

The Retrospective Study of Newborn Hearing Screening by Using Otoacoustic Emissions

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Abstract: Background: The incidence of congenital hearing loss in newborn population is greater than the combined incidence of all the metabolic conditions that we currently screen with blood investigations. Significant hearing loss is one of the major abnormalities present at birth. One in every thousand children is born profoundly deaf. Four times as many are born with moderate or severe bilateral hearing loss. Infants in Neonatal intensive care units are 10 - 20 times more likely to have significant hearing loss than healthy population. Aims: To assess the hearing status of newborns delivered in our hospital with help of otoacoustic emission testing and assess its importance for early intervention. Study Design: A Retrospective study. Setting: ENT Department, GMERS Medical College and Hospital, Sola, Ahmedabad. Materials and Methods: It was a retrospective study carried out in a tertiary care centre ENT Department Sola, Ahmedabad for a period of one year from APRIL 2022 TO OCTOBER 2022 Total 100 cases of newborn were included in this study. The parameters included in the study were prenatal and intranatal and post natal causes of newborn hearing loss. Result: Author is presenting a case study of 100 patients with newborn delivered in sola civil hospital. Out of 100 patients, 54 patients had PASS in OAE and 46 patients had REFER in OAE. Out of 46 patient, those who had REFER in OAE underwent a repeat OAE after 3 months, Out of these 46 patients, 34 patients obtained PASS and 12 patients had REFER. Out of those 12 patients who had REFER in OAE, BERA was performed. In BERA, 2 patients had Profound Sensorineural hearing loss and 10 patients had normal hearing. Conclusions: This is a retrospective study of newborn hearing screening by using OAE. This study used to detect any hearing loss as much as early possible. This is cost effective, easy and fast technique. By using OAE machine, newborn and child hearing screening can be done easily, low cost and non-invasive way.

Keywords: organ of corti, cochlea

1. Introduction

The incidence of congenital hearing loss in newborn population is greater than the combined incidence of all the metabolic conditions that we currently screen with blood investigations.

Significant hearing loss is one of the major abnormalities present at birth. One in every thousand children is born profoundly deaf. Four times as many are born with moderate or severe bilateral hearing loss. Infants in Neonatal intensive care units are 10 – 20 times more likely to have significant hearing loss than healthy population.

In 1993 a consensus statement from the National Institute of Health (NIH) recommended universal newborn hearing screening by the age of 3 months and also stated that otoacoustic emission might be the technology used for screening. These recommendations were based on the following:

- The incidence of hearing loss is 1 to 6 per 1000;
- Only one half of the infants with hearing loss are discovered with high-risk screening;
- The current 2 average age at diagnosis of hearing loss is 2.5 years

- Early identification and treatment by the age of 6 months will improve outcomes.

As the first year of life is substantially critical in the development of brain, absence of auditory experience during this period significantly retards the child's overall development. It sophisticatedly set only the function of outer hair cells. These sounds is detected and recorded to see hearing status of patient. These are the emission generated by the movement of OHCs towards tectorial membrane and assisted IHCs in mechano-electrical transduction of cochlea. By modulating the function of cochlea, these emissions are generated by OHCs. Thus there is a need for early identification of hearing loss through Newborn Hearing Screening Programmes which already exists in developed countries. OAEs is the sound generated by cochlear origin recorded by microphone fitted into the ear canal.

Aims and Objective

The objective is to study the different patterns of oral cavity lesions seen in a tertiary care hospital

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2. Materials and Methods

It was a retrospective study carried out in a tertiary care center ENT Department Sola, Ahmedabad for a period of one year from 2022 To 100 cases of newborn were included in this study. The parameters included in the study were prenatal and intranatal and post natal causes of newborn hearing loss

Inclusion Criteria

- 1) All newborn born in sola civil hospital
- 2) Newborn's parent gives informed consent

Exclusion Criteria

- 1) Newborn whose parents did not consent for enrolment in the study.
- 2) Newborn with active ear discharge
- 3) Newborn with congenital ear deformity

3. Case Study

Otoacoustic Emissions

They are biological sounds, which are generated in normal cochlea. This sound is generated in the cochlea either by itself (*called spontaneous acoustic emission*) or can be evoked when the cochlea is processing a sound stimulus the has been presented to it (*called evoked otoacoustic emission*). There are different types of evoked otoacoustic emission depending on the type of acoustic stimuli used to evoked the otoacoustic emission. Transient evoked otoacoustic emissions the type of otoacoustic emission that is evoked from the cochlea in response to clicks (like the one used for eliciting BERA but tone evoked TEOAEs) and this type of otoacoustic emission is commonly used for hearing assessment in children. The otoacoustic emission recording set-up basically consists of:

- a) A very powerful & sophisticated miniature microphone (to pick up the acoustic signals generated in cochlea), which is placed in external auditory meatus
- b) A micro-sized loud speaker to deliver the sound stimulus (for eliciting the otoacoustic emission from the cochlea)
- c) A computerized averaging system to obtain a clean recording with good signal to noise ratio
- d) An amplifier which amplifies the cochlear sound picked up by the microphone
- e) A mechanism to record the sound graphically on a moving strip of paper, or to indicate the presence of the emission by some electronic device like an LED lamp.

