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A STUDY OF HEARING LOSS IN INFANTS USING BRAIN STEM EVOKED RESPONSE AUDIOMETRY

Paediatrics

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ABSTRACT

Background: Hearing is necessary to learn languages, speech and to develop cognitive skills. Many children with severe hearing loss from birth are not diagnosed until 2.5-3 years of age. Implementing high-risk neonatal screening, detecting hearing loss before 3 months, intervention before 6 months will result in a better speech performance of neonates **Methods:** Detailed history taking, general & ENT examination were done to rule out external ear and middle ear pathology. Syrup pedichloryl 20 mg/Kg was given to sedate. BERA instrument was used. The study included a total of 60, 30 were in the high-risk group and 30 were in the normal group;14 males and 16 females in each group **Results:** 21 infants had hearing loss out of the 30 infants in high-risk group on initial screening. Repeat BERA after 3m on affected infants, 3 were having normal hearing, i.e., 18 out of 30 infants were affected. **Conclusion:** The study emphasizes importance of using ABR as a screening tool for the detection of hearing impairment at an early stage.

KEYWORDS

INTRODUCTION:

Hearing is a crucial link in the development of normal speech and language. The human ear has evolved in such a way as to be tuned with sensitivity to the range of human speech. Speech is the primary mode of human communication, but its acquisition relies upon auditory experiences during a critical period between birth and three years. With sensory experiences deprivation, a child's speech and language development will never fully attain its potential. Additionally, delays in speech and language development can cause delays in other aspects of child development, such as literacy, overall academic achievement, social and emotional development.

Speech and language development may begin as early as in the womb. However, environmental stimulation is of paramount importance to strengthen synaptic connections. If there is no stimulation, as in the case of deafness, the synapses die out. Hence, for synaptic maturation, the speech must be audible. Audition is vital in the process of normal speech and language development.

A deaf infant who ages without the ability to hear speech has fewer and fewer synapses available to develop auditory perceptions and language skills. These effects on development can be reduced with intervention. However, due to the brief and early critical period for language hearing, this intervention must occur as soon as possible in the hearing-impaired child's life.

All newborns should be screened at no later than one month of age for hearing. Those who do not pass screening should have a comprehensive audiological evaluation at no later than three months of age. Infants with hearing loss should receive intervention at no later than six months of age from healthcare and educational professionals with expertise in managing hearing loss and deafness in infants and young children.

In this context, the present study aims to evaluate the performance of Brainstem Evoked Response Audiometry (BERA)in detecting hearing loss in high-risk and normal neonates

AIMS & OBJECTIVES OF THE STUDY:

1. To study the incidence of hearing loss in normal and high-risk infants by using Brainstem evoked response audiometry (BERA)
2. To confirm the hearing impairment and its magnitude in the abnormal study subjects using a follow-up BERA
3. To analyze common risk factors associated with sensorineural hearing loss

MATERIALS AND METHODS:

Source Of Data:

Infants are brought to paediatrics opd, and infants are referred from the obstetrics department for screening of hearing in ENT department.

Methods Of Collection Of Data:

Study Design:

Hospital-based prospective study

Study Period:

May 2021 to October 2021

Place Of Study:

Department of Peadiatrics and ENT, Santhiram general hospital, attached to Santhiram Medical College.

Sample Size:

60(30 normal and 30 high risk) infants

Inclusion Criteria:

1. All infant (both normal and high risk) patients referred to the outpatient department of ENT for screening of sensorineural hearing loss will be included in the study
2. Only those cases registered, who will give consent for the protocol
3. Both sexes will be included

High-risk Criteria Include

1. Family history of congenital or delayed onset childhood sensorineural hearing loss
2. Maternal infections-toxoplasmosis, syphilis, rubella, cytomegalovirus, herpes
3. Birth weight <1500gm
4. Hyperbilirubinemia at a level exceeding for exchange transfusion
5. Ototoxic drugs(aminoglycosides) (Infant and mother)
6. Bacterial meningitis
7. Severe respiratory depression at birth
8. Stigmata or other findings associated with a syndrome known to include sensorineural hearing loss (e.g., Waardenburg's or Ushers syndrome)
9. Consanguineous marriage of parents

Exclusion Criteria:

Parents not willing to give consent

METHODOLOGY:

Detailed history taking and general and ENT examination were done to rule out external ear and middle ear pathology. BERA was done in a dust-free, sound-proof, airconditioned room. Feed was given 10–15 min before the procedure. Syrup pedichloryl 20 mg/kg was given to sedate the baby half an hour before the procedure. Intelligent hearing system BERA instrument was used.

Data will be analyzed statistically using descriptive statistics

RESULTS:

The study included a total of 60 infants.30 were in the high-risk group

and 30 were in the normal group. There were 14 males and 16 females in each group.

21 infants had hearing loss out of the 30 infants in the high-risk group on initial screening. On doing a repeat BERA after 3m on the affected infants, 3 were detected to have normal hearing, i.e., 18 out of 30 infants were affected. All the infants in the normal or no risk factor group had normal hearing. There were 8 infants with birth asphyxia, 10 infants with hyperbilirubinemia,1 with cytomegalovirus infection, 5 infants with low birth weight, 2 infants with craniofacial anomalies, and 4 infants with a family history of hearing loss.

