



NEONATAL HEARING SCREENING USING OTOACOUSTIC EMISSIONS IN A TERTIARY CARE CENTRE

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ABSTRACT

Introduction: Hearing is essential for the development of speech and language. Early detection and intervention are crucial to mitigate these effects. Tests such as otoacoustic emissions (OAE) are necessary for early screening of newborns. **Aims And Objectives:** The purpose of our study is to assess the incidence of early hearing loss in newborns using otoacoustic emissions (OAE) testing. **Methodology:** This prospective study was carried out in the ENT department at Basaveshwar Teaching and General Hospital in Kalaburagi. Data collected from May 1, 2024, to October 31, 2024 (6 months), were analyzed. Our sample size consisted of 300 newborns, all within 28 days of birth, and informed consent was obtained from their parents. Newborns with severe multiple anomalies incompatible with life, atresia of the external ear canals in both ears, and hearing loss associated with syndromes were excluded. We collected demographic, prenatal, and postnatal information, followed by thorough head and neck examination and otoscopy. OAE testing was performed to assess the hearing of each ear. **Results :** A total of 300 neonates were screened, comprising 164 males (54.6%) and 136 females (45.3%). Among them, 9 neonates (3%) failed OAE test in both ears. 2 neonates (0.6%) had refer in right ear only, and 1 neonate (0.3%) had refer in left ear only. Out of 300 neonates, 120 were classified as high-risk, with 8 failing the OAE test. In contrast, of remaining 180 normal neonates, 4 also failed the OAE test. **Conclusion:** Universal newborn hearing screening is essential in today's healthcare landscape. OAE serve as an effective tool for screening newborns for hearing loss. This examination can be easily conducted in newborns, regardless of their gestational age.

KEYWORDS

Newborn hearing screening, Otoacoustic emissions, High risk neonates

INTRODUCTION

Hearing is essential for the development of speech and language. Children with bilateral hearing loss frequently experience challenges in these areas, which can hinder their educational progress(1). Early detection and intervention are crucial to mitigate these effects. It is an established fact that if hearing loss is present, it should be detected and remediated before the baby is 6-month-old. Such infants can develop essential language and cognitive skills if the condition is detected early and they are provided with appropriate intervention services within the first year of life.(1)

The incidence of significant hearing loss among neonates ranges from 1 to 3 cases per 1,000 live births, increasing to 2 to 4 cases per 100 among infants who survive neonatal intensive care or those at high risk, including preterm infants, low birth weight infants, and those with a family history of hearing impairment, hyperbilirubinemia, meningitis, in utero infections (such as TORCH), exposure to ototoxic medications, or mechanical ventilation lasting five days or longer.(2)

Programs for the screening of hearing among newborns have been proven to be the best and the most desirable method in detecting permanent congenital loss of hearing among them, which can help to initiate auditory rehabilitation prior to three years of age comprehensively(3)

As a result, neonatal hearing screening programs are recommended in developing countries. Tests such as otoacoustic emissions (OAE) are necessary for early screening of newborns(3).

Otoacoustic emission (OAE) test has become an essential component of objective pediatric audiology assessment. In humans, the otoacoustic emissions are sounds generated from the intact cochlea by oscillation (contraction and elongation) of the outer hair cells and transmitted across middle ear to the external ear where they can be recorded by a sensitive microphone and can be considered as a marker for inner ear integrity and a way to screen for hearing impairment.(2)

In our study, hearing loss occurring at birth up to the first 28 days of life will be considered as neonatal hearing loss.

Objective

The purpose of our study is to assess the incidence of early hearing loss in newborns using otoacoustic emissions (OAE) testing

MATERIAL AND METHODS

A prospective cross-sectional study consisting of 300 neonates

Inclusion Criteria: All newborns within 28 days of life. Informed written consent was taken from the parents

Exclusion Criteria:

1. Newborns with severe multiple anomalies incompatible with life
2. Atresia or stenosis of the external ear canals in both ears
3. Hearing loss associated with syndromes

The study was conducted in the ENT department at Basaveshwar Teaching and General Hospital, Kalaburagi. Data collected from May 1, 2024, to October 31, 2024 (6 months), were analyzed. We collected demographic, prenatal, and postnatal information, followed by a thorough head and neck examination and preliminary otoscopy. Otoacoustic emissions (OAE) testing was performed as part of the Neonatal Hearing Screening Program to assess the hearing of each ear.

OAE testing uses a probe positioned within the ear to assess the inner-ear responses to sound. In order to perform the OAE, a small flexible plug is put into baby's ear. Specific sounds stimuli are generated via plug. A minute microphone in the plug records the otoacoustic responses of the inner ear in reaction to transmitted sounds. The test should be performed when the baby sleep. OAE screen displays the results of the test as 'PASS' or 'REFER'. Refer means either the ear is abnormal or there is false positive result due to debris in the external canal. This test takes between 1-5 minutes to perform

Statistical Analysis: The statistical data collected will be analyzed statistically using software version IBM SSPS version 25.0.