Method to perform OAE

In order to perform the OAE, a small flexible plug is put into baby's ear. Specific sounds stimuli are generated via plug. A minute microphone in the plug records the otoacoustic responses of the inner ear in reaction to transmitted sounds. The test should be performed when the baby sleep. OAE screen displays the results of test as PASS or REFER. Refer means either the ear is abnormal or there is false positive result due to debris in the external canal. This test takes between 1-5 minutes to perform. Sensitivity of OAE is 80 – 98% Specificity of OAE is >90

The present study aims to assess the hearing status of newborn babies delivered in our hospital using otoacoustic emission testing,

In this study, Total 100 patient were screened by using otoacoustic emission machine.

Out of 100 patients, 54 patients had PASS in OAE and 46 patients had REFER in OAE. Out of 46 patient, those who had REFER in OAE underwent a repeat OAE after 3 months, Out of these 46 patients, 34 patients obtained PASS and 12 patients had REFER. Out of those 12 patients who had REFER in OAE, BERA was performed. In BERA, 2 patients had Profound Sensorineural hearing loss and 10 patients had normal hearing.

OAE	Patients	OAE
Pass	54	84
Refer	46	16
Total	100	100

In comparison to the to analysis with the study of newborn hearing screening by OAE by PSG Institute of Medical Science and Research the Tamilnadu Dr M.G.R. Medical University Done By Dr. S. Sureshraj Kumar and Dr. V. Ravisankar, their study concludes 84 % patients had been detected with hearing loss as our study conclude 54 % patients had been detected with hearing loss

Repeat OAE	Patients	Repeat OAE
Pass	34	12
Refer	12	2
Total	46	14

In comparison to the analysis with the study of newborn hearing screening by OAE by PSG Institute of Medical Science and Research the Tamilnadu DR M.G.R. MEDICAL UNIVERSITY done by Dr. S. Sureshraj Kumar and dr. V. Ravisankar, their study conclude 85 % patients had been detected with hearing loss as our study conclude 26 % patients had been detected with hearing loss in repeat OAE

BERA	Patients	BERA
Normal	10	10
Profound	2	2
Total	12	12

Out of total 100 patients, according to birth history, 16 patients are having positive antenatal, perinatal and postnatal hearing loss

Birth History	Birth History	Birth History
Low Birth Weight	4	2
Meconium Aspiration Syndrome	4	2
Perinatal Asphyxia	2	4
Eclampsia	2	1
Preeclampsia	2	1
Epilepsy	2	1

In comparison to analysis with the study of newborn hearing screening by OAE by PSG Institute of Medical Science and Research the Tamilnadu Dr M.G.R. Medical University done by Dr. S. Sureshraj kumar and Dr. V. Ravisankar 4.5 %

patients with high risk and had hearing loss which is less favorable study as compared to our study as our study diagnosed 16 % patients like that

Out of 100 patients, 70 patients are male patients and 30 patients are female .Out of 70 patients, 38 patients had PASS in OAE and 32 patients had REFER in OAE . Out of 30 patients, 19 patients had PASS in OAE and 11 patients had REFER in OAE.

OAE	Pass	Refer	OAE
Male	38	32	55
Female	19	11	45
Total	70	30	100

In comparison to the to analysis with the study of newborn hearing screening by OAE by PG INSTITUTE OF MEDICAL SCIENCE AND RESEARCH THE TAMILNADU DR M.G.R. MEDICAL UNIVERSITY DONE BY DEPARTMENT OF ENT they conclude 55% were men and 45 % where female as our study conclude 70 % were men and 30 % were female

4. Conclusions

This is a retrospective study of newborn hearing screening by using OAE. This study used to detect any hearing loss as much as early possible. This is cost effective, easy and fast technique. By using OAE machine, newborn and child hearing screening can be done easily, low cost and non-invasive way.

In this study, Total 100 patients are taken . Out of 100 patients, 46 % had been detected with hearing loss in first screening of OAE. In REPEAT OAE, 26% patients had been detected with hearing loss.

BERA must done to confirm the OAE results as it is screening tool and 2% patients had profound hearing loss. Those patients can be candidate for cochlear implant surgery .In this study, 16% had positive family history had been detected hearing loss.

So, screening for hearing loss needs to be done as early as possible to prevent child from long life morbidity that is hearing loss. Hence early identification and intervention will allow children who are deaf and hard of hearing to develop language skills during a period of neural plasticity that would otherwise be forfeited, banishing them into a world of social isolation and educational malaise

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