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A PROSPECTIVE STUDY OF BRAINSTEM EVOKED RESPONSE AUDIOMETRY IN HIGH RISK NICU GRADUATES IN A TERTIARY CARE CENTER.

Paediatrics

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ABSTRACT

Hearing loss presents high incidence, affecting around 3 out of every 1000 live births. When used and interpreted properly, provide a powerful method of obtaining reliable estimates of auditory sensitivity in infants, young children who cannot otherwise provide reliable results on behavioral tests, In this study 146 high risk infants having one or more risk factors between corrected age 3 to 6 months were included in the study.

KEYWORDS

Neonatal Hyperbilirubinemia, BERA, Sensory neural deafness

INTRODUCTION-

Hearing loss presents high incidence, affecting around 3 out of every 1000 live births, and 2-4 out of every 100 newborns leaving NICU .The initial sign of hearing loss are very subtle and systematic neonatal hearing screening is the most effective means of early detection .Early diagnosis and intervention are decisive factors in development and prognosis of these children(1)

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BERA is one of the objective methods of hearing screening .When used and interpreted properly, provide a powerful method of obtaining reliable estimates of auditory sensitivity in infants,young children who cannot otherwise provide reliable results on behavioral tests(2)

Currently the average age of detection of hearing loss is 14 months The American Academy of Pediatrics supports the statement of Joint Committee on Infant Hearing)1994(, which endorses goal of universal detection of hearing loss in infants before 3 months of age, with appropriate intervention no later than 6 months of age(3). Multiple Logistic Regression Analysis has shown that variables which were associated with stastically significant profound hearing loss were Preterm, Neonatal hyperbilirubinemia, Bacterial sepsis, Birth asphyxia and INFANTS WITH Developmental delay.

AIMS & OBJECTIVE-

To know the hearing impairment by BERA in High Risk NICU graduates and to analyse associated factors

MATERIAL & METHODS -

In this study 146 high risk infants having one or more risk factors, according to criteria stated by JCIH 2007(4) were selected from BCHI, NICU between corrected age 3 to 6 months, b/w jan 2017 -jan 2018.

Inclusion Criteria -

1 Family history of hearing loss.
2 Hyperbilirubinemia requiring phototherapy & or exchange transfusion.
3 Birth Asphyxia
4 (Preterm)28 wk -36wk
5 Mechanical Ventilation
6 Bacterial Meningitis
7 Craniofacial Anomalies
8 (In utero infections) TORCH

EXCLUSION CRITERIA-

1) Babies> 1yr
2) Severe multiple anomalies incompatible with life.
3) Untreated otitis externa
4) Atresia /stenosis of external ear

BERA recording-

The infants were sedated followed by BERA recording in quiet and semidarkened room. RMS EMG EP MARK- II Machine used to record BERA ,interpretation of results done by the physiologist.

Procedure in brief-

Infants were sedated with syrup triclofos (pedichloryl 20mg/kg .The skin at the point of placement of electrodes was cleaned with abrasive strip.

Recording of BERA was carried in a quiet semi-dark room. Surface electrodes were placed at vertex,both mastoids, and forehead (ground). The resistance was kept below 5K.Monoaural auditory stimulus consisting of rarefraction clicks of 100 microseconds were deliverd through electrically shielded earphones at the rate of 11.1/sec. contralateral ear was masked with pure white noise of 40db. A band pass of 150-3000Hz was used to filter out undesirable frequencies in the surroundings . Responses to 2000 click presentations were averaged.(5)

RESULTS-

Table1- Characterstic Of High Risk Infant In Study Group N=146

Age in months	4.5±1.2
Birth weight(kg)	2.37±0.68
Normal/CS	105/41
Gender M/F	76/70
Term/Preterm	97/49

