"HEARING SCREENING IN HIGH-RISK NEONATES IN A TERTIARY CARE CENTER USING OTOACOUSTIC EMISSIONS"

By

Dr Tanmya Tyagaraj

Dissertation submitted to BLDE (Deemed to be University), Vijayapura.

In partial fulfilment of the requirements for the award of the degree of

DOCTOR OF MEDICINE

IN

PAEDIATRICS

Under the guidance of

Dr M M Patil

Professor Department of Paediatrics

BLDE (DEEMED TO BE UNIVERSITY)

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA, KARNATAKA.

2019

HEARING SCREENING IN HIGH-RISK NEONATES IN A TERTIARY CARE CENTER USING OTOACOUSTIC EMISSIONS

BLDE (DEEMED TO BE UNIVERSITY)

SHRI B. M. PATILMEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE

VIJAYAPUR – 586103

DOCTOR OF MEDICINE
IN
PEDIATRICS

ABBREVIATIONS

AAP	American Academy of Paediatrics
DCN	Dorsal Cochlear Nucleus
VCN	Ventral Cochlear Nucleus
NIH	National Institute of Health
NICU	Neonatal Intensive Care Unit
JCIH	Joint Committee on Infant Hearing
EHDI	Early Hearing Detection and Intervention
CDC	Centre for Disease Control
OAE	Oto Acoustic Emissions
AABR/ABR	Automated Auditory Brainstem Response
VLBW	Very Low Birth Weight
LBW	Low Birth Weight
NNHB	Neonatal Hyperbilirubinemia
ASD	Atrial Septal Defect
PDA	Patent Ductus arteriosus
PPHN	Persistent Pulmonary Hypertension
HIE	Hypoxic Ischemic Encephalopathy
PAH	Pulmonary arterial Hypertension

LIST OF TABLES

LIST OF FIGURES

19	Diagnosis in NICU	**58**
20	Respiratory support	**59**
21	Serum Bilirubin	**60**
22	Sepsis Screen	**61**
23	Echocardiography	**62**
24	Neurosonogram	**63**
25	Antibiotics	**64**
26	OAE first screening right ear	**65**
27	OAE first screening left ear	**66**
28	OAE second screening right ear	**67**
29	OAE second screening left ear	**68**

TABLE OF CONTENTS

ABSTRACT

Background: Congenital hearing loss is not an uncommon birth defect. The prevalence is as high as 17% in high-risk neonates. Hearing impairment has a detrimental impact on the development of neonates. The critical period for identification and treatment of hearing loss is before 6 months of a child's age. The paediatrician, being the primary care provider, is responsible for the evaluation of the child for hearing loss.

Objectives: To study the magnitude of neonatal hearing loss in high-risk neonates using OAE as a screening tool, and to know the various risk factors associated with hearing loss.

Type of Study: Observational study

Study period: December 2019 to May 2021

Study population: Neonates admitted in NICU with high-risk factors.

Methodology: All neonates under inclusion criteria were screened for hearing loss using OAE. Those who failed the screening were diagnostically evaluated.

Results: Hearing impairment was found in two of the 245 high-risk newborns in our study (0.8%). Hearing impairment was linked to prematurity, birth asphyxia, neonatal sepsis, hyperbilirubinemia, and ototoxic medicine, among the risk factors evaluated. Hearing impairment was found in 0.9% of newborns <35 weeks of gestation, 1.1% of neonates with respiratory distress, 4% of asphyxiated neonates, 1.4% of newborns with sepsis had related hearing loss, and 6.7%of mechanically ventilated babies.

Conclusion: Hearing is very crucial for the development of language and social skills. All newborns should be screened. If not feasible, at the most, high-risk neonates must be screened for hearing loss.

INTRODUCTION

Congenital hearing loss is not an uncommon birth defect. Hearing impairment has a detrimental impact on the development of neonates. The development of the brain is very significant in the first year of life. Hearing loss occurring very early in life affects the overall development of of the child by impairing language, speech and social development. It affects attention span, behaviour and academics. Unilateral hearing loss or mild hearing impairment may also affect the development of the child and school performance.

Neonates admitted in Neonatal intensive care units are at about 10 to 20 times higher risk to have significant hearing loss than the healthy population[(1)].

If hearing loss is detected and treated at an early age, the language development of the affected children can be comparable to the level of language as their peers of the same age without hearing impairment.

Hearing screening at birth is not routinely followed in most centers in India at the moment. The critical period for identification and treatment of hearing loss is before 6 months of a child's age[(2)]. Since the paediatrician is the primary care provider at this stage of life, it is the responsibility of the paediatrician to evaluate the child for hearing loss.

In addition, identifying hearing loss before it is clinically apparent also provides a baseline on which subsequent evaluation can be developed.

For language and speech development initial three years of life are very critical. Therefore, in many infants and young children in whom hearing impairment is not identified, much of this crucial period may be lost. Impaired language development can be the consequence of moderate to severe hearing impairment in early infancy, because the auditory stimuli during this period are crucial for the development of language skills and speech fluency [(6)]. This leads to impaired abilities of reading, poor performance academically, and lesser career opportunities.

The impact of hearing loss on social and personal aspects is very high. People with hearing loss usually have less desirable jobs and incomes than people without hearing loss.

AIMS AND OBJECTIVES OF THE STUDY

1. To study the magnitude of neonatal hearing loss in high-risk neonates using OAE as a screening tool.

2. To know the various risk factors associated with hearing loss.

REVIEW OF LITERATURE

EPIDEMIOLOGY

According to studies, congenital hearing loss is one among the most prevalent birth defects present in neonates. Permanent hearing loss is seen in about 2 to 3 per thousand live births[3]. Almost fifty percent of these infants are normal with at-risk attributes, hearing impairment diagnosis in them is delayed until they present with the delay of language milestones. The prevalence of permanent bilateral hearing loss in at-risk infants in India is reported to be1.61/1000 of at-risk infants, by newborn hearing screening programs [4]. The prevalence of hearing loss including both unilateral and bilateral, conductive and sensorineural hearing loss in at-risk infants is estimated to be 2.5 to 10%[5,6]. The newborn hearing screening program aims to detect hearing loss, which can be unilateral or bilateral; sensory or conductive hearing impairment, of an average of 30 – 40 decibels or more in the frequency region of 500 through 4000 HZ. Hearing impairment in the above said range has a high impact on speech acquisition [7].

American Academy of Pediatrics, Taskforce on newborn and Infant hearing stated that significant bilateral hearing loss is seen in approximately 1 to 3 per 1000 newborns in the well-baby nursery population and approximately 2 to 4 per 1000 infants in the intensive care unit population [8]. Congenital hearing loss has a high incidence of 30 per 10,000 population [9]. In a study conducted by Stadio et al, 16.3% of high-risk neonates screened had hearing loss [10].

In India, the incidence of impairment of hearing in both at-risk and not at risk newborns is known to be an average of 4 per 1000 neonates, the range is from 6-60 per thousand neonates [11]. Another study done in India has shown 4 in every 1000 infants born were had severe hearing loss [12].

For language and speech development initial three years of life are very critical. Therefore, in many infants and young children in whom hearing impairment is not identified, much of this crucial period may be lost. Impaired language development can be the consequence of moderate to severe hearing impairment in early infancy, because the auditory stimuli during this period are crucial for the development of language skills and speech fluency [6]. This leads to impaired abilities of reading, poor performance academically, and lesser career opportunities.

The impact of hearing loss on social and personal aspects is very high. People with hearing loss usually have less desirable jobs and incomes than people without hearing loss. In America, every congenital deafness individual's terms of lifetime expenditures is calculated to be over $1 million. The cost of programmes and services for the communicatively disabled are predicted to cost $23.4 billion each year in the United States of America. Other significant burdens are emotional stress, isolation of hearing-impaired persons from social gatherings, peers, and educational systems, and breakdowns in family communication.

Hearing impairment in an infant must be identified at the earliest to intervene and treat at the right period. The developing nervous system of the child is resilient, the right mediation at the correct time will help to optimize his or her social, psychological, emotional, and academic development [13,14,15].

The NIH in 1993 recommended that all babies must undergo hearing screening loss by three months of age. The joint committee on infant hearing (JCIH) endorsed this recommendation in 1994 and suggested that before a newborn is discharged from the hospital screening should take place to ensure that most of the children are screened.

On January 1, 2003, Universal newborn screening for hearing impairment was started. The goal is to detect hearing loss no later than age of three months and to initiate appropriate assistance before the age of six months. The same is recommended by the American Academy of Paediatrics (AAP) and the Joint Committee on Infant Hearing (JCIH). The Centers for Disease Control and Prevention's (CDC) Early Hearing Detection and Intervention (EHDI) Program also recommends the "1-3-6 plan," which calls for screening of all children by the age of one month, failing which the children must undergo diagnostic audiological testing before the age of three months, and children confirmed with impaired hearing need to be enrolled in appropriate intervention program by age of six months. [15].

The mean age at which hearing impairment was found before the commencement of universal neonatal hearing screening was 20.2 months. The mean age of patients at diagnosis has increased markedly to 3.8 months, 2 years after [16,14].

DEVELOPMENT OF EAR

External Ear

By the 4th week of gestation development of pinna starts. The development of the pinna is by the contribution of ridges known as Hillock's of His. Tragus develops from the mandibular arch. The majority of the pinna develops from the hyoid arch. By the fifth month of foetal life, the adult structure will be reached [17].

External Auditory Canal

The external auditory canal is formed from the first branchial cleft. The canal deepens in the second month, and a cord of epithelial cells grows medially into the mesenchyme to produce the Meatal Plate. The lamina propria of the tympanic membrane is formed adjacent to the meatal plate. The first pharyngeal pouch mucosa gives rise to the medial layer of the tympanic membrane [17].

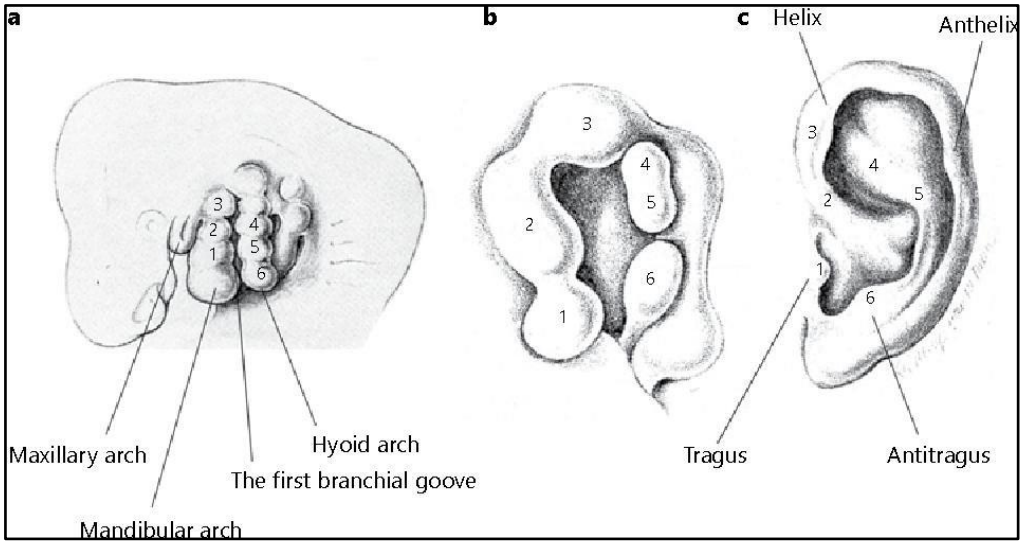


Fig no 1: Development of the auricle and external auditory canal

Tympanic Membrane

All the 3 germinal layers are the constituent parts of the tympanic membrane. The ectoderm - outer epithelial layer, the endoderm - inner mucosal layer, and the mesoderm - middle fibrous layer[17].

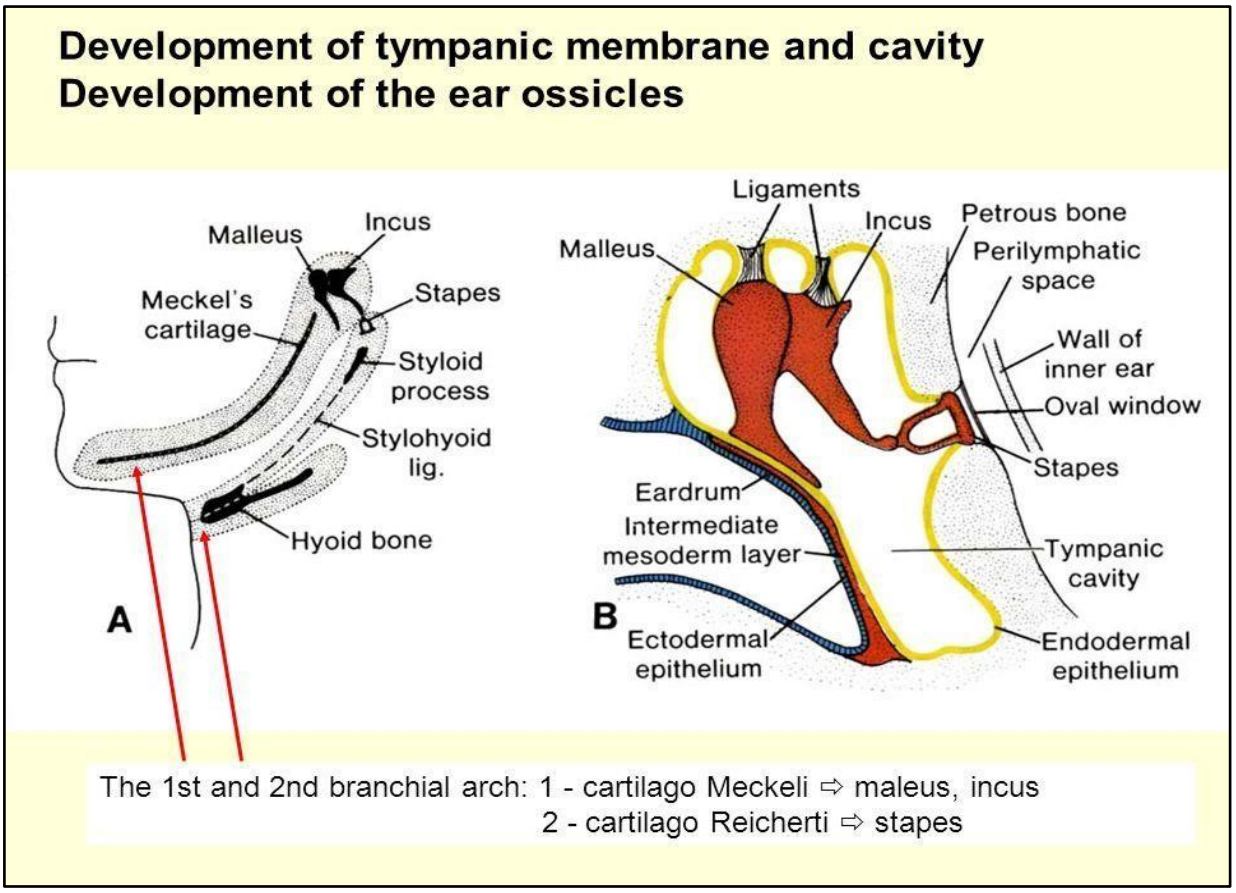


Fig no 2: Development of the tympanic membrane

Eustachian Tube

Auditory tube starts developing from the Tubo-tympanic pouch. The fibrocartilaginous tube is formed by the 30th week of gestation. The tubotympanic recess elongates, narrows, and undergoes mesodermal chondrification to form a fibrocartilaginous tube [(17)].

Ossicular Chain

The first ossicle forms around the fourth week of gestation. The hyoid arch give rise to the incus and stapes suprastructure: Reichert's cartilage, while mandibular arch - the malleus: Meckel's cartilage. The otic capsule - the stapes' footplate. The adult dimension of the bones is achieved by the fifteenth week of fetal life. The incus ossifies first, malleus second, and finally the stapes. At the same time, the middle ear muscles are formed [(17)].

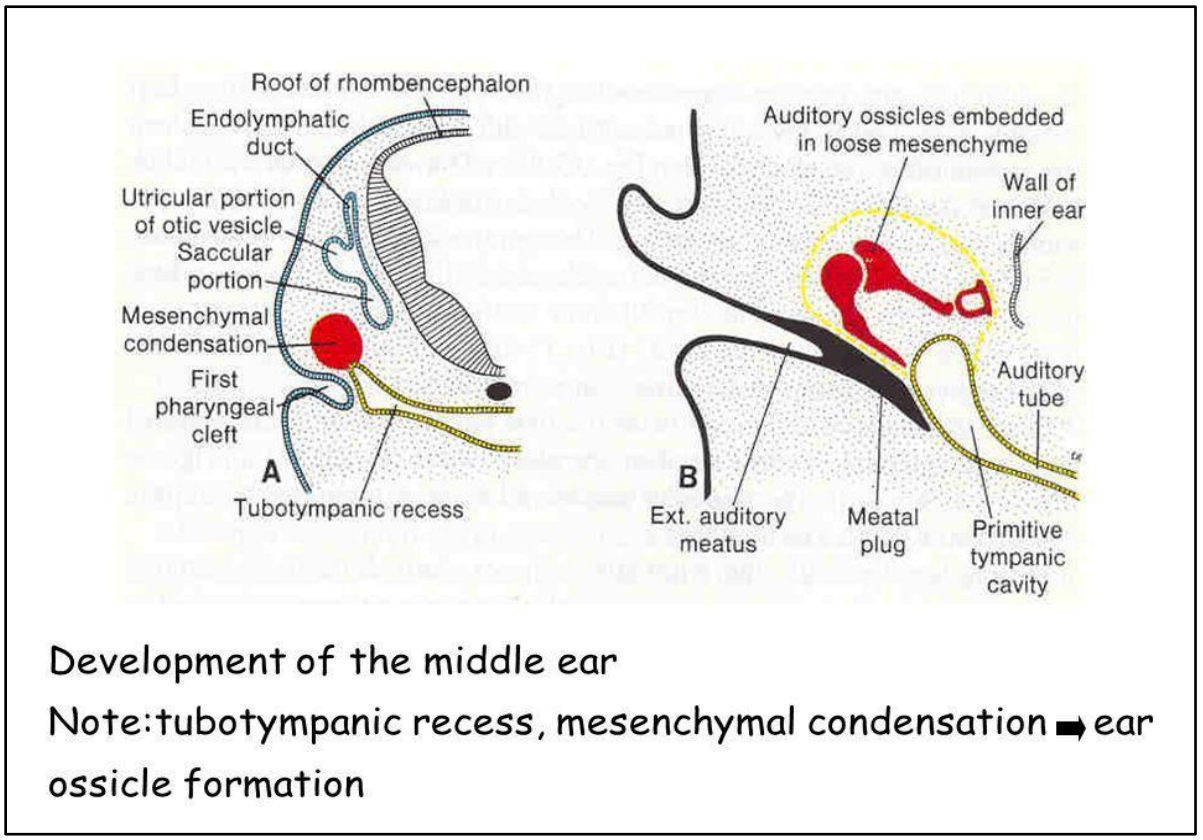


Fig no 3: Development of middle ear

Inner ear

The cochlear duct and the saccule form before the pars superior of utricle and semicircular canals which are phylogenetically older. The pars superior's phylogenetic development is associated with its relative resilience to developmental abnormalities as compared to the pars inferior (17). At the end of the third week, the otic placode in the first pharyngeal cleft. Within some days, the Auditory Pit is formed. The otocyst is created as the auditory pit expands and fuses with surrounding tissue. The mesenchymal tissue differentiates with the otocyst to form the Otic Capsule. Three deeper folds are created by the otocyst lengthening. This later forms the three semicircular ducts, the utricle, the endolymphatic duct and sac, and the saccule and also cochlear duct. Around eighth week of gestation, the cochlear duct completes two and a half turns. By the 20th week, the organ of Corti has developed to the point where the foetus may hear and respond to fluid-borne sounds. By the 25th week of pregnancy, the Corti organ similar to the adult form [(17)].

