

# Hearing Impairment in children with history of kernicterus and cerebral palsy

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## Abstract

**Introduction:** Critical period of development of speech and language is early 3 yrs of life. Even a mild hearing impairment can interfere with speech and language development. Hearing impairment has the highest incidence rate for any pediatric disability, since several risk factors in infants with cerebral palsy (CP) are the same risk factors to develop hearing impairment. Thus, it should come as no surprise that hearing impairment occurs more frequently among children with cerebral palsy than in the general population. Recent studies have shown that up to 13% of children with cerebral palsy suffer from a hearing loss and important cause of auditory neuropathy.

**Aim of the study:** To assess and analyze the audiological profile in children with cerebral palsy

**Materials and Methods:** A prospective study was done on 67 children of 1 to 16 years of age of both genders who were diagnosed with cerebral palsy. Tympanometry, otoacoustic emission, and auditory brain stem response hearing tests were employed to categorize the hearing impairment.

**Results:** Hearing impairment was observed in right ear 67.2 % and left ear 64.2% in children with cerebral palsy. Profound sensorineural hearing loss in 25.4% in bilateral ear was observed. History of kernicterus was found in 17.9% children with cerebral palsy.

**Conclusions:** Prevalence of hearing impairment in children with cerebral palsy is alarming. This warrants early identification and diagnosis of hearing impairment. This early identification may facilitate better development of speech and language as well as positive outcomes. Therefore audiological assessment should be incorporated into the diagnostic and therapeutic plan of all children with cerebral palsy

**Keywords:** Hearing Loss, Cerebral palsy, BERA, Kernicterus

## Introduction

Cerebral palsy was first described in 1862 by an orthopedic surgeon named William James Little.<sup>1</sup> Cerebral palsy is a condition caused by damage to the brain, usually occurring before, during or shortly after birth. 'Cerebral' refers to the brain and 'palsy' refers to a disorder of movement or posture. Cerebral palsy is a central nervous system (CNS) disorder of movement, coordination, and posture, reflecting a nonprogressive abnormality or insult to the immature brain.<sup>2,3</sup> Cerebral palsy is neither progressive nor communicable. It is also not curable, although education, therapy and applied technology can help people with CP lead productive lives. Children with CP have an organic complication in the peripheral and central nervous systems.<sup>4</sup> However of hearing impairment are amenable to the treatment and rehabilitation strategies if identified at an early age and effective intervention program can be initiated. Hearing impairment estimates as high as one third population of cerebral palsy, study done by Susan et al shows 4% to 13% hearing loss in children with CP.<sup>5</sup> Thus, overall future and success of a child can be improved by reducing the complications of hidden disability of hearing impairment

The hearing rehabilitation in children with cerebral palsy was studied by Melo et al said that currently there is still a controversy in cochlear implant centers regarding the indication of Cochlear implantation in cerebral palsy children. Those in favour of implantation theorize that minimizing auditory sensory deprivation can improve language and comprehension, and consequently the quality of life after cochlear implantation in this children and recommended cochlear implantation.<sup>6</sup>

However, there is less no data is available in the developing country like Indian context, with regards to the degree, and type of hearing impairment in children with cerebral palsy. The study was done to find the presence of hearing impairment in children with cerebral palsy. Our aim is to increase the awareness of possible correctable audiological impairment that hinder development and learning in children with cerebral palsy and timely intervention can be taken.

## Material and Methods

A total of 67 children in the age range of 6 month to 16 years diagnosed with CP were selected for the study. The subjects were referred to ENT OPD for hearing evaluation or visited as follow-up during

October 2017 and March 2018. The parental interview was conducted to obtain demographic information includes detailed history and examination with focus on prenatal, natal, postnatal history, etiology for Cerebral palsy and to find risk factors for CP. Audiological evaluation of these children was done using Otomicroscopy, Behavior observation audiometry (BOA), Otoacoustic Emission (OAE), Tympanometry, Pure Tone Audiometry (PTA) or Brainstem Evoked Response Audiometry (BERA).

### Statistical analysis

Descriptive analysis of demographics and audiological test findings was carried out to determine the prevalence and to categorize the different types and degree of hearing impairment.

