

# Newborn hearing screening – Need of the hour

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## Abstract

**Background:** Hearing loss in Newborns should be recognized as soon as possible after birth. If gone undetected, it affects the proper development of the central auditory nervous system because of lack of stimulation. Universal newborn hearing screening is the best method to reduce the number of undetected cases of congenital hearing loss. **Aims and Objectives:** 1) Hearing screening of 300 infants using DPOAEs. 2) To study the percentage of hearing loss in high risk and no risk infants. **Materials and Methods:** Irrespective of the risk factors 300 newborn babies were screened using DPOAEs (Distortion product otoacoustic emissions). After 4-6weeks second screening was done for all refer cases. Cases showing refer results after second screening were sent for BERA testing. **Results and Observations:** Out of 300 infants 26(8.6%) were high risk and 274(91.3%) were no risk babies. After first screening test 36 newborns showed refer result while after second screening only 3 babies showed refer result. Hearing loss is seen as 0.36% in no risk group while 8% in high risk group. **Conclusion:** Distortion product otoacoustic emissions are the cost effective hearing screening method if repeated after 4-6 weeks can reduce referral rates for BERA. DPOAEs along with BERA for confirmation of hearing loss can be effectively used as a screening tool.

**Keywords:** BERA, congenital hearing loss, newborn hearing screening, neonatal risk factors, otoacoustic emissions.

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## INTRODUCTION

Hearing, as one of the five senses, is one of the most essential senses that we have. The ability to hear greatly influence our way of life as it is important for effective communication. In a child hearing loss causes delay in the development of communication skills like speech and language. It also affects academic performance and social development of a child. The earlier the hearing loss occurs in a child's life, the effects are more severe on the child's overall development. So to avoid this, hearing loss should be detected as early as possible after birth. Similarly, if the problem is detected and treated at an early age, the results are better. According to the Joint committee on infant hearing, all children with hearing

loss should be provided appropriate intervention by 6 months of age Congenital hearing loss (CHL) is seen in 1.6 to 6 per 1000 newborns<sup>1</sup>. Though incidence is high in high risk babies, only including them in hearing screening may miss 50%of cases of CHL<sup>2</sup>. If all newborns are screened for hearing at birth early detection and rehabilitation of deaf child becomes easy. Behavioral audiometry has limited role at age less than six months. From 1978 OAE has emerged as a means to ascertain cochlear outer hair cell function.<sup>3</sup> Otoacoustic emissions is one of the objective hearing screening test which is sensitive, noninvasive and cost effective. This study is carried out to detect percentage of hearing loss in normal as well as high risk newborn babies using OAE as a hearing screening test.

## MATERIALS AND METHODS

This study was conducted on 300 neonates born in our hospital at Navi Mumbai between, 5th May 2015 to 13 May 2016. All babies were included in this study irrespective of the risk factors. Newborns from postnatal ward with no risk factors as well as newborns from NICU with high risk factors were included. Parents of the neonates were informed verbally about the study and also study information leaflets were provided to them both in Hindi and English language. A valid written consent was

taken from the parent to participate in the study. Detailed history was taken and records maintained in the neonatal record sheet. Both maternal and neonatal risk factors were identified. The newborn was included in high risk group if it shows one or more of the following risk factors

**Risk Factors Maternal Factors**

1. Ototoxic drugs during pregnancy
2. Prenatal infections such as cytomegalovirus, herpes, rubella, syphilis, and toxoplasmosis
3. Radiation to mother in first trimester
4. Other factors: nutritional deficiency, diabetes, toxemia, hypothyroidism, alcoholism
5. Family history of hearing loss
6. Consanguineous marriage

**Neonatal Factors**

1. Anoxia during birth Apgar score of 0-4 at 1 minute or 0-6 at 5 minutes (placenta praevia, prolonged labour, cord around neck, prolapsed cord)
2. Prematurity (<=34weeks)
3. Low birth weight (birth weight less than 1500gm)
4. Birth injuries (forceps delivery)
5. Neonatal jaundice (bilirubin level greater than 20 mg %)
6. Mechanically-assisted ventilation for 5 days or longer

7. Ototoxic medications used for meningitis or septicemia
8. Postnatal infections associated with hearing loss, including bacterial and viral meningitis
9. Craniofacial anomalies, particularly those that involve the pinna, ear canal, ear tags, ear pits
10. Findings suggestive of a syndrome associated with hearing loss

Accordingly the newborns were grouped into two groups, high risk and no risk groups. Both the normal and high-risk neonates were assessed for hearing within 48 hours of birth using DPOAEs. In case of babies kept in the NICU hearing assessment was done as soon as they become fit. Critically ill babies, babies with craniofacial anomalies and middle ear disease were excluded from the study. Also babies whose parents refused to participate in the study were excluded. Their complete ENT examination was done meticulously. External auditory canal was cleaned before performing the test. The study was conducted in a quiet side room of the ward. The instrument used was OAE Screener-otodynamics-otoport Model. Test results were recorded as PASS/REFER (FAIL). Neonates who failed to respond in the first screening were subjected to second screening between 4 - 6 weeks. Those who failed to respond in second screening were referred to higher centre for BERA testing.

