



ORIGINAL ARTICLE

Frequency of hearing loss in children with cerebral palsy and parents' perception regarding their child's hearing.

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ABSTRACT... Objective: To determine frequency of hearing loss in cerebral palsy (CP) children and perception of child's hearing and brain evoked response auditory (BERA) / brainstem auditory evoked potential (BAEP) results in CP patients. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatric Neurology, Liaquat National Hospital, Karachi. **Period:** January 2022 to December 2022. **Material & Methods:** The parents of all the CP children having cerebral palsy and who were not assessed for hearing screening at birth (newborn hearing screening) were included. In child neurology clinic, parents were interviewed for the perception of the hearing of the child. Parental perception, CP type and the BERA results were recorded. **Results:** Total 102 patients were studied with median age of 27.9 (IQR= 17 – 48) months. Majority of the patients were normally delivered (n=59, 57.8%). Nearly quarter of them underwent neonatal screening (n=22, 21.6%). Majority of mothers (n=85, 83.3%) and father (n=80, 78.4%) had perception of hearing. BERA test was normal for 44 (43.1%) children. Age was significantly higher among patients with abnormal results. Frequency mothers' perception of normal hearing was higher in abnormal BERA result. Frequency of difficult speech was higher in patients with abnormal BERA results. **Conclusion:** The frequency of hearing loss was high among children with CP. Frequency of mothers' perception of their CP child's normal hearing was higher when compared to the father's perception.

Key words: Brain Evoked Response Auditory, Brainstem Auditory Evoked Potential, Cerebral Palsy, Hearing Loss, Parental Perception.

INTRODUCTION

When there is an interruption in the sound transmission from the outer ear to the brain, hearing loss develops. Hearing loss can be conductive or sensorineural, and the interruption can occur at any time, either before or after the cochlea.¹ Cerebral palsy (CP) is a non-progressive motor disorder diagnosed in early childhood. These children may also have communication, cognition, perceptual, or sensation problems in addition to movement difficulties.² The auditory nerve and brainstem auditory sensory pathway's functional status can be assessed using BERA, which is a safe and effective method. Drugs, other environmental circumstances, and states of awareness do not greatly change it.³ Before Auditory Brainstem Response (ABR), brain

evoked response auditory (BERA) became the gold standard, a study found that the test had a sensitivity of 87.7% (74.5%-94.9%) and a specificity of 74.5% (60.0%-85.2%). The test had a negative predictive value of 86% (71.9%-94.3%) and a positive predictive value of 76.7% (63.2%-86.6%). The negative likelihood ratio was 6.08, while the positive likelihood ratio was 0.29 (0.18-0.46).⁴

According to estimates from "American Academy of Neurology", the prevalence of hearing loss in CP ranges from 30 to 40 percent.⁵ The findings of the one and only systematic review suggested that approximately 12% of children with CP have hearing loss.⁶ The Academy suggested in a training boundary that more kids with CP ought to

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be considered to decide explicit elements in view of clinical subtype. As a result, taken as a whole, they would add up to more evidence supporting the actual prevalence of hearing loss in CP.^{7,8}

Early detection of hearing loss in children with CP may lead to early interventions such as hearing aids and cochlear implants. One of the biggest challenges in early detection is parents' perception about a child's hearing as they think their child can hear properly whereas BERA test may indicate otherwise. In order to include BERA as an initial assessment tool of CP children in their first encounter in the pediatric neurological ward, we need to find the correlation between the perceptions of parents with BERA results. As there is no newborn screening program in our country. This may be the best time to screen. The objective was to determine the frequency of hearing loss in cerebral palsy children and to evaluate parents' perceptions about child's hearing versus BERA/ brainstem auditory evoked potential (BAEP) results in CP patients.

MATERIAL & METHODS

This cross-sectional study was performed in out-patient clinic of Pediatric neurology department, Liaquat National Hospital during January to December 2022. With ethical approval of hospital committee (IRB#App-0590-2020). All children having cerebral palsy and were not assessed for hearing screening on birth (newborn hearing screening) were included whereas All children with cerebral palsy who were previously screened on birth (Newborn hearing screening) were excluded.

The parents of all the CP children meeting Inclusion criteria, presenting in child neurology clinic were interviewed for the perception of the hearing of the child. Parental perception, CP type and the BERA results were recorded in a predesigned study proforma.

The collected data was entered into SPSS version 21 for statistical analysis. Categorical variables were expressed as frequency and percentage while mean \pm standard was computed for numerical variables. Median and inter-quartile

range was reported in case of non-normal distribution of numerical variables. Chi-square / Fisher-Exact test was applied to compare categorical variables among patients with and without hearing loss. P-value less than 0.05 was taken to comment on statistical significance.

RESULTS

Total 102 patients were studied with median age of 27.9 (IQR= 17 – 48) months. Majority of the patients were normally delivered (n=59, 57.8%). Nearly quarter of them underwent neonatal screening (n=22, 21.6%). MRI and CT scan was done in 37(36.3%) and 73(71.6%) patients respectively.

CP causes were asphyxia (n=96, 94.1%) and genetics (n=5, 4.9%) and unidentified in one patient (n=1, 1%). Figure-1 shows the frequency of CP type. One-third of the patients received antibiotic therapy (n=34, 33.3%). Majority of mothers (n=85, 83.3%) and father (n=80, 78.4%) had perception of normal hearing. More than half of the patients had oxygen deficit (n=89, 87.3%) and toner problem (n=78, 76.5%). 12 (11.8%) had complaint of difficult speech whereas 46(45.1%) were using hearing aid.

