Evaluation of Hearing Status in Various Type of Cerebral Palsy Children in a Tertiary Hospital

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Abstract

Background: *Cerebral palsy (CP) in children are frequently associated with sensorineural pathology.*

Objectives*: To assess the severity of hearing impairment in children with CP and correlate the auditory impairment with different types of CP.*

Materials & Methods: *This cross-sectional study was conducted in the Department of Pediatric neurology and Autolaryngiology- Head and Neck Surgery BSMMU, during March to September 2011. Diagnosed CP patients were included consecutively. After taking informed written consent, proper history and clinical examinations was done and severity of hearing loss was assessed.*

Results: *Among the 50 children with CP, Tympanometry result revealed that negative middle ear pressure was present in 32% in spastic quadriplegia(SQ), 24% in spastic hemiplegia (SH), 16% in spastic diplegia (SD) and 24% in mixed type. Eustachian tube dysfunction was present in 62.5% in spastic hemiplegia. In TOAE result 52% were pass and 48% were referred and ABR were suggested. On the basis of result of TOAE, those were referred, initially they were encountered as hearing impairment in this study. Among them, in SQ were 18%, SH were 12% and mixed. Follow up auditory brain stem response revealed mild, moderate and severe sensorineural hearing loss were 8% in spastic quadriplegic type and the spastic diplegia and athetoid group were 2% only mild, Moderate sensorineural hearing were 2% in spastic hemiplegia group.*

Conclusion: *Spastic Quadriplegic cerebral palsy patients had the maximum incidence of hearing impairment. Perinatal asphyxia and prematurity were the main risk factor of hearing impairment.*

Keywords: *Cerebral Palsy (CP), Hearing Status*

Introduction:

Cerebral palsy (CP) is the 'most prevalent childhood motor disability' today with approximately 8000 infants with CP born in the United States annually.[1,2] The international working group on definition and classification of cerebral palsy, defined CP as a group of permanent disorder of development of movement and posture causing activity limitation that are attributed to non progressive disturbances that occurred in the developing fetal or infant brain.[3]

Most common risk factors are low APGAR score (26.6%) then seizures (13.3%), prematurity (10%) and

lastly low birth weight. Intrauterine infections like cytomegalovirus and rubella, difficult labour, kernicterus are least common risk factors.[4] The prevalence of CP is increased among the low birth weight infants particularly those weighting less than 1000 gm at birth, primarily because of intracerebral hemorrhage and periventricular leukomalacia.[5]

Hearing loss accounts for 25% of cerebral palsy population in Western Europe. These abnormalities are thought to be associated with prenatal, perenatal and postnatal problems often multifactorial in nature.[6,7] In persons with cerebral palsy especially in the affected group, incidence of hearing impairment has been reported about 10- 41%. In Nigeria hearing loss in CP children was about 47%.[8] Out of 1649 cases of cerebral palsy 12 had severe hearing disability in England and Scotland. Hearing loss was averaged across frequencies 0.5 - 4 KHz and the disability classified as "mild" if hearing loss was 21- 45 dB,

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"moderate" for 45 - 70 dB loss, "severe" with a hearing loss >70 dB. Assessment of accurate hearing levels was often impossible in children with concomitant intellectual impairment.[9] Intrauterine infection, ototoxic drugs, bacterial meningitis, hypoxia, chromosomal abnormalities can cause both CP and hearing loss[10].Sensorineural hearing loss (SNHL) is found in a small proportion of very preterm survivors.[11]

There are many ways to detect hearing impairment in children. To formulate a protocol for infant hearing screening in developing countries enabling it to be later incorporated into their national deafness screening programs. The screening tool should be sensitive in detecting hearing loss in infants with high specificity.[12] Tympanometry or Audiometry is used to check the movement of the tympanic membrane. Tones are "bounced" off the tympanic membrane to determine the amount of sound that is reflected back through the ear canal. Middle air pressure, compliance and stepidial reflex threshold (SRT) could be measured by tympanometry. Transient Evoked Otoacoustic Emission (TEOAE) is reproducible, diagnostically accurate, easy to perform and minimally invasive.[13] TEOAE represents a quick, inexpensive, frequency specific, valid method for testing cochlear function. But it can be misleading in case of wax packed ear canal, middle ear effusion, external noise as these conditions often confound the real audiological output. Moreover, TEOAE cannot identify auditory neuropathy.[13,14]

Materials & Methods:
This cross-sectional study was conducted in the Pediatric neurology unit and Autolaryngiology – Head and Neck Surgery Department of BSMMU (full form). Duration of the study was from March 2011 to September 2011. Diagnosed CP patients who fulfiled the inclusion and exclusion criteria was selected purposively as study population. After taking informed written consent, proper history and clinical examinations was done . Hearing assessment was done by different tools of hearing in the auditory department of Autolaryngiology – Head and Neck Surgery. Transient evoked Otoacoustic emissions (TEOAE) test was done. During the test: the audiologist or other provider placed a small probe that looks like an earphone inside the ear canal. Sound was sent to the probe.The probe records and measures the inner ear's response to the sounds. Pure-tone audiometry was also done. During this test: The audiologist or other provider changed the pitch and loudness of the tones at different points during the test. The test helps find the quietest sounds your child can hear at different pitches. Each child was categorized

as mild (26-40 dB), moderate (41-60 dB), severe (61-80 dB) and profound (81 or more dB) deafness. Threshold tracing was done in descending order.