Incidence Of Hearing Loss Among High-risk Babies And Normal Infants

	Affected	Not affected	Total
High risk infants	21(70%)	9(30%)	30(100%)
Normal infants	0	30(100%)	30(100%)
Total	21	39	60

21 infants had hearing loss out of the 30 infants in the high-risk group on initial screening. All the infants in the normal or no risk factor group had normal hearing

The Difference In The Incidence Of Hearing Loss In High-risk Infants Before And After 3m Using Bera

	Hearing loss		
	Present	Absent	Total
Before 3 months	21(70%)	9(30%)	30(100%)
After 3 moths	18(60%)	12(40%)	30(100%)

On doing a repeat BERA after 3m on the affected infants, 3 were detected to have normal hearing, i.e., 18 out of 30 infants were affected

Hearing Level Among Various Risk Factors In The Left Ear In Males:

Risk factor	Mild	Moderate	Severe	Maturational delay	Normal	Total
Birth asphyxia	-	-	1(25%)	1(25%)	2(50%)	4
Hyper bilirubinaemia	1(25%)	-	2(50%)	-	1(25%)	4
low birth weight	-	-	-	-	2(100%)	2
CMV	-	-	-	-	-	-
Family history of hearing loss	-	1(33.33%)	-	-	2(66.6%)	3
Craniofacial anomalies	-	1(100%)	-	-	-	1

Hearing Level Among Various Risk Factors In The Right Ear In Males:

Risk factor	Mild	Moderate	Severe	Maturational delay	Normal	Total
Birth asphyxia	1(25%)	-	1(25%)	1(25%)	1(25%)	4
Hyper bilirubinaemia	1(33.3%)	-	2(66.6%)	-	-	3
Low birth weight	-	-	-	-	2(50%)	2
CMV	-	-	-	-	-	-
Family history of hearing loss	-	-	1(33.3%)	-	2(66.6%)	3
Craniofacial anomalies	-	1(100 %)	-	-	-	1

Hearing Level Among Various Risk Factors In The Left Ear In Females

Risk factor	Mild	Moderate	Severe	Maturational delay	Normal	Total
Birth asphyxia	-	3(75%)	-	-	1(25%)	4
Hyper bilirubinaemia	1(16.6%)	-	2(33.3%)	-	3(50%)	6
Low birth weight	-		-	-	3(100%)	3
CMV	1(100%)	-	-	-	-	1
Family history of hearing loss	--	-	-	-	1(100%)	1
Craniofacial anomalies	-	-	1(100%)	-	-	1

Hearing Level Among Various Risk Factors In Right Ear In Females

Risk factor	Mild	Moderate	Severe	Maturational delay	Normal	Total
Birth asphyxia	-	3(75%)	1(25%)	-	-	4
Hyper bilirubinaemia	1(16.66%)	-	2(33.3%)	-	3(50%)	6
Low birth weight	-		-	-	3(100%)	3
CMV	1(100%)	-	-	-	-	1
Family history of hearing loss	-	-	-	-	1(100%)	1
Craniofacial anomalies	-	-	1(100%)	-	-	1

DISCUSSION:

Among the infants with birth asphyxia, one infant had normal hearing, one had unilateral severe hearing loss and the rest had bilateral hearing loss.

Of the infants with bilateral hearing loss, 2 had severe hearing loss, 2 had moderate hearing loss, 1 had mild hearing loss, and 1 had a maturational delay.

Among the infants with hyperbilirubinemia, 2 had normal hearing and 8 had bilateral hearing loss in the initial screening. On repeat screening, 1 infant with maturational delay and 1 with mild hearing loss had normal hearing. Finally, we had 4 infants with severe hearing loss and 2 infants with mild hearing loss had 1 infant with mild hearing loss in the maternal infections group.

Of the 5 infants in the low birthweight group, 4 had normal hearing and 1 had a maturational delay on initial screening, on doing a repeat test the infant with maturational delay had normal hearing.

There were 4 infants with a family history of hearing loss, of which 2 had normal hearing, 1 had unilateral severe, and 1 had unilateral moderate hearing loss.

Hyperbilirubinemia is the most common risk factor associated with sensorineural deafness in neonates.

CONCLUSION:

The present study emphasizes the importance of using ABR as a screening tool for the detection of hearing impairment at an early stage which would have otherwise got unnoticed till about 2-3yrs.This would further help us in the early rehabilitation of the child as this would make the child socially acceptable.

ABR audiometry because of its accuracy has emerged as a technique of choice in screening infants. Since it is an objective test it is useful in the early identification of hearing loss.

Severe deafness in children is usually due to sensorineural hearing loss rather than conductive loss or auditory processing disorders.

Sensorineural deafness can be due to causes such as
(1) Hereditary (genetic),
(2) prenatal (rubella),
(3) perinatal (kernicterus, birth asphyxia, etc.), and
(4) childhood acquired deafness (following meningitis, trauma).

Delayed cry, birth asphyxia, cerebral palsy, and neonatal seizures can cause brain hypoxia affecting central auditory pathways and leading to hearing loss. In babies with neonatal jaundice, bilirubin toxicity or transient brainstem encephalopathy can cause sensorineural deafness. This is usually transient and improves with phototherapy. Persistent hearing loss in some cases is due to axonal degeneration and loss of myelin.