DOI: https://doi.org/10.53350/pjmhs221651132

ORIGINAL ARTICLE

Prospective Evaluation of Auditory Brainstem Response against Hearing Loss Risk Factrs. A Clinical Based Study

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ABSTRACT

Objective: The purpose of this study is to determine the improvement of auditory brainstem response against hearing loss risk factors among new born babies.

Study Design: Prospective study

Place and Duration: Bahawalpur Medical and Dental College, Bahawalpur and General Hospital, Lahore. Jan, 2021 to June, 2021

Methods: There were one hundred and thirty high risk infants were presented in this study. Birth weight and gestational age as well as transfusion and asphyxiation rates were documented once the parents provided written permission. Included patients had absent ABR or ABR thresholds ≥80 dBnHL. ABR testing during natural or chloral hydrate-induced sleep was part of the audiologist's examination. Patients with aberrant ABR responses underwent further testing, including optical absorption empiricism (OAE). Measurements of immittance were performed as necessary. All data was analyzed by using SPSS 22.0.

Results: Among 130 cases, majority of the infants were males 85 (65.4%) and 45 (34.6%) infants were females. Mean gestational age of the infants was 35.11± 6.42 weeks. Mean weight of the infants was 1899.1± 2.654 grams. Frequency of severe birth asphyxia was seen in 65 (50%) cases. We found exchange transfusion in 25 (19.2%) cases. Improvement in ABR threshold was seen in 70 (53.8%) cases, partial improvement in 27 (20.8%) cases and no improvement was seen in 33 (25.4%) cases. After 3-4 months among patients of no/partial improvement, 42 (70%) patients were improved and no improvement was seen in 18 (30%) cases.

Conclusion: We concluded in this study that the hearing loss can be improved in infants by early ear screening by using ABR thresholds. Re-screening of ABR thresholds provided better results among infants. Staged further hearing testing of babies is needed to monitor hearing development at an early age utilizing repeated ABR measures to identify hearing impairment and detect threshold changes crucial for treatment decision-making.

Keywords: Infants, ABR thresholds, Improvement, OAE

INTRODUCTION

Doctors generally agree that sensorineural hearing loss is the result of persistent or gradual damage to the hearing organ that cannot be reversed.

There have been stories, though, of youngsters regaining their hearing thresholds. They were published for the first time in the early 1980s when the Auditory Brainstem Responses (ABR), a recently established hearing assessment technology, could be used to evaluate changes in hearing status. Jaundiced babies' ABR thresholds changed at that time, according to researchers. After treatment, lengthy lag times were restored, as well as typical waveforms in situations where there were no responses at all [1–3]. To diagnose more instances with restored hearing during infancy, the widespread use of objective hearing tests for clinical and screening reasons has helped. Early maturity of the auditory system has been linked to an increase in hearing thresholds.[4-6]

There are a number of newborns and babies who are at risk for hearing loss who have shown an improvement in their objective hearing thresholds over the last two decades at our institution In the years 1992–2008, several of these have previously been documented [7].

Predictable reactions in behaviour from newborns might be helpful in healthcare settings [8].Infants' behavioural audiometry capabilities are well known by the time they are 5-6 months old, but this approach of hearing exploration is frequently regarded unworkable or unreliable until that point [9]. Reliable estimations of the behavioural pure-tone thresholds in the 2–4 kilohertz region may be obtained using the ABR-evoked click method (kHz). Down to 1kHz, more precise frequency-specific responses may be generated using particular fitting and stimulus setups.

As a newborn, your central auditory system is still developing. Most of a child's neurons mature during the first two years of life [8,9]. Within the first year of life, newborns' auditory maturation is critical, with the primary shortening of their auditory evoked potentials (AEPs) IPLs occurring.[10,11]

An advantage of early diagnosis is that a baseline for future evaluations may be established to compare the results. Conductive hearing loss may also be treated medically and surgically to slow its development. To help parents accept hearing loss and be ready for a family-centered rehabilitation programme, timely information is essential. [12] Universal newborn hearing screening is not accessible in impoverished countries like ours, and there are several challenges to its implementation [13,14]. There is no formal national programme in India for detecting hearing loss in babies. Four out of every 1000 newborns are estimated to suffer from severe to profound hearing loss [15].

In this article, we'll share our experience restoring objective hearing thresholds in high-risk (HR) newborns. Multivariate analysis was performed to see whether any signs could be used to predict the return of auditory function. Illustrative examples are shown..

