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BRAINSTEM EVOKED RESPONSE AUDIOMETRY AND ITS APPLICATION IN HEARING LOSS ASSESMENT IN CHILDRENS.

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ABSTRACT BERA is a non invasive technique, easily recordable, not affected by sedation, anesthesia or age which helps in hearing assessment. Approximately 1 of every 1000 children is born deaf. Early diagnosis of hearing impairment is important as the rehabilitative procedure can be started early which help speech and language development. Our aim is to find out its application of screening hearing loss in newborns with high risk and pediatric age group in ENT setup like our hospital. Objective of the study is screening of deafness in newborn and pediatric age group esp. high risk cases. A cross sectional prospective cohort study was carried out. 36 cases was taken, BERA was performed on them after clinical evaluation.Results were evaluated and statistical analysis done.

Out of 36 pediatric cases screened 15 cases(41.7%) had normal hearing on screening, 13 cases(36.1%) had profound hearing loss without any risk factors, 6 cases(16.7%) had hearing loss due to meningitis complications, 2 cases(5.6%) had hearing loss due to neonatal jaundice. Children with risk factors are **1.65** at more risk of developing hearing loss when compared to normal children; but statistically not significant.

KEYWORDS : Bera, Abr,newborn Screening,lbw,hearing Loss.

Introduction

BERA is a far field recording of the synchronized response of a large number of neurons in the lower auditory portions of the auditory pathways[1].

Diseases of the ear have profound effect on the health and quality of life of millions of people around the globe[2]. According to the 2005 estimates of WHO, 278 million people have disabling hearing impairment[3]. In India, approximately 6.3% of the population suffers from disabling hearing loss. The National Sample Survey Organization report of 2001 suggests that there are 291 persons per one lakh population who suffer from severe to profound hearing loss[4, 5]. Suffering children in the age group 0-14 years results in a severe loss of productivity, both physical and economic. Approximately 1 of every 1000 children is born deaf. Suffering children in the age group 0-14 years results in a severe loss of productivity, both physical and economic. Early diagnosis of hearing impairment is important as the rehabilitative procedure can be started early which help speech and language development. It is impossible to perform pure tone audiometric tests on children but BERA provides rapid and efficient way to screen for deafness.

BERA is a non invasive technique, easily recordable, not affected by sedation, anesthesia or age[6]; hence the present study.

METHODOLOGY

MATERIALS AND METHODS

This study was conducted in department of ENT, Vijayanagara institute of medical sciences, Bellary, Karnataka during December 2009 to May 2011.

SOURCE OF DATA: The patients attending the department of ENT and also patients referred from other departments of combined hospitals of MCH VIMS, Bellary form the subjects for our study in whom BERA can be done and are willing, during December 2009 to May 2011.

SAMPLING SIZE: 36

INCLUSION CRITERIA: Pediatric patients with suspected sensorineural hearing loss and with high risk factors.

EXCLUSION CRITERIA: All patients with conductive or mixed type of deafness were excluded.

The evaluation is done in following stages:

A written informed consent is taken from all patients included in the study. A detailed history-taking, thorough clinical examination done for these patients. The data collected is being entered into a specially designed case record form.

I:BERA apparatus: Machine used for recording BERA was RMS EMG EP MARK-II machine manufactured by RMS RECORDERS and MEDICARE SYSTEM, Chandigarh.

It is a computerized machine with facilities like
- artifact rejection
-common mode rejection

II. The room:

The test was carried out in pre-cooled (temperature 21 degree centigrade) sound treated room. The electrical interference was kept minimal by spacing away the test room transformers, lifts etc. the room was spacious 10 feet by 10 feet with couch to lie down for patient.

III. Pre Test preparation:

Each test carried out with prior appointment. Patient was subjected to ENT and pediatric examination prior to test. Patient was instructed to clean scalp with shampoo and not apply oil. Children given sedation syrup tricloryl as per dose recommended by pediatrician.

