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Original Research Article

# Analysis of Brainstem Evoked Response Audiometry in Sensorineural Hearing Deafness: A Hospital Based Observational Study

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**Conflict of interest: Nil**

**Abstract**

**Background:** Brainstem evoked response audiometry (BERA) is most specific and sensitive test for brain stem dysfunction. Aim of this study to evaluate role of Brainstem Evoked Response Audiomerty in assessment of patients of sensorineural hearing loss and to evaluate cases of sensorineural hearing loss to localize the exact size of damage: Cochler, rectocochler.

**Methods:** This Observational –Cross Sectional study was done at Department of Otorhinolaryngology, ANMMCH, Gaya, and Bihar from June 2025 to November 2025. Well informed consent was taken from the patients. Each patient was subjected to ENT & Pediatric examination, whenever necessary prior to test. Patient was instructed to clean the scalp with shampoo & not to apply oil on the day of appointment. The test was started after after patient was sedated and well asleep. The first stimulus was given at 90 dBnHL level (maximum intensity available) a decreased by 10 dBnHL for next run if wave V is present. At each intensity, run efforts were made to identify wave V.

**Result:** In this study threshold & latency measures were obtained from 50 cases (100 ears) by Brainstem Evoked Response Audiometry. No restrictions were imposed on age, sex, degree of hearing loss or audiometric configuration. The data was analyzed separately for pediatric age group (36 cases) and Adults (14 cases).

**Conclusion:** BERA is the accurate & reliable estimation of hearing levels in infants and young children. It helps in early identification of hearing impairment and rehabilitative measures can be taken at an early age. In this study BERA was effective in identifying hearing loss thresholds & assessing auditory pathway in infants and children's in whom behavioral methods and PTA evaluation is not possible and in children with significant prenatal history with risk of developing hearing loss.

**Keywords:** BERA, SNHL.

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## Introduction

Hearing is necessary to learn languages and speech and to develop cognitive skills. It helps the developing child to learn to recognize sounds, identify objects and internalize concepts. Hearing loss has the highest incidence amongst any pediatric disability and should be detected as early as possible.

The importance of timely referral of children with suspected hearing loss for a full hearing assessment cannot be overemphasized. As hearing is important for normal educational and social development, hearing loss can be devastating. [1]

In India 5–15% of high risk neonates are prone to hearing loss as compared to 1–2 out of 1000 normal newborns. [2] Hearing impairment is one of the important causes of developmental delay in children and, if not diagnosed and treated promptly, it could result in speech delay.

The use of informal methods of hearing assessment, such as the whisper test, can lead to late diagnosis of hearing loss and should be discouraged.

With modern screening and diagnostic equipment, hearing can and should be quantified. This can be accomplished in a screening and/or a diagnostic hearing assessment.[3].

Implementing high-risk neonatal screening, detecting hearing loss prior to 3 months and

intervention prior to 6 months will result in a better speech performance of neonates. [4]

## Materials and Methods

This cross-sectional observation study was ducted at Department of Otorhinolaryngology, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar from June 2025 to November 2025.

This study evaluates the need of Brainstem Evoked Response audiometry (BERA) in patients of sensorineural deafness. 50 patients with sensorineural deafness were subjected to pure tone audiometry and BERA.

The average hearing threshold of PTA is calculated by taking average of hearing threshold at 500, 1000, 2000 Hz. Stimulus given in the form of clicks @ rate of 11.3 /sec. Each click duration was between 150 to 3000 Hz. Analysis time was 10 ms, 2000 responses were averaged. All subjects with pure sensorineural deafness giving reliable response to pure tone audiometry and who had given consent were included Patients with conductive or mixed type of deafness, unreliable response to pure tone audiometry and not willing for procedure were excluded.

BERA waveform thus obtained following calculations were made:

1. Latency of each wave
2. Inter peak latency
3. Interaural latency
4. We used normative values determined by Gupta and Vishwakarma[5]

## Results

In our study we included subjects from the age of 4 years to 69 years.

**Table1: Age distribution**

| Age | Number of patients | Percentage |
|---|---|---|
| Pediatric age Group | 31 | 62.00% |
| Adult age Group | 19 | 38.00% |
| Total | 50 | 100 |

Out of 50 cases 31 cases were of paediatric age group (62%) and rest 19 cases to adult group (38%) (Mean age 21.34 years).

**Table 2: Sex distribution**

| Sex | Number of Patients | Percentage |
|---|---|---|
| Male | 30 | 60% |
| Female | 20 | 40% |
| Total | 50 | 100 |

The sex distribution showed increased incidence in males (60%) and remaining 40% was females. The male to female ratio was 1.5:1.

