 à 40 | De 40 à 50 | De 50 à 60 | 60 and more | Total | Chi2 |
|---|---|---|---|---|---|---|---|---|---|
| unknown | 6,2% | 10,5% | 7,1% | 2,9% | 1,9% | 0,5% | 2,4% | 31,4% | chi2= 6,23 |
| hereditairy | 2,9% | 2,4% | 2,4% | 2,9% | 0,5% | 1,4% | 0,5% | 12,9% | chi2= 7,23 |
| postnatal | 5,2% | 5,2% | 9,0% | 3,3% | 7,1% | 5,7% | 8,6% | 44,3% | chi2= 13,73 |
| Perinatal | 2,9% | 5,7% | 1,9% | 0,0% | 0,0% | 0,0% | 0,0% | 10,5% | chi2= 16,04 |
| Prenatal | 0,5% | 0,5% | 0,0% | 0,0% | 0,0% | 0,0% | 0,0% | 1,0% | chi2= 2,85 |

- **Notes:** Dependence is very significant. Chi2 = 57.61, ddl = 24, 1-p = 99.99%.
- Percentage of variance explained (Cramer's V): 6.86%.

**The prenatal causes:** Rubella tends today to scarce thanks to immunization programs. In our sample only 2 cases of profound deafness (caused by rubella) were detected (or 1% of the sample). Maternal infections during pregnancy by viruses or bacteria, leading to(possible) bleeding or hyperthermia, were observed in 10.5% of the sample, with a risk factor of deafness ($p = 10^{-4}$).

Prenatal causes may be secondary to the early pregnancy bleeding and vitamin deficits have been reported as prenatal causes of deafness [8].

No cases of deafness caused by ototoxic treatment were observed in our sample.

**The perinatal causes:** Perinatal deafness were observed in 22 cases - 12 of which are female, or 10.5% of the sample with 30% of premature infants, 45% of subjects are individuals born at term with a less than 2000 g birth weight, and have suffering of neonatal asphyxia. Concordance of the two factors is statically significant (p = 0,0165); acute fetal distress during Anoxia in childbirth is also a risk factor for perinatal deafness and was observed in 14% of children born at term with normal weight at birth.

The degree of hearing loss varies between average deafness and the bilateral cophosis. All individuals have another disability associated with Deafness (P = 0, 0114) such as mobility impairment, Visual impairment, mental handicap, heart disease and metabolic disease.

**Acquired postnatal deafness:** Acquired Postnatal Deafness may be secondary to different etiologies. They represent 44.3% of the sample (say 93 cases) of which 54 cases are female.

Studying deafness occurrence as a function of age shows that the difference between the age groups is significant, 11.9% of postnatal acquired deafness cases are due to typhoid fever and it is observed in patients aged 11 years and over.

Bacterial meningitis and hyperthermia are the major causes of acquired hearing loss in children under the age of 10 years with respectively 3.8% to 8.1%. Chronic otitis remains the last cause while (the) noise and injuries remain the major causes of deafness in adults aged 30 years and above with respectively 1.9% and 3.3%. The presbycusis and chronic ear infections are the major causes of deafness in the elderly of 60 years and more and is always a progressive deafness with respectively 4.8% and 10.5%.

## The unknown causes

In 31.4% of the sample the symptom is isolated and no history record suggested a particular etiology. It can be deduced that many sporadic deafness cases are in fact recessive autosomal genetic ones. Development of molecular diagnostics of routine targeted on connexins 26 and 30 genes should – in a progressive way, genetically feature these deafness cases for most patients [9].

## Social life and integration

Only 46.2% of individuals benefit from hearing aids, with only 1% benefiting exclusively of cochlear implant and come in the 90% of cases from poor families whose daily income less

than DH50 per day. The hearing impairment is more prevailing in poor families [10].

With regard to schooling 54% people are illiterate and the 46% of educated individuals claim that their disability is the first factor disrupting their curriculum [11-19].

## Conclusion

Works on the prevalence of deafness especially among children in the Morocco are still at the primary stage. Improvement of technical means by suitable support of pregnant women during birth, delivery and properly tackling neonatal suffering and other infections are measures to significantly reduce the deafness as part of primary healthcare by health education. Half of all cases of hearing loss could be avoided through primary prevention. Early detection and early intervention are the most important factors to minimize the impact of hearing loss.

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