Section: Otorhinolaryngology, Head and Neck Surgery

Original Research Article

COMPARISON OF OTOACOUSTIC EMISSIONS AND BRAINSTEM EVOKED RESPONSE AUDIOMETRY IN HIGH RISK CHILDREN & EFFICACY OF OTOACOUSTIC EMISSIONS IN DETECTING HEARING LOSS IN A TERTIARY CARE HOSPITAL IN SOUTH INDIA

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Abstract

Background: In this study, we used oto-acoustic emission (OAE) & brainstem evoked response audiometry (BERA) to measure the incidence of hearing loss in the juvenile population and investigate potential etiological factors & efficacy of otoacoustic emissions. **Materials and Methods:** A retrospective observational study was conducted in the Otorhinolaryngology (ENT), Obstetrics & Gynecology & Paediatrics Departments at velammal medical college & hospital, tamil nadu, india Between march 2023 & august 2023. The convenience sampling technique was used to select the patients. There were 155 infants in the final sample. In the beginning, screening methods were used on newborns to identify hearing loss that was permanent or fluctuating, bilateral or unilateral, sensory or conductive, and had an average frequency range of 30 to 40 dB or higher. Newborns were screened using objective, non-invasive physiologic measurements, like Oto-Acoustic Emission (OAE) test. The newborns with hearing impairment then underwent Brainstem Evoked Response Audiometry (BERA). **Result:** Out of 155 cases, <3months of age screened for OAE, which had 24 refer (hearing loss) of 52 high risk children (5 pre-term, 12 lbw, 5 hyperbilirubinemia, 1 genetic disorder, 2 HIE, 27 NICU admission). Further evaluated with BERA showed 18 had hearing loss, remaining 6 had normal hearing. Hearing loss is predominantly seen in low-birth weight newborns & prolonged NICU stay infants. **Conclusion:** Our current study suggests that OAE hearing screening and diagnostic services are necessary to identify any hearing issues in babies. All hospitals should implement BERA screening programs to evaluate newborn hearing at a young age.

INTRODUCTION

One of the most common birth defects is hearing loss. One baby out of every thousand is born profoundly deaf, and four times as many are born with bilateral moderate to severe hearing loss.[1] Compared to the general population, infants in neonatal intensive care units (NICUs) have a 10–20 times higher risk of suffering from a major hearing loss. In India, there is a range of 1 to 6 cases of hearing loss per 1000 live births, with an average of 4 cases.[2] The most crucial time for language and speech development is the first three years of life. Therefore, if hearing impairment is not identified in infancy, many babies and young children may miss a significant portion of the critical window for language and speech development.[3]

OAEs are energy types that are quantified as sound and are produced by the human cochlea's outer hair cells in reaction to sound stimuli. The screening test

was created in 1978 by David Kemp,[4] after being initially mentioned by a geophysicist in the middle of the 1940s. The National Institute of Health proposed universal new-born hearing screening by three months of age in a consensus statement in 1993.[5] The statement also mentioned the possibility of using oto-acoustic emissions (OAE) as the screening technique.

According to the national Early Hearing Detection and Intervention (EHDI) 1-3-6 goals, all new-borns should get a hearing loss screening before one month of age. If the screening is unsuccessful, the infants should receive diagnostic testing before three months of age, and if the hearing loss is persistent, early intervention (EI) services should be provided before six months of age.

MATERIALS AND METHODS

This study, which lasted six months from March 2023 to August 2023, was a retrospective observational study carried out at the ENT, Obstetrics & Gynecology & Paediatrics departments of Velammal Medical & Hospital. The patients were chosen using the convenient sampling method. There were 155 infants in the final sample.

Inclusion Criteria

- Birth asphyxia
- Low birth weight(LBW)
- Pre term gestation
- Hyperbilirubinemia
- Genetic disorder
- Mechanical ventilation > 5 days/NICU admission

Exclusion Criteria

- Those who are not willing to give consent
- Unstable and very sick neonates who cannot be shifted outside NICU for OAE testing.