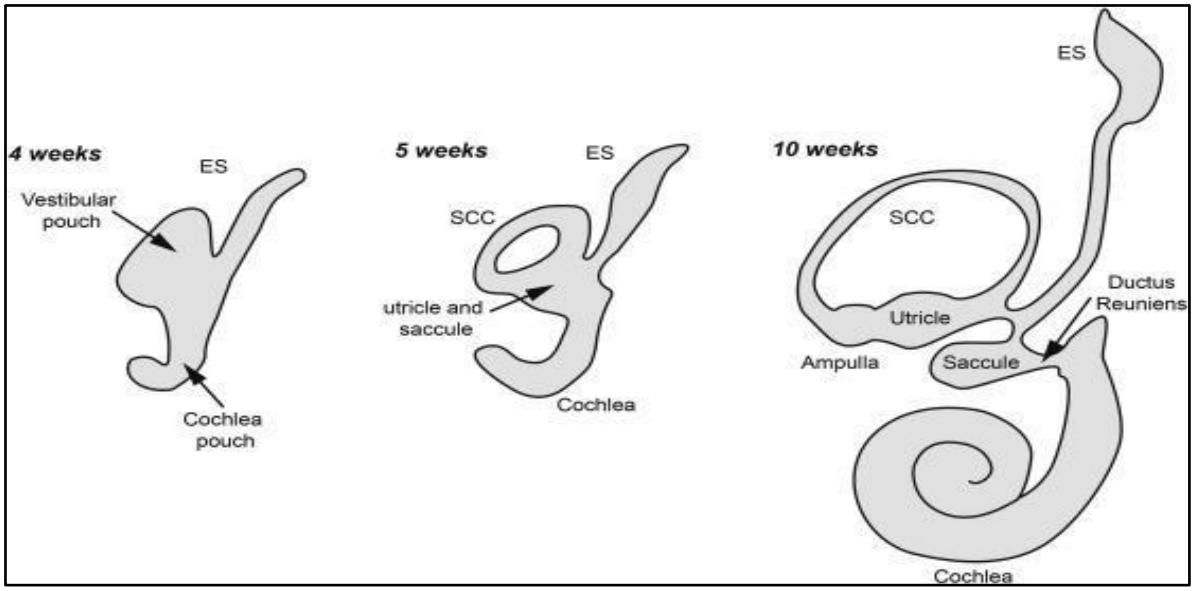


Fig no 4: Development of inner ear

Table no 1: Development of ear according to period of gestation

Development	**Middle Ear**	**Vestibular Labyrinth**	**Cochlea**	**Pinna**	**Meatus**
Begins by	3rd week	3rd week	3rd week	6th week	8th week
Completes by	30th week	20th week	20th week	20th week	28th week

ANATOMY OF THE EAR

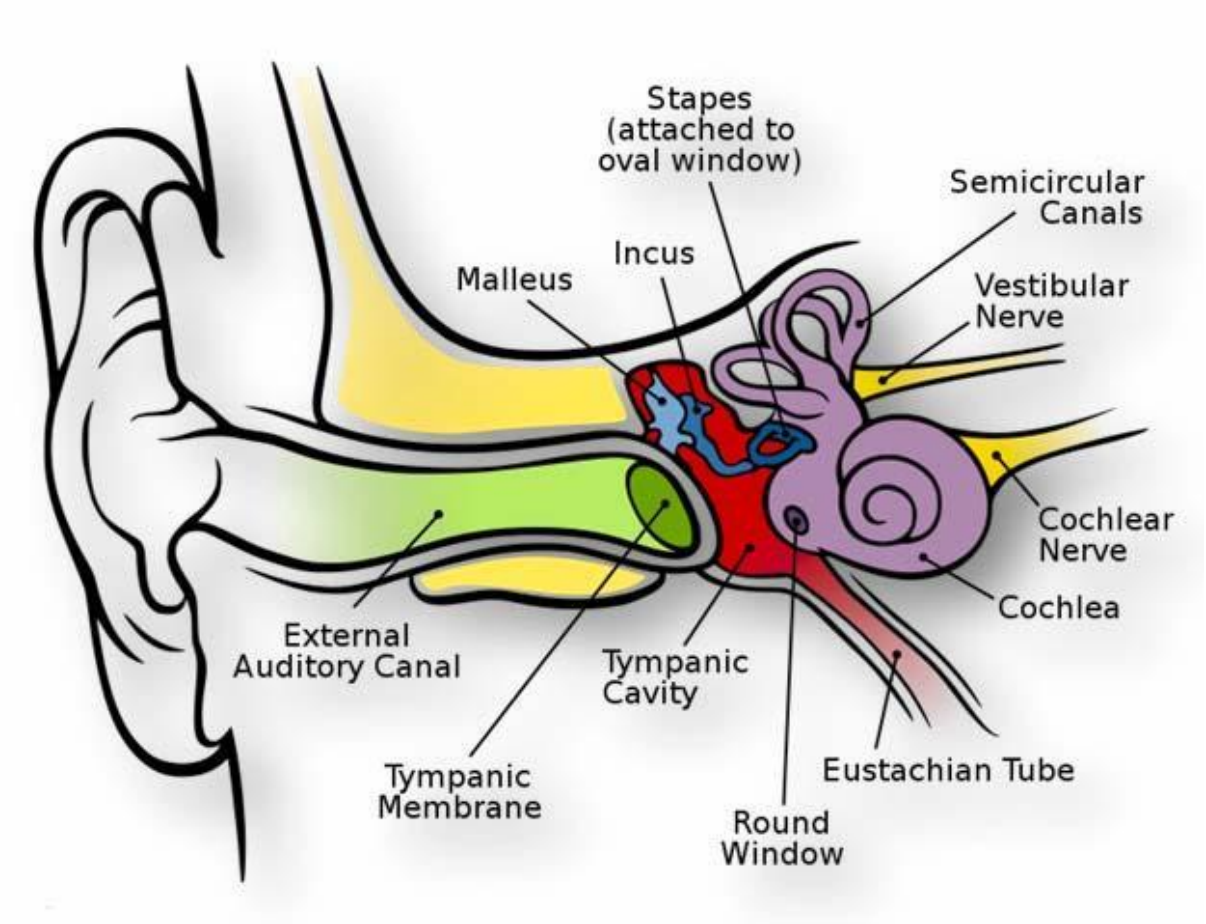


Fig no 5: Anatomy of the ear

The structure ear is divided into

1. External ear
2. Middle ear
3. Inner ear

Pinna: The Pinna is seen concave and angled forward on the outer surface. The pinna is formed by a single piece elastic cartilage. It has many elevations and depressions which are labelled [(18)].

The External Acoustic Meatus: The external auditory canal is also called the meatus acousticus externus.It extends from the ear drum to the concha's base. It measures around 4 cm long. The outermost part, pars externa is upward and forward, inward. The middle part, pars media is

backward and inward. The innermost part, pars interna is forward and downward, inward. Tympanic membrane is placed obliquely. The middle ear is closed by ear drum. There are two parts. Bony part is 16mm long. It is narrower. The cartilaginous part of the external auditory canal 8mm in length. The two parts are named meatus externus osseous and meatus externus cartilaginous respectively [17,18].

Tympanic Membrane: The outer wall of the tympanic cavity or the middle meatus is formed by the tympanic membrane. It is translucent. The fibrous annulus forms a sulcus called the tympanic sulcus. The tympanic membrane is placed in that sulcus. The tympanic membrane is made up of three layers, the lateral squamous epithelial layer, the medial mucosal layer, the fibrous layer is sandwiched between the two layers. The middle layer is called the lamina propria. The ear drum has 2 parts, the 'pars tensa' and 'pars flaccida'. 'Pars flaccida' is also called the 'Sharpenel's membrane' [19].

Middle ear muscles: The important muscles present in the middle ear are the tensor tympani and stapedius. The trigeminal nerve supplies the tensor tympani muscle. The seventh nerve supplies the stapedius muscle [17,19].

Ossicular Chain: The Malleus, the Incus, and the Stapes are the bones of the ear canal. These ossicles the sound from ear drum to the inner ear. The malleus has the following parts the head, the handle, the neck, the lateral processes and the anterior process. It is the outermost ossicle. The incus the largest of the ossicles. The incus possess a body and 3 processes. The lenticular process and the short and long processes. The tiniest ossicle is the stapes. The stapes' footplate is encompassed by the stapediovestibular ligament and rests in the oval window, while the stapes' head articulates with the incus' lenticular process. The stapedial head is connected to the footplate via the anterior and posterior crus of the stapes arch [17,19].

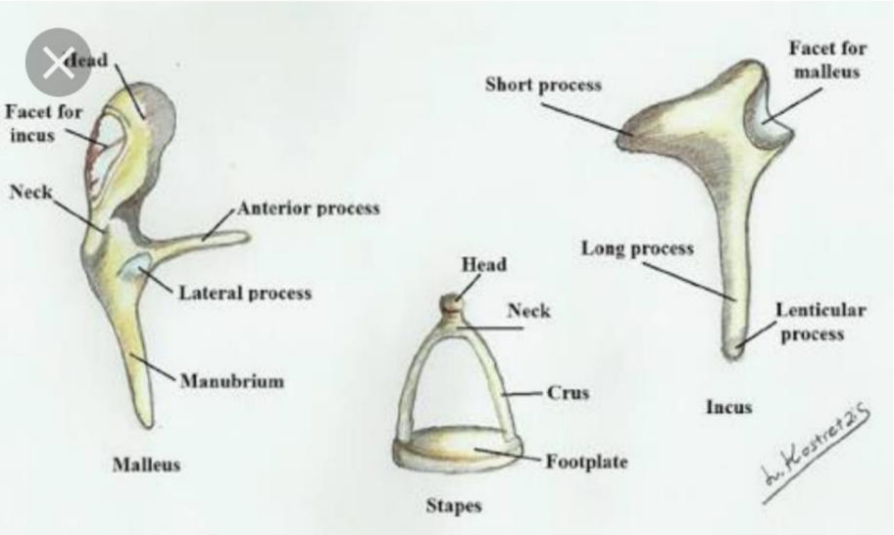


Fig no 6: Malleus, Incus, Stapes

Eustachian tube: The Eustachian tube extends from the anterior aspect of the tympanic cavity to the posterior aspect of the Nasopharynx, measuring roughly 35 mm. Mucociliary cells abound in the tube's lining mucosa, which is crucial to the tube's clearance function. The eustachian tube is fibrocartilaginous in the anteromedial two-thirds and bony in the rest. The tympanic aperture is located in the middle ear's anterior wall. The tube is closed in its resting posture; it is opened by the tensor veli palatini muscle, which is innervated by the trigeminal nerve. The lateral fat pad of Ostmann is a fat body that abuts the fibrocartilaginous tube on the lateral side [(17)].

Internal auditory canal: The superior and the inferior vestibular nerves, the facial nerve, the cochlear nerve, the intermediate nerves, and the labyrinthine vein and artery are all protected within the bony conduit of internal auditory canal [(20)].

Inner Ear: The sensory organs and soft tissue buildings of the internal ear are located in the bony labyrinth. It constitutes the vestibule, the cochlea, and three semi-circular canals. The modiolus is a two-and-a-half turn round the central axis found in the cochlea. The posterior semi-circular canal, the horizontal semi-circular canal and the lateral semi-circular canals are the three semi-circular canals. These are aligned orthogonally to each different and span a 240-degree arc. They have an ampullated and non-ampullated cease that connects to the utricle. The utricle and saccule have their very own niches in the vestibule [(17,18)].

MECHANISM OF HEARING

- The pinna collects sound from the environment, which travels via the outer ear canal and hits the ear drum.
- The eardrum's movements are transferred to the footplate of stapes via ossicular chain.
- The fluids in the labyrinthine cavity experience variations in pressure, which motive the membrane to shift. The hair cells in the organ of Corti are stimulated by this and they convert to electrical impulses from mechanical energy
- Dendrites of spiral ganglion bipolar cells innervate hair cells. The cochlear division of the eighth nerve, which enters the brain at the Ponto-medullary junction, is formed by the axons of those bipolar cells.
- The fibres bifurcate when they enter the brainstem. The upper-division terminates bilaterally at the Dorsal Cochlear Nucleus (DCN). In the Ventral Cochlear Nucleus (VCN), the lower division comes to an end.
- DCN 2nd order neurons climb in the lateral lemniscus. Ventral Cochlear Nucleus 2nd order nerves rest in the Superior Olivary Nucleus. 3rd order nerves emerge from the superior olivary nucleus.
- The Inferior Colliculus is where the lateral lemniscal fibres end. Intercollicular commissural fibers connect the colliculi and send impulses between them.
- Singles are sent to **Medial Geniculate Body** of the same side from the inferior colliculus.
- Singles are then directed to the **HESCHL'S GYRUS** or **AREA 41**, located in the Superior Temporal Gyrus, it is referred as the **Primary Auditory Area**. **AREA 42, the Auditory Association Area**, receives some impulses as well.

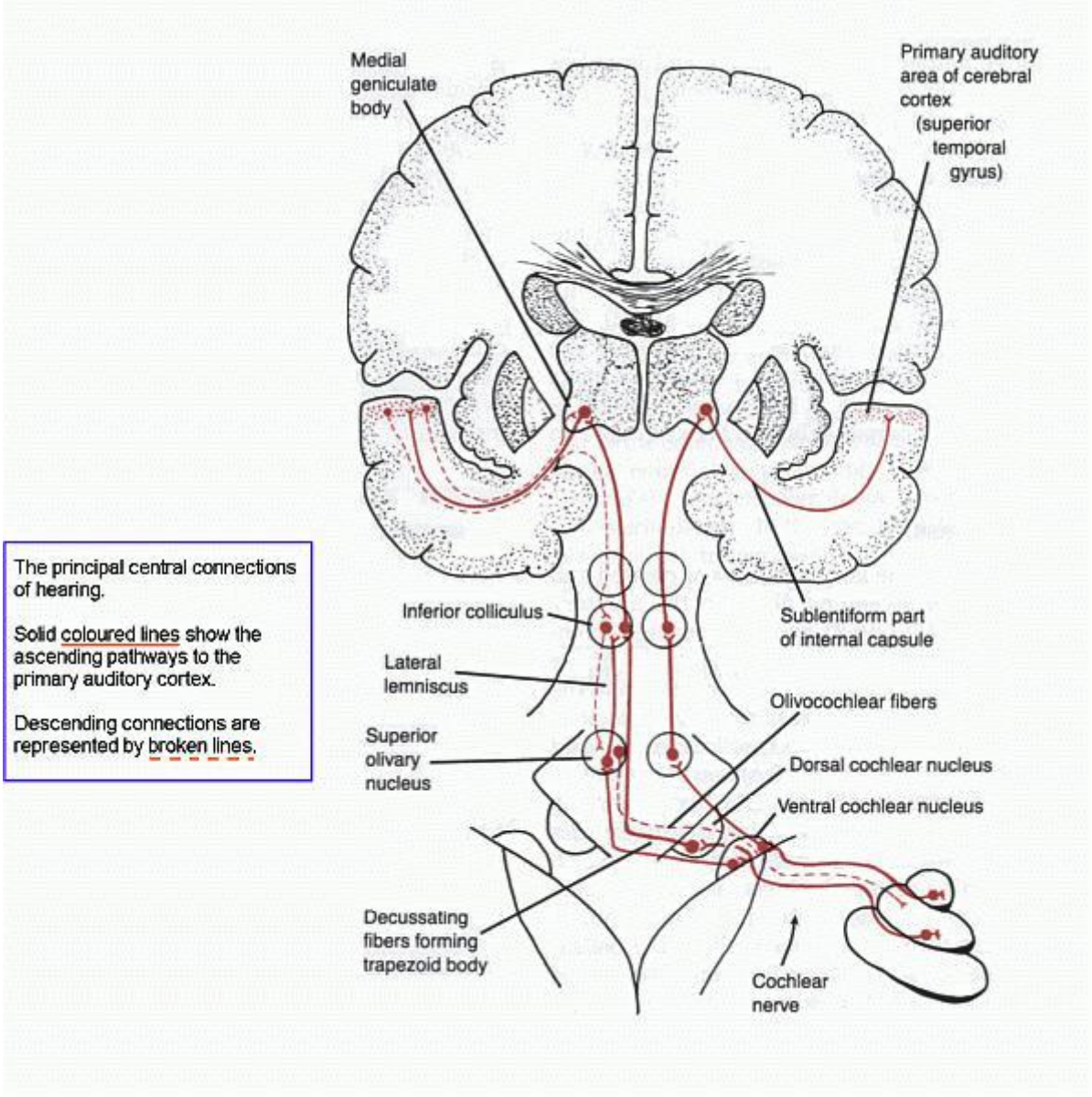


Fig no 7: Auditory Pathway

HEARING LOSS[21]

There are four major categories :

1. Sensorineural hearing loss
2. Conductive hearing loss
3. Auditory dyssynchrony or auditory neuropathy
4. Central hearing loss

• **Sensorineural loss:** The unusual development or injury to the Cochlear hair cells or acoustic nerve can result in sensorineural hearing impairment.

• **Conductive loss:** Any discrepancy with the travelling of sound waves from the outer ear to the inner ear, it leads to conductive hearing loss.

Frequently encountered cause for conductive deafness is fluid within the tympanic cavity or the middle ear effusion. Anatomic anomalies like microtia, stapes fixation, or canal stenosis which are seen in infants with craniofacial malformation are less frequently seen causes.

• **Auditory neuropathy or auditory dys-synchrony:** The transmission of impulses from the cochlea to the acoustic nerve is not normal. However, up to the cochlea receiving sound signal is normal here. Though the probable etiopathogenesis of this condition is not very well known, babies who are premature, who have severe hyperbilirubinemia requiring exchange transfusion, history of hypoxia, and immune disorders are at higher risk.

• **Central hearing loss:** Here, the auditory meatus and internal ear are intact and the neurosensory pathways are normal, however, the auditory processing at higher centres of the central nervous system is abnormal.

CAUSES FOR HEARING LOSS

The causes of hearing loss can be grouped into three categories.

•About fifty percent of all cases are because of **genetic inheritance**. Around 70 percent of these cases are autosomal recessively inherited,15 percent are autosomal dominant type of inheritance, and other 15 percent are miscellaneous. A mutation in the connexin 26 gene on chromosome 13q11-12 is the most common cause of hereditary deafness. The A1555G mutation in the mitochondrial gene 12S rRNA is linked to a risk of deafness after exposure to aminoglycoside drugs [(22)]. The majority of them are non-syndromic. Along with the deafness, there are various clinical manifestations in syndromic patients. One such example for syndrome associated with deafness is Usher syndrome.

• A **nongenetic cause** is found in about 25% of all cases of juvenile deafness. Deafness is thought to be caused by damage to the developing sensory system during the prenatal or intrapartum period. Infection, hypoxia, ischemia, metabolic illness, ototoxic medicine, or hyperbilirubinemia are all possible causes of damage. The most common cause of nonhereditary sensorineural deafness is congenital Cytomegalovirus infection (CMV). CMV infection affects about one percent of all newborns. Clinical indications of infection are present at delivery in about 10% of those babies. Of these 50-60 percent of babies develop deafness. In about 10–15 percent of those who are born with no symptoms as well, hearing impairment can be seen. The most prevalent symptom in infants with Congenital Rubella Syndrome is sensorineural deafness, which occurs when maternal infection occurs before 11 weeks of gestation.

• In about the rest 25% of cases there is no identifiable cause.

Middle ear effusion or fluid in the tympanic cavity, ossicular discontinuity, and congenital Cholesteatoma are few causes for **Congenital hearing loss**.

Sensorineural hearing loss causes:

Nonsyndromic sensorineural hearing loss: Two-thirds of all congenital hearing loss are nonsyndromic sensorineural hearing impairment. The autosomal recessive form of inheritance bills for the majority of congenital hearing loss, about 80%, whilst the autosomal dominant mode

is much less common, around 15 to 18 percent. X-linked and mitochondrial transmission are rare sorts of transmission that account for the final 2 percent of hearing impairment.

Syndromic sensorineural hearing loss: Few examples for syndromes associated with deafness are Waardenburg's syndrome, Pendreds syndrome, Stickler's syndrome, Usher syndrome. Other perinatally acquired cause can be meningitis, sepsis, trauma to the head, extracorporeal membrane oxygenation(ECMO) and severe hyperbilirubinemia [(23)].

Table no 2: Severity of deafness

15 -30 dB Loss	Mild impairment
30 -50 dB Loss	Moderate impairment
50 -70 dB Loss	Severe impairment
70+ dB Loss	Profound impairment

METHODS of SCREENING

The hearing evaluation used to be behavioural assessment, commonly known as Murphy's method. It is a method to assess the ability to locate auditory stimulus. The newborn would be exposed to a sound while an observer looked for a reaction from the baby (i.e., assessing the "startle response" of an infant). The observer's capacity to qualitatively assess the baby's response to the auditory stimulus at the time of the test is a common limitation of this.

