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ROLE OF BRAINSTEM EVOKED RESPONSE AUDIOMETRY IN DETECTING TYPE OF SENSORINEURAL HEARING LOSS IN PAEDIATRIC AGE-GROUP

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ABSTRACT

Objectives: Brainstem evoked response audiometry (BERA) is a non-invasive tool which is used to assess the early hearing loss in children. The objectives of the study were to find out the age-wise distribution and type of sensorineural hearing loss (SNHL) diagnosed in paediatric population. **Methods:** The present hospital based prospective study conducted on 4o children suffering from sensorineural hearing loss. Age wise distribution and type of sensorineural hearing loss was assessed in these children using brainstem evoked response audiometry. **Results:** Out of 40 children studied most of the patients (55%) belongs to 1-5 years age group. 16 patients (40%) belong to 6-11 years age group. 0nly 2 patients (5%) were observed in 12 years age group. Out of 40 children, 20% presented with Retro cochlear type (8 children) and 80% presented with Cochlear type (32 children) of sensorineural hearing loss.

Introduction

Hearing loss is imperceptible handicap, and usually occurs slowly. It may imitate as forgetfulness, mental dullness or inattentiveness. Worldwide prevalence of hearing loss in neonates is around 0.5/1000. [1] Neonates with history of neonatal intensive care admission have a high prevalence of hearing impairment with the figure of 1 % reported in Great Britain [2,3], 1.5% in the Netherlands [4], and 2 % in the United States of America. [5] The most important time for speech and language development is generally considered as the initial 3 years of life.

Different audiological methods like visual reinforcement audiometry, play audiometry, free field audiometry, and behaviour observation [6] are used to hearing assessment in children. But objective hearing test like Brainstem evoked response audiometry is more sensitive tool for assessment of hearing loss in children which is a simple, non-invasive, reliable test.

Aims and objectives

1. To find out the role of BERA in diagnosis of hearing loss in paediatric age group.
2. To assess the age-wise distribution and type of SNHL diagnosed in such cases.

Materials and methods

Study area: Department of Otorhinolaryngology, Silchar Medical College and Hospital.

Study population: Children with hearing impairment who attended outpatient department.

Study period: The study was conducted over a period of 1 year.

Sample size: 40 patients with sensory neural hearing loss.
Study design: Prospective observational study.

Inclusion criteria: Children between the age of 1 –12 years with hearing impairment and speech and language delay included in the study.

Exclusion criteria: Child below 1 year and above 12 years, subjects having active ear discharge, children with life threatening conditions and severe co-morbid stage were excluded from the study.

Pure tone audiometry was done in the children above 5 years with modified Hughson Westlake ascending and descending method and hearing thresholds were averaged .5, 1, 2 and 4kHz in both the ears.

Brainstem evoked response audiometry:
BERA was performed with Neuro-Audio system (Neurosoft) with model no 00821754 in quiet room with fully relaxed supine position. Each child was asleep with Trichlofos (20 mg/kg body wt.) during the test. Monoaural recording channel (vertex and ipsilateral mastoid) was used in all BERA tests. The inter electrode impedance was kept below 3 Ω.

The stimulus intensity given was 70dBnHL as the standard intensity, while a higher-level intensity was used if poor waveform morphology or abnormal results obtained. Any single intensity meeting the above criteria using an initial stimulus rate of 21.1/s was delivered.

Patients was diagnosed on the basis of morphology of wave V, absolute wave latencies, inter peak latencies and inter aural latency of wave V. Statistical analysis was done with student t test. P value <0.5 was considered as statistically significant.

Results and observations:

Among 50 patients who attended the department, 40 patients were found to have sensorineural hearing loss. Rest of the 10 patients had conductive hearing loss and were not taken for further study. All the parameters relating to the BERA recordings were assessed and compared for left and right ear separately.

1. Age wise distribution:
Out of 40 children, most of the patients (55%) belongs to 1-5 years age group. 16 patients (40%) belong to 6-11 years age group. 0nly 2 patients (5%) were observed in 12 years age group. (Figure 1.)