MATERIAL AND METHODS

This prospective study was conducted at Bahawalpur Medical and Dental College, Bahawalpur and General Hospital, Lahore and comprised of 130 infants. Birth weight and gestational age as well as transfusion and asphyxiation rates were documented once the parents provided written permission. Infants with severe other medical illness and those whose parents did not provide any written consent were excluded.

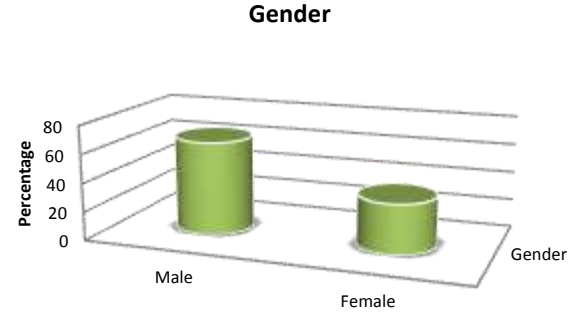
History-taking, otoscopy, and ABR testing were part of the audiologist's examination. All neonates and babies with aberrant ABR responses were also subjected to OAEs. When necessary, immittance measurements were made., the Biologic Traveller Express unit was utilised for ABR recordings, as was the Biologic System AEP Version 1.3.0 (Bio-Logic Systems Corp., Mundelein,

Chicago, IL, USA). A shielded TDH-39 headphone was used to provide alternating clicks at a rate of 31.1/sec in a monophonic fashion. An averaged and duplicated set of 2048 responses were gathered by employing four silver cup electrodes, which were subsequently amplified and filtered (100–3,000 Hz). A "normal" or "pass" response was defined as a 40 dBnHL waveform that could be replicated within the required latencies, indicating a normal hearing threshold. Uni- or bilaterally "failed" infants were reevaluated 2–4 months after the first assessment. Occasionally, a third ABR session has to be held. To qualify as recovery, the ABR threshold had to rise by at least 10dBnHL compared to the original ABR test.

The ILO88 Otodynamic Analyzer (Otodynamics) was used to measure click-evoked OAEs in their default settings. Probes for infants were utilised in all instances. A second OAE test was done on the majority of newborns who had been reexamined if the middle ear was clear of illness.

RESULTS

Among 130 cases, majority of the infants were males 85 (65.4%) and 45 (34.6%) infants were females.(table 1)



	Male	Female
Gender	65.4	34.6

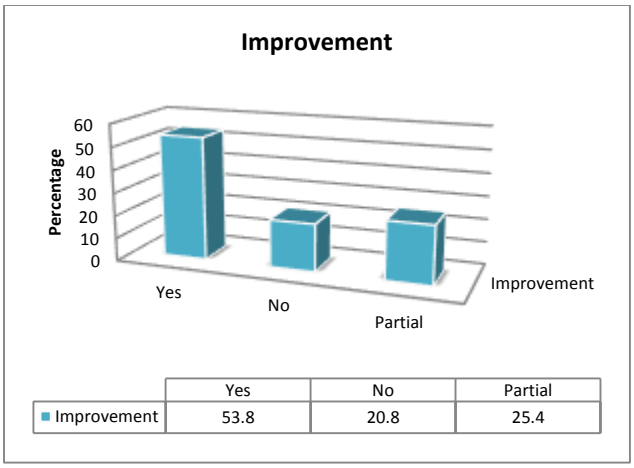
Figure 1: Included infants with gender distribution

Mean gestational age of the infants was 35.11± 6.42 weeks. Mean weight of the infants was 1899.1± 2.654 grams. Mean chronological age at first ABR was 111.2± 3.116 days and mean corrected gestational age at first ABR was 6.7± 12.18 weeks. Frequency of severe birth asphyxia was seen in 65 (50%) cases. We found exchange transfusion in 25 (19.2%) cases.(table 1)

Table-1: Baseline details of enrolled infants

Variables	Frequency	Percentage
Mean gestational age (weeks)	35.11± 6.42	
Mean weight (g)	1899.1± 2.654	
Age at first ABR (chronological) (days)	111.2± 3.116	
Corrected age at first ABR (weeks)	6.7± 12.18	
Birth Asphyxia		
Yes	65	50
No	65	50
Exchange transfusion		
Yes	25	19.2
No	105	80.2

Improvement in ABR threshold was seen in 70 (53.8%) cases, partial improvement in 27 (20.8%) cases and no improvement was seen in 33 (25.4%) cases.(fig 2)



