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Neonatal Hearing Screening Programme – In a Rural Based Tertiary Care Centre

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Abstract
Introduction: *Hearing loss and deafness are global issues that affect at least 278 million people worldwide[1]. The incidence of hearing impairment in India is 1-6 per thousand newborns screened[2].*
Objective: *To evaluate the incidence of hearing impairment among high risk neonates in a rural based tertiary care hospital. To detect permanent hearing impairment of moderate to severe degree, at the earliest possible time. To provide appropriate intervention (medical/surgical/rehabilitation) following the detection of a permanent hearing impairment.*
Methods and Materials: *It is a descriptive, observational and interventional study conducted over a span of 2years.*
Inclusion Criteria: *All high risk neonates born in a rural based tertiary care hospital during the study period.*
Exclusion Criteria: *Cases of congenital meatal atresia were excluded from the study.*
Method of Study: *All high risk neonates born and high risk neonates admitted during the study period have undergone hearing assessment using transient evoked otoacoustic emissions (TEOAE), as the first level of hearing screening.*
Results: *315 at risk neonates were screened and 3 were detected to have hearing impairment which is an incidence of 9.5 per 1000 screened.*
Conclusion: *While it may not be technically feasible to screen all newborns in a rural setting like ours, screening must definitely be made mandatory for all high risk neonates using otoacoustic emissions as early as possible in order to preserve the deepest ,most humanizing philosophical sense man possesses, that is, hearing.*
Keywords: *High risk newborns, Transient evoked otoacoustic emissions, Hearing impairment.*

Introduction

Hearing is the deepest, most humanizing philosophical sense man possesses. Hearing loss and deafness are global issues that affect at least 278 million people worldwide. Two third of these people live in developing countries.[1] The

incidence of hearing impairment in India is 1-6 per thousand newborns screened.[2] It is well recognised that unidentified hearing impairment can adversely affect optimal speech and language development. Over 5% of the world's population has disabling hearing loss of which 10% (32 million) are children.[2] The world health organization has quoted that in infants and children with hearing loss, early identification and management through infant hearing screening programmes can improve the linguistic and educational outcomes for each child. Most of the developed countries have successfully finalised universal neonatal hearing screening programmes, however in India, such programmes are still nascent. Financial and social constraints have augmented its nationwide application.

Otoacoustic emission (OAE) will be used in this study as it is very sensitive, noninvasive, cost and time effective making it an ideal screening method.[3] OAEs are used to assess the structural and functional measurements of the response of outer hair cells of the cochlea to acoustic stimuli. They serve as a fast objective screening test for normal cochlear function.[4]

Transient evoked otoacoustic emissions (TEOAE) has a sensitivity as high as 95%-98% and a specificity of 80%-85%.[5] Hence, the current study is planned to find the incidence of hearing impairment in high risk newborns in a rural based tertiary care centre.

High Risk Infants

Joint committee of Infant hearing guidelines for high risk criteria.[6]

1) Caregiver concern regarding hearing, speech, language, or developmental delay.
2) Family history of permanent childhood hearing loss.
3) Neonatal intensive care of more than 5 days or any of the following regardless of length of stay: assisted ventilation, exposure to ototoxic medications (gentimycin and tobramycin) or loop diuretics like furosemide and hyperbilirubinemia that requires exchange transfusion.
4) In utero infections, such as CMV, herpes, rubella, syphilis, and toxoplasmosis.
5) Craniofacial anomalies, including those that involve the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.
6) Physical findings, such as white forelock, those are associated with a syndrome known to include a sensorineural or permanent conductive hearing loss.
7) Syndromes associated with hearing loss or progressive or late-onset hearing loss
8) Neurodegenerative disorders
9) Culture-positive postnatal infections associated with sensorineural hearing loss, including confirmed bacterial and viral (especially herpes viruses and varicella) meningitis.
10) Head trauma, especially basal skull/temporal bone fracture that requires hospitalization.
11) Chemotherapy.

Materials and Methods

Study Design

It is a descriptive, observational and interventional study conducted over a span of 2years from November 2017 to October 2019.

Source of Data

Study conducted among the high risk newborns at Rajah Muthiah Medical College Hospital.

Study Period

November 2017 to October 2019.

Study Population

Total number of high risk newborn admitted at Rajah Muthiah Medical College Hospital during the period of 2017-2019.