Table 2 Distribution Of Risk Factors In Infants With Normal & Abnormal Bera

	Normal BERA	Abnormal BERA	P - Value	ODDS Ratio
Pre Term	18(32%)	31 (34%)	0.04	1.12
Family h/o hearing loss	1 (1.8%)	1 (1%)	1	0.47
Torch	2(3.6%)	3(3.2%)	0.52	0.69
Mechanical ventilation	1(1.8%)	3(3.2%)	0.05	1.44
Craniofacial anomalies	1 (1.8%)	5(5.4%)	0.52	0.67
Birth asphyxia	12 (21.8%)	27(29.6%)	0.03	1.12
b .meningitis/sepsis	7 (12.7%)	15 (16.4%)	0.04	1.02
NNHB	16 (29%)	33 (36.9%)	0.02	1.20
Dev.Delay	15 (27.5%)	33 (36.9%)	0.04	1.48

TABLE 3 -Number of risk factors in infants & BERA Outcome Depicted In Number %Age

Risk Factor	Normal	MILD SNHL	Moderate SNHL	Severe SNHL	Profound	Total
1	31	11	3	2	2	49
2	18	6	15	1	10	50
>3	6	2	10	4	25	47
Total	55(37.6%)	19(13%)	28(19%)	7(4.7%)	37(25.3%)	146

Out of 146 high risk infants 47 had >3 risk factor .Among them 37 had profound hearing loss.

TABLE -4, Incidence of hearing impairment in High risk infants

BERA	NO OF CASES	%AGE
Normal	55	37.6%
Mild SNHL	19	13%
Moderate SNHL	28	19%
Severe SNHL	7	4.7%
Profound SNHL	37	25.3%
TOTAL	146	

Incidence of hearing impairement in high risk infant in our setup was found to be 62.4%, among them 37) 25.3%(had profound , 7) 4.7%(had severe SNHL .28) 19%(Had moderate SNHL, 19) 13%(Mild SNHL

TABLE 5 -BERA in relation with term and preterm infants

Out of 146 high risk infant, we observed that 60 term infant)61%(and 31) 63%(preterm infants had hearing impairement.

TABLE 6-BERA in relation to Hyperbilirubinemia

	Normal	Mild SNHL	Moderate SNHL	severe SNHL	Profound SNHL	Total
PRESENT Hyperbilirubinemia	16 (32.7%)	3(6%)	11 (22.4%)	4 (8.1%)	15 (30%)	49
Absent Hyperbilirubinemia	39 (40%)	16 (16.4%)	17 (17.5%)	3 (3%)	22 (22%)	97

Of 146 high risk infants , 49 had jaundice requiring phototherapy and or DVET , 97 had other risk factors , 16 had normal hearing, 3) 6%(had mild hearing impairement, 11) 22.4%(had moderate SNHL, 4) 8 (%HAD SEVERE SNHL, 15) 30%(Profound SNHL.

TABLE 7-BERA IN relation with bacterial meningitis/ septicaemia

	Normal	Mild SNHL	Moderate SNHL	Severe SNHL	Profound SNHL	Total
Present	7 (31.8%)	3 (13.6%)	3 (13.6%)	0	9 (40.9%)	22
Absent	48 (38.7%)	16 (12.9%)	25 (17.1%)	7 (5.6%)	28 (19.1%)	124
Total	55	19	28	7	37	146

22 high risk infants during NICU stay had bacterial meningitis/septicaemia, 7) 31.8%(had normal hearing, 3) 13.6%(had mild hearing impairement, 3) 13.6%(moderate SNHL,9) 40.9%(had profound hearing impairement.124 high risk infants had hearing impairement due to other risk factors.

TABLE 8 -BERA in relation with Mechanical Ventilation-

	Normal	Mild snhl	Moderate SNHL	Severe SNHL	Profound SNHL	Total
Ventilation recieved	1 (25%)	1 (25%)	2 (50%)	0	0	4
No mechanical ventilation	54	18	26	7	37	142
Total	55 (38%)	19 (13.3%)	28 (19.7%)	7 (4.9%)	37 (26%)	146

Of the 4 high risk babies ventilated for different risk factors , 2 had moderate hearing impairment both were case of Birth asphyxia HIE Stage 2 , 1) 25%(had mild hearing impairment, it was case of preterm with early onset sepsis, 1) 25% (case of birth asphyxia HIE 2, found to have normal hearing during follow up.