Result we studied 67 children with cerebral palsy, hypotonic type 14(20%), 33(49.2%) spastic, 13(19.4%) dystonic and mixed 7(10%) Majority of the subjects were males; 44(65.7%). The mean age of the study group was 2.9 years. The age group below 5 yrs was 52(77.7%). The youngest child in the study was 9 months old and oldest child being 14 years old. Consanguinity of marriage between the parents was studied. In the present study non-consanguineous marriages were 58(86.6%) and consanguineous marriages between parents were 9(13.4%). On birth history record the cerebral palsy children were born full term baby 55(82.2%) and 44(65.7%) were with normal birth weight and 39(58.2%) cried immediately at birth. Out of 67 children on post natal History of kernicterus was found in 17.9% children with cerebral palsy. Behavioral observation audiometry result showed 25(37.3%) had hearing loss and 42(62.7%) had normal hearing. Otoacoustic Emissions findings in this study showed Out of 67 children right ear OAE were absent in 37(55.2%) ears and present in 16(23.9%) ears and not done in 14(20.9%). Left ear OAE result show absent in 34(50.7%) and present in 19(28.4%) not done in 14(20.9%). The findings on Brain Evoked Response Audiometry (BERA) showed out of 67 children examined for BERA on right ear 22(32.8%) had normal hearing, 7(10.4%) had minimal loss, 5(7.5%) had mild hearing loss, moderate hearing loss in 8(11.9%) ears, moderately severe in not seen, severe in 4(6%) ears, profound in 17(25.4%) ears and not done in 4(6%) ear. BERA on left ear 24(35.8%) had normal hearing, 5(7.5%) had minimal loss, 7(13.6%) had mild hearing loss, moderate hearing loss in 7(10.4%) ears, severe in 3(4.5%), profound in 17(25.4%) ears and not done in 4(6%) ears. Findings of Tympanometry were Out of 67 children with cerebral palsy on right ear A type curve, 41(61.2%) B

type curve in 4(6.0%) and 14(20.9%) have C type curve. Out of 67 children with cerebral palsy on left ear A type curve, 42(62.7%) B type curve in 3(4.5%) and 3(20.9%) have C type curve.

### Discussion

CP consists of a heterogeneous group of nonprogressive clinical syndromes that are characterized by motor and postural dysfunction due to the damage to developing brain. A concomitant disability such as hearing impairment often exists with CP. The coexistence of unidentified hearing impairment can affect the treatment plan and long-term outcome of CP. Therefore, an understanding of the interaction of the motor components and associated deficits in children with CP is necessary for setting comprehensive and realistic goals and better outcomes. The cross-sectional observational study was done in tertiary care center from October 2017 to March 2018 to find the clinical and audiological profile of children with cerebral palsy attending to otorhinolaryngology out patient department after obtaining consent of the parents. Various studies have attempted to establish an association between cerebral palsy and hearing loss, most of these studies being from developed countries. The commonest type of cerebral palsy was spastic type, which was similar to studies done by Chitra et al and Pratiba et al.<sup>7,8</sup>

Moralis et al studied 64 children with cerebral palsy and found 60% sensorineural hearing loss.<sup>9</sup> Zafeiriou et al studied hearing in children using brainstem evoked response in spastic cerebral palsy children and found 22% had abnormal finding in brain stem evoked audiometry.<sup>10</sup>

Our data differ from Morales *et al.* who stated prevalence of 60% hearing impairment among CP,<sup>8</sup> whereas our data had similar result as Odding and Roebroech Hendrik et al reported 25% incidence of hearing impairment in cerebral-palsied population.<sup>11</sup> The differences in frequency of hearing impairment in CP in these studies may be due to the variations in types of CP in each case study and/or the variable causes of CP in these cases.

The highest number of children with CP found to have sensorineural hearing impairment followed by conductive and mixed type of hearing impairment that can be accounted for damage to the growing brain and compounded with the associated problems such as poor body growth, oral-aural hygiene, and frequent

cold and cough. All children who have hearing impairment exhibited defective speech and language skills.

### Type of Study

A prospective Observational, descriptive study

### Period of Study

March 2017 to March 2018

### Institute of Study

Christian Medical College, Vellore, Tamil Nadu

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None.

### Conflicts of interest

There are no conflicts of interest

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