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ROLE OF AUDITORY BRAINSTEM RESPONSE AUDIOMETRY IN UNIVERSAL HEARING SCREENING.

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ABSTRACT **Introduction:** Early identification through Auditory Brainstem Response (ABR) is vital to avoid missing the window of neural plasticity, allowing for intervention (like hearing aids or cochlear implants) that supports age-appropriate speech and language development.[1,2] **Aim And Objectives:** To screen all the "fail" cases of Otoacoustic Emissions (OAE) and confirm the hearing loss and provide timely intervention for the newborns so that there is no delay in speech and language development. **Study Design:** The newborns who "fail" Universal Hearing Screening with OAE were subjected to ABR and results plotted for analysis. **Results And Conclusion:** A total of 41 newborns were screened who have "fail" OAE. Normal -19; Conductive hearing loss-10; Sensorineural hearing loss(SNHL)-10; Congenital Hearing loss(CHL)-2. Thus the timely therapy of hearing and speech for SNHL and CHL infants were given.

KEYWORDS :

INTRODUCTION:

In Universal Newborn Hearing Screening (UNHS), ABR serves as a critical objective tool for identifying hearing impairment shortly after birth. It is often utilized in its automated form (AABR) for primary screening and its diagnostic form (Clinical ABR) for confirming hearing loss.[3]

Core Roles Of ABR In Screening:

1. Comprehensive Evaluation: Unlike OAE, which only assesses the function of the cochlea's outer hair cells, ABR evaluates the entire auditory pathway from the cochlea through the auditory nerve and into the brainstem [4]
2. Detection of Auditory Neuropathy: ABR is the only screening method capable of detecting Auditory Neuropathy Spectrum Disorder (ANSD). Infants with ANSD may have normal OAE results but abnormal neural transmission, meaning they would "pass" an OAE screen despite having significant hearing impairment.[4]
3. Gold Standard for High-Risk Infants: Current guidelines recommend AABR as the first-choice screening method for high-risk neonates, such as those in the Neonatal Intensive Care Unit (NICU), due to their higher prevalence of neural hearing loss.[3]
4. Reduced False Positives: ABR is less sensitive than OAE to ambient noise and transient middle ear conditions (like fluid or debris), leading to lower referral rates and fewer false positives.[4]

Comparison of Screening Technologies;[3,4]

Sl. no	Feature	Otoacoustic Emission (OAE)	Automated ABR (AABR)
1	Site of Testing	Cochlea (Outer Hair Cells)	Cochlea Auditory Nerve, Brainstem
2	Sensitivity	Approximately 78.7%-95%	Approximately 91.7%-100%
3	Specificity	Approximately 88.8%-91%	Approximately 92.1%-98%
4	Test Duration	Rapid (approx. 4min)	Longer (approx. 12min)
5	Cost	Generally lower per test	Higher per test

Clinical Significance and Protocols:

Most universal programs follow a multi–stage protocol to balance accuracy and cost-effectiveness.[2]

1. Initial screen: Often OAE for well-babies (due to speed/cost) or AABR for NICU babies.
2. Rescreen: Infants who "refer" (fail) the first screen are typically re-tested with AABR to filter out transient issues like amniotic fluid.[5].
3. Diagnostic Confirmation: If an infant fails the AABR, a diagnostic ABR is performed before 3-6 months of age to determine the exact degree and type of hearing loss.[6,3]

AIM AND OBJECTIVES:

1. To identify hearing loss in neonates during the first few hours after birth.
2. To provide timely intervention for the newborns so that their developmental milestone with respective to speech and language is not delayed and are absorbed in the mainstream without any handicap.

MATERIAL AND METHOD:

The following study was carried out in PES IMSR, Kuppam, Chittoor district (AP) during the period between June 2022- December 2025.

Table1: Results Of Newborns Screened With ABR After "fail" In OAE.

Sl.no	Type of Hearing loss	No. of Newborns
1	Normal	19
2	Conductive Hearing loss	10
3	Sensorineural Hearing loss	10
4	Congenital Hearing loss	02
5	Total	41

From the above study, it can be inferred that 19 cases which failed OAE turned out be normal. 10 cases were conductive hearing loss which is treatable without much intervention. Whereas the sensorineural hearing loss- 10 cases and congenital hearing loss-2, were advised hearing aids and cochlear implant respectively.

DISCUSSION:

In the context of UNHS, "high-risk" factors (often called risk indicators) are specific medical or genetic conditions that increase the likelihood of a baby being born with hearing impairmentor developing it later in childhood.

The Joint Committee on Infant Hearing (JCIH) provides the gold-standard list of these factors. If a baby has even one of these, they typically bypass the standard "fast" screen (OAE) and go straight to Automated ABR (AABR), and they require long-term monitoring.

1.Neonatal Intensive Care (NICU) Factors:

The most common high-risk babies are those who spend more than 5 days in the NICU. Specific triggers include:

a. Mechanical Ventilation: Use of a breathing machine for 5 days or more.

b. Ototoxic Medications: Certain life-saving antibiotics (like Gentamicin) or "loop" diuretics (like Lasix) that can accidentally damage the delicate hair cells in the inner ear.

c. Hyperbilirubinemia (Severe Jaundice): Specifically when levels are high enough to require an exchange transfusion. This is because high bilirubin can be toxic to the auditory nerve (leading to Auditory Neuropathy)

d. ECMO: The use of a heart-lung bypass machine.

2. Genetic and Physical Factors

a. Family History; Having a parent or sibling with permanent childhood hearing loss.

b. Craniofacial Anomalies: Physical differences in the shape of the face or head, such as:
1. Microtia/ Atresia (small or missing outer ear/canal).
2. Cleft palate
3. Ear tags or pits

c. Syndromes: Over 400 syndromes are linked to hearing loss, including Down syndrome, Usher syndrome, and Waardenburg syndrome (often marked by a white forelock of hair or different colored eyes).

3. Infections (In-Utero and Postnatal):
a. TORCH Infections: Infections passed from mother to baby during pregnancy, including:
1. Cytomegalovirus (CMV) – The #1 non-genetic cause of sensorineural hearing loss.
2. Toxoplasmosis, Rubella, Syphillis, and Herpes.

b. Postnatal Infections: Specifically Bacterial Meningitis, which is a high-risk medical emergency for hearing loss because it can cause the cochlea to "ossify".

4. Birth Conditions
a. Very Low Birth Weight: Babies weighing less than 1500gm (approx, 1.5kgs) at birth.
b. Low Apgar Scores: Especially scores of 0-4 at one minute or 0-6 at five at five minutes, indicating significant distress or lack of oxygen at birth.

If a baby is identified with these factors:
1. Mandatory ABR: They must be screened with AABR because OAEs can miss neural hearing loss (like Auditory Neuropathy) common in NICU babies.
2. Ongoing Surveillance: Even if they "pass" at birth, they are at risk for late onset or progressive hearing loss. JCIH recommends they have a full diagnostics audiology follow-up by 9 months of age.

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