RESULTS

Table 1: Distribution Of Newborns On The Basis Of Sex And OAE Results

Sex	Frequency	OAE -refer	Percentage
Males	164(54.6%)	7	4.2%
Females	136(45.3%)	5	3.6%
Total	300		

Table 2: Distribution Of Hearing Loss In Newborns On The Basis Of Affected Ear.

Affected ear	Frequency	%
Right ear	2	0.6%

Left ear	1	0.3%
Bilateral ears	9	3%
TOTAL	12	4%

Table 3: Presence Of High Risk Factors And OAE Results.

High risk factors	Frequency	OAE fail
Present	120	8(6.6%)
Absent	180	4(2.2%)

DISCUSSION

Hearing loss is a hidden disability that does not attract much sympathy like other physical disabilities. Universal hearing screening represents the only way to identify neonates with hearing loss. This can be achieved using OAE or ABR audiometry or both OAE and ABR in a two-staged program. Screening with OAE is a non-invasive, quick, simple, and safe method of detecting hearing loss in the neonatal period. Once hearing loss is identified, effective treatment options are available, which can secure holistic development of the child (4).

There are certain factors that might bring about delays in diagnosis and intervention in children with hearing loss in our society, including low literacy rate among parents, cultural considerations, doubts about the degree of hearing loss, uncertainty about the benefits of hearing amplification, attitudes towards wearing hearing aids, and cost and technical considerations(3)

In this study only OAE has been used for screening the neonates.

In our study out of 300 neonates, majority of participants were male 164 (54.6%) compared to females 136 (45.3 %) whereas in the study conducted by John et al in Southern India to screen neonates for hearing loss, majority that is 51.8% of the participants were females(5) and in Study conducted by sureshraj Kumar et al among 1040 participants 51% (n=527) were females (1)

In our study, referral rates in males was 4.2% and in females 3.6% with male preponderance, which is similar with the study from Qatar that reported referral rate of 2.7% in males and 2.5% in females[14].

Whereas other studies have contrast results, in study done by Abdullahi A et al Out of the 12 neonates who failed the screening, the referral rate in females was 6.7% compared to 1.3% in males. This has a P value of .024, which is statistically significant. This is due to the fact that more females were recruited in the study compared to males(4).

A total referral rate of 4% is obtained in our study with bilateral hearing loss being 3% and 0.6% and 0.3% in only right and left ear respectively. Other studies like study done by Abdullahi A et al show a referral rate of 8% for bilateral hearing loss(4). This is similar to a study done in Shanghai, China, that reported a referral rate of 8%[10] using OAE. Helge in a two-tier screening process a referral rate of 5.18% with TEOAE (11). Bielecki et al. reported a referral rate of 4.54% in Poland, [12] whereas Korres et al. reported a referral rate of 2.3% in well-baby nursery(13).

The recognized risk factors observed in NICU are consanguinity, low birth weight, prematurity, congenital malformations, Rhesus incompatibility, premature rupture of membrane, antenatal ototoxicity, and maternal febrile illness.

In our study, referral cases in high risk neonates (6.6%) was more when compared to normal neonates (2.2%). In study done by Kardman SE et al, the calculated prevalence of neonatal hearing loss was 5.2 and 10.8 per 1000 in well-baby nursery and NICU respectively which is alarmingly high which is similar to our study with high risk neonates having more referral rate.(2)

John et al conducted a pilot study for neonatal screening to detect hearing loss, results of the study showed that 9.2% of newborn had one or more high risk factors and thus concluded that the frequency of moderate to moderately severe sensorineural hearing loss in our study population was 0.6%.(5)

A hearing screening study by Nagapoomima et al was conducted at St. John's medical college hospital, Bangalore on 1769 infants (1490: not at risk, 279: at risk). It showed the incidence of hearing impairment to be 5.65 per 1000 screened. 3 "at risk" infants and 7 "not at risk" infants were found to have hearing impairment. It was thus concluded that

basic hearing screening of all neonates was necessary(8).

In 1994, the Joint Committee on Infant Hearing (JCIH) established in the US recommended screening of high risk babies for hearing loss using High Risk Registry [15]. Several studies thereafter suggested that up to 50% of all the children with congenital hearing loss have no risk factors and would be missed by screening only those at high risk [16,17]. Universal Screening of all infants for hearing loss within the first few months of life hence became the accepted strategy [16].

The incidence thus being 0.77 per 1000 live births. The screening with OAE multiple times helped in reducing the number of children to be subjected for BERA. Since all children were included in the study, irrespective of risk factors, universal screening was achieved. (7)

CONCLUSION

Hearing impairment is a hidden condition present at birth, which typically becomes noticeable only when a child fails to develop speech as expected. Early identification of this condition is crucial for prompt rehabilitation, as it allows for the utilization of the child's neural plasticity. Otoacoustic emission (OAE) testing is a quick, cost-effective, non-invasive, and widely accepted screening method that can be performed at the bedside. Universal newborn hearing screening is vital in modern healthcare, and OAE testing is a reliable tool for detecting hearing loss in newborns, regardless of their gestational age. These points underscore the critical need for a national program for neonatal hearing screening and the importance of addressing preventable risk factors for hearing impairment in developing countries.

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