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Original Article

Etiological factors of deafness and results of aided audiogram among below 12 years deaf children in a deaf school

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Abstract:

Introduction: Deafness is the invisible disability and the commonest human sensory defects. It leads to difficult speech development, poor educational and employment prospects of chilhood. Comprehensive otologic and audiological evaluations are very much essential for etiological assessment of hearing impaired children and management efficacy.

Methods: A cross-sectional study was carried out with the aim to evaluate the etiological factors, degree of hearing loss, type of hearing loss, and results of aided audiogram among the below 12 years deaf children. The study included 100 deaf children below 12 years with history of deafness and non-development of speech.

Result: The etiology of deaf Children was diverse. Infection was the predominating etiological factor (38%). The infections were: measles (31.5%), pneumonia (26.2%), typhoid (21.5%), maternal rubella (5.2%), varicella (5.2%), mumps (5.2%) and meningitis (5.2%). 48% of deaf child had a parental suspicion of deafness below the one year of age. 35% had a positive family history and 32% had history of consanguinal marriage. The deaf children were managed with hearing device, among them 89% with hearing aid and 11% with cochlear implant 42.7% of child used hearing aid in both ears. The results of aided audiogram reflected that, the gain after using hearing aid within 31-60 dB were 80%. 10% in right ear, 71.10% in left year and 70.00% in both ears, so average gain after using hearing aid was 74% within 31- 60 dB.

Key words: *Deafness; aided audiogram; deaf children*

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Introduction:

Speech and hearing are closely integrated. A profound hearing impaired child cannot speak or develop speech as he or she cannot hear. Hearing impaired children may have defective speech and perform poorly in school and labeled as mentally retarded. Children can not complain about impaired hearing and sometimes even their parents cannot notice. Guardians are known to be unaware of this disability in at least 30% of affected children[1]. So, early identification of hearing loss is desirable to optimize rehabilitation. But, deafness of children is still a special problem in our country in terms of assessment and

rehabilitation. For this reason, comprehensive otologic and audiological evaluations are very much essential for suspected hearing impaired children.

The term 'deafness' and deaf' are used to cover moderate, severe and profound hearing loss. In Bangladesh, deafness is a major public health problem. The country has a population of over 150 million and about 15 million people are suffering from severe to profound hearing loss leading to disability[2].

In UK, approximately one in 1000 is born with a bilateral permanent childhood hearing impairment (PCHI). This is defined as confirmed permanent bilateral hearing impairment exceeding 40 dBHL (Hearing level) (average of pure tone thresholds at 0.5, 1, 2 and 4 KHz in the better hearing ear). About 60% of these children have a moderate (41-60dHBz) hearing loss, while the remainder have a severe (61-80dBHL) or profound (>81 dBHz) loss[3].

Hearing loss in a child may be present at birth (congenital) or may develop after birth (acquired). The prevalence of permanent childhood hearing impairment (PCHI) increases with age, suggesting that a further one in 1000 children develop acquired or progressive hearing impairment[4].

In the developing world, the greatest proportion of childhood hearing loss is caused by infection. This includes congenital conditions such as rubella and cytomegalovirus and acquired childhood infection such as mumps, measles, meningitis and chronic otitis media. In the developed world, about half of children with permanent childhood hearing impairment (PCHI) have a genetic cause for their deafness[5].

One analysis suggests that consanguinity contributes to the raised prevalence of deafness in the Bangladeshi British population. The distribution of causes of deafness has been genetic causes in 60% acquired/environmental in 18% and unknown in 22% of the 134 subjects in the study carried in East London Bangladeshi population. Amongst the genetic causes, most of the children (58%) had non-syndrome deafness. Even after genetic analysis, the cause of deafness remains undetermined in 22% patient[6].

In nearly half of children with permanent hearing impairment the cause is genetic[7, 8]. Of the genetic causes of hearing loss, syndromic form of deafiness accounts for 30% and non-syndromic hearing loss accounts nearly 70% cases[9].

It has been estimated that approximately one in 1000 live births suffer from profound deafness, and greater than 50% of this group is of genetic etiology[10].

Approximately 70-80% is autosomal recessive. 15-20% autosomal dominant and 2-3% are X-linked or mitochondrial[11-12].

Earlier detection with universal neonatal screening is now practiced in developed countries. Advances in detection, genetics, imaging and treatment including amplification and cochlear implantation – for these children have meant that new guidelines and way of working are needed for health-care professionals.

In our country, government runs seven deaf schools, where education is given free of cost. In the non-government sector there are about thirty schools for deaf[2].

Amplification with hearing aid for these children is mainstay of rehabilitation in all countries. The benefit of use of hearing aid can be assessed by subjective improvement and also by doing aided audiogram some of the children will need cochlear implantation whose aided gain was beyond the speech banana that means beyond 60dB of hearing.

The present study was carried out in Integrated Pre-School of Hearing Impaired Children (IPSHIC) of SAHIC, as all children admitted in this school were below the age of 12 years and the facilities of aided audiogram was available. To find out the cause, degree and type of hearing loss among children of this school as well as to evaluate the hearing gain after hearing aid were the aim and objectives of this study.

Methods:

This cross-sectional study was carried out in integrated pre-School of Hearing Impaired Children (IPSHIC) of SAHIC, Dhaka in the period of August 2009 to February 2010. Purposely 100 deaf children, age below 12 years were selected for study. Data was collected by personal interview with data sheet and examination of ear nose throat with audiological tests before and after hearing aid were done.