Inclusion Criteria

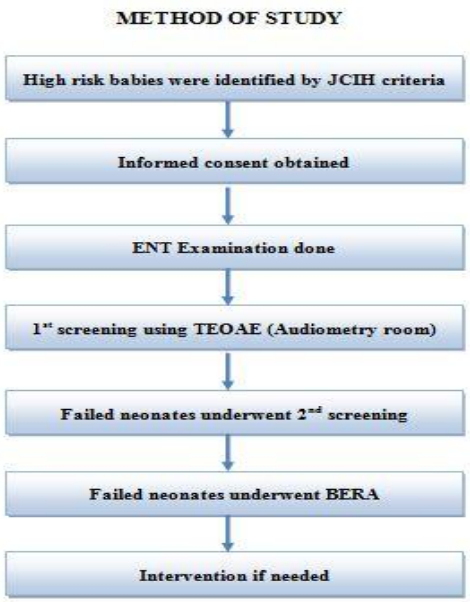
All high risk neonates admitted in Rajah Muthiah Medical College Hospital during the study period 2017-2019 were screened for hearing loss prior to discharge from the hospital.

Exclusion Criteria

Cases of congenital meatal atresia were excluded from the study.

Method of Study

- After obtaining ethical committee approval, study was started in Rajah Muthiah Medical College Hospital. Parents/grandparents of the neonates were informed, counselled and written consent was obtained about the study and neonatal hearing screening programme.
- Each participant's demographic details along with their perinatal and postnatal data were taken, and ear, nose, and throat examination was done. Details were filled in the participant's proforma.
- All high risk neonates born during the study period in the Rajah Muthiah Medical College Hospital underwent hearing assessment using *transient evoked otoacoustic emissions (TEOAE)*, as the first level of hearing screening .Neonates who failed the first level of hearing screening were subjected to a second level of hearing screening after 10 days by performing 2nd TEOAE test.
- This was done in the department of otorhinolaryngology and head and neck surgery at Rajah Muthiah Medical College Hospital using a *MADSEN AccuScreen OAE & ABR Screener*, which is a completely automated analysis system that gives a *"PASS"* or *"REFER"* result.
- "PASS" - suggest that the neonate has no hearing impairment in the specific frequency tested and "REFER" – suggest a possibility of a sensorineural hearing loss or indicates requirement of further diagnostic hearing evaluation.
- Neonates who did not pass the 2nd TEOAE test underwent confirmatory test brain stem evoked responses (BERA) at the age of 3months.



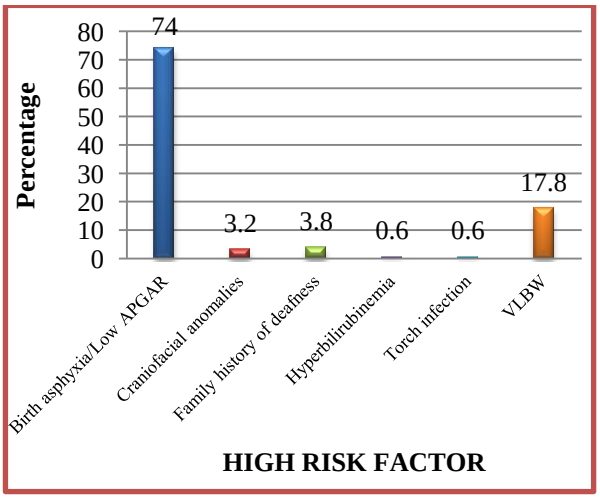
Observation and Results

Table – 1: Sex

	No of Babies	Percentage
Male	156	49.5
Female	159	50.5
Total	315	100.0

Table – 2: High Risk Factor

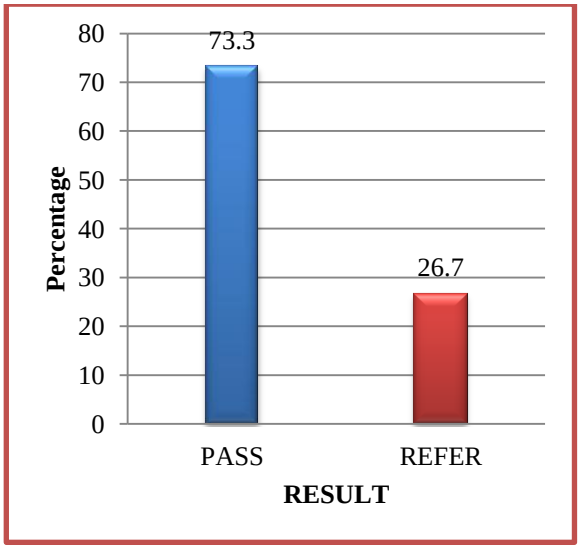
	No of babies	Percentage
Birth asphyxia / Low APGAR	233	74.0
Craniofacial anomalies	10	3.2
Family history of deafness	12	3.8
Hyperbilirubinemia	2	0.6
Torch infection	2	.6
VLBW	56	17.8
Total	315	100.0



The most common high risk factor encountered in our study was birth asphyxia with low APGAR (74%)