In the past 20 years, better techniques are created and used to detect the physiologic changes occurring on exposure to auditory stimulus in newborns. Hearing examinations for neonates are currently done in two different ways.

1. Otoacoustic emission (OAE)

2. The Automated Auditory Brainstem Response (AABR)

For newborns under the age of six months, these procedures are more accurate than behavioural testing. The American Academy of Paediatrics and the Journal of Clinical Investigation have both endorsed these tests. The above procedures are realistic and functional assessments. The individual's active engagement is not required as in standard hearing assessment methods [(7)].

These screening methods give faster results as PASS or FAIL. Those who pass the hearing test are assumed to be having no hearing impairment. Those who fail should see an audiologist for a thorough examination.

All of the tests discussed above are non-invasive and safe. The only side effects of AABR are some skin abrasions from the electrodes; no side effects have been recorded during OAE testing. With the infant awake, nursing, or sucking on a pacifier, otoacoustic emission testing can be performed. The infant must be asleep for AABR to work.

The Hearing Screening programme is divided into three parts.

• Screening

• Confirmation (Audiologic evaluation with abnormal results)

• Early intervention for those who have been diagnosed with hearing loss.

OTOACOUSTIC EMISSIONS(OAE)

KEMP was the first to describe otoacoustic emissions in 1978. In a healthy cochlea, the movement of hair cells in response to auditory stimuli produce acoustic energy known as Otoacoustic emissions. **OAE** are very faint sounds which are produced in the cochlea (inner ear) in response to a sound stimulus. The OAE screening method detects stimulated acoustic energy generated in the inner ear, a tiny microphone detects the sound as it comes through the middle ear and into the ear canal. OAE is a sensitive, non-invasive, cost-effective, and time-effective screening tool [(24)]. As a result, OAE testing assesses the internal ear's health. OAE are produced by those who have normal hearing. Those who have a hearing loss of 25 to 30 dB do not. OAE screening can identify blockages in the outer canal, middle ear fluid, and damage to the cochlea's outer hair cells.

A thin flexible plug is put into the baby's ear to perform the OAE. Through the plug, specific sounds are produced. The inner ear's otoacoustic responses to transmitted sounds are recorded by a tiny microphone in the plug. The test is normally carried out when the baby is sleeping.

Automated OAE screeners report them as 'PASS' or 'REFER.'

REFER means either an abnormal ear or a false positive result caused by dirt in the external canal. This exam takes anything from 1 to 5 minutes to complete.

Fig no 8: OAE instrument

AUTOMATED AUDITORY BRAINSTEM RESPONSE(AABR)

The AABR tests the auditory pathway all the way up to the brainstem. Involving the middle ear, the inner ear, and the 8th Nerve. Electrodes are put on the nape of the neck, the forehead and on the shoulder or cheek during AABR. A click stimulus at one loudness level is delivered to each of the child's ears during AABR screening. The response of the child is matched to that of those with normal hearing. The child is said to have passed the screening if the responses match; if they don't, the child has a hearing problem. After delivery, AABR conducts screenings and uses a strict statistical pass threshold to eliminate bias in interpretation. The AABR is a screening tool for infants who have reached at least 34 weeks of gestation until they reach the age of six months [(25)]. To create a PASS or REFER result, the automated screener averages results from multiple stimulus delivered and uses an algorithm. The threshold is set at 35 dB.

During testing, tranquilisation is used to reduce intrusion produced by movement of muscle. Within the first 10 milliseconds, a normal person produces seven waves. Waves I, III, and V can be reliably obtained by people of all ages. Waves II and IV have a less constant appearance. With a fall in stimulus intensity or loudness, the latency of each wave increases, and the amplitude decreases [(26,27)]. Although the specific anatomic site of wave formation is still debated, they are likely to originate from the following:

Table no 3: Site of origin of ABR waves

Wave I	VIII Nerve
Wave II	Cochlear Nuclei in the Pons
Wave III	Superior Olivary Complex in the Pons
Wave IV	Lateral Lemniscus in the Pons
Wave V	Inferior Colliculus in the Midbrain
Wave VI	Medial Geniculate Body in the Thalamus
Wave VII	Auditory Radiations (Thalamo-Cortical region)

WHO SHOULD UNDERGO SCREENING?

Before discharge from the hospitals where they were born, congenital hearing loss and neonatal-onset hearing loss are to be screened in all babies. The newborns with the risk characteristics listed below should COMPULSORILY be checked if not the above due to budgetary constraints [11,21,26,28,29].

1. Any diagnoses that necessitates a stay in the NICU for at least 24 hours.

2. Weighing less than 1500 grams at birth.

3. An Apgar score of 0-4 at 1 minute and 0-6 at 5 minutes.

4. Serum hyperbilirubinemia necessitating exchange transfusion.

5. Ototoxic medications –Aminoglycosides and loop diuretics used for >5 days

6. Mechanical ventilation for at least 5 days and PPHN.

7. Bacterial meningitis.

8. Infections by the TORCH group of microbes in the womb.

9. Craniofacial defects, such as structural abnormalities of the pinna and ear canal.

10. Any features associated with syndromes known to include sensorineural and/or conductive hearing impairment, such as Waardenburg syndrome (pigmentary abnormalities), branchio-oto-renal syndrome (ear tags or pits), Usher syndrome (retinitis pigmentosa), Pendred syndrome (thyroid enlargement), Jervell and Lange-Nielsen syndrome etcetra.

11. History of permanent childhood hearing loss in the family.

Despite the fact that high-risk neonates have a higher risk of hearing loss, they only account for around half of all babies with hearing loss.

Only approximately one out of every 10 neonates is examined. Only fifty percent of the infants with hearing loss are diagnosed since only high-risk neonates are checked [30].

NEXT STEP AFTER FAILING THE SCREENING?

After one month, infants who do not pass the first OAE screening are subjected to a second OAE screening. Rescreening lowers the number of false positives [31,32]. If the second screening is also abnormal, the infant is directed for follow-up audiological and medical tests, which should take place no later than 3 months of age. These tests identify the presence of hearing loss, determine the kind, and cause of the hearing loss where possible, and aid in the decision-making process on the interventions. Hearing loss treatment must begin before the child reaches the age of six months.

SPECIFICITY AND SENSITIVITY

OAE sensitivity ranges from 80 to 98 percent, while AABR sensitivity ranges from 84 to 90 percent.

The specificity of both approaches is greater than 90% [24].

LIMITATIONS OF THE TESTS

A calm baby and a quiet testing setting are required for both OAE and AABR.

The outer, middle and inner ears must all be functional for OAE, while the lower auditory pathway must also be functional for AABR. The screening tests are not intended to detect hearing loss in the central ear. Because the stimuli for both tests are delivered through the external ear canal, debris or middle ear fluid can influence the test's accuracy. When testing is done within the first 48 hours after birth, amnionic fluid within the auditory meatus may have an impact on OAE results.

INTERVENTIONS FOR HEARING IMPAIRMENT

Several teams of experts work together to provide care to an infant with hearing loss, which include:

• The Paediatrician

• The Otorhinolaryngologist

• The Speech Therapist

• The Audiology team with the audiologist

• The Alternate Language Teachers

• The Surgeon

USE OF HEARING AIDS IN CHILDREN

Hearing aids, both the behind the ear (BTE) and the in the ear (ITE), can be utilised to augment sound for children with hearing loss. Hearing aids that are totally inside the ear are known as ITE hearing aids. Older children can use ITE hearing aids. Hearing aids for children and infants should involve an eminent audiologist trained in paediatrics.

As the dimensions and shape of the ear alter as the child grows during infancy and early childhood, BTE hearing aids are safer and can be worn for extended periods. Infants as young as two months old could be fitted with hearing aids.

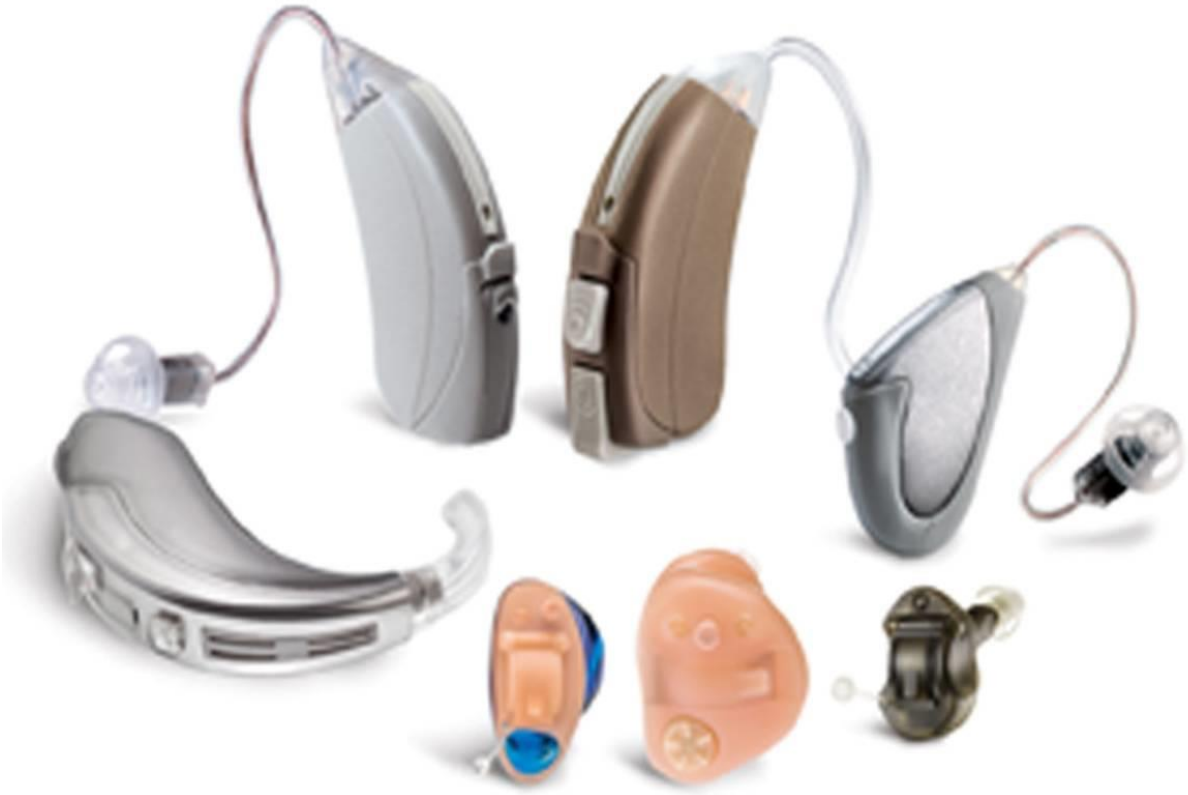


Fig no 9: Hearing Aids

COCHLEAR IMPLANTS

Hearing aids may not be very effective in several conditions. Cochlear implants may be a solution for people who have profound sensorineural deafness. A cochlear implant is a type of electronic hearing aid. There is an exterior component and an interior component that is surgically placed. The sound is picked up by the outer part of the implant, which then converts it to electrical energy and sends it to the internal component. The receiver receives the signal and sends them straight to the 8th cranial nerve, auditory part. Meningitis caused by pneumococci is severe consequence of cochlear implants. Pneumococcal vaccination is required for all children who receive a cochlear implant.

Fig no 10: Cochlear implant

HOW DOES A COCHLEAR IMPLANT WORK?

1. The microphone picks up the sound signal.

2. The signal is then “coded” to convert into electrical impulses.

3. These impulses are conveyed to the coil. Then its transmits them to the implant through the skin.

4. The electrodes in the cochlea receive electrical impulses from the implant.

5. The electrical impulses are picked up by the auditory nerve and sent to the brain. These signals are recognised by the brain as sounds.

Nagapoornima *et al*[11] – Conducted a prospective non-randomized study in a tertiary care hospital in Bengaluru estimating the incidence of hearing impairment in at-risk and normal neonates. Hearing impairment was found in 7 out of 1490 normal neonates and 3 out of 279 neonates at-risk [11].

A study was conducted to know the efficacy of BERA for hearing evaluation in icteric newborns by **Sharma** *et al* [25], who came to the conclusion that BERA could be a simple, reliable, and useful tool for detecting hearing impairment in neonates [25].

In a study conducted by **Vaid** *et al* [52] OAE and BERA were used to screen 2621 neonates in a tertiary care hospital in Pune, and 15 babies were found to have a substantial hearing impairment [52].

Transient induced otoacoustic emissions in hearing screening programmes: protocol for poor countries was published by **Bansal** *et al* [31]. The goal of this study was to design a methodology for infant hearing screening in underdeveloped nations so that it could be implemented into their national deafness screening programmes later. The study included 2659 infants between the ages of 0 and 3 months. They were placed into three groups, each with an age range of 0-1, 1-2, and 2-3 months. Transient evoked otoacoustic emission (TEOAE) was used to test everyone's hearing. Those who did not pass the initial screening were followed up with after a month. Brainstem Evoked Response Audiometry was used on infants who failed the second screening (BERA). This study found that delaying hearing screening until the age of three months reduces the frequency of falsely labelled cases of hearing impairment, reducing resource waste, as a result, for developing countries, universal neonatal hearing screening within the first 48 hours of life is unrealistic. Merging hearing screening with the third dose of vaccination would result in a practical, feasible, and universal hearing screening programme that could be incorporated into developing nations' national deafness programmes [31].

Heinemann *et al*[32] conducted a study to estimate the cost-effectiveness of newborn hearing screening with different instruments and found that two step screening, first with OAE and then with BERA was the most economical [32].

Finckh Kramer *et al*[33] studied the prevalence of hearing loss in high-risk neonates who graduated from the Neonatal Unit.

Sharma *et al* and **Dorman** *et al* [34] found that resilience of the neural tissue in the auditory system begins to deteriorate around the age of three and half years, and that earlier intervention leads to normal or almost normal central hearing physiology.

Philips *et al* [35] discovered that early assessments resulted in a better outcome for children who were diagnosed with substantial hearing loss and received cochlear implants right away. They came to the conclusion that hearing reception skills were improved as a result of the prior intervention.

Apuzzo and Yoshinaga-Itano[14] state that newborns who are detected with hearing loss earlier have a better outcome than later identified contemporaries and diagnosis and treatment implemented before two half years of age favours all infants with hearing loss, regardless of disability. This effect is most noticeable in participants who were recognised before the age of two months [14].

White and Maxon[36] discovered that universal newborn hearing screening is more cost-effective than screening only high-risk newborns.

The 1993, 'Panel on Early Identification of Hearing Impairment in Infants and Young Children by National Institute of Health' recommended hearing screening of all neonates over that which exclusively assess at-risk neonates. The reason being that, 'high-risk' screening only detects fifty percent of babies with hearing loss.

For all newborns who fail the OAE test, a two-stage screening paradigm must be used. First OAE 2nd screening (Oto-acoustic emission) and then ABR (Automated auditory brain stem response) [37].

When a two-stage technique is utilized, **Kurt** *et al* found that OAE testing may be done simple newborn nursery with few false positive cases [38].

According to **Kittrell** *et al* [30], the first diagnosis of hearing loss was 20.2 months on an average, and the average age of initial amplification was 31.7 months, with the average age of diagnosis improving to 3.8 months two years after universal screening implementation.

Karen Jo Doyle *et al* [53] compared pass rates in healthy babies for two distinct hearing screening procedures as a function of age. At the University of California-Irvine Medical Center, hearing screening tests were performed on two-hundred healthy neonates. The AABR pass rate did not differ significantly between infants aged 0–24 hours and newborns aged >24 hours. However,

when comparing infants aged 0–24 hours to those aged >24 hours, the OAE pass rate improved dramatically (P-value 0.01).

M D Mohd Khairi *et al* [39] performed a two-stage hearing evaluation on 401 at-risk newborns and found that mechanical ventilation for more than five days was not a risk factor for hearing loss independently.

MATERIALS AND METHODS

SOURCE OF DATA:

All high-risk newborns admitted in NICU, including both inborn and referred cases, of Shri B.M Patil Medical College, Hospital and Research Center, Vijayapura, fulfilling the inclusion and exclusion criteria.

METHOD OF COLLECTION OF DATA

Neonates fulfilling selection criteria will be included

SELECTION CRITERIA

Inclusion criteria :

Following High-Risk Neonates are included in the study.

- Gestational age < 35 weeks
- Birth weight < 1.8 kg
- Respiratory Distress Syndrome
- Intraventricular hemorrhage
- Pulmonary hypertension
- Multiple births
- Hypoxic ischemic encephalopathy
- Hyperbilirubinemia
- Bacterial meningitis
- Meconium aspiration

Exclusion criteria :

- Babies with obvious congenital ear anomalies
- Those babies of parents who are not willing for participating in the study

STUDY PERIOD: 18 moths

STUDY DESIGN: Observational study

DATA ANALYSIS

Determination of sample size (n):

Sample size:

With the anticipated Proportion of Impairment of hearing 16.3% [10], the minimum sample size was calculated to be 209 patients with a 99% level of significance and 1% absolute error.

Formula used

$$n=\frac{z^2\ p*q}{d^2}$$

Statistical analysis

Data will be represented using Mean ±SD, percentages and diagrams, and association.

METHODS OF COLLECTION OF DATA:

A hospital-based prospective study was conducted on neonates admitted in the neonatal intensive care unit at SHRI B.M PATIL MEDICAL COLLEGE AND RESEARCH HOSPITAL, A TERTIARY CARE HOSPITAL AT VIJAYAPURA, KARNATAKA. Our study was conducted over a period of 18 months (December 2019 to May 2021).

Hearing assessment using otoacoustic (OAE) emission was done using the ECHOSCREEN device, it consists of a handheld unit that is positioned in the babies' ear. If the response is detected the test produces a 'PASS' result while failure to detect a response within 180 seconds produces a 'REFER' result. All high-risk babies admitted in NICU were screened using the device at least 72 hours after birth or before discharge once their general condition is stable. Mothers of all babies admitted in the NICU were counselled regarding the benefits of hearing screening, the procedure of the screening test, the need for follow-up and further tests if the neonate failed the screening test, and the interventions available if hearing loss was confirmed The first screening test was done in NICU after obtaining informed consent from the mother. Babies were screened by portable handy equipment.

Babies who failed the first OAE underwent a second OAE at 4 weeks or first immunization visit. These babies were screened for the second time in a quiet room.

Babies who failed second testing underwent ABR and further diagnostic hearing assessment.

RESULTS

The current study was done over a period of 18 months from December 2019 to May 2021. A total of 251 babies were involved in this study. This included both term and preterm babies admitted in NICU, fulfilling the inclusion criteria. The study results are represented in tables (Table no. 4-36) and figures (Fig no. 11-29)

Table no 4: Age in days

Age in days	No. of patients	percentage
<= 30	226	90.0
31 - 60	21	8.4
61+	4	1.6
Total	**251**	**100**

A total of 251 newborns were screened, the majority of them, 90% were within 30 days of age.

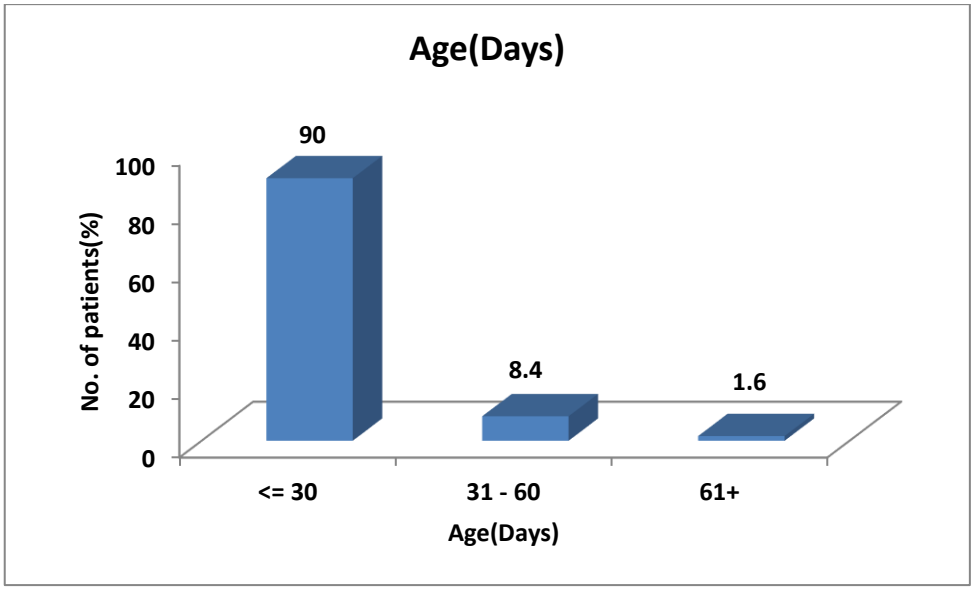


Fig no 11: Age in days

Table no 5: Gender

Gender	No. of patients	percentage
Female	104	41.4
Male	147	58.6
Total	**251**	**100**

Out of 251 neonates involved, 147 (58.6%) were male babies, 104 were females.

