

## Original Research Article

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# Screening of high-risk newborns for hearing in MRMC using OAE and BERA

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### ABSTRACT

**Background:** Hearing is necessary to learn languages and speech and to develop cognitive skills. As hearing is important for normal educational and social development, hearing loss can be disastrous and for the family it can be very distressing. With early detection of hearing loss using OAE and BERA, we can ensure normal language development and help the growing child to lead a near normal life.

**Methods:** 500 cases- out of which 400 normal babies and 100 high risk babies are taken for the study who attend Pediatric OPD and IPD of Basaweshwara Teaching and General Hospital (BTGH) and Sangameshwar hospital attached to MRMC.

**Results:** Out of 400 cases 2 cases have impaired hearing and out of 100 cases with high risk 6 cases have hearing loss.

**Conclusions:** This study highlights the need for OAE and BERA for early identification of hearing loss and that although universal hearing screening programs are warranted but most of the cases with hearing loss can be identified based on the risk factors and High-risk Screening can suffice in areas with limited resources.

**Keywords:** OAE, BERA, High risk factors for hearing loss in newborns

### INTRODUCTION

Hearing loss and deafness are global issues that affect 360 million people worldwide. In India, 63 million people (6.3%) suffer from significant auditory loss. Nationwide disability surveys have estimated hearing loss to be the second most common cause of disability. In our Hyderabad Karnataka region because of lack of awareness patient present at a late age when the brain has lost its neural plasticity. Hearing is necessary to learn languages and speech and to develop cognitive skills. Hearing helps the developing child to learn to recognize sounds, identify objects and internalize concepts. As hearing is important for normal educational and social development, hearing loss can be devastating. So, there is a need for early identification of hearing loss. This can be

done by screening all the newborns or by screening newborns with high risk factors.

This study is an effort to assess the role of OAE and BERA in hearing loss and to screen both normal babies and high-risk babies to know the incidence among them.

With early detection using otoacoustic emission (OAE) and brainstem evoked response audiometry (BERA), we can ensure normal language development by appropriate intervention like hearing aids and infant stimulation.

The prevalence of mild to profound hearing loss is reported to be 1.1 to 6 per 1000 live births and 2.5% to 10% among high risk infants.

The study conducted by many authors highlights that although universal hearing screening programs are warranted, most newborns with a detected hearing loss had one or more risk factors. Thus, a targeted approach for hearing screening may be more feasible in resource limited settings.

For hearing assessment in newborns objective tests must be used like OAE and BERA.

### **Otoacoustic emission (OAE) test**

OAEs are biological phenomena generated in the normal cochlea when the cochlea processes an incoming auditory impulse. This biological process is a mechanical activity that takes place in the outer hair cells (OHCs) of the cochlea before the inner hair cells transduce the mechanical activity into action potential to stimulate the auditory nerve. This mechanical activity that takes place in the outer hair cells of the cochlea, spontaneously or in response to sound can be picked-up, recorded and measured by placing a microphone in the deep external meatus. OAE are proof of a healthy cochlea and a properly functioning middle ear. OAE is an easy, cost effective, non-invasive, easily repeatable and reliable method of testing large number of infants of hearing loss. It is very fast test which usually requires 5-7 minutes.<sup>1</sup>



**Figure 1: Portable handheld OAE screener Emissia from RMS.**

### **Brainstem evoked response audiometry (BERA)**

BERA is an objective electrophysiological test of the auditory system. Being an electrophysiological test, it basically ascertains the structural and functional integrity of the auditory system. BERA is a way of eliciting brain stem potentials in response to audiological click stimuli. These waves are recorded by electrodes placed over the scalp. BERA is an effective and non-invasive means of assessing the functional status of the auditory nerve and brainstem auditory sensory pathway. It is not significantly altered by the state of consciousness, drugs and variety of environmental factors.<sup>2</sup>



**Figure 2: BERA machine neuro-audio from Neurosoft with electrodes, insert ear phones, conducting gel (ten20) and skin preparation pastes (Nuprep).**

### **Objectives**

- Assessment of hearing.
- To know the prevalence of high-risk factors associated with hearing impairment.

### **METHODS**

#### **Study design**

This is a prospective cohort study.

### Study period

This study is conducted between November 2016- May 2018.