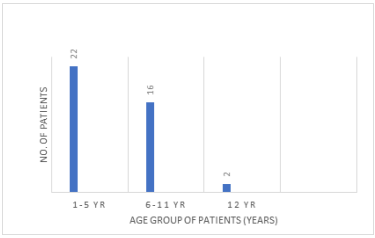


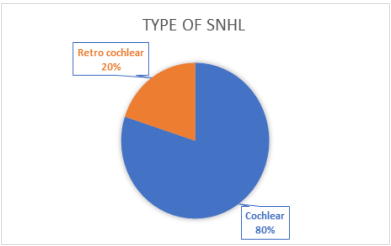
Figure 1: Showing age-wise distribution of study population (n=50)

2. Distribution according to the gender:
In 1-5 years age group, 12 (54.54%) cases were male and 10 cases (45.45%) were female. 16 patients were seen in 6- 11 years including 7 male (43.75%) patients and 9 female patients (56.25%). Only 2 male patients were observed in 12 years age, making male to female ratio of 1.11:1. (Table 1.)

Table 1. Showing distribution according to the gender:

Age group (In years)	No. of male case	Percentage	No. of female cases	Percentage	Total no. of cases (n=40)
1-5	12	54.54	10	45.45	22
6-11	7	43.75	9	56.25	16
12	2	100	0	0	2

4. Type of sensorineural hearing loss:



Out of 40 children, 20% presented with Retro cochlear type (n=8/40) and 80% presented with Cochlear type (n=32/40) of sensorineural hearing loss. (Figure 2.)

Table 2: BERA findings showing mean Absolute latency (AL) and IPL values in millisecond (ms) in study population (n=40)-

(n=40)	Absolute and interpeak latency	Right ear Mean ±SD	Left ear Mean ±SD	P value	Significance
	I	2.17±.78	2.30±.97	.48	Not significant
	III	4.29±.76	4.35±.87	.69	Not significant
	V	6.19±.76	6.33±.86	.40	Not significant
	I-III	2.12±.27	2.05±.27	.24	Not significant
	III-V	1.93±.26	2.0±.26	.18	Not significant
	I-V	4.05±.34	4.07±.36	.73	Not significant

The above table shows prolongation of the wave I, III and V of the right and left ear. There was no statistically significant difference in the absolute latencies of wave I, III and V in right and left ear. IPL of right ear and left ear within normal limit. There was no statistically significant difference in the interpeak latency of right and left ear in study population.

Table 3: Mean AL and IPL in Cochlear and Retro cochlear of right ear with p value-

Right ear	Absolute and interpeak latency	Cochlear mean ± SD	Retro cochlear mean ± SD	P value	Significance
(n=40)	I	2.16±.83	2.23±.61	.82	Not significant
	III	4.22±.77	4.59±.64	.18	Not significant
	V	6.10±.77	6.55±.65	.10	Not significant
	I-III	2.06±.15	2.36±.48	0.002*	Significant
	III-V	1.89±.20	2.70±.41	0.06	Not significant
	I-V	3.95±.28	4.44±.30	0.0009*	Significant

The above table shows delayed absolute latencies of the wave I, III and V of cochlear and retro cochlear lesion of right ear. There was no statistically significant difference in wave I, III and V of right ear in Cochlear and Retro cochlear lesion of right ear in study population. Statistically significant difference was observed in IPL of wave I-III and I-V in Cochlear and Retro cochlear lesion.

Table 4: Mean AL and IPL in Cochlear and Retro cochlear of left ear with p value-

Left ear	Absolute and interpeak latency	Cochlear mean ± SD	Retro cochlear mean ± SD	P value	Significance
(n=40)	I	2.22±.93	2.64±1.10	0.24	Not significant
	III	4.25±.84	4.81±.92	0.08	Not significant
	V	6.21±.85	6.80±.78	0.052	Not significant
	I-III	2.02±.20	2.17±.40	0.26	Not significant
	III-V	1.97±.23	2.11±.35	0.26	Not significant
	I-V	4.02±.29	4.28±.52	0.36	Not significant

The above table shows delayed absolute latencies of the wave I, III and V of cochlear and retro cochlear lesion of left ear. There was no statistically significant difference in wave I, III and V of left ear in Cochlear and Retro cochlear lesion. There was no significant prolongation of the IPL in both the lesion.