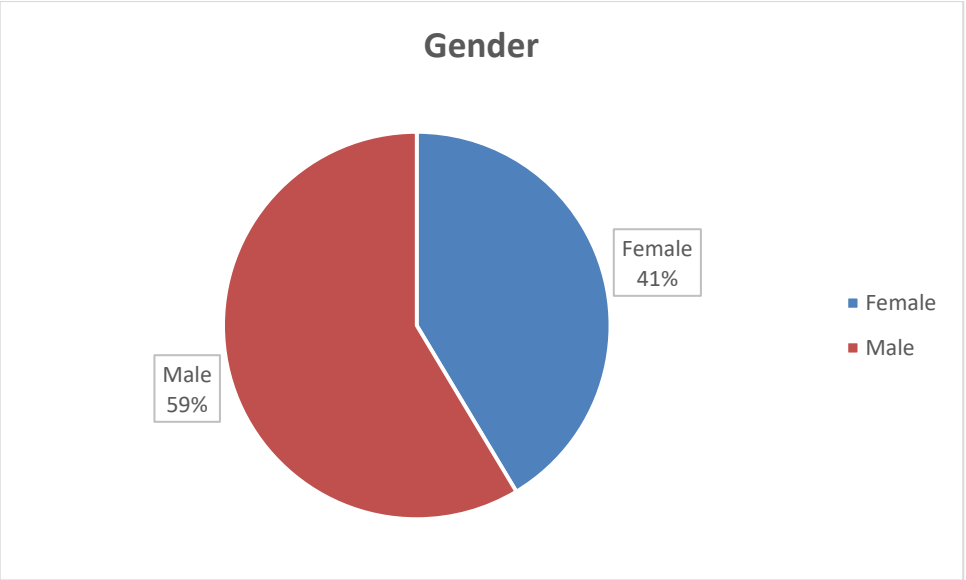


Fig no 12: Gender

Table no 6: Gestation

Gestation	No. of patients	Percentage
Late preterm (34 0/7 to 36 6/7)	48	19.1
Preterm (<34wks)	70	27.9
Term (.37 completed wks)	133	53
Total	**251**	**100**

Out of 251 high-risk babies screened 53% were term, 19.1% were late preterm and 27.9% were preterm.

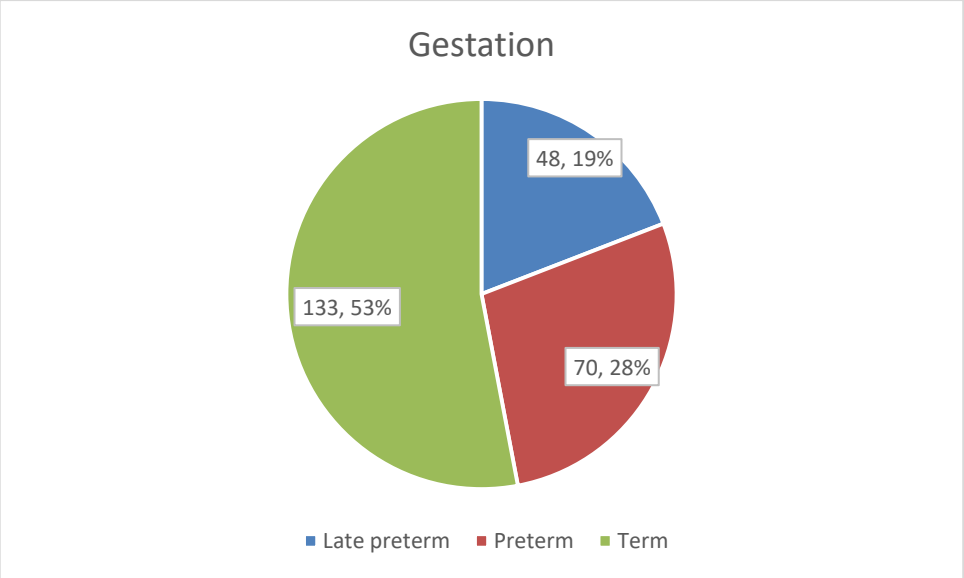


Fig no 13: Gestation

Table no 7:Socioeconomic status

Class	No. of patients	Percentage
Lower	19	7.6
Lower middle	158	62.9
Upper middle	74	29.5
Total	**251**	**100**

62.9% of the patients belonged to lower-middle-class socioeconomic status, 29.5% belonged to upper-middle-class socioeconomic status and 7.6% belonged to lower socioeconomic status.

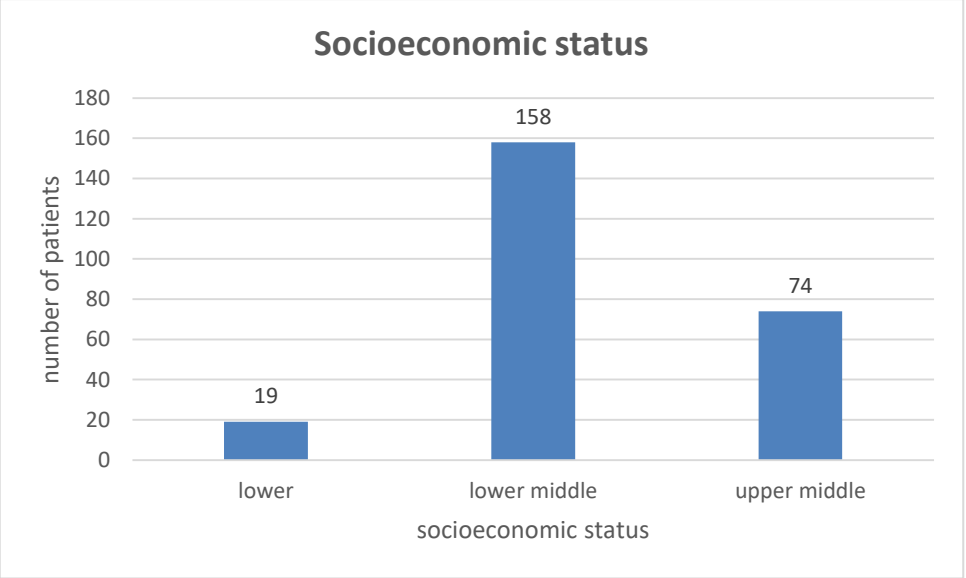


Fig no 14:Socioeconomic status

Table no 8: Parity

Parity	Mothers	Percentage
1	140	55.8
2	82	32.7
3	25	9.9
4	4	1.6
Total	**251**	**100**

55.8% of the mothers were primipara, 32.7% were para 2, 9.9% were para 3 and 1.6% were para 4.

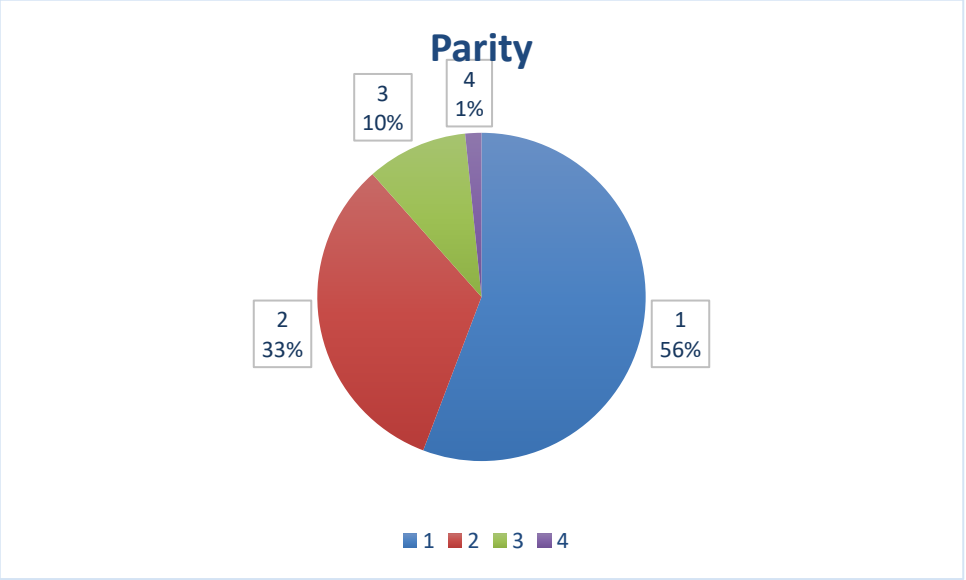


Fig no 15: Parity

Table no 9: Maternal History

Maternal history	No. of patients	Percentage
PIH/ Pre-eclampsia	49	19.5
GDM	8	3.2
PPROM/ PROM	13	5.2
Anaemia	5	2
Multiple gestation	10	4
Hypothyroidism	1	0.4
Established preterm	2	0.8
Elderly primi	2	0.8
Bad obstetric history	1	0.4
Breech	1	0.4
Previous LSCS	1	0.4
No risk factors	158	62.9
Total	**251**	**100**

37.1% of the mothers had risk factors. 19.5% had pregnancy-induced hypertension. 5.2% had premature rupture of membranes. 4% had multiple gestation. 3.2% had gestational diabetes mellitus. 2% had anaemia. Established preterm and elderly primi were 0.8% each. Breech, previous LSCS, bad obstetric history, and hypothyroidism were 0.4%

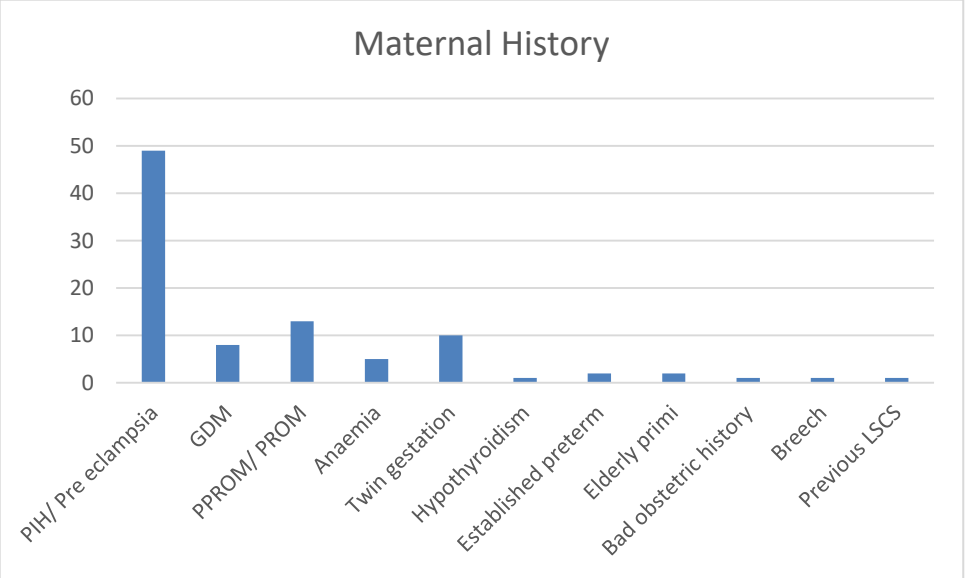


Fig no 16: Maternal history

Table no 10: Birth weight

Birth weight	No. of patients	Percentage
Low birth weight (1.5-2.5Kg)	102	40.6
Very low birth weight (<1.5Kg)	28	11.2
Extremely low birth weight (<1Kg)	3	1.2
Normal	118	47
Total	**251**	**100**

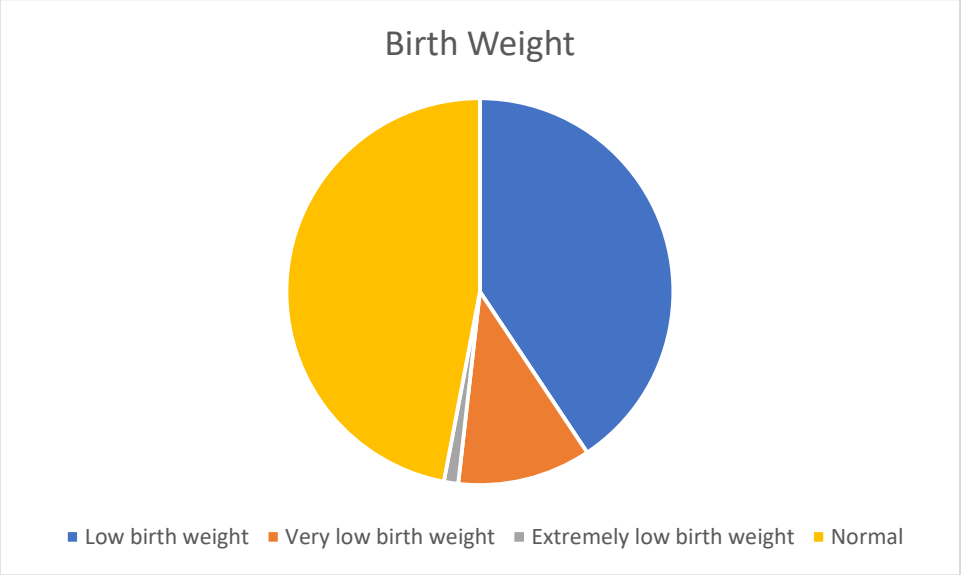


Fig no 17: Birth weight

Table no 11: Weight for gestational age

Weight for gestational age	No. of patients	Percentage
AGA	215	85.7
SGA	36	14.3
Total	**251**	**100**

85.7% of neonates were appropriate for gestational age, 14.3% were small for gestational age

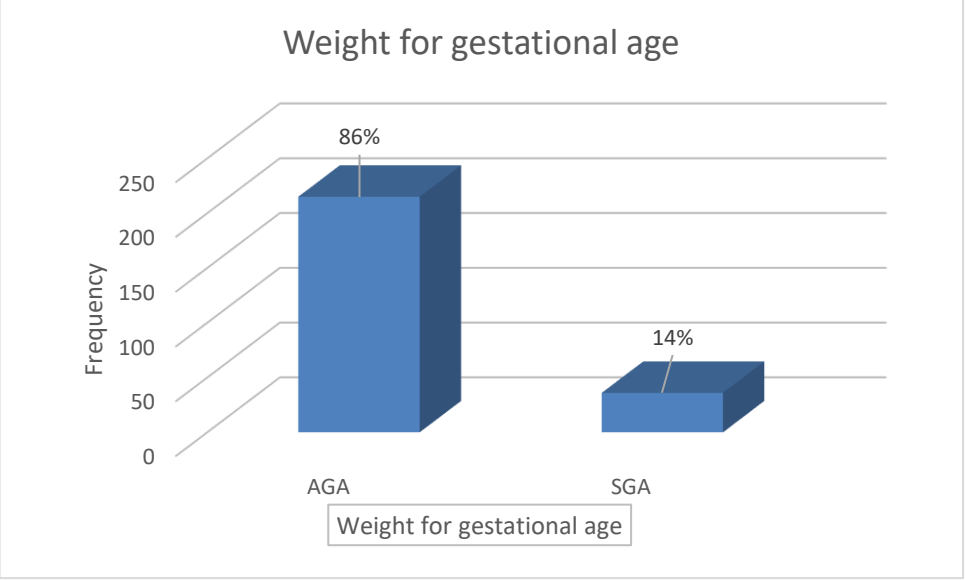


Fig no 18: Weight for gestational age

Table no 12: Diagnosis in NICU

Diagnosis in NICU	No. of patients	Percentage
TTNB	22	8.8
RDS	93	37
Birth asphyxia/ HIE	50	19.2
Sepsis	19	7.6
NNHB	65	25.9
MAS	31	12.4
Congenital Pneumonia	5	2
NEC	2	0.8
PPHN	19	7.6
Polycythemia	5	2
Bacterial Meningitis	2	0.8
Anemia	3	1.2
Dehydration fever	3	1.2
Hypoglycemic seizures	1	0.4
Septic arthritis	1	0.4
IDM	2	0.8
Cleft lip and cleft palate	1	0.4
Insulinoma	1	0.4

Babies were admitted to NICU with various diagnoses which are the risk factors for hearing loss. 37% were admitted with respiratory distress syndrome, 19.2% with birth asphyxia, 25.9% with neonatal hyperbilirubinemia, and 12.4% with meconium aspiration syndrome.

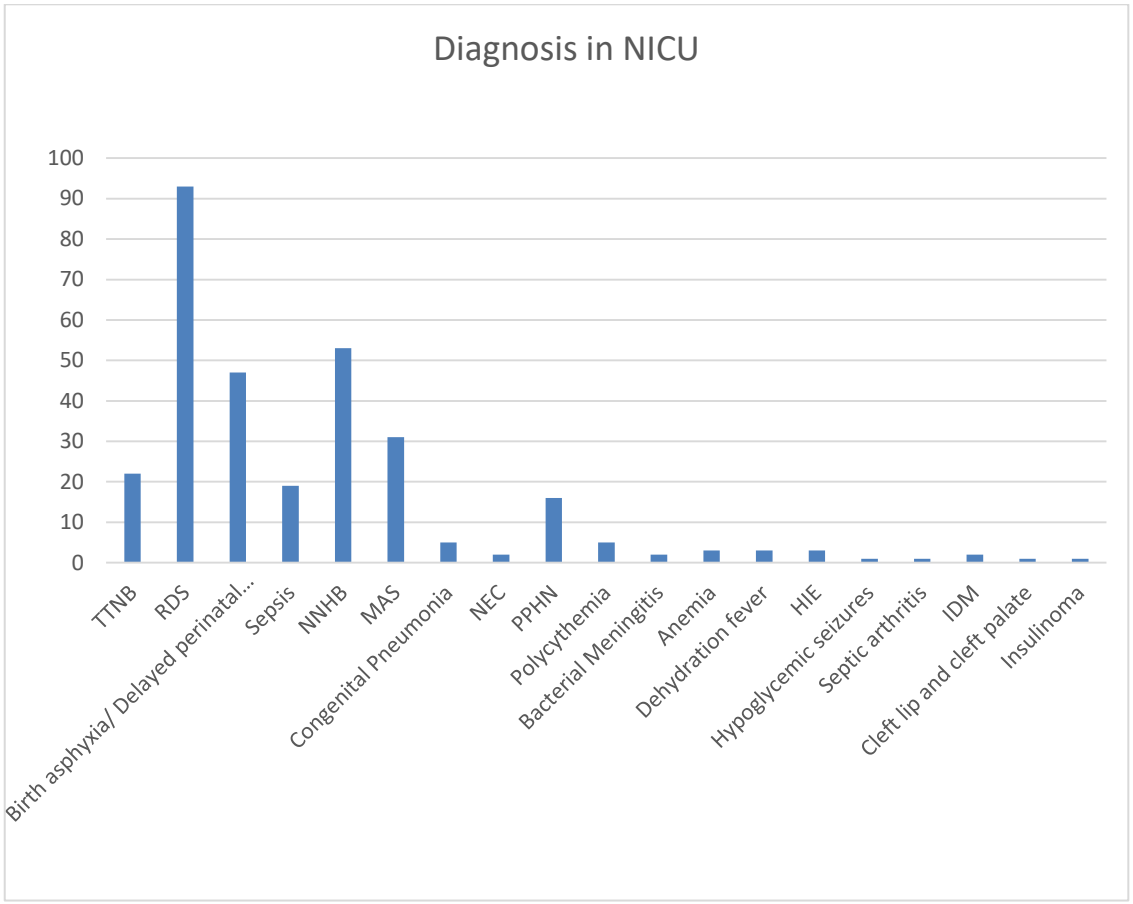


Fig no 19: Diagnosis in NICU

Table no 13: Respiratory support

Respiratory Support	No. of patients	Percentage
CPAP	29	11.6
HHHFNC	5	2
Mechanical Ventilation	15	6
Nasal / Hood oxygen	161	64.1
None	41	16.3
Total	**251**	**100**

210 babies were on respiratory support in NICU. 64.1% were on inhalational oxygen via nasal canula or hood. 11.6% were on continuous positive pressure ventilation support. 6% were on mechanical ventilation. Heated humidified high-flow nasal canula oxygen was given to 2% of babies.