Results:

Results are compiled in following tables

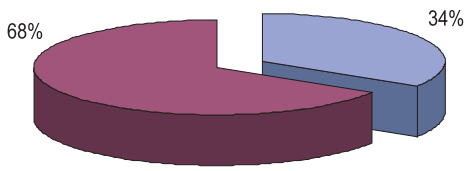

Figure 1: *Family history of deafness (n=100).* Positive family history was found in 34%.

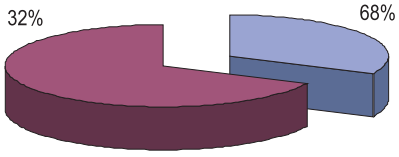

Figure 2: *Type of marriage (n = 100).* Consanguineous Marriages found in 32 %.

Table-I

Etiology of deafness (n = 100).

Age group (years)	Number of patients	Percentage (%)
Infection	38	38
Low birth weight & Prematurity	14	14
Birth asphyxia	16	16
Neonatal Jaundice	6	6
Birth trauma	4	4
Ototoxic drug	2	2
Down's syndrome	2	2
Cerebral palsy	8	8
Unknown	10	10

The etiology of deaf child was diverse. Commonest (38 %) causes of deafness was infection.

Table-II

Type of infection (n = 38).

Name of infection	Number of patients	Percentage (%)
Prenatal		
Maternal rubella	2	5.2
Postnatal		
Measles	12	31.5
Pneumonia	10	26.2
Typhoid	8	21.5
Varicella	2	5.2
Mumps	2	5.2
Meningitis	2	5.2

Measles was found as the commonest infection (31.5 %).

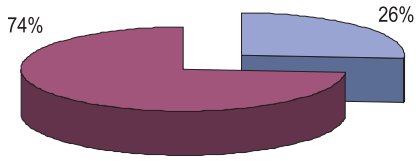

Figure 3: *Type of hearing loss (n = 100).*

Majority of patients hearing loss (74%) presented were sensorineural in type.

Table-III

Type of hearing device (n = 100).

Hearing device	Number of patients	Percentage (%)
Hearing aid	89	89
Body worn (BW)	58	58
Behind the ear(BTE)	31	31
Cochlear implant	11	11

Most of the deaf child (58%) use body worm type hearing aid, a number of deaf child 11% use cochlear implant.

Table-IV

Audiological results after hearing aid fitting (n = 89)

Audiological results after using hearing aid	No. of patients			Percentage (%)		
	Rt. ear	Lt. ear	Both ear	Rt. ear	Lt. ear	Both ear
0-30dB	0	0	0	0	0	0
31-60dB	72	64	62	80.10	71.10	70.00
>60 dB	16	25	38	19.90	28.90	30.00

Audiological results after using hearing aid were 80.10% in right ear, 71.10% in left ear and 70.00% in both ears within 31 dB – 60 dB which were within speech banana that means below 60 dB. Results after using hearing aid were 19.90% in right ear, 28.90% in left ear and 30.00% in both ears which were beyond the speech banana that means beyond 60 dB.

Discussion:

In this study one hundred (100) deaf children aged below 12 years have been studied. Emphasis was given of history, clinical examination and audiological investigation before and after hearing aid fitting. Although this study had been carried out with a limited period of tome and with a limited number of patients yet this may reflect the overall situation of the society as the patient had been collected from a referral centre where patients are referred from different areas of the country.

In this study, the age at parental suspicion of deafness was below one year in 48% children. This result is consistent with the findings of other series[13, 15].

This study reflected positive family history of deafness in 34% and consanguinal marriage in 32% which was supported by another study[6].

The identification of etiological factors of deafness was mainly based on history taken from of parents. In this series, the etiology of deafness was diverse. Main etiological factor of deafness was infection (38%) which is supported by many other series[13, 14, 15, 16].

Other etiological factors were birth asphyxia (16%), prematurity and low birth weight (14%), unknown (10%), cerebral palsy (8%), neonatal jaundice (6%), birth trauma (4%) ototoxic drug 2% and Down's syndrome 2% More or less similar findings are noted in High Care study.

Among the infection, measles contributes in 31.5% followed by pneumonia (26.2%), typhoid (21.5%), maternal rubella, vareclla, mumps, meningitis contributes 5.2% each. This findings is in accordance with other series[13, 14]

Here pure tone audiometry (PTA) was done in 50% deaf child and behavior observation audiometry (BOA) in 32% and free field audiometry (FFA) in 18% of deaf child. 90% of deaf child presented with bilateral profound hearing loss and 10% presented with bilateral severe hearing loss. 74% were bilateral sensorineural and 26% were bilateral mixed type hearing loss. The above results are consistent with findings of other series [13.17].

In this study, 58% used body worn (B/W) hearing aid, 31% used behind the ear (BTE) & 11% used cochlear implant (CI). Most of the child (42.7%) used hearing aid in both ear, 30.30% used in right ear and 27.00% used hearing aid in left ear.

WHO report of in inter-country consultation [18] showed that body worn type was dominant in India where as BTE type in Indonesia.

The results of aided audiogram of this study showed that aided gain within 31-60 dB were 80.10% in right ear, 71.10% in left ear and 70.00% in both ears. The above findings were within the speech banana. So, average gain after using hearing aid was 74% within 31-60 dB.

Aided gain above 60 dB was 19.9% only in right ear, 28.9% only in left ear and 30% in both ears. So, average gain after using hearing aid is 26% in above 60 dB.

The facts and figures mentioned here may vary from series to series, still then, as the cases were collected from a deaf school with limited period of time, this study may be of some value in reflecting certain facts regarding etiological factors of deafness and results of aided audiogram among the deaf children.

Conclusion:

Earlier detection with universal neonatal screening should be practiced in our country and amplification with hearing aid for hearing impaired children will be the effective mode of rehabilitation.

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