BERA test was normal for 44(43.1%). Table-I shows the comparison of patients' features among normal and abnormal BERA test results. Age was significantly higher among patients with abnormal results. Frequency mothers' perception of normal hearing was higher in abnormal BERA result. Frequency of difficult speech was higher in patients with abnormal BERA results.

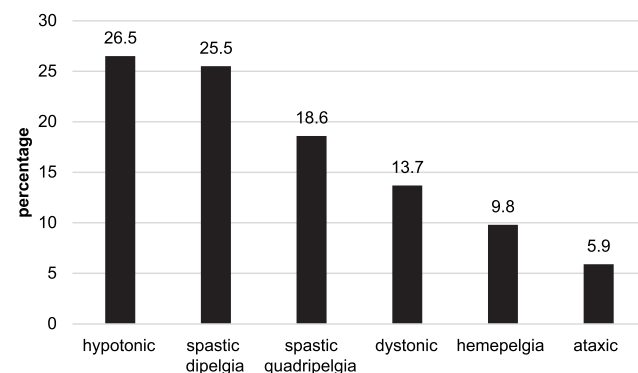


Figure-1. Frequency of CP type

Patients' Features	Normal Count (%)	Abnormal Count (%)	P-Value
Age (in months)*	36 (21 – 58.5)	24 (16 – 39.1)	*0.013
Neonatal screening	11 (50%)	11 (50%)	0.463
Difficult speech	1(8.3)	11(91.7)	*0.010
Oxygen deficit	37(41.6)	52(58.4)	0.404
Toner problem	36(46.2)	42(53.8)	0.267
Mother perception of normal hearing	42(49.4)	43(50.6)	*0.004
Father perception of normal hearing	38(47.5)	42(52.5)	0.090
CP Type			
Spastic dipelgia	10(38.5)	16(61.5)	0.698
Dystonic	8(57.1)	6(42.9)	
Hemepelgia	5(50)	5(50)	
Spastic quadriplegia	6(31.6)	13(68.4)	
Ataxic	2(33.3)	4(66.7)	
Hypotonic	13(48.1)	14(51.9)	

Table-I. Comparison of patients features among normal and abnormal BERA test results
#: Age is expressed as median with inter-quartile range

DISCUSSION

Global data reveals that children with CP frequently present having associated impairments.^{9,10} The present study was aimed to find out the frequency of hearing loss among children with CP and we found the frequency of CP to be 56.9% which is very high. Data from “Australian CP Register (ACPR)” revealed that 12% had hearing impairment while 61% had speech impairment.¹¹ A recent study from Bangladesh found that hearing impairments were noted among 18% children with CP while speech impairments were noted in 74% children.¹² Contemporary data from USA has reported the frequency of hearing loss to be 39% in children with CP.¹³ The same study concluded that hearing loss among children with CP could be of large degree of sensorineural loss while the predisposition could be bilateral and the extent of hearing loss could be linked with severity of motor or neurological disability among children with CP.¹³ A systemic review by Susan et al reported that the proportion hearing loss ranges between 4-13% among children with CP.¹⁴ All these studies exhibit that there lies a difference in the frequency of hearing loss among children with CP and the differences could be attributed to variations in the extent of functional impairment, motor types, etiology, age of the diagnosis and rehabilitation care among children with CP.^{15,16} It is very important for early screening, intervention and rehabilitation among children with CP as

proportion of comorbidities is significantly higher among these set of children. In a country like Pakistan, there is lack in the services and initiation of early interventions among children with CP that prevent many of the children with CP to lack in improvement in functional capacities.¹⁷

In the present study, we noticed that the frequency of mothers' perception of their CP child's normal hearing was higher when compared to the father's perception. There were 83.3% children's mothers who believed that their children could hear; however, about 50.6% of children had abnormal BERA results which indicated hearing loss. On the other hand, there were 78.4% children's fathers who had the perception that their child could hear normally but the BERA results came out abnormal in 52.5% children. It was not surprising that children who had abnormal BERA results had speech difficulties (91.7%). In a country like Pakistan where the screening for the newborn's hearing is not done routinely, there is a need to create awareness among parents about the possible signs of hearing impairment especially among children who have CP. The present study highlights that a major proportion of parents consider their child, who have CP, to have normal hearing. Therefore, there is a need that routine screening for children who have CP need to be conducted so that children who have hearing loss or who are at high risk for developing hearing loss

could be identified.¹⁸ Timely identification and intervention for hearing loss among children with CP should be performed to decrease the overall burden of impairment among these children.¹⁹

As this was a single center study conducted on a relatively small sample size during the Covid-19 pandemic, our findings cannot be generalized and should further be verified in large scale multi-centric studies. Furthermore, due to a lack of education and awareness among parents of CP children, consent was not given by some of the parents for the questionnaire to be filled.

CONCLUSION

The frequency of hearing loss was high among children with CP. Frequency of mothers' perception of their CP child's normal hearing was higher when compared to the father's perception. There is a need for routine screening of hearing impairments among children with CP so that timely intervention and rehabilitation care can be done in these children.







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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Raman Kumar	Conception, the study, designed study protocol revised initial draft.	
2	Julie	Study protocol, Drafting.	
3	Laiba Shakeel	Performed literature search and involved in initial manuscript drafting.	
4	Syed Muneer Mansoor	Literature review.	
5	Noureen Durrani	Data analysis.	
6	Komal Fatima	Data collection.	
7	Hiba Shahid	Data collection.	