IV. Preparation of patient:

Patient was made to lie down on couch with head supported by pillow. Skin was prepared with surgical spirit. Electrode gel (Ten 20 conductive gel) was applied. Gel is non staining, non irritant to skin, sodium chloride free, water soluble.

V. Electrode placement:

Silver electrodes were used and applied in following fashion:

Cz	Vertex	Δ
Active	Testing ear mastoid	+ve
Non active	Non testing ear mastoid	Ground

Electric impedance is always kept less than 3K Ohms and difference between electrodes was not more than 1K Ohms.

VI. The machine setting:

Acoustically shielded TDH 32 earphones were used to cut down acoustic interference. Stimulus was given in the form of clicks at a rate of 11.3 per second. Each click duration was kept between 150 to 3000 Hz. Analysis time was 10 ms, 2000 responses were averaged.

VII.Test:

The test was started after baby is asleep. The first stimulus was given at 125 dBnHL level (maximum intensity available) and decreased by 10 dBnHL for next run if wave V present. Both ears were tested

separately. At each intensity run efforts were made to identify wave V. it was confirmed by re-run. Presence of peak V was taken as ability to hear. Each patient was categorized into normal, mild, moderate and severe hearing loss.

From BERA waveform thus obtained following calculations were made

1. Inter aural latency difference in I-V inter peak interval
2. I-V Inter peak interval
3. Inter aural difference in wave V latency
4. Absolute latency of wave V
5. Selective loss of late waves
6. Grossly degraded wave form morphology

Guidelines used to identify wave V are:

1. Appears after latency of 5 milliseconds (mean 5.7±0.25 ms)
2. With decrease stimulus intensity its latency increases.
3. Can be reproduced following re-run.
4. Absence of peak in neutral run.

We used normative values determined by Gupta and vishwakarma[7,8] in Indian setup.

The report of test was given in the format shown in proforma. Statistical test and Mc.Namara's test was applied whenever applicable.

RESULTS AND OBSERVATIONS:

The observations recorded in the study are described under following headings:

PERINATAL HISTORY:

In our study maximum pediatric patients (36.1%) had normal perinatal history, apart from which post-meningitis (27.8%) was the most common perinatal history.

ABSOLUTE LATENCY OF V (ms)

The absolute latency of wave V was normal in 26 patients (72.2%) and abnormal in 10 patients (27.8%) in our study among the pediatric age group. The mean absolute latency of wave V is 5.76±0.39 ms in left and 5.75±0.41 ms in right ear.

INTERAURAL DIFFERENCE IN WAVE V LATENCY (ms)

In our study the interaural difference in wave V latency was normal in most patients (83.3%) & abnormal in 16.7% in the pediatric age group. The mean interaural difference in wave V latency is 0.02±0.03 ms.

INTERPEAK LATENCY I-V (ms) RIGHT EAR:

The interpeak latency I-V for the right ear was abnormal in 19 patients (52.8%) & normal in 17 patients (47.2%) in the pediatric age group in our study. The mean interpeak latency I-V for the right ear is 4±0.01 ms.

INTERPEAK LATENCY I-V (ms) LEFT EAR:

The interpeak latency I-V for the left ear was abnormal in 19 patients (52.8%) & normal in 17 patients (47.2%) in the pediatric age group in our study. The mean The mean interpeak latency I-V for the left ear is 4±0.01 ms.

INTERAURAL LATENCY DIFFERENCE IN I-V INTERPEAK INTERVAL:

In our study in the pediatric age group the interaural latency difference in I-V interpeak interval was abnormal in 19 patients (52.8%) & normal in 17 patients (47.2%). The mean interaural latency difference in I-V interpeak interval was 0.0094±0.0075.

GROSSLY DEGRADED WAVE : In our study in the pediatric age group normal wave was seen in 16 patients (44.4%), only wave V was present in 13 patients (36.1%), wave V & III in 1 patient (2.8%) & no wave could be identified in 6 patients (16.7%).

