A CLINICAL AND AUDIOLOGY STUDY OF HEARING IMPAIRED PRE-SCHOOL CHILDREN

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SYNOPSIS

Otological and audiological evaluations were performed on 45 hearing-impaired children who were due to register for primary education. The E.N.T. specialist and the audiologist had to decide the type of school for those hearing-impaired children. Of the total sample, 16.7% showed a good chance of integrating with normal hearing school children based on audiometrical finding of less than 90dB HL for the average hearing levels at 0.5, 1 and 2KHz. The rest of the cases (83.3%) had to attend educational programmes offered by special school for the deaf. The aetiology of Deafness and the use of hearing aids are being examined. Also the basic requirements for an integration of hearing-impaired children in regular educational programmes are critically discussed here.

INTRODUCTION

In recent years, our E.N.T. Dept. have been confronted with an increased number of young children referred with suspected hearing impairment. This is because there is an increased focus by educators and clinicians upon early identification of sensory deficits and upon the optimal language learning period.

The E.N.T. specialists and the audiologist have to decide the future type of school for the hearing-impaired children after a thorough otological and audiological examinations. Final decisions are made as to where to place these children, who are to commence school attendance after the age of six. Hearing-impaired children, especially of the profoundly deaf, usually attend educational programmes offered by special school for the deaf in Singapore. Pupils in the school for the deaf generally have great difficulties in oral communication. However, those hearing-impaired children where hearing loss is not too severe can be completely integrated with hearing classes as soon as they have been adequately equipped with a good hearing aid and provided that they can receive appropriate help from a speech therapist. Such children may never need to attend special class for the deaf, especially if proper attention of their hearing handicap and to their language development has been given in the pre-school period.

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Here, we have attempted to perform otological and audiological evaluations on these 45 hearing-impaired children due to register for primary school. The basic requirements for a integration of the hearing-impaired children in regular educational programmes are critically discussed here.

MATERIALS AND METHODS

The subjects were 23 males and 22 females ranging from 5 to 6 years old. All the subjects were subjected to a careful ear examination by the E.N.T. specialist and the relevant medical history was recorded.

The audiological examinations comprised of conditioning audiometry with bone and air conduction, acoustic reflex test and tympanometry. All the audiometric examinations were carried out in an audiometric two-room suite. A clinical diagnostic audiometer (Beltone Model 200-C) was used and was calibrated conforming to ISO 1964 standard. Air conduction and bone conduction thresholds were obtained for the frequencies 250Hz to 4000Hz.

In the Impedance audiometry, an Amplaid Impedance Meter was used. The stapedius reflex recording and the tympanometric determination of the eardrum mobility were carried out using the technique designed by Anderson et al (1) and described in detail by Klockhoff (2) The stapedius reflex was elicited by means of an audiometer capable of delivering an output of 125dB HL at 500Hz to 4000Hz and for white Noise.

RESULTS

In most cases, the hearing loss in a particular subject was identified from the medical history. Idiopathic causes account for 37.8%. We listed 8 classes into which we had been able to distribute the subjects and this is shown in Table 1.

It was also noted that in 75.5% deafness was detected before the 3rd birthday. A breakdown of the various age level in which deafness was detected, can be seen in Table 2: 11.1% of the cases were not known.

Table 3 compares the presence of conductive pathology as indicated by otoscopy and tympanometry. Tympanometry indicated conductive pathology in 7 ears (7.8%) whereas otoscopy indicated 8 ears (8.9%). The various tympanometric patterns found in this study are: normal Type A tympanograms were found in 71 (78.9%) ears and Type C tympanograms (middle-ear pressure greater than (150H²0mm) had 7 (7.8%) ears. No other tympanogram types were observed.in this sample.

The average hearing threshold in each ear was computed at 500, 1000 and 2000Hz. We divided our audiogram results into 4 categories and this is shown in Table 4. Majority of the children had average hearing level of more than 90dB HL. For the acoustic reflex testing, many of the ears showed no acoustic reflex responses. The acoustic reflex results are shown in Table 5.

Another aspect of the survey showed that 75.5% of all the subjects seen during the time of testing, had a body-worn hearing aid. Of these 64.4% used a monoaural hearing aid and 11% used binaural hearing aid (Y-cord Type). It was not known how often they used their hearing aid per day. Table 6 shows the number of subjects who had monoaural hearing aids, binaural hearing aids and those who had no hearing aid at all.

DISCUSSION

Clearly, a comprehensive medical examination is of utmost importance to detect any other abnormality especially of the Central Nervous System or to identify features of recognisable syndromes connected with hearing impairment. The examination should include a most careful examination of the ears, nose and throat. The value of a medical history is fairly self-evident, especially concerning the identification of pre-natal infections and when serological evidence from ante-natal studies are available.

Some studies (3,4) have shown that the greatest number of hearing-impaired children fall into 6 categories of risk. The 6 categories are:-

1) history of hereditary childhood hearing impairment
2) Rubella or other nonbacterial intraauterine fatal infection (e.g. Cytomeglovins infection, herpes infection)
3) Deficits of ear, nose or throat: malformed, lowset or absent pinnae, cleft lip or palate, any residual abnormality of the otorrhinolaryngeal system.
4) Birth weight less than 1500 grams
5) Neonatal jaundice
6) Neonatal meningitis

In our study, using the above categories, 62.2% of our cases can be linked to one of the above factors. A high proportion of the cases, we could not identify the causes because of inadequate medical history and investigations (neurological and serological).

