

**A Study of Hearing Screening in Newborn Admitted in NICU at Tertiary Care Hospital using Oae (Otoacoustic Emission)**Happy A. Patel<sup>1</sup>, Palak A. Patel<sup>2</sup>, Arundhati R. Patel<sup>3</sup>, Foram Parikh<sup>4</sup><sup>1</sup>Senior Resident, Department of ENT, Shantaba Medical College, Amreli, Gujarat<sup>2</sup>Senior Resident, Department of ENT, Government Medical College, Majuragate, Surat, Gujarat<sup>3</sup>3rd Year Resident, Department of ENT, Smt. NHLMMC, Ahmedabad, Gujarat<sup>4</sup>Assistant Professor, Department of ENT, GCS Medical College and Research Center, Ahmedabad, Gujarat

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**Abstract****Background:** Hearing is the ability to perceive sound by detecting vibrations through the ear and is one of the most precious senses. About one in every thousand children is born profoundly deaf. Infants in the NICU are ten to twenty times more likely to have significant hearing loss than healthy populations. This study was conducted to evaluate impact of different risk factors on hearing of newborn baby admitted in NICU.**Methodology:** A prospective study done in 700 newborn babies admitted in NICU at tertiary care hospital using OAE. Newborns admitted in NICU have been screened for hearing between 48 hours to 108 hours. Information collected regarding selected cases were recorded in proforma. Analysis conducted based on incidence of different risk factors on hearing of newborn babies in NICU.**Results:** In this study, out of total 700 newborn babies, 364 were male and 336 were female. 16 babies dropped out after the first screening test. At end of 3 stage screening test, 680 babies had normal hearing and 4 babies had hearing impairment. Out of 4 babies, 2 babies had ototoxic drug exposure and 2 babies had meningitis.**Conclusion:** In this study of 700 babies, 4 babies had hearing impairment. Out of 7 risk factors screened, only 2 risk factors were associated with hearing impairment. 2 out of 20 ototoxic drug exposed babies and 2 out of 50 of babies with meningitis had hearing impairment. Hearing impairment is not seen in low-birth-weight babies, respiratory distress syndrome babies, TORCH infected babies, hyperbilirubinemia, ventilated babies due to early and effective management.**Keywords:** Otoacoustic emission, Neonatal Intensive Care Unit, Risk factors.

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**Introduction**

Hearing is one of our most precious senses. Well-developed hearing is very important in the development of speech and language. [4] Newborn hearing screening can help to identify children with congenital hearing impairment to support early intervention that can make a big difference in their communication and language development. [12]

As a part of the “Universal newborn hearing screening” programme and national programme for newborn hearing screening, I have conducted this study for early detection and intervention of hearing impairment in newborn babies. The aim of the newborn hearing programme is detection of hearing loss before 3 months of age and the initiation of appropriate intervention no later than 6 months of age. [12]

OAE is a very sensitive, non-invasive, cost effective, time effective method. So, that is an ideal

screening method. [1] OAE is an objective method that screens hearing in a range of sound frequencies critical for normal speech and language development. OAE was first discovered by David T. Kemp in 1978 who has changed both hearing science and audiology. [3] OAE is defined as the release of sound energy produced in the cochlea and its propagation to the middle ear and external auditory canal. These emissions are produced by outer hair cells (OHCs) of the cochlea as a result of active and nonlinear mechanical feedback processes. [6]

Two different sources of OAEs are: distortion source emissions which arise by nonlinear distortion and reflection source emissions which arise by linear reflection. Evoked emissions are typically a mixture of these two different emission types. [6] OAEs are classified as spontaneous otoacoustic emissions (SOAEs), distortion product

otoacoustic emissions (DPOAEs), stimulus frequency otoacoustic emissions (SFOAE) and transient evoked otoacoustic emissions (TEOAEs).[3] Two types of OAEs are commonly used:

1. DPOAEs
2. TEOAEs

### Material and Methods

The study was a prospective review of 700 newborn babies admitted in NICU at S.C.L. General Hospital, smt. NHL Municipal Medical College, Ahmedabad from November 2020 to May 2022. Newborns with purulent ear discharge, wax, external and middle ear anomaly, not admitted in NICU and more than 5 days of age were excluded. All the information was retrieved from patients' medical records as per standard guidelines and ethical standards. The initial examination was carried out by OAE. If it is normal, then hearing is

presumed to be normal. If initial screening is abnormal then the newborn is subjected to second screening again by OAE after 15 days. If second screening is abnormal then newborn is subjected to third screening by OAE after 1 month. If third screening is abnormal then subjected to BERA. Based on the results of BERA, early intervention is done. CHI Square test has been applied to find the statistical significance of outcome of risk factors and P-value <0.05 was considered as statistically significant.