### Place of study

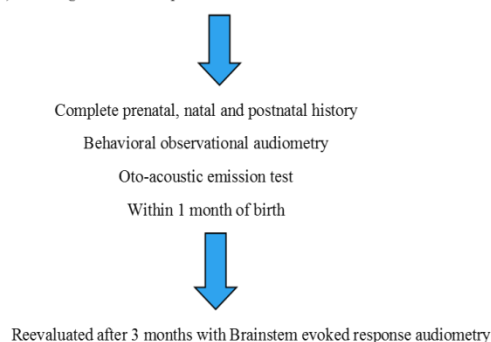
Basaweshwara Teaching and General Hospital (BTGH) attached to Mahadevappa Rampure Medical College, Kalaburgi.

### Sample size

500 cases, 400 normal newborns and 100 high risk newborns.

OAEs are recorded using OAE machine Emissia from RMS and BERA is recorded using Neuro-Audio by Neurosoft in a sound proof room with the baby in natural sleep (Figure 1 and Figure 2). Flow chart of study design is shown in Figure 3.

All neonates who attend Pediatric OPD and IPD of Basaweshwara Teaching and General Hospital (BTGH) and Sangameshwar hospital attached to MRMC.



**Figure 3: Flow chart of study design.**

Ethical clearance has been obtained from the “Institutional Ethical Committee” of MRMC, Kalaburgi.

### Inclusion criteria

All neonates who attend Pediatric OPD and IPD of Basaweshwara Teaching and General Hospital (BTGH) and Sangameshwar hospital attached to MRMC.

### Exclusion criteria

Exclusion criteria were meatal atresia, anomalies of external ear; otitis media, otitis externa, discharge and wax in EAC; those who do not give consent.

Infants were considered to be at risk for hearing loss based on the recommendations of Joint Committee on Infant Hearing, 1994 Position Statement.<sup>3</sup>

These high-risk factors include:

- Family history of hereditary childhood sensorineural hearing loss.
- Congenital perinatal TORCH infection.
- Craniofacial anomalies.
- Birth weight less than 1500 grams.
- Hyperbilirubinemia more than 15 mg/dl.
- Ototoxic medications.
- Bacterial meningitis or bacteriologic proven sepsis.
- Mechanical ventilation lasting 5 days or longer.
- Postnatal asphyxia (Apgar scores of 0 to 4 at 1 minute or 0 to 6 at 5 minutes).
- Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss.

## RESULTS

All cases who attend pediatric OPD and IPD of BTGH and Sangameshwar hospital are referred to Department of ENT for hearing evaluation using OAE and BERA.

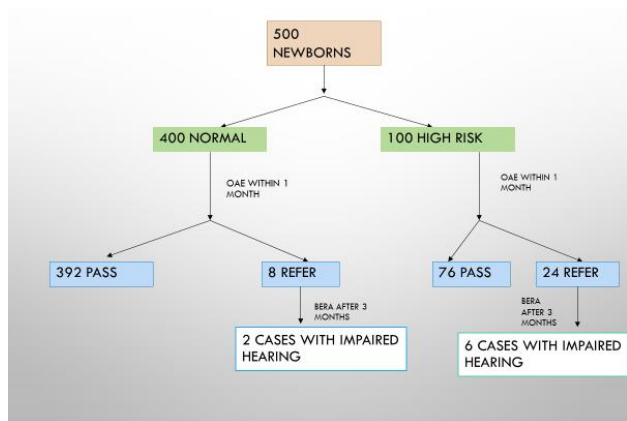
**Table 1: No. of cases in each group.**

Total no. of cases	No. of normal cases	No. of high-risk cases
500	400	100

**Table 2: No. of cases in high risk group.**

Risk factor	Total cases
Family history of hereditary childhood sensorineural hearing loss	1
Congenital perinatal TORCH infection	1
Craniofacial anomalies	2
Birth weight less than 1500 grams	20
Hyperbilirubinaemia more than 15 mg/dl	35
Ototoxic medications	0
Bacterial meningitis or bacteriologic proven sepsis	5
Mechanical ventilation lasting 5 days or longer	24
Postnatal asphyxia (Apgar scores of 0 to 4 at 1 minute or 0 to 6 at 5 minutes)	12
Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss	0

Cases are then divided into two groups, babies with no risk factors i.e. Normal babies and other group with high risk babies (Table 1). No of cases in high risk group are given in Table 2.



