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A demographic study of hearing loss among children below 5 yrs in a rural tertiary care hospital

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Abstract:
Objectives *: To analyze the demographic aspects of hearing loss among children below 5 yrs attending Burdwan medical College & Hospital, Burdwan.*
Materials and Methods *: Descriptive study over a period of 2 years (July, 2016 to June, 2018), Total of patients included into this study were 4517 who had hearing problem assessed in the department of ENT , Burdwan Medical College, Burdwan.*
Results*:. Out of 4517 patients below 5yrs of age , 141 patients had hearing loss as diagnosed by BERA. 1.91% had a mild degree of hearing loss, 1.91% had a moderate degree of hearing loss, 2.87% had a moderately severe degree of hearing loss, 7.65% had a severe degree of hearing loss, and 53.11% had a profound degree of hearing loss*
Conclusion*: This study identified a large number of children with hearing impairment. This study indicates the necessity of universal hearing screening programme.*
Key words: *Hearing loss ; Children ; BERA ; OAE*

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I. Introduction

Hearing loss in very early life has shown multiple deleterious effects on the child related to attainment of speech and language. Early screening and recognition of hearing impairment is the fundamental step to reduce the negative consequences on a child's psychosocial, educational and social-emotional development. If recognized and intervened before 6 months, this can result in significantly better specch & language development in the child [1,2]. The prevalence of congenital hearing loss has been estimated to be 1.2 – 5.7 per thousand live births [3,4].

Early detection and appropriate treatment provides the best choice maximizing the critical period of hearing and thereby availing the resources to improve hearing and oral communication skills. On the other hand late detection and treatment leaves the children with poor speech & language development and educational achievement. Programmes that focus on detecting hearing disabilities at an early part of life help in improving the overall development of the child in cognitive, motor and social domain [5]. That is why hearing screening of neonates is essential and have been widely and strongly advocated.

II. Materials and methods

This descriptive study was conducted at ENT department of Burdwan Medical College & Hospital, Burdwan - a tertiary level hospital between July, 2016 to June, 2018. Total 4517 children below 5 years with high risk factor delivered in our hospital were screened between 24 hours and 72 hours after birth as well as the child below 5 years with positive history of delayed speech and language development who came to ENT department or referred from pediatric department were also screened.

Hearing assessment was done in three stages. In first & second stage, hearing screening was done by using Oto-Acoustic- Emission (OAE) , a highly reliable instrument and in third stage, hearing thresholds were estimated by using Brainstem Evoked Response Audiometry (BERA). OAE screening was performed by Sentiero TE machine (Path medical) that uses Transient-Evoked Oto Acoustic Emission. Distorsion Product Oto Acoustic Emission (DPOAE) was performed by Echolab OAE machine by Labat, Italy. Children with a normal OAE were discharged, but in cases with abnormal OAE (unilateral or bilateral), they were referred for second OAE. Second OAE were performed after 4 weeks. In cases of abnormal OAE in second step, children were referred for diagnostic BERA by RMS MK II ABR for confirmation of hearing loss. Hearing thresholds were estimated and recorded as per norms guided by American Speech and Hearing Association.

III. Observation

The sample size was 4517 in this study [Table–1]. At the first stage, 3071patients (67.98%) passed and 1446 (32.02%) failed the screening test. 109 patients dropped out for 2nd screening. During the second stage screening 976 patients (72.99%) out of 1337 passed and 361 patients (27.01%) failed. The dropped out patients were 152 for BERA screening. Finally, third stage 209 patients came for BERA. During BERA 68 patients (32.54%) passed and 141 patients (67.46) failed. 118 patients (56.44%) were male and 91 patients (43.56%) were female [Table -2]. According to age, the hearing impaired patients were divided in to five categories as below 1 year (9 patients), 1-2 years (19 patients), 2-3 years (39 patients), 3-4 years (38 patients) and 4-5 years (36 patients). Maximum patients fall within the age group between 2-4 years and among them the most common age group of presentation was 2-3 yrs[53 patients (25.37%)]. [Table -2]. We found that 4 patients (1.91%) had a mild degree of hearing loss, 4 patients (1.91%) had a moderate degree of hearing loss, 6 patients (4.23%) had a moderately severe degree of hearing loss, 16 patients (7.63 %) had a severe degree of hearing loss and 111 patients (53.11%) had a profound degree of hearing loss[Table -3].

IV. Discussion

For proper development of speech and language, normal hearing status is a very important crucial criteria for newborn [6].Most crucial time for this speech and language development is the first three years of life [7]. Hearing loss very early in life can affect social, emotional and academic achievement of the child. Even mild or unilateral involvement may affect the language development and school performance [8] of a young child. If children with impaired hearing were identified and treated by 6 months of age, they will grow as their age-matched peers who are not hearing impaired [8]. Hence neonatal hearing screening programs have been widely and strongly advocated for early identification of hearing impairment and early intervention can improve prognosis [8].

Screening programs for hearing impairment may be either "universal" or "high risk" population based [9]. But if we go for the "high risk" screening, then we may miss a large amount of infants with hearing loss caused by other than high risk factors. Hence, the American Academy Of Paediatrics endorses the goal of universal detection of hearing loss in infants before 3 months of age [8].

In our study we used OAE and BERA to assess hearing loss as these tools are objective and sensitive, specific, time-tested, unaltered by sleep or sedation and can be done at any age [10].