INTERPRETATION: TABLE 1

INTERPRETATION	Frequency	Percent
NO WAVE IDENTIFIED	6	16.7%
NORMAL WAVE WITH NORMAL LATENCIES	15	41.7%
ONLY WAVE III AND V IDENTIFIED	1	2.8%
ONLY WAVE V IDENTIFIED AT 120 dB	14	38.9%
Total	36	100.0%

In our study in pediatric age group, 15 cases(41.7%) was interpreted normal wave with normal latencies after analysing all the values. Only wave V identified in 14 cases (38.9%) in children with profound hearing

CONCLUSION: TABLE 2

CONCLUSION	Frequency	Percent
BILATERAL PROFOUND HEARING LOSS	13	36.1%
PROFOUND HEARING LOSS POST NEONATAL JAUNDICE	2	5.6%
SEVERE TO PROFOUND HEARING LOSS POST MENINGITIS	6	16.7%
NORMAL HEARING	15	41.7%
Total	36	100.0%

In our study in pediatric age group, 15 cases(41.7%) had normal hearing on screening, 13 cases(36.1%) had profound hearing loss without any risk factors, 6 cases(16.7%) had hearing loss due to meningitis complications, 2 cases(5.6%) had hearing loss due to neonatal jaundice.

INFERENCE: TABLE 3

PERINATAL HISTORY	Abnormal	Normal	TOTAL
No risk	10	9	19
Row %	52.6	47.4	100.0
Col %	47.6	60.0	52.8
Risk	11	6	17
Row %	64.7	35.3	100.0
Col %	52.4	40.0	47.2
TOTAL	21	15	36
Row %	58.3	41.7	100.0
Col %	100.0	100.0	100.0

P value-0.46

ODDS RATIO: 1.65

Children with risk factors are **1.65** at more risk of developing hearing loss when compared to normal children; but statistically not significant.

DISCUSSION

In our study out of 36 children 23(63.9%) had risk factors like meningitis 11 cases(27.8%), low birth weight 6 cases(16.7%), neonatal jaundice 2 cases(5.6%), mentally retarded 2 cases(5.6%), preterm 2 cases(5.6%) and autistic child 1 case(2.8%) and 13(36.1%) had no risk factors.

At the end of the study we found Children with risk factors are **1.65** at more risk of developing hearing loss when compared to normal children; but this was not statistically significant.

In a study conducted by Savić L, Milosević D[9] 89 children evaluated and following risk factors was present :positive family anamnesis (deafness/severe hearing impairment) in 11 cases (12.3%). The other risk factors were found in 25 (28.1%): preterm infants 12 (48%), hypoxia and asphyxia 6 (24%), usage of the ototoxic drugs 3 (12%), hyperbilirubinaemia 2 (8%), exsanguinotransfusion 1 (4%), hydrocephalus 1 (4%).

In a study conducted by Bhandari V, Narang A[10] 30 jaundiced babies were evaluated.

In a study done by Northern JL, Hayes D: Universal screening for infant hearing impairment, approximately 10% of all newborns are at risk for some type of developmental disability including hearing loss. Of these newborns at risk, 30% to 50% of every 1,000 have hearing impairments[11].

BERA is the accurate and reliable estimation of hearing levels in infants and young children and helps in early identification of hearing impairment and rehabilitative measures can be taken. In our study BERA was effective in identifying hearing loss thresholds and assessing auditory pathway in infants and children's in whom behavioral methods and PTA evaluation is not possible and in children

with significant perinatal history with risk of developing hearing loss. BERA is non invasive, easy to perform and interpret and cost effective screening test to assess hearing loss in infants and children which can be done in any OPD settings.

CONCLUSION

In overall assessment following conclusion can be drawn:

- In our study BERA was effective in identifying hearing loss thresholds by identifying wave V and its threshold and assessing auditory pathway in infants and children's depending on the wave latencies.
- When compared to children who had risk factors with normal perinatal history children, Children with risk factors are **1.65** at more risk of developing hearing loss when compared to normal children; but statistically not significant as the study group was small.
- BERA along with Otoacoustic emissions can be used for screening children with high risk factors like low birth weight, post meningitis, post neonatal jaundice etc and also for newborn hearing screening.

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