**Figure 4: Flow chart of OAE and BERA results.**

Out of 400 normal babies 2 cases had impaired hearing and out of 100 high risk cases 6 had impaired hearing (Figure 4).

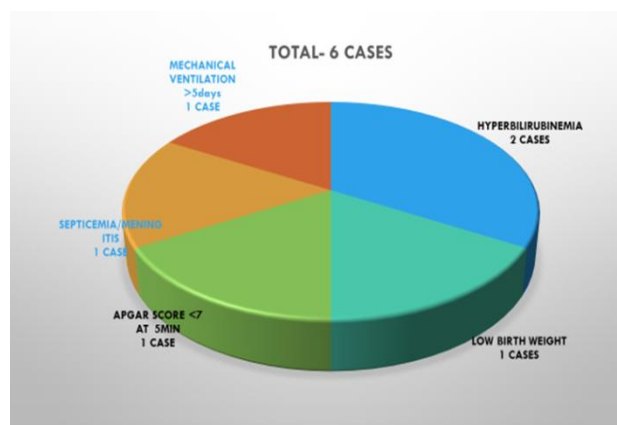
**Table 3: Distribution of cases in each high-risk group and no of cases with abnormal BERA in each group.**

Risk factor	Total cases	Abnormal BERA
Family history of hereditary childhood sensorineural hearing loss	1	0
Congenital perinatal TORCH infection	1	0
Craniofacial anomalies	2	0
Birth weight less than 1500 grams	20	1
Hyperbilirubinaemia more than 15 mg/dl	35	2
Ototoxic medications	0	0
Bacterial meningitis or bacteriologic proven sepsis	5	1
Mechanical ventilation lasting 5 days or longer	24	1
Postnatal asphyxia (Apgar scores of 0 to 4 at 1 minute or 0 to 6 at 5 minutes)	12	1
Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss	0	0

Distribution of cases in each high-risk group and no of cases with abnormal BERA in each group (Table 3).

Out of 400 normal cases 2 cases have hearing loss and out of 100 cases with high risk factors 6 cases have hearing loss.

Incidence of hearing loss in high risk newborns is 12 times more common than normal newborn.



**Figure 5: Correlation between various risk factors and hearing impairment.**

## DISCUSSION

OAE and BERA was recorded in 500 cases. Out of 400 normal babies two cases had impaired hearing and out of 100 high risk cases 6 had impaired hearing. Out of 35 cases of hyperbilirubinemia 2 cases has hearing loss. 1 case has hearing loss out of 20 cases of LBW. Out of 12 cases of Birth asphyxia with hypoxic ischemic encephalopathy 1 case has hearing loss. Out of 5 cases of Bacterial meningitis or bacteriologic proven sepsis 1 case has hearing loss. Out of 24 cases of Mechanical ventilation lasting 5 days or longer 1 has hearing loss.

A study conducted by B. De. Capua has found that the prevalence of congenital loss of hearing was 11.2 times higher in the high-risk subpopulation compared to control group.<sup>4</sup>

Study by Aiyer on 30 normal and 60 high risk neonates found that all the normal neonates had click threshold consistent with normal hearing, 12 of the high risk neonates showed hearing loss out of which 2 had persistent hearing loss. He concluded that high risk infants have a substantially higher incidence of hearing loss as compared to normal neonates.<sup>5</sup>

A study conducted by Bhatt found that incidence of SNHL in high risk newborns was 5% and in normal newborns 0.5%. Incidence of hearing loss in high risk newborns is 10 times higher than normal newborns.<sup>6</sup>

A study conducted on the cost-effectiveness analysis of newborn hearing screening strategies by Kemper shows universal screening detects more cases of congenital hearing loss, at the expense of both greater cost and more false positive screening results.<sup>7</sup>

In the present study incidence of hearing loss in high risk newborns is 12 times more common than normal newborn which is comparable to other studies.

## CONCLUSION

This study highlights the need for OAE and BERA for early identification of hearing loss and that although universal hearing screening programs are warranted but most of the cases with hearing loss can be identified based on the risk factors and high-risk screening can suffice in areas with limited resources.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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