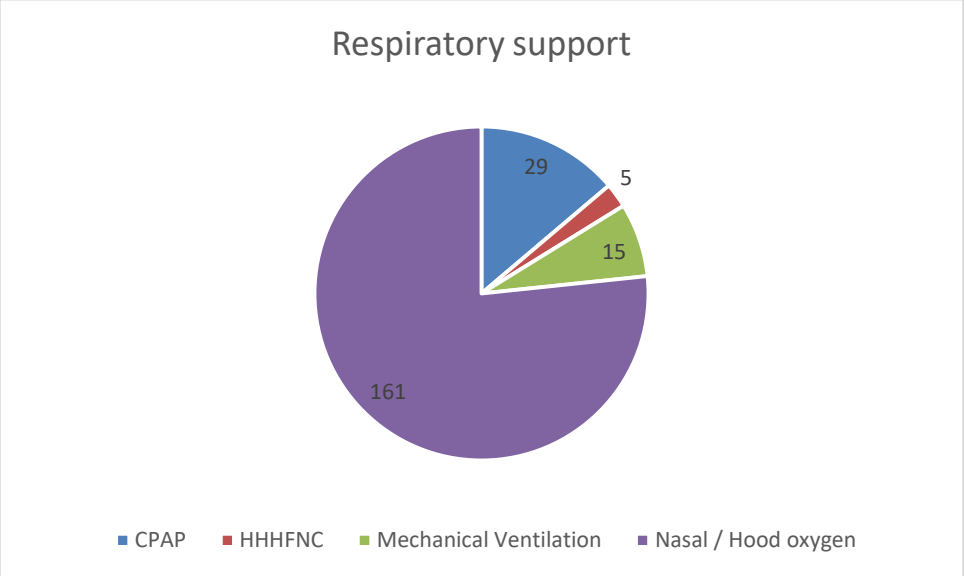


Fig no 20: Respiratory support

Table no 14: Serum Bilirubin

Serum Bilirubin	No. of patients	Percentage
Exchange zone	1	0.4
Normal	51	20.3
Phototherapy zone	64	25.5
Not applicable	135	53.8
Total	**251**	**100**

65 babies, 25.9%, were having neonatal hyperbilirubinemia. 25.5% were given phototherapy and 0.4% needed exchange transfusion.

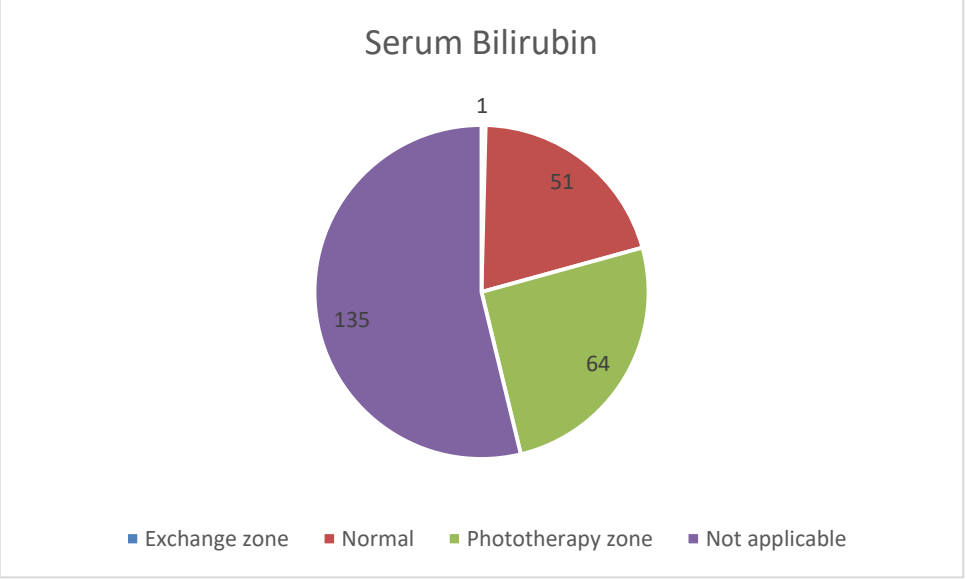


Fig no 21: Serum Bilirubin

Table no 15: Sepsis screen

Sepsis screen	No. of patients	Percentage
Negative	152	60.6
Positive	70	27.9
Not applicable	29	11.6
Total	**251**	**100**

27.9% were sepsis screen positive.

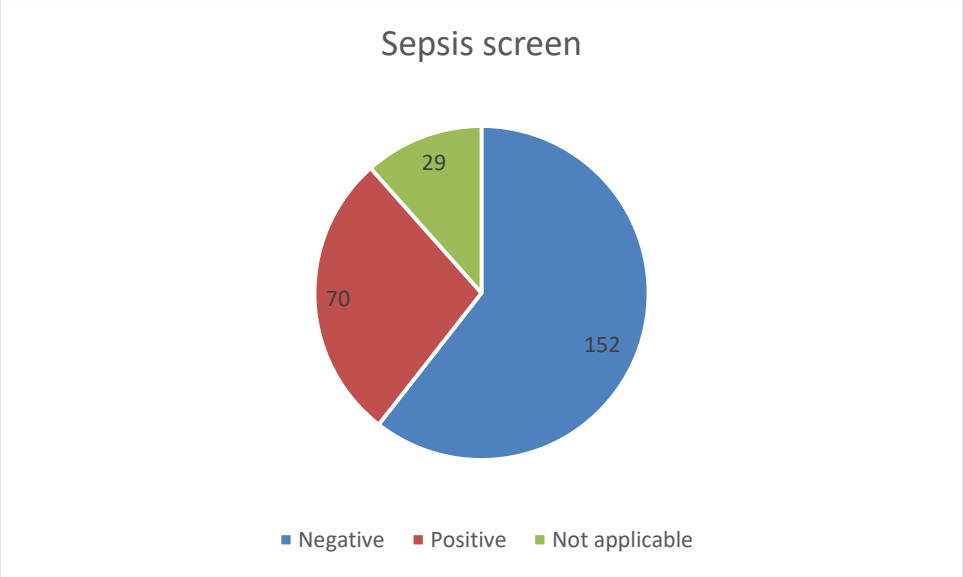


Fig no 22: Sepsis screen

Table no 16: Echocardiography

Echocardiography	No. of patients	Percentage
PAH	19	7.6
ASD	5	2
PDA	32	12.7
PFO	51	20.3
Global hypokinesia	1	0.4
Normal	99	39.4
Total	**207**	**82.5**

Echocardiography was done for 82.5% of patients. 39.4% were normal. 7.6% had pulmonary arterial hypertension.

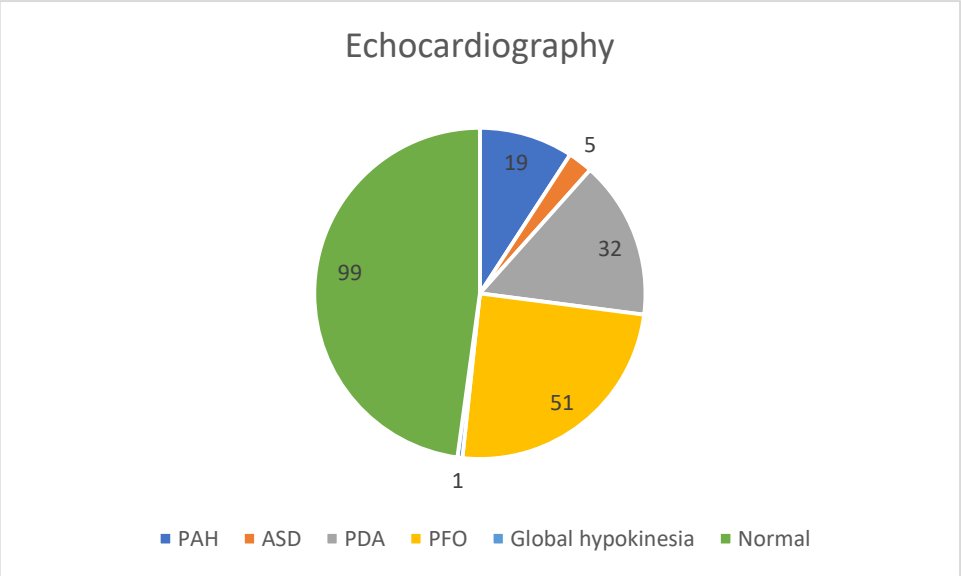


Fig no 23: Echocardiography

Table no 17: Neurosonogram

Neurosonogram	No. of patients	Percentage
Flare	2	0.8
Grade 1 IVH	2	0.8
HIE	9	3.6
Normal	143	57
Total	**156**	**62.2**

For 62.2% of babies, neurosonogram was done. 57% of patients were normal, 3.6% had HIE changes. 0.8% had a flare and 0.8% had grade1 intraventricular haemorrhage.

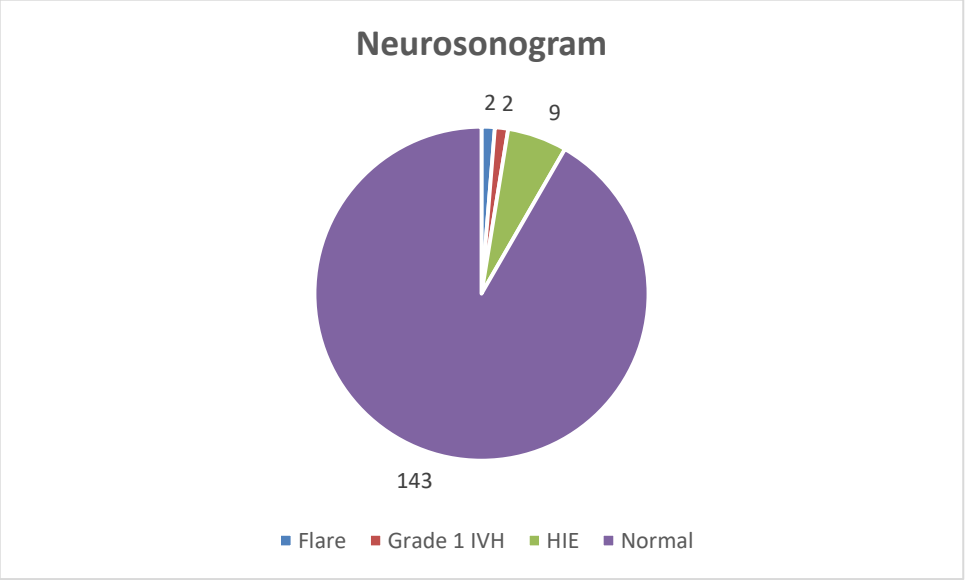


Fig no 24: Neurosonogram

Table no 18: Antibiotics

Antibiotics	No.of patients	Percentage
Piperacillin tazobactam	210	83.7
Amikacin	82	32.7
Meropenem	23	9.2
Vancomycin	5	2
Colistimethate	4	1.6
None	40	15.9

211 of the babies screened were given intravenous antibiotics. 83.7% of them received piperacillin-tazobactam. 32.7% received Amikacin. 9.2% received Meropenem. 2% received Vancomycin and 1.6% were given Colistimethate.

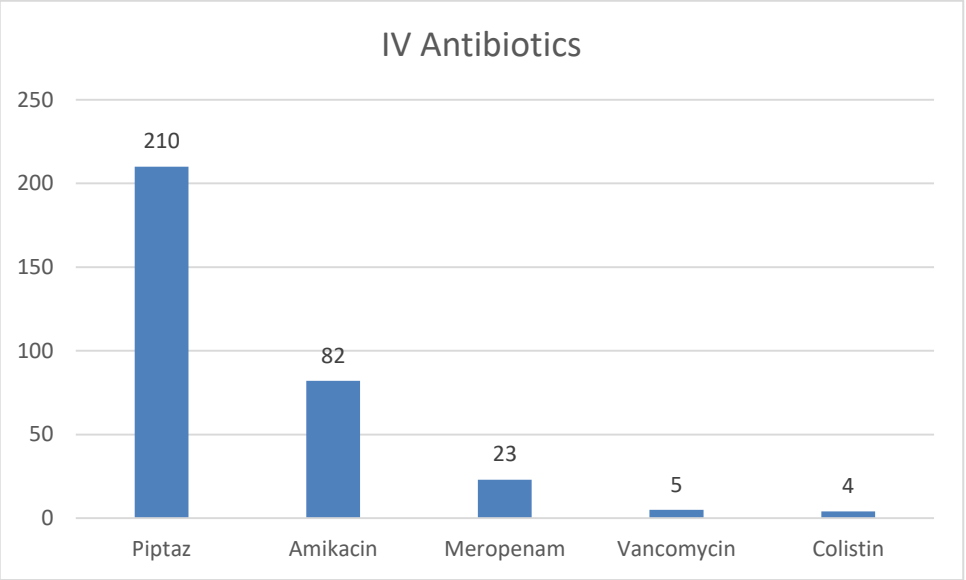


Fig no 25: Antibiotics

Table no 19: OAE first screening right ear

OAE right ear	Frequency	Percent
Pass	238	94.8
Refer	13	5.2
Total	**251**	**100**

94.8% of the screened patients showed pass results and 5.2% showed refer results for the Right ear.

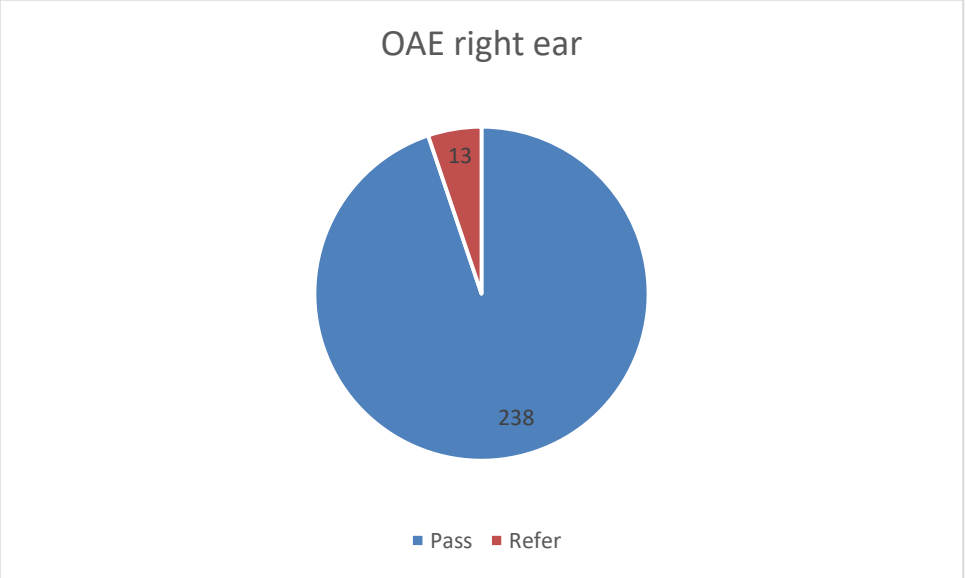


Fig no 26: OAE first screening right ear

Table no 20: OAE first screening left ear

OAE left ear	Frequency	Percentage
Pass	232	92.4
Refer	19	7.6
Total	**251**	**100**

92.4% of the screened patients showed pass results and 7.6% showed refer results for the Left ear.

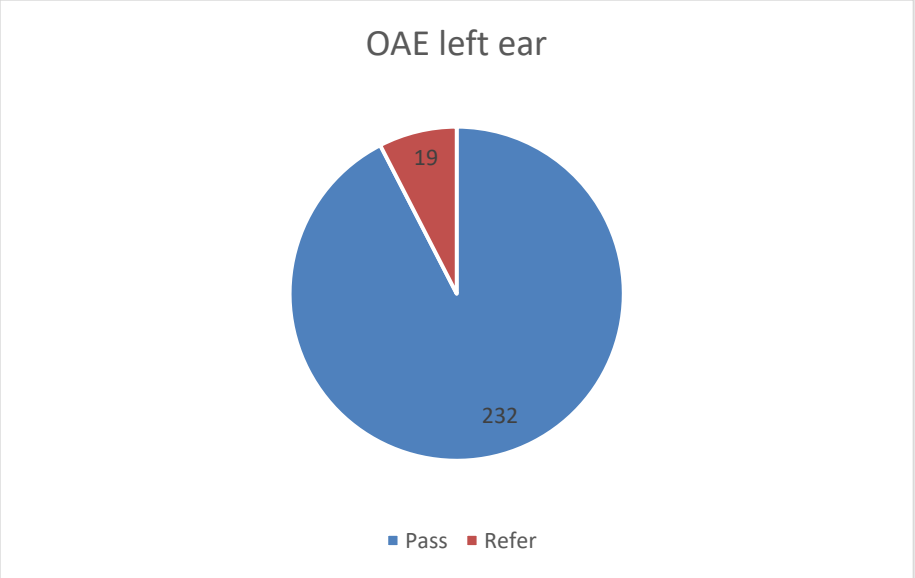


Fig no 27: OAE first screening left ear

Table no 21: OAE second screening right ear

2nd OAE right ear	Number	Percentage
Pass	11	84.61
Refer	2	15.38
Total	**13**	**100**

A total of 13 babies underwent a second screening. 84.61% had pass results and 15.38% had refer results for the right ear.

Fig no 28: OAE second screening right ear

Table no 22: OAE second screening left ear

2nd OAE left ear	Number	Percentage
Pass	12	92.31
Refer	1	7.69
Total	**13**	**100**

A total of 13 babies underwent a second screening. 92.31% had pass results and 7.69% had refer results for the left ear.

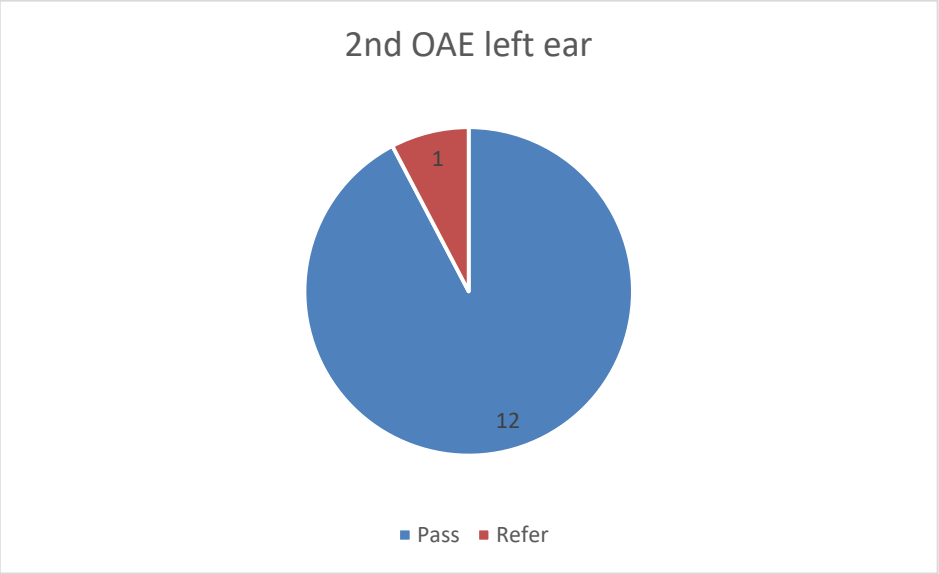


Fig no 29: OAE second screening left ear

First screening total number of babies: 251

Normal first screening results: 232(92.4%)

Number babies with REFER result in first screening: 19(7.6%)

Dropouts following first screening: 06(2.4%)

Total neonates subjected to second screening: 13, 68.4% of those who failed first screening

Total neonates who passed second screening: 11 (84.6% of those who underwent second screening)

Total neonates who failed second screening: 02 (15.4% of those who underwent second screening)

Out of 245 high-risk newborns, two were found to have hearing impairment. The percentage of incidence is 0.8 percent. Other studies have shown an incidence of 2.5- 10% in high-risk newborns.