	Yes	No	Partial
Improvement	53.8	20.8	25.4

Figure-2: Improvement of ABR thresholds among all cases

Re-screening performed after 3-4 months among 60 cases patients of no/partial improvement, 42 (70%) patients were improved and no improvement was seen in 18 (30%) cases.(table 2)

Table-2: Outcomes of re-screening ABR threshold

Variables	Frequency (60)	Percentage
Improvement		
Yes	42	70
No	18	30

DISCUSSION

The development of linguistic, cognitive, and social abilities depends on early identification and correction of hearing loss. Thousands of hearing-impaired youngsters throughout the world have reaped the advantages of this technique, achieving educational and professional levels equivalent to those of their hearing counterparts. The identification of hearing loss in newborns and babies is still challenging even today, despite the tremendous developments in diagnostic audiology. Several factors contribute to diagnostic ambiguity, chief among them the inability to use subjective testing, the presence of middle ear issues, and the presence of other medical conditions. Low and mid-frequency residual hearing is difficult to detect in normal audiological evaluations of very young children, whereas disorders with an auditory neuropathy characteristic further complicate the diagnosis procedure. [16]

An further element that has surfaced is the possibility for total or partial recovery of auditory thresholds in neonates and babies with high risk factors for hearing loss over time, according to many investigations. Several paediatric hospitals have verified these results. In this study 130 infants had high risk factors of hearing loss were presented. Among 130 cases, majority of the infants were males 85 (65.4%) and 45 (34.6%) infants were females. Mean gestational age of the infants was 35.11± 6.42 weeks. Mean weight of the infants was 1899.1± 2.654 grams. Mean chronological age at first ABR was 111.2± 3.116 days and mean corrected gestational age at first ABR was 6.7± 12.18 weeks. Frequency of severe birth asphyxia was seen in 65 (50%) cases. We found exchange transfusion in 25 (19.2%) cases. These results were comparable to the previous studies.[16-19]

21.2 percent of HR babies with symmetric sensorineural hearing loss, including a kid whose initial missing ABR recovered entirely at follow-up assessment, showed considerable progress toward normal hearing or minor hearing loss.[20] Similar results were observed by Hof et al. [21] in a group of preterm newborns with initially aberrant ABR thresholds. Remarkably, 64% of the population demonstrated complete or partial recovery in the first year of life. As a result, they also observed situations where ABR

was entirely missing at the first examination but later returned to normal. [22] In the last six years, Psarommatis et al. [22] have been reporting the findings of an HR newborn hearing screening programme. Regardless of the kind or degree of ABR elevation, they found reversible ABR abnormalities in 64% of the children tested.. Incredibly, half of the patients with no waveforms or an ABR threshold of 80 dBnHL at first screening recovered entirely on reexamination within the first year. Researchers in the aforementioned studies have mostly linked the recovery of sensorineural loss to delayed maturity of the auditory system. In our study, we found exchange transfusion in 25 (19.2%) cases. Improvement in ABR threshold was seen in 70 (53.8%) cases, partial improvement in 27 (20.8%) cases and no improvement was seen in 33 (25.4%) cases.

In current study, re-screening performed after 3-4 months among 60 cases patients of no/partial improvement, 42 (70%) patients were improved and no improvement was seen in 18 (30%) cases. Nine out of 18 children with AN showed improvement in behavioural thresholds over time, according to Madden et al. [23]. It was found by Psarommatis et al. that ABR thresholds would be largely or entirely recovered in most HR children with AN throughout infancy, and this condition was termed "transient infantile auditory neuropathy" by the authors [24]. Five young AN cochlear implant candidates were studied by Attias and Raveh, who found that after 7–12 months of follow-up testing, all five had recovered fully or partially [25]. According to Harrison et al., "...some threshold recovery to a level of hearing that permitted sufficient speech comprehension and language development without a hearing prosthesis" [26] was identified in one in five children with AN more recently.

As a result, there is enough data to suggest that in certain HR newborns with hearing loss of the auditory neuropathy type, the impaired hearing thresholds may be repaired or reversed within a few months. For clinical practise, such an idea might have a significant influence.

CONCLUSION

We concluded in this study that the hearing loss can be improved in infants by early ear screening by using ABR thresholds. Re-screening of ABR thresholds provided better results among infants. Staged further hearing testing of babies is needed to monitor hearing development at an early age utilizing repeated ABR measures to identify hearing impairment and detect threshold changes crucial for treatment decision-making.

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