To perform the OAE, the baby should be should be either sleeping or under sedation (using syrup PEDICLORYL (triclofos) 30mg/kg. The baby's ear is fitted with a small, flexible probe which is snugly fit. Plugs are used to create specific auditory stimulation which is done by standard SENTIERO DESKTOP Class 1 Tympanometer (part number 100497-ED) & MIRA SOFTWARE. The otoacoustic responses of the inner ear to transmitted sounds are captured by a tiny microphone embedded in the plug. The OAE screen shows "PASS" or "REFER" as the test results. When something is referred, it indicates that either the ear is aberrant or that the exterior canal material is causing a false positive result. One to five minutes are needed to complete this procedure.

Newborn and upto <3 months of age are taken & performed.

Newborn screened with OAE showed refer are further evaluated with BERA.

RESULTS

Among a total of 155 children selected for this study, 77(49.7%) are male & 78(50.3%) are female. Out of 155 children, 52 (33.5%) are high risk 5(3.2%) pre-term, 12(7.7%) low-birth weight, 5(3.2%) hyperbilirubinemia, 1(0.6%) genetic disorder, 2(1.3%) hypoxic ischemic encephalopathy, 27(17.4%) NICU admission of which 24(15.5%) had OAE refer, are further evaluated with BERA showed 18(75%) had deafness.

Table 1: Sex Distribution.

Variable n=155	Frequency	Percentage %
Male	77	49.7
Female	78	50.3
Total	155	100

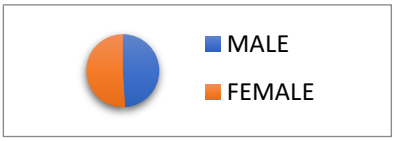

Table 2a: Incidence of Risk Factor (Pre-Term)

Variable =155	Frequency	Percentage %
Preterm (no)	150	96.8
Preterm (yes)	5	3.2
Total	155	100

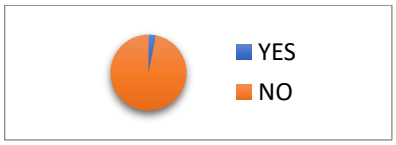

Table 2b: incidence of risk factor (low birth weight-lbw)

Variable N=155	Frequency	Percentage%
LBW (NO)	143	92.3
LBW (YES)	12	7.7
Total	155	100.0

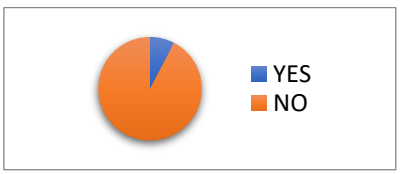

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Table 2c: incidence of risk factor (hyperbilirubinemia)

Variable N=155	Frequency	Percentage %
Hyperbilirubinemia (NO)	150	96.8
Hyperbilirubinemia (YES)	5	3.2
Total	155	100.0

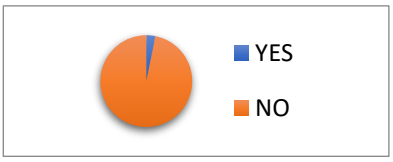


Table 2d: incidence of risk factor (genetic disorder)

Variable N=155	Frequency	Percentage %
Genetic disorder (no)	154	99.4
Genetic disorder (yes)	1	.6
Total	155	100.0

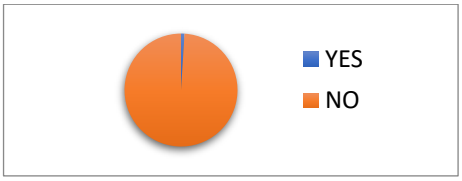


Table 2e: incidence of risk factor (hypoxic ischemic encephalopathy - HIE)

Variable n=155	Frequency	Percentage %
HIE (NO)	153	98.7
HIE (YES)	2	1.3
Total	155	100.0

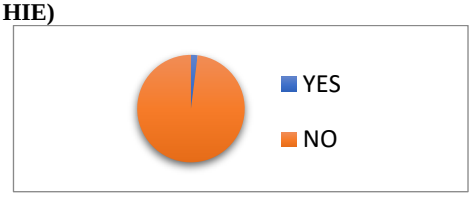


Table 2f: incidence of risk factor (neonatal intensive care unit – NICU admission)