Risk factors screened

Table no 23: Gestational age less than 35weeks

OAE 1st Screening	**Gestational age less than 35 weeks**
109	Total neonates enrolled
99	Intact hearing
6	Unilateral impairment
4	Bilateral impairment
OAE 2nd Screening	**Gestational age less than 35 weeks**
6	Neonates with 2nd screening
5	Intact hearing
0	Unilateral impairment
1	Bilateral impairment

Prematurity is one of the risk factors for hearing impairment. In our study, we had screened 109 babies less than 35 weeks period of gestation. Of which 95.4% were having normal hearing, whereas 0.9% had hearing loss in both ears. There were 4 dropouts (3.7%)

Table no 24: Birth weight less than 1.8Kg

OAE 1st Screening	**Birth weight less than 1.8Kg**
63	Total neonates enrolled
55	Intact hearing
5	Unilateral impairment
3	Bilateral impairment
OAE 2nd Screening	**Birth weight less than 1.8Kg**
5	Neonates with 2nd screening
5	Intact hearing
0	Unilateral impairment
0	Bilateral impairment

Low birth weight is also one of the high-risk factors for congenital hearing loss. We screened 63 babies less than 1.8Kg. 95.2% had normal hearing. 4.8% failed to follow up.

Table no 25: Respiratory distress syndrome

OAE 1st Screening	**Respiratory distress syndrome**
93	Total neonates enrolled
84	Intact hearing
5	Unilateral impairment
4	Bilateral impairment
OAE 2nd Screening	**Respiratory distress syndrome**
5	Neonates with 2nd screening
4	Intact hearing
0	Unilateral impairment
1	Bilateral impairment

94.6% of respiratory distress syndrome patients had normal hearing screening. 4.3% dropped out. 1.1% , which means 1 baby had bilateral hearing loss.

Table no 26: Intraventricular haemorrhage

OAE 1st Screening	**Intraventricular haemorrhage**
2	Total neonates enrolled
1	Intact hearing
1	Unilateral impairment
0	Bilateral impairment
OAE 2nd Screening	**Intraventricular haemorrhage**
1	Neonates with 2nd screening
1	Intact hearing
0	Unilateral impairment
0	Bilateral impairment

There were 2 babies with intraventricular haemorrhage. Both babies' hearing screening results were normal.

Table no 27: Pulmonary Hypertension

OAE 1st Screening	Pulmonary Hypertension
19	Total neonates enrolled
18	Intact hearing
1	Unilateral impairment
0	Bilateral impairment

Pulmonary arterial hypertension was present in 19 babies screened. 94.7% were normal. 5.3% failed first screening, second screening was not done as they were lost to follow up.

Table no 28: Birth asphyxia, Hypoxic Ischemic Encephalopathy

OAE 1st Screening	**Birth asphyxia, Hypoxic Ischemic Encephalopathy**
50	Total neonates enrolled
44	Intact hearing
1	Unilateral impairment
5	Bilateral impairment
OAE 2nd Screening	**Birth asphyxia, Hypoxic Ischemic Encephalopathy**
6	Neonates with 2nd screening
4	Intact hearing
1	Unilateral impairment
1	Bilateral impairment

Asphyxia is one of the important risk factors for hearing loss. We had 50 babies with a history of asphyxia. 96% had a normal hearing screen. 4% had impaired hearing. 2% unilateral hearing loss and 2% had bilateral hearing loss.

Table no 29: Hyperbilirubinemia

OAE 1st Screening	**Hyperbilirubinemia**
65	Total neonates enrolled
58	Intact hearing
2	Unilateral impairment
5	Bilateral impairment
OAE 2nd Screening	**Hyperbilirubinemia**
4	Neonates with 2nd screening
4	Intact hearing
0	Unilateral impairment
0	Bilateral impairment

Hyperbilirubinemia babies were 65, all passed hearing screening.

Table no 30: Bacterial Meningitis

OAE 1st Screening	**Bacterial Meningitis**
2	Total neonates enrolled
1	Intact hearing
1	Unilateral impairment
0	Bilateral impairment
OAE 2nd Screening	**Bacterial Meningitis**
1	Neonates with 2nd screening
1	Intact hearing
0	Unilateral impairment
0	Bilateral impairment

2 babies with bacterial meningitis, one passed hearing screening. One lost to follow up.

Table no 31: Neonatal Sepsis

OAE 1st Screening	**Neonatal Sepsis**
70	Total neonates enrolled
58	Intact hearing
7	Unilateral impairment
5	Bilateral impairment
OAE 2nd Screening	**Neonatal Sepsis**
8	Neonates with 2nd screening
7	Intact hearing
1	Unilateral impairment
0	Bilateral impairment

70 babies were sepsis positive. 92.9% passed hearing screening. 1.4% had a unilateral hearing impairment.

Table no 32: Mechanical Ventilation

OAE 1st Screening	Mechanical Ventilation
15	Total neonates enrolled
12	Intact hearing
1	Unilateral impairment
2	Bilateral impairment
OAE 2nd Screening	**Mechanical Ventilation**
2	Neonates with 2nd screening
1	Intact hearing
1	Unilateral impairment
0	Bilateral impairment

15 babies were on mechanical ventilation. 86.7% had normal hearing and 6.7% had unilateral hearing loss.

Table no 33: Ototoxic medication

OAE 1st Screening	**Ototoxic medication**
84	Total neonates enrolled
73	Intact hearing
6	Unilateral impairment
5	Bilateral impairment
OAE 2nd Screening	**Ototoxic medication**
9	Neonates with 2nd screening
8	Intact hearing
1	Unilateral impairment
0	Bilateral impairment

82 babies who received ototoxic medication were screened in two steps, 98.8% were normal. 1 baby had a unilateral hearing impairment.

Table no 34: Final outcome of screened infants

Outcome	Total number
Normal hearing	243
Impaired hearing	02

Table no 35: Gender distribution of neonates with impaired hearing

Gender	Number
Male	2
Female	0
TOTAL	2

Table no 36: Final Outcome Of At-Risk Neonates

Risk Factor	Total Cases	Normal Hearing
Hypoxic Ischemic Encephalopathy	50	48
Ototoxic Drugs	82	81
Neonatal Sepsis	66	65
Gestational Age <35weeks	105	104
On Mechanical ventilation	14	13
Respiratory Distress Syndrome	89	88
Birth Weight <1.8kg	60	60
Bacterial Meningitis	1	1
Jaundice	62	62
Intraventricular Haemorrhage	2	2
Pulmonary Hypertension	18	18

After the initial screening test, six babies dropped out. 243 babies (99.2%) had normal hearing and 2 babies (0.8%) showed hearing impairment after the two-stage screening test, both of whom were males. One baby was preterm at 30 weeks gestation with birth asphyxia. Another baby was severely birth asphyxiated and had neonatal sepsis, neonatal hyperbilirubinemia. This baby also received ototoxic medication.

DISCUSSION

Congenital hearing loss is one of the common treatable conditions. Hearing impairment has an inimical impact on the development of a newborn. For the development of the brain, the first year of life is very crucial. Hearing impairment occurring very early in life affects the overall development. The language and vocabulary, the development socially, attention span and academics are severely impacted. Unilateral hearing loss or mild hearing impairment may also affect the development of the child and school performance.

Permanent hearing loss is seen in about 2 to 3 per thousand live births [3]. Almost fifty percent of these infants do not have any risk factors for hearing loss. As a result hearing loss may not be detected in them until they present with the delay of language milestones. The prevalence of permanent bilateral hearing loss in at-risk infants in India is reported to be1.61/1000 of at-risk infants, by newborn hearing screening programs [4]. The prevalence of hearing loss including both unilateral and bilateral, conductive, and Sensorineural hearing loss in at-risk infants is estimated to be 2.5 to 10% [5,6].

The objectives of the study were to study the magnitude of neonatal hearing loss in high-risk neonates using OAE as a screening tool & to know the various risk factors associated with hearing loss. We Included High-Risk Neonates for the study such as Gestational age < 35 weeks, Birth weight < 1.8 kg, Respiratory Distress Syndrome, Intraventricular haemorrhage, Pulmonary hypertension, Multiple births, Hypoxic ischemic encephalopathy, Hyperbilirubinemia, Bacterial meningitis, Meconium aspiration and excluded Babies with obvious congenital ear anomalies. The study was conducted for a period of 18 months. Though the sample size was worked out to be 209, was able to carry out a study for 251 neonates.

The study participants ranged in age from 5 to 65 days. There were 147 male newborns (58.6%) and 104 girl babies (41.4%). The study group's gestational age ranged from 27 to 41 weeks. The birth weight ranged from 800 to 4310 grams. After the initial screening test, six babies dropped out. 243 babies (95.5%) had normal hearing and 2 babies (0.8%) showed hearing impairment after the two-stage screening test, both of whom were males. One baby

was preterm at 30 weeks gestation with birth asphyxia. Another baby was severely birth asphyxiated and had neonatal sepsis, neonatal hyperbilirubinemia. This baby also received ototoxic medication. Number of babies with REFER result in first screening: 19(7.6%). Dropouts following first screening: 06(2.4%). Total neonates subjected to second screening: 13, 68.4% of those who failed the first screening. Total neonates who passed second screening: 11 (84.6% of those who underwent second screening). Total neonates who failed second screening: 02 (15.4% of those who underwent second screening). Out of 245 high-risk newborns, two were found to have hearing impairment. The percentage of incidence is 0.8 percent. Other studies have shown the incidence of 2.5- 10% in high-risk newborns. In our study, we had screened 109 babies less than 35 weeks period of gestation. Of which 95.4% were having normal hearing, whereas 0.9% had hearing loss in both ears. There were 4 dropouts (3.7%). Low birth weight is also one of the high-risk factors for congenital hearing loss. We screened 63 babies less than 1.8Kg. 95.2% had normal hearing. 4.8% failed to follow up. 94.6% of respiratory distress syndrome patients had normal hearing screening. 4.3% dropped out. 1.1% i.e 1 baby had bilateral hearing loss. There were 2 babies with intraventricular haemorrhage. Both babies' hearing screening results were normal. Pulmonary arterial hypertension was present in 19 babies screened. 94.7% were normal. 5.3% failed first screening, second screening was not done as they were lost to follow up. Asphyxia is one of the important risk factors for hearing loss. We had 50 babies with a history of asphyxia. 96% had normal hearing screen. 4% had impaired hearing. 2% unilateral hearing loss and 2% had bilateral hearing loss. Hyperbilirubinemia babies were 65, all passed hearing screening. 2 babies with bacterial meningitis, one passed hearing screening. One lost to follow up. 70 babies were sepsis positive. 92.9% passed hearing screening. 1.4% had unilateral hearing impairment. 15 babies were on mechanical ventilation. 86.7% had normal hearing and 6.7% had unilateral hearing loss. 82 babies who received ototoxic medication were screened in two steps, 98.8% were normal. 1 baby had unilateral hearing impairment.

Nagapoornima *et al*[11] – Conducted a prospective non-randomized study in a tertiary care hospital in Bengaluru estimating the incidence of hearing impairment in at-risk and normal neonates. Hearing impairment was found in 7 out of 1490 normal neonates and 3 out of 279 neonates at-risk [11].

A study was conducted to know the efficacy of BERA for hearing evaluation in newborns with jaundice by **Sharma** *et al* [25], who came to the conclusion that BERA could be a simple, reliable, and useful tool for detecting hearing impairment in neonates [25].

In a study conducted by **Vaid** *et al* [52] OAE and BERA were used to screen 2621 neonates in a tertiary care hospital in Pune, and 15 babies were found to have a substantial hearing impairment [52].

Transient induced otoacoustic emissions in hearing screening programmes: protocol for poor countries was published by **Bansal** *et al* [31].

Heinemann *et al*[32] conducted a study to estimate the cost-effectiveness of newborn hearing screening with different instruments and found that two step screening, first with OAE and then with BERA was the most cost-effective [32].

White and Maxon[36] discovered that universal newborn hearing screening is more cost-effective than screening only high-risk newborns. **M D Mohd Khairi** *et al* [39] performed a two-stage hearing evaluation on 401 at-risk newborns and found that mechanical ventilation for more than five days was not a risk factor for hearing loss independently**.**

Sharma *et al* and **Dorman** *et al* [34] found that plasticity of the neural tissue in the auditory system begins to deteriorate around the age of three and half years, and that earlier intervention leads to normal or almost normal central hearing physiology.

Philips *et al* [35] discovered that early screenings resulted in a better outcome for children who were diagnosed with substantial hearing loss and received cochlear implants right away. They came to the conclusion that hearing reception skills were improved as a result of the prior intervention.

Apuzzo and Yoshinaga-Itano[14] state that newborns who are detected with hearing loss earlier have a better outcome than later identified contemporaries and diagnosis and treatment implemented before two half years of age favours all infants with hearing loss, regardless of disability. This effect is most noticeable in participants who were recognised before the age of two months [14].

CONCLUSION

Hearing impairment was found in two of the 245 high-risk newborns in our study (0.8 percent).

Hearing impairment was linked to prematurity, birth asphyxia, neonatal sepsis, hyperbilirubinemia, and ototoxic medicine, among the risk factors evaluated.

Hearing impairment was found in 0.9 percent of newborns born before 35 weeks of pregnancy.

1.1 percent of neonates with respiratory distress had hearing loss.

Hearing impairment was found in 4% of asphyxiated neonates.

1.4 percent of newborns with sepsis had related hearing loss.

Hearing loss was found in 6.7 percent of mechanically ventilated babies.

As a result, early detection and intervention will permit deaf and hard-of-hearing individuals to increase language capabilities at some stage in a time of cerebral plasticity that would otherwise be lost, relegating them to a life of social isolation and instructional ennui.

LIMITATIONS OF THE STUDY

Our research focused on high-risk infants, who account for only half of all newborns with hearing loss. This method will leave the other half of the population undiscovered at birth.

All high-risk babies must have their hearing tested every six months during the first three years of their lives, something we were unable to do in our study.

The OAE checking cannot diagnose central hearing loss.

RECOMMENDATIONS

Developing countries, such as India, must take the lead in establishing a neonatal hearing screening programme. This programme can be implemented by first establishing a centralised screening center.

A programme should be managed by each District Hospital, with the Audiologist serving as the programme coordinator.

Every child born in the district should be screened either at birth or within a month of their birth. Referral arrangements should be made by primary health centres and community health centres. Anganwadi personnel may be trained in cost-effective behavioural observation methods utilizing calibrated noise-making toys, and they may be advised to refer to higher centres if necessary.

Newborns who do not pass the screening should receive a diagnostic test and appropriate treatment within three months.

Even if they are cleared at the screening, those who are at high risk must be followed up at six month intervals. If resources are limited, a focus on high-risk infants could be implemented first, followed by universal screening. "Don't take a chance, have all newborns screened for hearing loss."

REFERENCES

1. Vashistha, I., Aseri, Y., Singh, B. K., & Verma, P. C. (2016). Prevalence of Hearing Impairment in High-Risk Infants. *Indian journal of otolaryngology and head and neck surgery: official publication of the Association of Otolaryngologists of India*, *68*(2), 214–217.
2. Yoshinaga-Itano C, Apuzzo M. (1998). Identification of Hearing Loss After Age 18 Months Is Not Early Enough. *American Annals of the Deaf* 143(5): 380-87.
3. Moeller MP, Hoover B, Putman C, Arbataitis K, Bohnenkamp G, Peterson B, Wood S, Lewis D, Pittman A, Stelmachowicz P. Vocalizations of infants with hearing loss compared with infants with normal hearing: Part I– phonetic development. Ear and hearing. 2007 Sep 1;28(5):605-27.
4. World Health Organization. Newborn and infant hearing screening: Current issues and guiding principles for action. Geneva: World Health Organization. (Accessed 06 December 2010.
5. Abdullah A, Hazim MY, Almyzan A, Jamilah AG, Roslin S, Ann MT, Borhan L, Sani A, Saim L, Boo NY. Newborn hearing screening: experience in a Malaysian hospital. Singapore medical journal. 2006 Jan 1;47(1):60.
6. Asma A, Wan Fazlina WH, Almyzan A, Han YS, Jamilah AG, Roslin S. Benefit and pitfalls of newborn hearing screening. Med J Malaysia. 2008 Oct 1;63(4):293-7.
7. Universal hearing screening in Illinois 2003-2004, published report of Illinois Dept of Public health, Division of Epidemiologic studies, August 2006, 1-11.
8. Erenberg A, Lemons J, Sia C, Trunkel D, Ziring P. Newborn, and Infant Hearing Loss: Detection and Intervention. (1999). *PEDIATRICS*, 103(2): 527-30.
9. Sharma P, Chhangani N, Meena K, Jora R, Sharma N, Gupta B. (2006). Brainstem evoked response audiometry (BAER) in neonates with hyperbilirubinemia. *The Indian Journal of Pediatrics*, 73(5): 413-6.
10. Stadio A, Molini E, Gambacorta V, Giommetti G, Volpe A, Ralli M, Lapenna R, Trabalzini F, Ricci G. (2019). Sensorineural Hearing Loss in Newborns Hospitalized in Neonatal Intensive Care Unit: An Observational Study. *The International Tinnitus Journal*. 23(1).

11. Nagapoornima P, Ramesh .A, Srilakshmi, Suman Rao, Patricia. P.L. and Madhuri Gore. Universal Hearing Screening. Indian Journal of Paeditrics.2007 Jun;74(6):545 – 9

12. Ansari MS. Screening programme for hearing impairment in newborns: A challenge during rehabilitation for all. Asia pacific disability rehabilitation journal. 2004;15(1):83-9.

13. Kumudha J. Follow up of high risk neonates. Indian Journal of Practical Pediatrics.2009 ; 11(4) : 329-36.

14. Yoshinaga-Itano C, Sedey AL, Coulter DK, Mehl AL. Language of early-and later-identified children with hearing loss. Pediatrics. 1998 Nov 1;102(5):1161-71.

15. Andrew P. McGrath, Betty Vohr and Courtney A. O'Neil. Medicine & health/rhode island.2010.93(5) : 42-44.

16. Kittrell AP, Arjmand EM. The age of diagnosis of sensorineural hearing impairment in children. International journal of pediatric otorhinolaryngology. 1997 Jun 20;40(2-3):97-106.

17. Martin Berry, Lawrence H Banister, Susan M Standring. Auditory and vestibular apparatus.In Grays Anatomy- The Anatomical Basis of Medicine and Surgery (eds) Peter L Williams.38 thedn.2005.1367-1397

18. Allen M Seiden Thomas A, Robin T Cotton. Anatomy and Physiology of the ear. In Rick A Freidman (eds) OtolaryngologyEssentials.3-13.

19. Walter Becker, Hans Heinz Neumann. Applied anatomy and Physiology. Ear, Nose Throat Diseases - A pocket reference. Theime .3-13

20. Aina Juliana Gulya. Anatomy of the Ear and Temporal Bone..In :Glasscock- Shambough. (eds) Surgery of the Ear.5th edn. B.C Deker Inc.Elsevier.35-57

21. Jane E.Stewart and Jeffrey W.Stolz. Manual of Neonatal Care - 6th edition: pages 644-647.

22. Böttger EC. Mutant A1555G mitochondrial 12S rRNA and aminoglycoside susceptibility. Antimicrobial agents and chemotherapy. 2010 Jul;54(7):3073-5.

23. Glasscock, M. and Gulya, A., 2003. *Glasscock-Shambaugh surgery of the ear*. 5th ed. Hamilton, Ont.: BC Decker, pp.104-121.

24. Coates H, Gifkins K. Newborn hearing screening.

25. Sharma P, Chhangani NP, Meena KR, Jora R, Sharma N, Gupta BD. Brainstem evoked response audiometry (BAER) in neonates with hyperbilirubinemia. The Indian Journal of Pediatrics. 2006 May;73(5):413-6.

26. Joseph haddad Jr. Text book of Paediatrics - 18th edition; pages 2620-2626

27. Dhingra, P., Dhingra, S. and Dhingra, D., 2014. *Diseases of ear, nose and throat & head and neck surgery*. New Delhi, India: Elsevier.

28. Paul AK. Early identification of hearing loss and centralized newborn hearing screening facility-the Cochin experience. Indian pediatrics. 2011 May 1;48(5):355-9.

29. Joint Committee on Infant Hearing. Joint Committee on Infant Hearing Year 2000 Position Statement: Principles and Guidelines for Eary Hearing Detection and Intervention Programs. 2000. Audiology Today; Special Issue: 6-27.

30. Kittrell and Arjmand. The age of diagnosis of sensorineural Hearing impairment in children. 1997. International Journal of Pediatric Otorhinolaryngology; 40:97-106.