**Table 3: Symptoms**

| Symptoms | Number of Patients | Percentage |
|---|---|---|
| Difficulty hearing | 50 | 100% |
| Mutism | 28 | 56% |

Hearing loss was commonest complaint (100%). Other presenting symptoms were mutism (60%) particularly in the paediatric age group. Of the 50 subjects, 29 cases were of mild hearing loss, 6 cases were of moderate hearing loss (41-50dB), 5 cases had Moderate-severe deafness (56-70dB) and 10 cases had severe deafness.

**Table 4: Hearing loss by pure tone audiometry**

| Grade | Number of Patients | Percentage |
|---|---|---|
| Mild | 58 | 58% |
| Moderate | 12 | 12% |
| Moderate to severe | 10 | 10% |
| Severe | 20 | 20% |

**Table 5: The hearing loss categorized by applying Jerger factor**

| | | |
|---|---|---|
| 25 -40 dB | (Mild) | 58 Ears |
| 41 -70 dB | (Moderate) | 42 Ears |
| 56 -70 dB | (Mod-Severe) | 00 Ears |
| 70 -90 dB | (Severe) | 0 Ears |

The Smith prediction factor (ABR-15dB=PTA threshold) was accurate in 84 ears (84%). Another 16.6% cases fall in ± 5 dB variation. The 16 cases which were missed by Smith factor 14 had mild hearing loss (87%). There was no special audiometric configuration on PTA in missed cases.

**Table 6: Hearing loss staged by applying Smith factor**

| | | |
|---|---|---|
| 26 -40 dB | (Mild) | 56 ears |
| 41 -55 dB | (Moderate) | 16 ears |
| 56 -70 dB | (Mod-Severe) | 10 ears |
| 70 -90 dB | (Severe) | 18 ears |

**Table 7: Correlation hearing loss Jerger factor, Smith factor**

| Grade | Pure tone Audiometry | | Jerger Factor | | Smith Factor | |
|---|---|---|---|---|---|---|
| Mild | 58 | 58% | 58 | 58% | 56 | 56% |
| Moderate | 12 | 12% | 42 | 42% | 16 | 16.% |
| Moderate to Severe | 10 | 10% | 00 | 00% | 10 | 10% |
| Severe | 20 | 20% | 00 | 00% | 18 | 18.% |

**Chi-square=51.947, p-value < 0.01, highly significant**

**Table 8: Distribution of bera parameters on the basis smith factor**

| Study parameter | Hearing loss type | No. | Mean | SD | P value |
|---|---|---|---|---|---|
| Average threshold Right | Mild | 23 | 52.61 | 13.131 | <0.05 |
| | Moderate to Severe | 27 | 70.74 | 22.956 | |
| Average threshold Left | Mild | 23 | 49.35 | 8.568 | <0.05 |
| | Moderate to Severe | 27 | 70.74 | 21.29 | |
| Latency wave I Right | Mild | 23 | 2.04 | 0.209 | >0.05 |
| | Moderate to Severe | 27 | 2.22 | 0.424 | |
| Latency wave I Left | Mild | 23 | 2.00 | 0.0 | <0.05 |
| | Moderate to Severe | 27 | 2.22 | 0.424 | |
| Latency wave III Right | Mild | 23 | 4.17 | 0.388 | >0.05 |
| | Moderate to Severe | 27 | 3.96 | 0.706 | |
| Latency wave III Left | Mild | 23 | 4.26 | 0.449 | >0.05 |
| | Moderate to Severe | 27 | 4.11 | 0.641 | |
| Latency wave V Right | Mild | 23 | 6.17 | 0.388 | >0.05 |
| | Moderate to Severe | 27 | 6.00 | 0.480 | |
| Latency wave V Left | Mild | 23 | 6.22 | 0.422 | >0.05 |
| | Moderate to Severe | 27 | 6.26 | 0.447 | |