Variable N=155	Frequency	Percentage %
NICU admission (NO)	128	82.6
NICU admission (YES)	27	17.4
Total	155	100.0

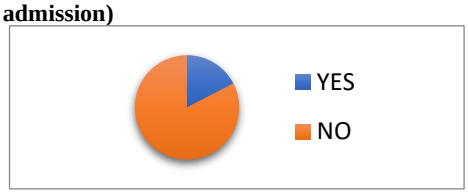


Table 3: results of otoacoustic emission test – OAE

Variable N=155	Frequency	Percentage%
OAE (PASS)	131	84.5
OAE (REFER)	24	15.5
Total	155	100.0

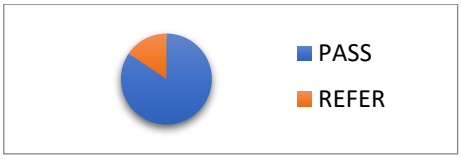
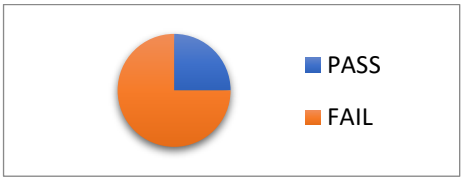


Table 4: Results of Brainstem Evoked Response Audiometry – BERA

Variable N=24	Frequency	Percentage %
BERA (PASS)	6	25
BERA (FAIL)	18	75
Total	24	100.0



DISCUSSION

Before being discharged from the birth hospital, every infant should ideally have a hearing test to rule out hearing loss. Still, this isn't always possible in a developing nation with the kind of resources India has. Therefore, neonates should be tested, if they have risk factors for hearing loss. OAE will be utilized for screening, while BERA will be utilized to confirm hearing impairment.

This study sought to determine the incidence of hearing loss in the juvenile population and investigate potential etiological factors & efficacy of otoacoustic emissions in the screening of neonates for hearing loss and the early diagnosis of the condition in order to give early intervention and identify risk factors in patients with hearing loss.

According to van Dommelen et al., hearing loss was increased in low birth weight babies. About 1.4–4.8% of babies weighing 750–1500 g had hearing loss. In the present study, 111 infants with low birth weight (<2.5 kg) had REFER OAE results.[6] In our study about 18% had OAE refer. Atighechi S et al performed OAE on thirty-five neonates with hyperbilirubinemia, thirty cases (85.7%) passed whereas the remaining (14.3%) seemed to be failures.[7] In our study of 5 cases of hyperbilirubinemia, none of them had OAE refer.

According to Kumar et al. (2015), 21.75 % of study subjects were admitted to the NICU, with 94.1 % of them being OAE referred.[8] In our study 17.4% of cases were admitted in NICU of which 88.8% had OAE refer. According to Valse D et al. (2017), the referral rate was 9% when OAE was used alone in

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his study, but it was reduced to 2% when combined with BERA.[9] In our study 15.5% when OAE was used alone but it was reduced to 11.6%.

Singh PK et al. reported a prospective study for neonatal hearing screening (2017). On retesting the OAE, 21.41/1000 high newborns were found to be referred, whereas 11.53/1000 were found to be BERA failures.[10] Jaideep Bhatt et al. (2015), who conducted a study to assess the sensitivity and specificity of the OAE test in neonates with ABR, OAE had a sensitivity of 70% and specificity of 61% at 0 months, and a sensitivity of 70% and specificity of 99% at 3 months.[11] Raghuwansi et al (2019) discovered that neonatal

screening has a sensitivity of 66.7 % and a specificity of 98.8 % in detecting newborn hearing loss.[12] In our study sensitivity of OAE is 75% and a specificity is 81.6%.

CONCLUSION

The results of this study demonstrated how crucial it is to test newborns for hearing loss. Our research has shown that BERA provides an excellent representation of hearing sensitivity. Therefore, BERA should be used as a standard practice in all high-risk neonates to identify hearing impairment. Early implementation of rehabilitative interventions and routine follow-ups are crucial. Our current study recommends that all hospitals should implement OAE hearing screening and diagnostic BERA screening programs in order to prevent any issues with infants' hearing function.

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