Several studies have indicated the high incidence of middle ear disorder in infants and children (5,6). The severity of sensorineural hearing loss prevent accurate measure of hearing sensitivity by bone conduction and that no air-bone gap could be noticed. It has been suggested that acoustic-impedance bridge procedures be used for the detection of conductive pathology (7). The results of our study suggest that otoscopic examination as well as tympanometry can be used successfully to detect conductive pathology.

The main use of the acoustic reflex lies in the identification of the nature of sensorineural hearing losses whether it be cochlear or retrocochlear (8). In children, where alternate loudness balance test or the loudness discomfort test is not available, the acoustic reflex is one method to aid diagnosis. Haivng established the normal acoustic reflex span at each frequency, the presence of loudness disorder can be deduced by the identification of the reflexes in cases of sensorineural deafness. Two difficult pathologies will indicate this possibility. It is known that genetically inherited deafness is normally due to cochlear disorder, whereas deafness from jaundice is usually due to damages of the cochlear nuclei in the brainstem. In the former case, where the lesion is cochlear, the condition is assocaited with loudness discomfort whereas the latter is not so.

In our study we found that 16.7% of the cases had average Hearing level of less than 90dB for frequency 0.5, 1 & 2KHz. We noticed also that these sample of children had acquired more speech than those who had poorer hearing. The advantages of early detection of hearing impairments have been well documented (9, 10) and it makes possible immediate remedial action or the introduction of an habilitation programme which can result in substantial cost saving in the later treatment of a handicapped child (10). About 75.5% of our cases were known

to have hearing loss before the age of 3 year old. Once their deafness were being confirmed, they were referred for speech therapy and prescribed a body-worn hearing aid. However, a common finding in this study was that only a minority of subjects makes extensive use of their hearing aids. A substantial proportion made no use of the aids prescribed. The majority of them was using the instruments for rather limited period of time and for a limited range of activities. One of the major reasons advanced for the infrequent usage by the subjects was the poor acceptability of the aids. The parents expressed that there was a stigma attached to the wearing of such an instrument. Another substantial source of complaint was the poor fitting of the earmould into the child's ear.

There seems to be a wistful hope among some educators and parents of the hearing-impaired children that if one can detect a profoundly deaf infant early enough and apply powerful amplifications, he will hear enough to acquire speech and language. The hearing-impaired children have special needs which must be met by very special teachers and parents. Whether a hearing-impaired child shall be integrated into a regular educational programme or not depends very much on the way the child was brought up at home and in the pre-school. There is a growing number of hearing-impaired children who, as a result of early home training and education in a normal kindergarten, go to school reading and with much more speech and language and more mature personalities than the children entering school for the deaf 5 to 10 years ago. We must learn to take advantage of the increased potential of these children which is a challenge to all of us concerned with the education of hearing-impaired hearing.

Lowe (11) had listed the basic requirements for an integration of hearing-impaired children in regular educational programmes and they are as follows:-

- — the age at onset of loss
- — the degree of loss in the speech range
- — the quantity and quality of his language development
- — the age at which his hearing begin, the earlier the training begin, the more likely he will have a chance to enter an integrated class
- — additional handicaps, the multi-handicapped hearing impaired child is more likely to go to a school for the deaf
- — the quality of parent child relationships
- — the socio-economic background of the family
- — the lip reading ability
- — the proper fitting of good hearing aids
- — the availability of supplemented instruction services

CONCLUSION

1. Early identification of deafness would assure early diagnostic assessment and management.
2. Early educational placement could assist in the development of better communication skills.
3. Hearing-impaired children would be prevented from entering the wrong type of school.

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TABLE 1: PROBABLE CAUSES OF DEAFNESS

Causes	Number of Cases	%
Rubella & other Viral exantherm	12	26.7
Meningitis	5	11.1
High Fever	5	11.1
Premature Birth	3	6.7
Head Injury	1	2.2
Kernicterus	1	2.2
Hereditary	1	2.2
Unknown	17	37.8

TABLE 2: AGE GROUP IN WHICH DEAFNESS IS DETECTED

	since Birth	1 year	2 year	3 year	4 year	Not Known
Number of Cases	11	5	18	5	1	5
%	24.4	11.1	40	11.1	2.0	11.1

TABLE 3: INDICES OF CONDUCTIVE PATHOLOGY

Procedure	Findings	No. of Ears
I) Otoscopy	Pathologic Non-pathologic Non-Examinable	8 (8.9%) 80 (88.9%) 2 (2.2%)
II) Tympanometry	Pathologic Non-pathologic Non-testable	7 (7.8%) 71 (78.9%) 12 (13.3%)

TABLE 4: AVERAGE HEARING THRESHOLDS IN EACH EAR COMPUTED AT 500, 1000 AND 2000 Hz

	Number of Cases	%
Good Residual Hearing (< 90dBHL)	15	16.7
Poor Residual Hearing (> 90 — 110dBHL<)	48	53.3
No Residual Hearing (> 110dBHL)	19	21.1
Not Tested	8	8.9

TABLE 5: ACOUSTIC REFLEX THRESHOLDS RESULTS

	Number of Ears	%
A/R/Ts elicited for at least 2 frequencies	12	13.3
Negligible A/R/Ts	66	73.3
No A/R/Ts Done	12	13.3

TABLE 6: TYPES OF BODY-WORN HEARING AIDS

Body-Type Hearing Aids	Number of Cases	%
Monoaural	29	64.4
Binaural (Y-Type)	5	11.1
No Hearing Aid	11	24.4