
Otoacoustic Emission Screening of Auditory Dysfunction of High Risk Infants at Tertiary Care Setting

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Abstract

Objective: Hearing deficit in newborns may go unnoticed leading to crucial handicap to language development and impaired socioacademic profiles. Early detection and intervention is of utmost importance as safeguard against the consequent healthcare burden.

Method: Present study employed two stage distortion product otoacoustic emissions (DPOAE) for assessment of hearing function in infants of high risk background referred by the obstetric and pediatric sections of medical college. Cases failing hearing function test by DPOAE at both stages were given Brain stem evoked response audiometry testing to confirm hearing loss.

Results: Gestational diabetes and hypertension were the commonest risk factors for reference of babies for auditory function screening in the studied 50 cases. 84% of the referred high hearing risk children passed the DPOAE test at very first stage. Further 14% cleared hearing test on repeat DPOAE testing, leaving just 1(2%) baby then sent for BERA testing and definitive diagnosis of hearing loss.

Conclusion: The Distortion product oto acoustic emission, two stage screening strategy for auditory dysfunction in infants proved highly sensitive and reliable for early detection and hence early intervention. The DPOAE screening is best suited for early detection and intervention programme in infant hearing loss deserving wide adoption.

Keywords: Infant hearing screening; otoacoustic emissions, BERA.

1. Introduction

Early hearing loss is invisible determinant to compromise normal development, performance and achievement of growing children. In about 1 to 6 per thousand live births, congenital hearing defect is documented to prevail [1,2]. Early detection and address may help curtail risk of stunted speech development and school performances. Early detection and intervention strategies envisage overall improvement of cognitive, motor and social development of affected child. Very crucial, yet feasible early intervention is hearing function screening in newborns. Their hearing apparatus is critically sensitive to variety of conditions affecting mother's health, pregnancy and neonatal period. This study was an endeavourer for early detection of hearing loss in referred infants from the maternity and pediatric sections of MGM hospital Vashi, Navi Mumbai, an affiliate of MGM Medical College, during June 2008 to December 2009 period.

Two staged distortion product otoacoustic emission (DPOAE) screening was administered to high risk infants.

Cases failing both hearing screens were subjected to diagnostic brain stem evoked response audiometry (BERA) for further steps.

2. Subjects and method

It was cross sectional study carried out under ENT department at tertiary care hospital on outskirts of Mumbai metro. Babies with high risk profile for hearing loss were referred for hearing test by obstetric and pediatric sections. The defined high risk situations for hearing loss in newborns and infants were: pregnancy in women over 35 year age, multiple pregnancy, premature births at least 2 week before expected date of delivery, prolonged labour; assisted labor; low birth weight and low APGAR score at birth, babies of diabetic and hypertensive mothers; babies suffering birth trauma, Rh hemolytic disease, unduly long icterus or sepsis. Mothers were told about the purpose and nature of procedures and written consent was obtained before inclusion of the baby in study. The study protocol was approved by college research board.

The particulars of perinatal history of baby as well as any family history of hearing impairment were noted. Babies underwent examination for any lesions of auditory canal and tympanum using Heine 3000 series otoscope. They were then taken, preferably when asleep, to sound treated test room, along with one parent Intelligent Hearing System Smart DPOAE version 4.00 PC software was used for data collection and analysis. Initial DPOAE testing of the neonates was at minimum 1 week after birth or later when their health stabilized on normal course. The DPOAE test was conducted in two staged protocol. Second testing was only for infants failing the first stage test. Those failing both stages were subjected to diagnostic brainstem evoked response audiometry (BERA) test toward confirmative elucidation of hearing loss.

2.1 DPOAE test:

With gentle traction of pinna in downward and backward direction, soft rubber probes with a standardized infant eartip kit was inserted in right ear. The fit and seal of probe in ear was checked by curbing of extrinsic noise levels indicated on connected computers with preloaded software. Two pure tone stimuli X and Y were given, where Y was higher than X. X/Y ratio was adjusted to about 1.22-1.23. Range of sound frequencies 2kHz, 3kHz, 4kHz and 6kHz were tested. The procedure was repeated for left ear. Two stimuli were given at asymmetrical intensity level of L1=65dB SPL and the second intensity L2=55dB SPL (keeping L1 more than L2).

After the probe was well placed with proper fit and seal, DPOAEs were initiated. The amplitude and noise floor adjacent frequency regions of distortion product 2F1-F2 were recorded. Hearing with DPOAE was assessed as acceptable or hampered. Infants that failed the DPOAE test would undergo second DPOAE screening. Persisting failure was indication for evaluation by Brainstem evoked response audiometry toward elucidation of hearing loss.

3. Observations and result

In all 50 infants (27 males and 23 females) in various risk categories were subjected to 2 staged DPOAE screening.

Table 1: Clinical profile of screened infants was as under:

Age in days at examination	2.66±2.3(2-20)
Birth weight in Kgs	2.88±0.74 (1.8-3.6)
Gestation weeks at birth	37.±1.86 (31-40)

Table 2: Maternal Risk Factors

Gestational Diabetes	12 (24%)
Gestational hypertension	9(18%)
Gestational hypothyroidism	3(6%)
Fever/infection	3(6%)

Table 3: Risk factors associating infant

Low (under 7) APGAR score at birth	1
Low (under 35 week) gestation age	2
Low (under 2.5 kg) birth weight	13(26%)
Meconium aspiration	6(12%)
Neonatal Resp Distress	5(10%)
Prolonged ICU care	9(18%)
Prolonged neonatal jaundice	5(10%)
Frequent hypoglycaemia	15(30%)
Neonatal infection	3(6%)

Table 4: Result of Oto-Acoustic Emission Screening

Result	First stage	Second stage
Both Ear Pass	42(84%)	7(87.5%)
Right ear failed	3(6%)	1(12.5%)
Left ear failed	1	0
Both ears failed	4(8%)	0

In the first stage of screening with DPOAE total 8 cases (16%) failed the test. Second stage screening was administered to these 8 failing infants, wherein 7 passed. The single persisting failed infant was subjected to BERA, in which sensorineural hearing loss was confirmed. The infant was male and had history of prolonged neonatal jaundice.

4. Discussion

Scientific evidence supports diagnosis and remedial intervention before 6 months of age in congenital hearing loss cases to help acquire age appropriate language development, social, emotional and cognitive growth and academic achievement in child [3]. This is consistent neuroplasticity and brain development essentially in initial 3 years of age. All infant should ideally be hearing screened using objective physiological measures.

The otoacoustic emission is quick, easy and noninvasive method, providing physiological screening resource. The DPOAE carries information of frequency (cochlear attribute). It is sensitive to low frequency hearing loss and is useful test to assess organ of Corti function. There are no standard reference charts and normal range values are obtained in screening the proper controls for specific population and equipment.

The 2 stage screening protocol of otoacoustic emission, followed by confirmatory BERA screen in infants has been advocated by experts [4,5]. Adopting the protocol in studied sample of 50 high risk infants revealed 2% prevalence of deafness. Most studies reveal around 1% prevalence of congenital deafness but those surveys include all infants of very large sample [6,7].

5. Conclusion

The adopted DPOAE 2 stage hearing screening in high risk infants gave very pointed information on hearing loss, in one case bearing sensorineural defect and history of neonatal jaundice. The noninvasive, easy test is specific to asses organ of Corti function. 2 stage DPOAE screening ought be made routine procedure in early detection and intervention strategy to guard high risk babies against deafness.

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