Result:

Table- I
Demographic characteristics of study population
(n=50)

Characteristics	Frequency(%)
Gender	
Male	32(64)
Female	18(36)
Age group	
1-3 year	22(44)
3-6 year	16(32)
6-15 year	12(24)
Socio-economic status	
Poor	26(52)
Middle class	22(44)
Higher class	02(4)
Residence	
Rural	27(54)
Urban	23(46)

Table-I shows male was 64% and female was 36% of study population. About 44% children were 1-3 years' age group, 32% children were 3-6 years' age group and 24% children were 6-15 years' age group. Mean age in year 5.57±3.89, age range 1-15 years. Regarding socioeconomic status, poor was 52%, middle class was 44% and higher class was 04%. About 54% children came from rural area, and 46% children came from urban area.

Table-II
Type of CP in the study population (n=50)

Type of CP	Frequency (%)
Spastic Quadriplegia (SQ)	21(42)
Spastic Hemiplegia (SH)	11(22)
Spastic Diplegia (SD)	08(16)
Athetoid	02(4)
Mixed	08(16)
Total	50

Table- II: shows out of 50 patients 42%, had spastic quadriplegia, 22% had spastic hemiplegia, 16% had spastic diplegia, 04% were athetoid and 18% were mixed CP.

Table- III
Tympanometry report of various type of CP (n=50)

Tympanometry	Type of CP					
	SQ	SH	SD	Mixed	Athetoid	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Negative middle ear pressure	8(32)	6(24)	4(16)	6(24)	1(4)	25 (50)
Eustachian tube dysfunction	2(25)	5(62.5)	1(12.5)	0(0)	0(0)	08 (16)
SRT (Absent)	4(36.4)	4(36.4)	0(0)	2(18.2)	1(9.1)	11 (22)

Coefficient value 0.40, (p=0.12) [SQ=Spastic Quadriplegia, SH=Spastic Hemiplegia, SD=Spastic Diplegia]

Table- III. Tympanometry result shows negative middle ear pressure was present in 32% of SQ patients Eustachian tube dysfunction in 25% SQ patients. In 24% SH pateints there was negative middle ear pressure and 62.5% had Eustachian tube dysfunction SRT was absent in 36.4% in SQ and SH. (P=0.12) that was not statistically significant.

Table-IV
Transient- evoke otoacoustic emission (TEOAE) of study population (n=50)

TEOAE	Frequency
Pass	26(52%)
Refer	24(48%)

"Z" test p-value: 0.84

Out of 50 children, transient- evoke otoacoustic emission was pass in twenty-six (52%) and refer in twenty-four (48%) patients in this study population. (P=0.84) that was not statistically significant.

Table-V
Hearing status by TEOAE in various type of CP (n=50)

Type of CP	Number of Children	Refer N (%)	P value
SQ	21	09 (18)	0.25
SH	11	06 (12)	0.01
SD	08	03(06)	0.12
Athetoid	02	02 (04)	1.0
Mixed	08	04(08)	0.03
Total	50	24(48)	

Chi-Square test was done

Table-V TEOAE result shows hearing impairment of various type of CP. Among SH patients 12% had refer, (p = 0.01) that was statistically significant and in mixed CP, 10% had refer, (p= 0.03) that was statistically significant.

Discussion

It has been noted that roughly 20 percent or one fifth of children with cerebral palsy suffer from hearing loss and typically, the hearing loss is sensorineural. CP patients are usually associated with disability like, hearing loss, visual impairments, epilepsy, speech and language disorders, and cognitive impairments.[6,15,16] In this study out of fifty children, majority (32/50) were male and maximum (18/50) children were from 1-3 year age group (Mean age was 5.57 years).

In the study, hearing impairment was associated with preterm low birth weight in 34%, perinatal asphyxia 52%, severe Jaundice 04%, neonatal septicemia 22% and neonatal seizure in 24% of cases. Shilpi Arora and LK Kochher[17] in their study searched risk factors for hearing loss and found low birth weight in 41.42% which was similar with our study but, hyperbilirubinemia in 25.71% and perinatal asphyxia in 7.14% cases which was dissimilar to this study. In another study by YN Jibril et al.[16] found motor disabilities among 42% patients, hearing loss 63%, cognitive delay 40% and speech delay in 30% of cases which were similar with our study.

Tympanometry result showed negative middle ear pressure (secretary otitis media) in 32%, Eustachian tube dysfunction in 25% (combined were 57%) patients. About 24% had negative middle ear pressure, 62.5% had Eustachian tube dysfunction in SH, SRT was absent in 36.4% in SQ and SH. In the study by Behairy E. H. et al, abnormal tympanometry in the

form of secretary otitis media, eustachian tube dysfunction, was present in 52% of spastic quadriplegic patients while other types of cerebral palsy had normal tympanometry.[4] This is similar to in this study.

Conclusion:

In this study, spastic quadriplegic cerebral palsy patients had the maximum incidence of hearing impairment. Though the cases of athetoid CP were less but all of them had hearing impairment. Perinatal asphyxia and prematurity were the main risk factors of hearing impairment.

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