**Table 9: Distribution of Bera parameters on the basis Jerger factor**

| Study parameter | Hearing loss type | No. | Mean | SD | P value |
|---|---|---|---|---|---|
| Average threshold Right | Mild | 30 | 49.67 | 12.65 | <0.05 |
| | Moderate to Severe | 20 | 81.75 | 12.67 | |
| Average threshold Left | Mild | 30 | 47.17 | 8.48 | <0.05 |
| | Moderate to Severe | 20 | 81.50 | 12.26 | |
| Latency wave I Right | Mild | 30 | 2.23 | 0.43 | <0.05 |
| | Moderate to Severe | 20 | 2.00 | 0.0 | |
| Latency wave I Left | Mild | 30 | 2.20 | 0.407 | <0.05 |
| | Moderate to Severe | 20 | 2.00 | 0.0 | |
| Latency wave III Right | Mild | 30 | 4.33 | 0.479 | <0.05 |
| | Moderate to Severe | 20 | 3.65 | 0.489 | |
| Latency wave III Left | Mild | 30 | 4.40 | 0.498 | <0.05 |
| | Moderate to Severe | 20 | 3.85 | 0.489 | |
| Latency wave V Right | Mild | 30 | 6.13 | 0.571 | >0.05 |
| | Moderate to Severe | 20 | 6.00 | 0.0 | |
| Latency wave V Left | Mild | 30 | 6.37 | 0.490 | <0.05 |
| | Moderate to Severe | 20 | 6.05 | 0.224 | |

## Discussion

Brainstem Evoked Response Audiometry (BERA) is an electrophysiological test procedure which studies the electrical potential generated at various levels of auditory system starting from cochlea to cortex.[6] BERA was first described by Sohmer and Feinmesser in 1967.[7] Auditory brainstem

response applications were described by Hecox and Galambos (1974) [8]

In our study we included subjects from the age of 4 years to 69 years. Out of 50 cases 31 cases were of paediatric age group (62%) and rest 19 cases to adult group (38%) (Mean age 21.34 years). The sex distribution showed increased incidence in males (60%) and remaining 40% was females. The male to female ratio was 1.5:1. Hearing loss was commonest complaint (100%). Other presenting symptoms were mutism (60%) particularly in the paediatric age group.

**Pure tone Audiometry**

**Hearing Threshold:** Of the 50 subjects, 29 cases were of mild hearing loss, 6 cases were of moderate hearing loss (41-50dB), 5 cases had Moderate-severe deafness (56-70dB) and 10 cases had severe deafness.

**Audiometric Configuration**

- 8 of our subjects showed low frequency sensorineural deafness (20%).
- 6 cases showed selective high frequency loss at 4,6Khz) (12%).

**BERA:** Analysis was done under following headings.

**Hearing Threshold by Wave V:** 58 ears out of 100 ears (58%) had accurate Jerger factor (ABR X0.6 = PTA threshold) of the remaining 42 ears which missed Jerger factor, 36 had moderate severe loss (85%). This includes all the 8 cases of selective low frequency loss.The Smith prediction factor (ABR-15dB=PTA threshold) was accurate in 84 ears (84%). Another 16.6% cases fall in ± 5 dB variation. The 16 cases which were missed by Smith factor 14 had mild hearing loss (87%).

There was no special audiometric configuration on PTA in missed cases.

**Conclusion**

Commonest complaints were hearing loss and mutism (in paediatric age group). By PTA, majority had only mild hearing loss. Some cases had a different audiometric configuration such as selective high frequency or low frequency hearing loss. The latencies of the waves III & V and the IPLs I-III and I-V were more prolonged in the subjects above 50 years as compared to the subjects below 50 years of age.

BERA is an accurate method for prediction of hearing loss. Estimation of the hearing threshold with application of Smith factor is more accurate than Jerger's method.

We also found that Jerger factor overcorrects ABR threshold with high decibel loss. BERA is reliable and it helps in early identification of hearing impairment so that rehabilitative measures can be taken.

**References**

1. Behrman RE, Kliegman R, Jenson HB. Nelson textbook of pediatrics. 18th. Philadelphia: WB Saunders; 2007. pp. 2620–2628.
2. Rahul KS, Michael CL, Glenn CI (2011) Hearing impairment clinical presentation. Medscape Reference.
3. Mitchell RB, Pereira KD (eds.) (2009) Pediatric otolaryngology for the clinician. Springer, Berlin. 10.1007/978-1-60327-127-1_2.
4. Fakhraee SH, Kazemian M, Amidieh AA. Hearing assessment of the high-risk neonates admitted to Mofid hospital for children during 2001–2002, using auditory brainstem response (ABR) Arch Iran Med. 2004;7(1):44–46.
5. Gupta and Vishwakarama "Brainstem Audiometry Evoked Response-evaluation of hearing loss" Indian journal of otolaryngology 1989 41 No 2 (54-58).
6. Jerger and Maudlin, "Prediction of sensorineural hearing level from the brainstem evoked response". Arch Otolaryngol 1978 104:456-461.
7. Smith and Simmon, "Accuracy of auditory brainstem evoked response with hearing level unknown". Ann OtolRhinolLaryngol 1982, 91.