TABLE 9-BERA in relation to developmental delay

	Normal	Mild	moderate	severe	profound	Total
Developmental delay present	15	0	18(36.7%)	2(3.3%)	28(58%)	48
No developmental delay	40	19	10	5	9	98

Of 146 high risk infants studied , 48 had developmental delay in any of 4 domains tested, when compared with 98 high risk infants without developmental delay .among 48 baby with developmental delay, 15) 26.7 (%normal hearing , 18) 36.7%(moderate snhl, 2) 3.3%(severe SNHL, and 28)58%(profound SNHL.

TABLE 10-BERA in relation to BIRTH ASPHYXIA

	Normal	Mild	Mod	Severe	Profound	Total
BA	12	2	13	1	11	39
NO birth asphyxia	43	17	15	6	26	107
Total	55	19	28	7	37	

OF 146 high risk infants studied 39 had birth asphyxia during NICU stay during followup BERA 3-6 MONTHS 12) 30.8%(had normal hearing, 2) 5.1%(Mild, 13) 33.3%(moderate , 1) 2.6%(severe & 11) 28.2%(profound hearing impairment.

Results of multivariate analysis-

Method-Multiple logistic regression, dependent variable BERA

Effects	-2 long likelihood of reduced model	Chi-square	Df	Significant p -Value	
intercept	125.7		0		
Preterm	129.2	3.48	2	0.17	Significant
TORCH	126.2	0.47	2	0.79	NS
NNHB	129.16	3.46	2	0.16	Significant
Bact meningitis/sepsis	129.2	3.48	2	0.17	Significant
BA	131.2	5.5	2	0.14	Significant
Delayed milestones	129.1	3.40	2	0.15	Significant

Among all variables introduced in) p< 0.20(significant multivariate analysis Preterm ,NNHB, Bacterial meningitis/sepsis, BA, delayed Milestones were found to be associated with BERA

DISCUSSION:

Brainstem evoked response audiometry, and otoacoustic emission (OAE) are two commonly used objective tests for childhood deafness. Most of the abnormal BERA's were associated with Preterm babies, A study done by Soni.A (6) has shown that there is a significant relationship between hyperbilirubinemia and BERA changes.30% of persistent jaundice cases had profound hearing loss. 40.9% babies with sepsis with or without meningitis had profound hearing impairement.. 28.2% babies who had a significant history of birth asphyxia had profound hearing impairment. In a study done in Nigeria there was a significant correlation between meningitis and BERA responses RR = 4.8, and the same study showed correlation between severe perinatal asphyxia and BERA findings with a relative risk RR = 7.(7)

Multiple Logistic Regression Analysis has shown that variables which were associated with Stastically significant profound hearing loss were Preterm, Neonatal hyperbilirubinemia, Bacterial sepsis, Birth asphyxia and infants with Developmental delay. A similar study done in South India in a similar setting has shown a significant co-rrelation between Neonatal Hyperbilirubinemia and BERA changes.(8)

CONCLUSION -

Hearing impairment is common in high risk NICU graduates, All high risk NICU graduates have some form of hearing impairment when compared with age matched controls, Hyperbilirubinemia contributed in majority of cases followed by prematurity, birth asphyxia, bacterial meningitis & sepsis. High risk infant with multiple risk factors found to have profound hearing impairment. Bilateral hearing impairment is more common in high risk infants. Ideally in a given situation hearing loss should be identified early enough in order to treat and prevent sequale of speech delay, At least all high risk infants must be screened for hearing impairement prior to discharge from hospital using BERA. Retesting of infants with abnormal BERA within 3 months and several times within the first year if abnormal responses persist, is important.

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