### Results

The study was attempted on 700 newborn babies. Of the 700 babies, 684 babies completed the test and 16 babies missed the complete screening procedure. All the 16 babies were on mechanical ventilation support because of respiratory distress and they died until reaching the end of the procedure.

**Table 1: Study of Population**

Total no. of babies tested	700
No. of babies completed test	684
No. of drop out babies	16

**Table 2: Risk Factors Screened**

Risk Factors	Male	Female	Total	%
Hyperbilirubinemia	106	94	200	28.6%
Low birth weight	91	99	190	27.1%
Mechanical ventilated babies due to respiratory distress syndrome	100	70	170	24.3%
Babies of diabetic mother	24	36	60	8.6%
Meningitis	26	24	50	7.1%
Ototoxic drugs	10	10	20	2.9%
TORCH infections	07	03	10	1.4%

**Table 3: Screening of Individual Risk Factors Hyperbilirubinemia**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	200	18	01	-
Normal hearing	182	17	01	-
Impairment in one ear	03	-	-	-
Impairment in both ears	15	01	-	-

**Table 4: Low Birth Weight**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	190	46	05	-
Normal hearing	144	17	05	-
Impairment in one ear	06	-	-	-
Impairment in both ears	40	05	-	-

**Table 5: Respiratory Distress Syndrome (Mechanical Ventilation)**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	170	09	01	-
Normal hearing	145	08	01	-
Impairment in one ear	02	-	-	-
Impairment in both ears	23	01	-	-

**Table 6: Babies of Diabetic Mother**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	60	28	03	-
Normal hearing	32	25	03	-
Impairment in one ear	03	-	-	-
Impairment in both ears	25	3	-	-

**Table 7: Meningitis**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	50	13	02	02
Normal hearing	37	11	-	-
Impairment in one ear	02	-	-	-
Impairment in both ears	11	02	02	02

**Table 8: Ototoxic Drugs**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	20	07	03	02
Normal hearing	12	04	01	-
Impairment in one ear	01	-	-	-
Impairment in both ears	06	03	02	02

**Table 9: TORCH Infections**

Risk Factors	Screening by OAE			BERA
	1st	2nd	3rd	
Total babies screened	10	02	-	-
Normal hearing	08	02	-	-
Impairment in one ear	01	-	-	-
Impairment in both ears	01	-	-	-

**Table 10: Final Outcome of Screened Babies**

Outcome	Number of babies
Normal hearing	680
Hearing impairment	04
Drop out babies	16
Total screened babies	700

## Discussion

In the present study, 700 newborns admitted in NICU aged between 48 hours to 108 hours were examined.

In total, 700 newborns were checked for hearing screening in which 364 were male newborns and 336 were female newborns. The proportion of male to female newborns was 52% and 48% respectively.

In our present study, hearing loss was seen in four

newborns that is 0.6% of the total screened newborns, out of which 75% were male newborns and 25% were female newborns but relative percentage is 0.8% in male and 0.2% in female newborns from total study populations.

In the present study, babies with LBW had normal hearing as in a study by Christine Ohl et al [9] showed low birth weight is not a risk factor for hearing impairment.

In our study, 2 babies with meningitis had hearing

impairment in both ears but Nagapoornima et al [5] screened 14 babies with meningitis but none had hearing impairment.

In our study, 170 babies with respiratory distress syndrome were screened for hearing but none had hearing impairment and Nagapoornima et al [5] screened 96 babies with respiratory distress syndrome and showed respiratory distress syndrome is not a risk factor for hearing impairment.

In the present study, 200 babies with hyperbilirubinemia required exchange transfusion were screened for hearing but none had hearing impairment as in Nagapoornima et al [5] screening.

In our study, aminoglycosides are a risk factor for hearing impairment but Finckh Kramer et al [7] concluded that aminoglycosides are not an important risk factor.

In our study, mechanical ventilation was not an independent risk factor for hearing impairment as M D Mohd Khairi et al [10] conducted a hearing assessment in 401 at-risk neonates and concluded the same.

In our study, 10 babies with TORCH infection were screened for hearing but none had hearing impairment as in Nagapoornima et al [5] screening.

So, in our study of hearing screening, 4 babies had hearing impairment (0.6%) out of 684 babies.

### Conclusion

In this study of 700 babies, 4 (0.6%) babies had hearing impairment (severe to profound hearing loss). Out of 7 risk factors screened, only 2 risk factors (Ototoxic drug exposure and Meningitis) were associated with hearing impairment. 2 out of 20 (10%) Ototoxic drug exposed babies and 2 out of 50 (4%) of babies with meningitis had hearing impairment. Hearing impairment is not seen in low-birth-weight babies, TORCH infected babies, hyperbilirubinemia, ventilated babies and respiratory distress syndrome babies due to early and effective management. Early identification and intervention will allow deaf and hard of hearing

children to develop language skills during a period of neural plasticity.

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