During OAE testing a small earphone, or probe, is placed in the ear. The probe puts sounds into the ear and measures the sounds that come back. The subject do not need to do or say anything during the test. The OAE test is used to find out how well the inner ear, or cochlea, works. It measures otoacoustic emissions, or OAEs. These are sounds given off by the inner ear when responding to a sound. There are hair cells in the inner ear that respond to sound by vibrating. The vibration produces a very quiet sound that echoes back into the middle ear. This sound is the OAE that is measured. If a person have normal hearing, it will produce OAEs. If the hearing loss is greater than 25–30 decibels (dB), it will not produce these very soft sounds. It is very significant for new born hearing screening with other clinical importance.

BERA test is used for children or others who cannot complete a typical hearing test. During BERA three or four electrodes put on the specific place to get ready for the BERA. The electrodes are stuck to the skin and connected to a computer. They record brain wave activity in response to sounds to hear through earphones. All the subject has to do is rest quietly or sleep during the test. For newborn hearing screen BERA check where the baby either pass or fail. When the BERA is used for screening, only one loudness level is checked. The baby passes if his brain shows that it is hearing the sound. If the baby fails the test, more specific testing will be done and that is diagnostic BERA.

Technological advances make it possible to evaluate auditory function in neonates and infants. These electro-physiologic and acoustic responses can be safely applied without reliance on a behavioral response. OAE and BERA are physiologic responses related to peripheral hearing status but constitute indirect measures of hearing.

To predict hearing status in children 0 to 12 months of age, a multicenter longitudinal study compared the accuracy of click-evoked BERA and TEOAEs. The results indicated no significant differences among these measures.[11,12] However, a recent study comparing two-step TEOAEs and BERA found that BERA was more effective for new born hearing screening because it yields fewer false-positive results and a lower referral rate compared with TEOAE, resulting in a smaller percentage of infants lost during follow-up[13].

Hyde and associates [14] reported BERA sensitivity of 98% and specificity of 96% if the average target hearing loss is 40 dBHL at 2 and 4 kHz.

Yousefi, Jaleh et al [15] did a study of comparing specificity and sensitivity of TEOAE and BERA. They found that OAE has 66.7% sensitivity and 98.8% specificity in diagnosis of neonatal hearing impairment.

According to the American Academy of Family Physicians studies (2007), the sensitivity of OAE in identification of hearing loss was 84 % and the specificity of it was 90%.

In our study sensitivity & specificity of OAE 68% and 87% at below 3 months and 72% and 98% at 6 months which is less than the above study and BERA sensitivity and specificity at below 3 month 90% and 99% and at 6 month 100% and 99% which is relatively similar to above studies; therefore, combination of OAE & BERA is effective tool for hearing screening.

We found that that 1.91% had a mild degree of hearing loss, 1.91% had a moderate degree of hearing loss, 4.23% had a moderate degree of of hearing loss, 7.63% had a moderate degree of hearing loss and 53.11% had a profound degree of hearing loss. This result signifies the importance of universal hearing screening. If these children with hearing impairment can followed up with proper hearing aid trial, speech therapy, special educational guidance and when required cochlear implant, then they will be able to hear better, develop the ability to listen, to understand and to speak and they can be brought back to the main stream of our society as they will be able to interact with their peers and the society.

V. Tables

Table – 1

Screening stage		Male	Female	Total
		2168	2349	4517
1st OAE	PASS both ears	1478	1593	3071
	REFER	695	751	1446
Dropout		59	50	109
2nd OAE	PASS	469	507	976
	REFER	174	187	361
Dropout		73	79	152
ABR	PASS	32	36	68
	REFER	75	66	141

Table – 2

Age group	Male (%)	Female (%)	Total (%)
Upto 1 yr	19 (9.09%)	13 (6.23%)	32 (15.32%)
1-2 yr	15 (7.17%)	17 (8.14%)	32 (15.31%)
2-3 yr	31 (14.83%)	22 (10.54%)	53 (25.37%)
3-4 yr	36 (17.22%)	14 (6.69%)	50 (23.91%)
4-5 yr	17 (8.13%)	25 (11.96%)	42 (20.09%)
Total	118 (56.44%)	91(43.56%)	209 (100%)

Table – 3

	Normal hearing (%)	Mild hearing loss (%)	Moderate hearing loss (%)	Moderately-severe hearing loss (%)	Severe hearing loss (%)	Profound hearing loss (%)	Total
Male	43	2	2	3	9	59	118
Female	25	2	2	3	7	52	91
Total	68 (31.21%)	4 (1.91%)	4 (1.91%)	6 (4.23%)	16 (7.63%)	111 (53.11%)	209

VI. Conclusion

Our study identified a large number of children with hearing impairment. Prelingual deafness or permanent childhood hearing loss (PCHL) is particularly devastating for children and has been described as a developmental emergency because of the limited time available for intervention which extends from birth till 3-4 years of age. Increasing delay in intervention after this age results in worsening prognosis for the child's developmental outcome. Because of this urgency, all developed countries have mandated early screening and diagnosis of hearing loss in babies through universal newborn hearing screening (UNHS) to conform with the standard formulated by the Joint Committee on Infant Hearing (JCIH)of America for screening, diagnosis and intervention within periods of 1, 3 and 6 months of birth of the child respectively. This study indicates the necessity of universal hearing screening programme so that we can detect hearing loss and do the necessary

intervention at an early age to improve the language development so that no children with hearing impairment can be left out from the main stream of our society.

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