Table – 3: OAE 1

Result	No of babies	Percentage
Pass	231	73.3
Refer	84	26.7
Total	315	100.0



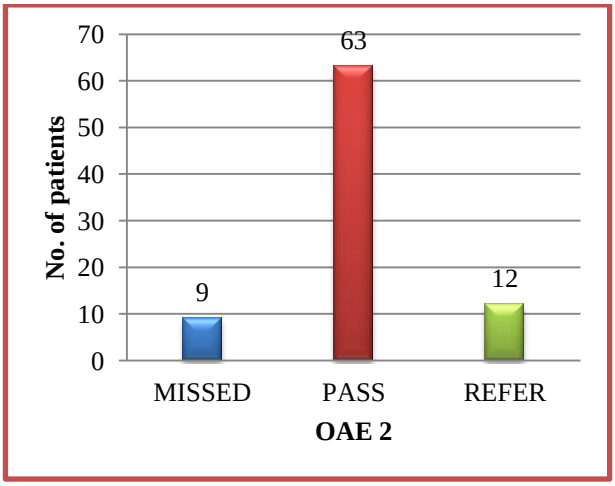
Out of 315 babies screened using OAE, 231 babies (73.3%) passed the test on the first occasion. 84 babies had to undergo second OAE.

Table – 4: High Risk Factor * OAE 1 Cross tabulation

High risk factor	OAE 1		Total
	Pass	Refer	
Birth asphyxia / Low APGAR	175	58	233
Craniofacial anomalies	7	3	10
Family history of deafness	8	4	12
Hyperbilirubinemia	2	0	2
Torch infection	1	1	2
VLBW	38	18	56
Total	231	84	315

Table – 5: OAE 2

OAE 2	No of babies	Percentage
Missed	9	10.71
Pass	63	75.0
Refer	12	14.29
Total	84	100.0



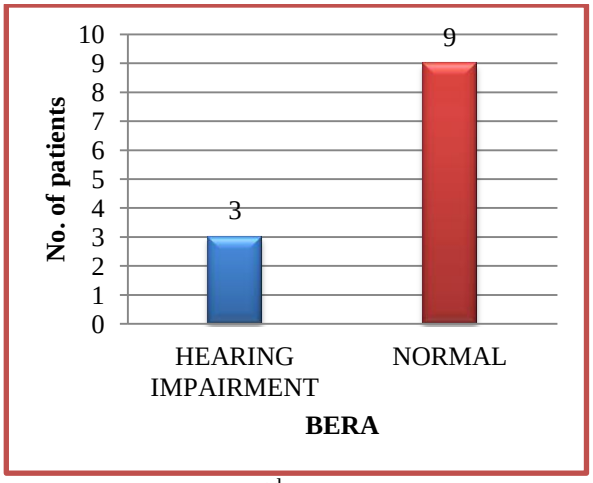
Of the 84 babies referred for 2nd OAE, 63 babies passed the OAE test, 9 babies did not turn up for the 2nd OAE test and 12 babies did not pass the test.

Table – 6: High Risk Factor*OAE2

High risk factor	OAE 2			Total
	Missed	Pass	Refer	
Birth asphyxia	5	49	4	58
Craniofacial anomalies	0	2	1	3
Family history of deafness	1	2	1	4
Torch infection	0	1	0	1
VLBW	3	9	6	18
Total	9	63	12	84

Table – 7: BERA

BERA	No of babies	Percentage
Hearing impairment	3	25
Normal	9	75
Total	12	100.0



12 babies who failed 2nd OAE underwent BERA.

Table – 8: High Risk Factor * BERA Cross tabulation

High Risk Factor	BERA		Total
	Hearing impairment	Normal	
Birth asphyxia / Low APGAR	0	4	4
Craniofacial anomalies	1	0	1
Family history of deafness	1	0	1
VLBW	1	5	6
Total	3	9	12

Summary

315 at risk neonates were screened over a period of two years in Rajah Muthiah Medical College Hospital to evaluate the incidence of hearing impairment in a rural based tertiary care centre. 156 were male babies (49.5% and 159 were female babies (50.5%). The most common high risk factor encountered was birth asphyxia/low APGAR (74%), very low birth weight (17.8%).

Of the 315 neonates screened, 294 passed the OAE test. 9 babies were lost for follow up. 12 babies underwent BERA test.

Among 12 babies in whom BERA was done, 3 babies had moderate to severe hearing impairment which accounts to an incidence of 9.5 per 1000 screened.

3 babies with hearing impairment were advised for cochlear implantation work up.

Conclusion

While it may not be technically feasible to screen all newborns in a rural setting like ours, hearing screening must definitely be made mandatory for all high risk neonates using otoacoustic emissions as early as possible to preserve the deepest, most humanising philosophical sense man possesses, that is, hearing.

Developing countries like India must take initiatives to implement newborn hearing screening programme at the level of district hospitals and primary health centres.

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