Discussion:
Age of presentation:

In present study, the age of patients presenting to the OPD of ENT Department ranged from 1 year to 12 years (mean age 5.56 years, S.D. = 3.07). Most of the patients were in age group of 1-5 years (55%), 40% in 6-11 years range group and 5% patients in 12 years.

In the study by Ramanathan Thirunavukarasu et al (7) majority of the patients (68%) with hearing loss belonged to 1-5 years age group.

Study by O.P. Shrivastava et al (2018) (8), found the mean age of patient presenting to OPD was 5.44 years with 3.43 standard deviation. Probably reasons for the difference between studies relate to the variance in sample population.

Distribution according to the gender:

The present study of 40 cases of SNHL consisted of 21 males (52.5%) and 19 females (47.5%) with male preponderance of 1.11:1.

Present study correlates with the study of Talita Le Roux et al. (2015) (9) showed even gender distribution (50.4% male and 49.6% female). Study by O. P. Shrivastave et al. (2018) (8) found female preponderance in children with sensory neural hearing loss (54% female and 46% male).

Type of sensorineural hearing loss:

In this study, 80% (40) of the total patients (50) showed sensorineural hearing loss and 10 patients (20%) found to have conductive hearing loss, which is similar to the study by De Wet S wanepoel et al (11) they also found 76% of permanent hearing loss (SNHL, ANSD and mixed) and 23% cases had conductive hearing loss. Among sensorineural hearing loss, 8 patients (20%) found to have retrocochlear hearing loss and 32 patients (80%) had cochlear hearing loss. In the study by Shashidhar S. Suligavi et al (12) 40 patients (72.72%) were found to have sensorineural hearing loss.

SNHL according to site of pathology from BERA findings:

In our study, we found mean inter peak latency of I-III, III-V and I-V of right ear and left ear of I-III (mean- 2.06mS & 2.02mS), III-V (mean- 1.89mS & 1.97mS) and I-V (mean- 3.95mS & 4.02mS) in 32 patients (80%). (Table 3 and 4). All the interpeak latencies are within normal range. Normal range of IPL is suggestive of peripheral auditory pathway involvement, so this is suggestive of cochlear hearing loss.

In rest 8 patients (20%), mean IPL of I-III, III-V and I-V of right ear and left ear was observed, I-III (mean- 2.36mS & 2.17mS), III-V (mean- 2.70mS & 2.11mS) and I-V (mean- 4.44mS & 4.28mS). (Table 3 and 4). The I-V IPL shows neural conduction time between the auditory nerve and brainstem nuclei and reproduces upon the efficiency of the auditory pathway.

There was statistically significant difference IPL of wave I-III and I-V ($p < .05$) in cochlear and retro cochlear hearing loss in right ear. In the study by Lakshmi T et al (13) (2015) found that prolongation of I-V IPL is a feature of neurological disorder and is a sign of delay in neural conduction up to the brainstem. Talita le Roux et al (14) in their study found that only 5% cases were ANSD and 95% cases were sensorineural hearing loss.

Conclusion:

Hearing loss generally goes unnoticed until it affects the child's communication in the form of speech and language. Hearing loss and language delay are a disease entity, which should be diagnosed as early as possible to have the better benefit of the cerebral plasticity in the critical period of language development.

Unfortunately, the mean age group of hearing loss children was found to be 5.56 years in the study population probably due to lack of awareness. In fact, significantly better language development is associated with early detection of sensorineural hearing loss.

A standardized hearing assessment must be conducted in every child presenting with speech-language delay, mostly for pre-lingual children with profound hearing loss, to obtain intervention consisting both of a hearing aid and intensive speech and language training, and also cochlear implant.

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