**RESULTS**

Out of the 300 newborns screened 26 were high risk babies and 274 were normal babies. Distribution of newborns by gender is shown by the pie diagram.

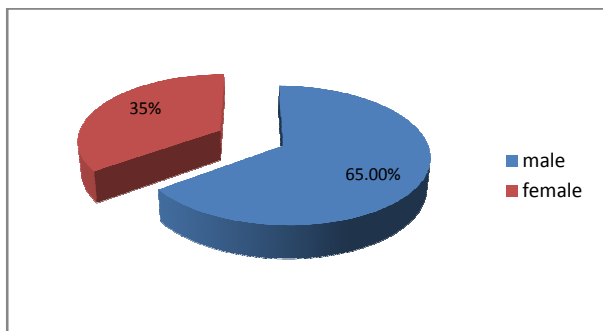


Figure 1: Gender

Total 196 were male babies and 104 were female babies. Distribution of cases according to risk factors

**Table 1: Distribution on of risk factors**

Risk factors	No. of cases
Pre-eclampsia	4
Maternal diabetes	1
Nutritional deficiency	5
prematurity	6
Low birth weight	7
Neonatal jaundice	3

**Table 2:** Test results of hearing screening

No. of screened infants	First oae screening		Lost in follow-up	Second oae screening	
	PASS	REFER		PASS	REFER
No risk group(274)	252	22	2	19	1
High risk group(26)	12	14	1	11	2
<b>Total 300</b>	<b>264</b>	<b>36</b>	<b>3</b>	<b>30</b>	<b>3</b>

In the first OAE screening, out of 274 no risk infants, 252 passed and 22 showed REFER results. Out of 26 high risk infants, 12 passed and 14 failed in the first OAE screening. Two infants from no risk group and one infant from high risk group lost in follow up. In the second OAE testing out of 20 no risk infants 19 passed and only one showed persistent REFER result. While out of 13 high risk infants 11 passed and 2 got REFER result. Both infants were having low birth weight as a risk factor. All the infants with REFER result were sent for further testing like BERA at higher centre.

## DISCUSSION

According to WHO around 360 million people are living with disabling hearing loss which is approximately 5.3% of the worlds population. Out of these 32 million are children<sup>4</sup>. The vast majority of these are living in developing countries like India. This high incidence could be because of improper maternal and child health care. The time period from birth to 5 years of age is crucial for the development of speech and language. Hearing loss at an early age leads to difficulty in learning spoken language and affects overall emotional, cognitive and social development of a child. Universal hearing screening will help to detect congenital hearing loss by 3 months and intervention by 6 months of age. In infants OAE is the cheaper method used for hearing screening. Oaes are low intensity sounds generated by outer hair cells of normal cochlea in response to auditory stimuli. Otoacoustic emissions are objective response which will be picked up by very sensitive microphone placed in the infant's external auditory canal. Oaes are of two types: spontaneous and evoked. The latter are further classified into transient evoked OAEs (TEOAEs) and distortion product OAEs (DPOAEs).TEOAEs and DPOAEs are commonly used for newborn hearing screening. TEOAEs are evoked by broadband clicks while in DPOAEs two tones are simultaneously presented to the cochlea to create distortion products. TEOAEs are not frequency specific while DPOAEs are used to test hearing in the range of 1000-8000Hz.In this study we have used DPOAEs for infant screening. In a normal neonatal cochlea as outer hair cell function is normal, OAEs will be generated and the result will be shown as PASS (normal).When the outer hair cells are damaged, cochlea will not respond and the result will be shown as REFER.

**Figure 1:** Screenshot of DPOAE equipment showing PASS result.

In our study referral rate after first OAE screening was 12% while it was 9.8% in study by Mozafer S.<sup>5</sup>, 59.1% in P.K.Nag<sup>1</sup> study and 6.4% by John and Balraj study.<sup>6</sup> It was 4% by Owen and Evans study<sup>7</sup> which has considered unilateral pass as screening pass while we have taken unilateral pass infants as screening failures. Referral rate in our study got reduced to 1% after second screening between 4-6 weeks. This shows the importance of second OAE screening in reducing referral rates. In a highly populated and developing country like India twice OAE screening (i.e. at birth and between 4-6 weeks) is the best method to do hearing screening of large masses. It is cost effective as well as reduces the referral rates for BERA. In our institution BERA is not available so we were not able to confirm the hearing loss in second OAE screening failures. It is desirable to refer all failed infants for BERA after universal newborn screening using OAEs.

## CONCLUSION

To reduce the great impact of hearing loss on Childs life early detection and intervention is important. Along with that improvement in maternal and child health care services is also essential to minimize the incidence of congenital hearing loss. In a developing country like India, universal newborn hearing screening with otoacoustic emissions is highly sensitive, time saving and cost effective method. It will somehow reduce the financial burden of treating and rehabilitating the deaf children.

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