31. Bansal S, Gupta A, Nagarkar A. Transient evoked otoacoustic emissions in hearing screening programs—Protocol for developing countries. International journal of pediatric otorhinolaryngology. 2008 Jul 1;72(7):1059-63

32. Heinemann M, Bohnert A. Hearing screening in newborn infants. Comparative studies and cost analysis with different instruments. Laryngo-rhino-otologie. 2000 Aug 1;79(8):453-8.

33. Finckh-Kramer U, Gross M,Bartsch M, Kewitz G, Versmold H and Hess M. Hearing screening of high risk newborn infants. HNO.2000 Mar : 48(3) 215 - 20.

34. Leigh G, Schmulian-Taljaard D, Poulakis Z. Newborn hearing screening. Newborn screening systems. The complete perspective. San Diego: Plural Publishing. 2010 Feb 1:95-115.

35. Boons T, Brokx J, Frijns J, Philips B, Vermeulen A, Wouters J, van Wieringen A. Newborn hearing screening and cochlear implantation: impact on spoken language development. B-ENT. 2013 Jan 1;9(Suppl 21):91-8.

36. White KR, Maxon AB. Universal screening for infant hearing impairment: simple, beneficial, and presently justified. International journal of pediatric otorhinolaryngology. 1995 Jul 1;32(3):201-10.

37. National Institutes of Health. Early identification of hearing impairment in infants and young children. NIH Consens Statement. 1993;11:1-24.

38. Kurt A.Stone, Brian D.Smith, Jeanie M.Lembke, Leroy A.Clark and Mary Beth McLellan. Universal Newborn Hearing Screening. The Journal of Family Practice. November 2000 (Vol.49,No.11) : 1012-1016.

39. Khairi MM, Din S, Shahid H, Normastura A. Hearing screening of infants in Neonatal Unit, Hospital Universiti Sains Malaysia using transient evoked otoacoustic emissions. The Journal of Laryngology & Otology. 2005 Sep;119(9):678-83.

40. Abdullah A, Hazim MY, Almyzan A, Jamilah AG, Roslin S, Ann MT, Borhan L, Sani A, Saim L, Boo NY. Newborn hearing screening: experience in a Malaysian hospital. Singapore medical journal. 2006 Jan 1;47(1):60.

41. Gifkins K. Newborn hearing screening. Australian Prescriber. 2003;26(4).

42. Sayed Hossein Fakhraee, Mohammad Kazemian,and Amir- Ali Hamidieh. Hearing assessment of the high risk neonates. Arch Iranian Med. 2004 . 7(1): 44 – 46.

43. Nelson HD, Bougatsos C, Nygren P. Universal Newborn Hearing Screening: Systematic Review to Update the 2001 U.S. Preventive Services Task Force Recommendation. Evidence Synthesis No. 62. AHRQ Publication No. 08- 05117-EF-1. Rockville, Maryland: Agency for Healthcare Research and Quality, July 2008

44. Thompson DC, McPhillips H, David RL, Lieu TL, Homer CJ, Helfand M. Universal newborn hearing screening: Summary of evidence. JAMA. 2001;286:2000–10.

45. Berg AL, Spitzer JB, Towers HM, Bartosiewicz C, Diamond BE. Newborn hearing screening in the NICU: Profile of failed auditory brainstem response/passed otoacoustic emission. Pediatrics. 2005;116:933–8.

46. Patel H, Feldman M. Universal newborn hearing screening. Paediatr Child Health. 2011 May;16(5):301-10. doi: 10.1093/pch/16.5.301. PMID: 22547950; PMCID: PMC3114997.

47. Ciorba A, Hatzopoulos S, Camurri L, Negossi L, Rossi M, Cosso D, Petruccelli J, Martini A. Neonatal newborn hearing screening: four years' experience at Ferrara University Hospital (CHEAP project): part 1. Acta otorhinolaryngologica italica. 2007 Feb;27(1):10.

48. Doyle KJ, Fujikawa S, Rogers P, Newman E. Comparison of newborn hearing screening by transient otoacoustic emissions and auditory brainstem response using ALGO-2®. International journal of pediatric otorhinolaryngology. 1998 May 15;43(3):207-11.

49. Berg AL, Spitzer JB, Towers HM, Bartosiewicz C, Diamond BE. Newborn hearing screening in the NICU: profile of failed auditory brainstem response/passed otoacoustic emission. Pediatrics. 2005 Oct 1;116(4):933-8.

50. Boo NY, Rohani AJ, Asma A. Detection of sensorineural hearing loss using automated auditory brainstem-evoked response and transient-evoked otoacoustic emission in term neonates with severe hyperbilirubinaemia. Singapore medical journal. 2008 Mar 1;49(3):209

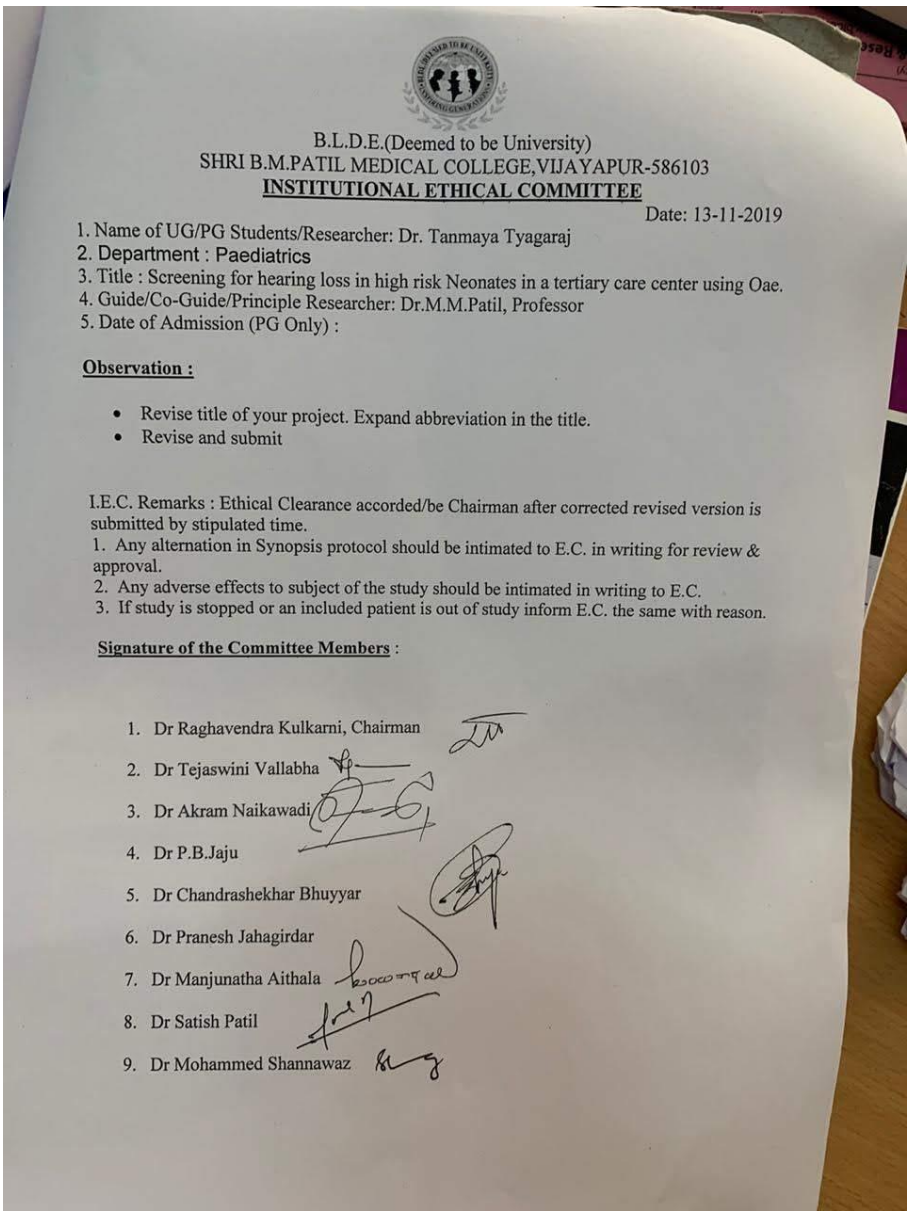
51. Kountakis SE, Skoulas I, Phillips D, Chang CJ. Risk factors for hearing loss in neonates: a prospective study. American journal of otolaryngology. 2002 May 1;23(3):133-7.

52. Vaid N, Shanbhag J, Nikam R, Biswas A. Neonatal hearing screening–The Indian experience. Cochlear implants international. 2009;10(S1):111-4.

53. Doyle KJ, Burggraaff B, Fujikawa S, Kim J. Newborn hearing screening by otoacoustic emissions and automated auditory brainstem response. International journal of pediatric otorhinolaryngology. 1997 Aug 20;41(2):111-9.

ANNEXURE – I

ETHICAL CLEARANCE CERTIFICATE



B.L.D.E.(Deemed to be University)
SHRI B.M.PATIL MEDICAL COLLEGE,VIJAYAPUR-586103
INSTITUTIONAL ETHICAL COMMITTEE

Date: 13-11-2019

1. Name of UG/PG Students/Researcher: Dr. Tanmaya Tyagaraj
2. Department : Paediatrics
3. Title : Screening for hearing loss in high risk Neonates in a tertiary care center using Oae.
4. Guide/Co-Guide/Principle Researcher: Dr.M.M.Patil, Professor
5. Date of Admission (PG Only) :

Observation :

- Revise title of your project. Expand abbreviation in the title.
- Revise and submit

I.E.C. Remarks : Ethical Clearance accorded/be Chairman after corrected revised version is submitted by stipulated time.
1. Any alternation in Synopsis protocol should be intimated to E.C. in writing for review & approval.
2. Any adverse effects to subject of the study should be intimated in writing to E.C.
3. If study is stopped or an included patient is out of study inform E.C. the same with reason.

Signature of the Committee Members :

1. Dr Raghavendra Kulkarni, Chairman
2. Dr Tejaswini Vallabha
3. Dr Akram Naikawadi
4. Dr P.B.Jaju
5. Dr Chandrashekhar Bhuyyar
6. Dr Pranesh Jahagirdar
7. Dr Manjunatha Aithala
8. Dr Satish Patil
9. Dr Mohammed Shannawaz

IEC/NU-121/2019
22-11-2019

B.L.D.E. (DEEMED TO BE UNIVERSITY)
(Declared vide notification No. F.9-37/2007-U.3 (A) Dated. 25-2-2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)
The Constituent College
SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The ethical committee of this college met on 13-11-2019 at 3-15 pm to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: Screening for hearing loss in high risk neonates in a tertiary care centre using Oae.

Name of PG student: Dr Tanmaya Tyagaraj, Department of Paediatrics

Name of Guide/Co-investigator: Dr M M Patil Professor Department of Paediatrics

DR RAGHVENDRA KULKARNI
CHAIRMAN
Institutional Ethical Committee
BLDEU's Shri B.M. Patil
Medical College,BIJAPUR-586103

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.

18

ANNEXURE-II

B.L.D.E.U. SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR-586103

RESEARCH INFORMED CONSENT FORM

PURPOSE OF RESEARCH:

I have been informed that the present study will help in screening for hearing loss in high risk neonates admitted to Shri B.M. Patil Medical College.

PROCEDURE:

I understand that after having obtained a detailed clinical history, thorough clinical examination and relevant investigations, hearing screening will be done in high risk neonates.

RISK AND DISCOMFORTS:

I understand there is no risk involved and that the baby may experience some pain and discomforts during the examination. This is mainly the result of the condition and the procedures of this study are not expected to exaggerate these feelings which are associated with the usual course of treatment.

BENEFITS:

I understand that my participation in the study will have no direct benefit to me other than the potential benefit of the research and education.

CONFIDENTIALITY:

I understand that the medical information produced by this study will become a part of hospital records and will be subject to the confidentiality. Information of sensitive personal nature will not be part of the medical record, but will be stored in the investigations research file. If the data are used for publication in the medical literature or for teaching purpose, no name will be used and other identifiers such as photographs will be used only with special written permission. I understand that I may see the photograph before giving the permission

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time; Dr.Tanmaya Tyagaraj, at the department of Pediatrics is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might influence my continued participation. A copy of this consent form will be given to me to keep for careful reading.

REFUSAL FOR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice. I also understand that Dr. Tanmaya Tyagaraj may terminate my participation in the study after she has explained the reasons for doing so.

INJURY STATEMENT:

I understand that in the unlikely event of injury to my baby resulting directly from baby's participation in this study, if such injury were reported promptly, the appropriate treatment would be available to the baby. But, no further compensation would be provided by the hospital. I understand that by my agreements to participate in this study and not waiving any of my legal rights.

I have explained to the purpose of the research, the procedures required, and the possible risks to the best of my ability.

_____ _____

Dr. Tanmaya Tyagaraj Date

(Investigator)

PARENTS / GUARDIAN CONSENT STATEMENT:

We confirm that Dr. Tanmaya Tyagaraj is doing a study on **"**Hearing screening in high risk neonates in a tertiary care center using otoacoustic emissions" a hospital based prospective observational study. Dr.Tanmaya Tyagaraj has explained to us the purpose of research and the study procedure. We are willing to give as much as information required for the study and consent for investigations and the possible discomforts as well as benefits. We have been explained all the above in detail in our own language and we understand the same.

Therefore we agree to give consent for the baby's participation as a subject in this research project.

_____ _____

(Parents / Guardian) Date

_____ _____

(Witness to signature) Date

ANNEXURE – III

PROFORMA

HEARING SCREENING OF HIGH-RISK NEONATES USING OTOACOUSTIC EMISSION (OAE)

Name :

Age (days/weeks):

Sex –Male /Female

Address OP No.

Phone No IP No.

DOB

Mother Age: Parity

Socioeconomic Class – Lower / Middle/Higher

Racial and Ethnic differences :

(Any genetic predisposition)

Antenatal history

Birth weight

Diagnosis in NICU

Antenatal check-ups: done/not done

History s/o intrauterine Infection.

Physical examination

Vitals Temp RR HR

General examination

Pallor / Jaundice/Cyanosis/ Edema /Clubbing;

Other relevant findings -

RS/ P/A/CNS/CVS

Investigation

Serum Bilirubin

Sepsis Screen-

Neurosonogram

ECHO

Treatment History:

IV Antibiotics- Drug Dose duration

Any Ototoxic medication- Drug Dose duration

Oxygen

Mechanical Ventilation

Phototherapy/ Exchange Blood Transfusion

OAE Test

First Screen date Result; Pass/Refer

Second Screen date Result; Pass/Refer

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Baby of	Age	Sex	IP/OP no	Diagnosis (in NICU)	Gesta	Birth weigl	Gesta	weight	Parit	Maternal H	Socioe	Serum Bil	Sepsis S	Neurosono	2D echo	Respiratory su	IV Antibiot	OAE Rigl	OAE Le	OAE right	OAE left ea
2	Geetha	5	Male	108720	Birth Asphyxia/ Dela	38	2700	Term	AGA	1	Uneventful	upper	not applic	Positive	Normal	PFO	Nasal / Hood	Piptaz, Am	Pass	Pass		
3	Jagadev	5	Male	108650	NNHB	38	2600	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
4	Nagla N	5	Male	108638	Birth Asphyxia/ Dela	39	2700	Term	AGA	1	Uneventful	lower	not applic	Negative	Normal	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
5	Neelamı	4	Male	100648	Birth Asphyxia/ Dela	36	2200	Late	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
6	Savitha	4	Male	100643	MAS	38	2400	Term	AGA	2	Uneventful	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
7	Shridevi	5	Fem	41060	MAS	38	3200	Term	AGA	2	Uneventful	lower	normal	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
8	Megha I	10	Male	40456	NNHB	37	2800	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
9	Laxmi pu	7	Male	98156	Birth Asphyxia/ Dela	37	2600	Term	AGA	1	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
10	Ashwini	6	Fem	40964	TTNB	38	2950	Term	SGA	3	Uneventful	lower	not applic	Negative	Not Done	PDA	Nasal / Hood	Piptaz	Pass	Pass		
11	Shobha	10	Fem	40552	MAS	40	2760	Term	AGA	1	Uneventful	lower	not applic	Negative	Not Done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
12	Jyothi Je	8	Male	95117	RDS	30	1200	Prete	SGA	2	PIH/ Pre ec	lower	photothe	Positive	Normal	PFO, PDA,	CPAP	Piptaz, Me	Pass	Pass		
13	Lalitha k	5	Male	93517	RDS	34	2300	Late	AGA	2	PIH/ Pre ec	upper	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
14	Pooja JH	5	Male	41457	NNHB	39	3100	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
15	Laxmi H	6	Male	91678	Birth Asphyxia/ Dela	38	2800	Term	AGA	1	Uneventful	lower	not applic	Negative	Not done	PFO	Nasal / Hood	Piptaz	Pass	Pass		
16	Savitha	7	Fem	89097	MAS	37	2400	Term	AGA	1	Uneventful	lower	not applic	Negative	Not done	PFO, PAH	Nasal / Hood	Piptaz, Am	Pass	Pass		
17	Kaveri G	7	Fem	41744	NNHB	38	2650	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
18	Mallamr	8	Male	88907	Birth Asphyxia/ Dela	38	3000	Term	AGA	1	Uneventful	lower	not applic	Negative	HIE	PFO, PAH	Mechanical V	Piptaz, Am	Pass	Pass		
19	Lakshmi	9	Male	79329	Birth Asphyxia/ Dela	39	2700	Term	AGA	2	Uneventful	lower	not applic	Positive	HIE	PFO, PDA,	Mechanical V	Piptaz, Am	Pass	Pass		
20	Aishwar	5	Male	72933	RDS	30	1100	Prete	SGA	1	PIH/ Pre ec	upper	not applic	Positive	HIE	PFO, PDA,	Mechanical V	Piptaz, Am	Pass	Pass		
21	Nirmala	22	Male	41422	RDS	33	2300	Prete	AGA	1	Uneventful	lower	normal	Negative	Normal	PFO	CPAP	Piptaz	Pass	Pass		
22	Savithri	5	Male	75948	Congenital pneumo	39	2700	Term	AGA	1	PPROM or	lower	not applic	Positive	Not done	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
23	Shantha	9	Male	82719	NNHB	38	2900	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
24	Bibifath	5	Fem	67919	MAS, PPHN	39	2700	Term	AGA	3	Uneventful	lower	not applic	Positive	Normal	PDA, PAH	HHHFNC	Piptaz, Am	Pass	Pass		
25	Roopa V	10	Male	60647	Birth Asphyxia/ Dela	38	2900	Term	AGA	1	Uneventful	upper	not applic	Negative	HIE	PFO, PAH	Nasal / Hood	Piptaz	Pass	Pass		
26	Rizwana	8	Fem	59441	Birth Asphyxia/ Dela	38	3100	Term	AGA	2	Uneventful	lower	not applic	Negative	HIE	PDA	Nasal / Hood	Piptaz, Am	Pass	Pass		
27	Anitha P	19	Male	40338	TTNB	34	2200	Late	AGA	2	Uneventful	upper	not applic	Positive	Normal	PFO	CPAP	Piptaz, Am	Pass	Pass		
28	Devamn	6	Fem	57936	Birth Asphyxia/ Dela	38	2900	Term	AGA	1	Uneventful	upper	not applic	Negative	Normal	Normal	HHHFNC	Piptaz	Pass	Pass		
29	Sahana	6	Male	52114	NNHB	39	2600	Term	AGA	2	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
30	Shruthi (	6	Fem	56283	Birth Asphyxia/ Dela	40	3000	Term	AGA	1	Uneventful	lower	not applic	Positive	Norm	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
31	Padmav	15	Male	39590	Hypoglycemic seizur	38	2900	Term	AGA	2	Uneventful	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
32	Kaveri N	6	Male	48231	NNHB, MAS	38	2650	Term	AGA	2	Uneventful	lower	photothe	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
33	Rukmini	6	Fem	45321	MAS	40	2760	Term	AGA	1	Uneventful	lower	not applic	Positive	Not done	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
34	Iramma	20	Male	40329	RDS	34	2310	Late	AGA	1	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
35	Athira W	30	Male	40156	NNHB	40	3000	Term	AGA	1	Uneventful	upper	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
36	Bhagyas	20	Male	39940	NNHB	38	2600	Term	AGA	2	Uneventful	lower	photothe	Negative	Not Done	Not Done	None	none	Pass	Pass		
37	Pavitra	23	Fem	41144	RDS	33	2000	Prete	AGA	1	Uneventful	upper	not applic	Negative	Normal	Normal	CPAP	Piptaz, Am	Pass	Pass		
38	Pavitra	23	Male	41143	RDS	33	2100	Prete	AGA	1	Uneventful	lower	not applic	Negative	normal	Normal	CPAP	Piptaz, Am	Pass	Pass		
39	Rajashri	8	Male	41412	NNHB	39	2500	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
40	Shahin C	6	Fem	1503	NNHB	40	2900	Prete	AGA	2	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
41	Pooja Sa	8	Fem	1151	NNHB	39	3400	Term	AGA	1	Uneventful	upper	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
42	Sunitha	10	Fem	40294	MAS	38	3000	Term	AGA	1	Uneventful	upper	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
43	Jayashri	6	Male	2295	RDS	33	2100	Prete	AGA	2	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
44	Shirin C	10	Male	40823	RDS	36	2100	Late	AGA	1	Uneventful	upper	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
45	Farahan	15	Male	39590	RDS	34	1800	Late	SGA	2	PIH/ Pre ec	lower	not applic	Positive	Normal	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
46	BibiAyes	13	Male	1790	RDS	32	1800	Prete	AGA	1	Uneventful	lower	not applic	Negative	Not Done	Normal	CPAP	Piptaz	Pass	Pass		
47	Sameen	12	Fem	39346	RDS	32	1540	Prete	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	Normal	CPAP	Piptaz	Pass	Pass		
48	Laxmi Sa	12	Male	27837	RDS, PPHN	35	2200	Late	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	PDA, PAH	Nasal / Hood	Piptaz, Am	Pass	Pass		
49	Roopa S	13	Fem	1796	MAS, PPHN	41	3000	Term	AGA	4	Uneventful	upper	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
50	Shivaka	15	Male	1822	NNHB	39	3270	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
51	Shaila K	20	Male	40042	NNHB	39	2780	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
52	Yallaww	10	Male	2546	Birth Asphyxia/ Dela	38	3100	Term	AGA	2	Uneventful	lower	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
53	Mayamr	8	Male	72278	RDS	30	1300	Prete	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	PDA	CPAP	Piptaz	Pass	Pass		
54	Ambika	4	Male	4348	RDS	33	1700	Prete	AGA	1	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
55	Ambika	4	Fem	4347	RDS	33	1640	Prete	AGA	1	Uneventful	lower	not applic	Negative	Normal	Normal	CPAP	Piptaz	Pass	Pass		
56	Nivedith	5	Male	4310	NNHB	40	4310	Term	AGA	2	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
57	Aisha Ha	6	Fem	4199	RDS	35	2300	Late	AGA	2	Uneventful	lower	not applic	Negative	Not Done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
58	Afreen B	6	Male	4178	TTNB	37	2100	Term	SGA	1	Uneventful	lower	photothe	Negative	Not Done	Normal	None	Piptaz	Pass	Pass		
59	Anitha P	8	Male	3901	TTNB	38	2600	Term	AGA	2	Uneventful	lower	normal	Negative	Normal	PDA	Nasal / Hood	Piptaz	Pass	Pass		
60	Prema C	8	Male	3942	RDS	35	1900	Late	AGA	3	Uneventful	lower	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz, Am	Pass	Pass		
61	Sunitha	18	Male	1668	RDS	31	1600	Prete	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz, Am	Pass	Pass		
62	Shakunt	21	Fem	2269	RDS	32	1450	Prete	SGA	2	PIH/ Pre ec	upper	not applic	Negative	Normal	Normal	CPAP	Piptaz	Pass	Pass		
63	Shruthi	12	Male	4136	NNHB	40	2760	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
64	Nagamn	10	Male	4354	RDS	32	1580	Prete	AGA	2	PIH/ Pre ec	lower	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
65	Anjum M	10	Male	4508	RDS	33	1760	Prete	AGA	3	Uneventful	lower	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
66	Pooja Be	13	Fem	4204	NNHB	38	2800	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
67	Danamn	9	Male	4705	RDS	32	1340	Prete	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
68	Danamn	9	Fem	4707	RDS	32	1410	Prete	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz, Am	Pass	Pass		
69	Danamn	9	Fem	4708	RDS	32	1400	Prete	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	PDA	Nasal / Hood	Piptaz, Am	Pass	Pass		
70	Neelam	11	Fem	27626	Birth Asphyxia/ Dela	38	3000	Term	AGA	3	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
71	Jyothi P	18	Male	35603	Birth Asphyxia/ Dela	39	2900	Term	AGA	1	Uneventful	lower	not applic	Negative	Normal	PAH	HHHFNC	Piptaz	Pass	Pass		
72	Shaheec	20	Male	35622	RDS	35	1700	Late	SGA	2	GDM	lower	normal	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
73	Anushre	40	Fem	27733	Birth Asphyxia/ Dela	39	3000	Term	AGA	1	Uneventful	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
74	Sadiya S	12	Male	23375	TTNB	38	2600	Term	AGA	3	Breech	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
75	Bharath	10	Male	24445	NNHB	38	2800	Term	AGA	3	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
76	Bansid P	48	Male	21725	Sepsis: EOS/LOS, An	39	2900	Term	AGA	1	PPROM or	lower	not applic	Positive	Not done	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
77	Shivraj B	56	Male	22552	Septic arthritis	38	3200	Term	AGA	1	Uneventful	upper	not applic	Positive	Not done	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
78	Lakshmi	10	Fem	24365	NNHB	38	2600	Term	AGA	3	Uneventful	upper	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
79	Renuka	13	Male	22633	RDS	33	1700	Late	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
80	Deepa	13	Fem	22571	RDS, Birth Asphyxia	33	2100	Late	AGA	1	Threatene	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
81	Anitha	4	Fem	24541	TTNB	38	2600	Term	AGA	1	Uneventful	lower	not applic	Positive	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
82	Kaveri L	5	Fem	24522	Birth Asphyxia/ Dela	38	2500	Term	AGA	1	Uneventful	lower	not applic	Negative	Normal	Not done	Nasal / Hood	Piptaz	Pass	Pass		
83	Ashwini	5	Male	24302	Congenital pneumor	39	2600	Term	AGA	2	Uneventful	lower	not applic	Negative	Not done	PFO, PDA	Nasal / Hood	Piptaz, Am	Pass	Pass		
84	Preethi	7	Male	23826	NNHB	39	2700	Term	AGA	1	Uneventful	upper	photothe	Negative	Not done	Not done	None	none	Pass	Pass		
85	Lalima	6	Male	24147	RDS	34	2200	Late	AGA	###	PIH/ Pre ec	lower	not applic	Negative	Not done	PFO, PDA	Nasal / Hood	Piptaz	Pass	Pass		
86	Suman M	8	Male	24574	NNHB	38	2650	Term	AGA	2	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
87	Mamath	14	Male	21775	RDS	35	2000	Late	AGA	1	Anaemia	lower	photothe	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
88	Ambavv	14	Fem	22063	RDS	32	1300	Prete	SGA	1	PIH/ Pre ec	lower	not applic	Negative	Flare	PFO, PDA	CPAP	Piptaz, Me	Pass	Pass		
89	Shamsa	8	Male	23492	RDS	32	1400	Prete	SGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	PFO	CPAP	Piptaz	Pass	Pass		
90	Misaba	41	Male	17625	RDS	32	1800	Prete	AGA	2	PPROM or	lower	not applic	Positive	Normal	PFO, PAH	CPAP	Piptaz, Am	Pass	Pass		
91	Shoba H	7	Male	22852	RDS, Sepsis: EOS/LO	27	1000	Prete	AGA	3	PIH/ Pre ec	lower	not applic	Negative	Normal	Global hyp	CPAP	Piptaz	Pass	Pass		
92	Jayashri	8	Fem	22484	Birth Asphyxia/ Dela	39	2800	Term	AGA	2	Uneventfu	lower	not applic	Negative	Normal	Not done	Nasal / Hood	Piptaz	Pass	Pass		
93	Anita Yo	11	Fem	23041	Birth Asphyxia/ Dela	40	3200	Term	AGA	3	Uneventfu	lower	not applic	Positive	HIE	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
94	Sangeet	11	Fem	24596	NNHB	39	2640	Term	AGA	1	Uneventfu	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
95	Shankar	6	Fem	23036	Congenital pneumor	34	1800	Late	AGA	2	PPROM or	lower	not applic	Negative	Not done	PDA	Nasal / Hood	Piptaz	Pass	Pass		
96	Suman	6	Male	23363	RDS	35	2000	Late	AGA	2	PIH/ Pre ec	lower	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
97	Manasvi	8	Male	35582	Birth Asphyxia/ Dela	35	2000	Late	AGA	2	Uneventfu	upper	not applic	Negative	Normal	PDA, PAH	Nasal / Hood	Piptaz, Am	Pass	Pass		
98	Savitha I	15	Male	35586	PPHN	36	2000	Late	AGA	1	GDM	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
99	Shamith	24	Male	35742	NNHB	38	2800	Term	AGA	1	Uneventfu	lower	photothe	Negative	Not done	Not done	None	none	Pass	Pass		
100	Pruthas	24	Male	35575	RDS, Polycythemia	35	2000	Late	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
101	Renuka	20	Male	35574	RDS	32	1400	Prete	SGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	PFO, PAH	CPAP	Piptaz	Pass	Pass		
102	Akshath	12	Male	35572	RDS, PPHN	31	1500	Prete	AGA	3	PIH/ Pre ec	upper	not applic	Positive	Normal	PFO, PAH	CPAP	Piptaz, Am	Pass	Pass		
103	Prashan	25	Male	35591	RDS	29	1200	Prete	AGA	1	PIH/ Pre ec	lower	not applic	Positive	Flare	PDA, PAH	Mechanical V	Piptaz, Am	Pass	Pass		
104	Shamsir	12	Male	35623	RDS, PPHN	34	2200	Late	AGA	1	Uneventfu	lower	not applic	Negative	Normal	PFO, PDA,	CPAP	Piptaz	Pass	Pass		
105	Vijayala	7	Fem	18787	TTNB	37	2800	Term	AGA	1	Uneventfu	upper	not applic	Negative	Normal	PFO, PDA	Nasal / Hood	Piptaz, Am	Pass	Pass		
106	Pooja ka	8	Fem	18782	MAS	38	2700	Term	AGA	2	Uneventfu	lower	not applic	Negative	Not done	PDA	Nasal / Hood	Piptaz	Pass	Pass		
107	Kashimb	9	Fem	18311	TTNB	37	2600	Term	AGA	1	Uneventfu	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
108	Rekha	26	Fem	12669	RDS, IDM	32	1650	Late	SGA	3	GDM	lower	not applic	Negative	Normal	PFO	CPAP	Piptaz	Pass	Pass		
109	Gurubai	14	Male	17405	NNHB	40	2800	Term	AGA	1	Uneventfu	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
110	Shobha	45	Male	8649	PPHN	32	1700	Prete	SGA	2	Uneventfu	lower	not applic	Negative	Normal	PDA, ASD	Nasal / Hood	Piptaz	Pass	Pass		
111	Ashwini	23	Fem	12302	RDS	32	1600	Late	SGA	1	Uneventfu	upper	not applic	Negative	Normal	PFO, PDA	CPAP	Piptaz	Pass	Pass		
112	Jyothi	80	Male	13625	HIE	28	1100	Prete	SGA	1	Uneventfu	upper	not applic	Positive	Normal	PFO, PDA	Nasal / Hood	Piptaz, Me	Pass	Pass		
113	Meenak	9	Fem	16217	RDS, GDM	35	1800	Late	SGA	1	GDM	lower	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
114	Jayashre	8	Male	17467	TTNB, NNHB	38	2500	Term	AGA	1	Uneventfu	upper	photothe	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
115	Savitha	26	Fem	18064	RDS	33	1200	Late	SGA	1	Twin gesta	upper	normal	Negative	Normal	PDA	CPAP	Piptaz	Pass	Pass		
116	Priyanka	7	Male	15481	Dehydration	37	2600	Term	SGA	1	Uneventfu	lower	normal	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
117	Ashwini	7	Male	15689	Birth Asphyxia/ Dela	38	2800	Term	AGA	1	Uneventfu	lower	normal	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
118	Nagamn	8	Male	15487	Birth Asphyxia/ Dela	38	3100	Term	AGA	1	Uneventfu	lower	not applic	Positive	Normal	PDA	Nasal / Hood	Piptaz, Am	Pass	Pass		
119	Shrada	9	Fem	15427	PPHN	40	3000	Term	AGA	2	Uneventfu	upper	normal	Positive	Normal	PDA	Nasal / Hood	Piptaz, Me	Pass	Pass		
120	Ashwini	16	Fem	13320	RDS	28	1200	Prete	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	PFO, PDA	Mechanical V	Piptaz	Pass	Pass		
121	Rajashre	10	Male	13554	Birth Asphyxia/ Dela	34	2000	Prete	AGA	1	Uneventfu	lower	normal	Positive	Normal	PFO	HHHFNC	Piptaz	Pass	Pass		
122	Sidamm	10	Male	13551	Birth Asphyxia/ Dela	36	1900	Late	SGA	2	Uneventfu	lower	normal	Negative	HIE	Normal	Mechanical V	Piptaz, Am	Pass	Pass		
123	Khatubi	14	Fem	12820	MAS	39	3000	Term	AGA	2	Uneventfu	upper	not applic	Positive	Normal	Normal	Mechanical V	Piptaz, Am	Pass	Pass		
124	Sanjana	10	Male	35621	RDS	34	2090	Late	SGA	1	Uneventfu	lower	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
125	Radhika	14	Male	11734	Birth Asphyxia/ Dela	35	2100	Late	AGA	4	Uneventfu	lower	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
126	Savitha	47	Male	2E+06	Sepsis: EOS/LOS	38	2590	Term	AGA	1	PPROM or	upper	normal	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
127	Sangeeth	46	Male	2768	Birth Asphyxia/ Dela	38	2700	Term	AGA	1	Uneventfu	upper	normal	Negative	Normal	Normal	Nasal / Hood	Amikacin	Pass	Pass		
128	Rekha C	5	Fem	12669	RDS, IDM	32	1800	Prete	AGA	3	GDM	upper	normal	Negative	Normal	PFO	CPAP	Piptaz, Am	Pass	Pass		
129	Jyothi p	48	Male	2E+06	PPHN	38	2560	Term	AGA	1	Uneventfu	upper	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
130	Sunitha	10	Fem	11696	RDS	35	1800	Prete	AGA	2	PIH/ Pre ec	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
131	Rajashre	9	Male	11492	RDS	32	1300	Term	AGA	3	PIH/ Pre ec	upper	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
132	Annapur	13	Fem	10998	RDS	34	2200	Term	SGA	1	PPROM or	upper	normal	Positive	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
133	Roopa A	12	Fem	11291	NNHB	39	2600	Term	AGA	2	Uneventful	lower	photothe	Not app	Not done	Normal	None	none	Pass	Pass		
134	Jyothi B	13	Male	10917	Birth Asphyxia/ Dela	36	2400	Prete	AGA	1	Uneventful	lower	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
135	Pooja	8	Fem	1681	MAS	38	3100	Prete	AGA	2	Uneventful	upper	not applic	Negative	Normal	Not applica	Nasal / Hood	Piptaz	Pass	Pass		
136	Lakshmi	28	Fem	10865	RDS	32	1900	Prete	SGA	1	Precious p	upper	not applic	Negative	Normal	Normal	CPAP	Piptaz, Am	Pass	Pass		
137	Prakruti	6	Fem	9644	MAS	38	2650	Term	AGA	1	Uneventful	upper	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
138	Surekha	8	Male	9427	NNHB	38	2600	Term	AGA	2	Uneventful	upper	photothe	Negative	Not applica	Normal	None	none	Pass	Pass		
139	Sujatha	9	Fem	10071	NNHB, Dehydration	37	2400	Term	AGA	2	Uneventful	upper	photothe	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
140	Shobha	8	Male	8649	RDS	32	1400	Prete	SGA	2	PIH/ Pre ec	lower	not applic	Positive	Normal	PDA, PAH,	Nasal / Hood	Piptaz, Me	Pass	Pass		
141	Jyothi	34	Male	13625	Sepsis: EOS/LOS	28	1100	Prete	AGA	1	PIH/ Pre ec	upper	not applic	Positive	HIE	PFO, PDA,	Mechanical V	Piptaz, Me	Refer	Pass		
142	Kavitha	10	Male	2E+06	MAS, PPHN	40	2850	Term	AGA	1	Uneventful	upper	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
143	Sunitha	12	Fem	1541	NNHB	38	2650	Term	AGA	2	Uneventful	lower	photothe	Not app	Not done	Normal	None	none	Pass	Pass		
144	Sidamm	18	Fem	6073	Birth Asphyxia/ Dela	38	3100	Term	AGA	1	Uneventful	upper	normal	Negative	Not applica	Normal	Nasal / Hood	Piptaz	Pass	Pass		
145	Devika	17	Male	202069	MAS, PPHN	40	2800	Term	AGA	1	Uneventful	upper	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
146	Anjana	17	Male	19052	NNHB	39	3200	Term	AGA	2	Uneventful	upper	photothe	Not app	Not applica	Normal	None	none	Pass	Pass		
147	Renuka	20	Fem	18916	RDS	30	1600	Prete	AGA	1	PIH/ Pre ec	upper	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
148	Pooja M	22	Fem	18822	RDS	35	2210	Late (	AGA	2	Anaemia	lower	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
149	Deepa	23	Male	18841	TTNB	35	2300	Late (	AGA	2	Uneventful	lower	normal	Negative	Not applica	Normal	Nasal / Hood	Piptaz	Pass	Pass		
150	Gauri Ku	22	Fem	18736	Sepsis: EOS/LOS, NN	37	2200	Term	SGA	3	Previous LS	lower	photothe	Positive	Normal	ASD	Nasal / Hood	Piptaz	Pass	Pass		
151	Shantam	23	Male	18800	NEC	35	1800	Late (	AGA	2	PIH/ Pre ec	upper	not applic	Negative	Normal	Normal	Nasal / Hood	none	Pass	Pass		
152	Pooja Ra	18	Male	18730	Sepsis: EOS/LOS	36	2300	Late (	AGA	1	Uneventful	lower	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
153	Jyothi	19	Fem	18680	Polycythemia	35	2100	Prete	SGA	1	GDM	upper	normal	Positive	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
154	Laxmi	22	Fem	18457	Congenital pneumo	34	2200	Prete	AGA	1	PIH/ Pre ec	lower	normal	Positive	Normal	PFO	CPAP	Piptaz, Am	Pass	Pass		
155	Draksha	21	Male	1390	NNHB	37	2900	Term	AGA	1	Uneventful	lower	photothe	Negative	Normal	Normal	None	none	Pass	Pass		
156	Kasturi	11	Fem	1684	Polycythemia	32	1400	Term	AGA	1	Uneventful	upper	normal	Positive	Not applica	Normal	Nasal / Hood	Piptaz	Pass	Pass		
157	Kasturi T	11	Male	1683	Polycythemia	32	1600	Prete	AGA	1	Twin gesta	upper	not applic	Negative	Normal	Not applica	Nasal / Hood	Piptaz	Pass	Pass		
158	Kamala	20	Fem	17953	Birth Asphyxia/ Dela	39	3000	Term	AGA	2	Uneventful	upper	photothe	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
159	Sangeet	5	Male	18916	RDS	35	1420	Prete	SGA	1	PIH/ Pre ec	upper	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
160	Pushpa	14	Fem	18318	RDS, NEC	34	1500	Prete	SGA	1	Uneventful	lower	normal	Positive	Normal	PFO	Nasal / Hood	Piptaz, Am	Pass	Pass		
161	Kavitha	20	Male	17946	Birth Asphyxia/ Dela	38	3200	Term	AGA	3	Uneventful	upper	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
162	Aswini	16	Fem	5166	TTNB	35	2200	Late (	AGA	3	Uneventful	upper	normal	Negative	Not applica	Normal	Nasal / Hood	Piptaz	Pass	Pass		
163	Suma Su	21	Male	17716	RDS, Anemia	30	1640	Prete	SGA	1	Uneventful	upper	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
164	Komal	23	Male	17580	RDS	31	1560	Prete	AGA	2	Uneventful	lower	not applic	Positive	Not applica	Normal	Nasal / Hood	none	Pass	Pass		
165	Shahista	20	Fem	168074	RDS	32	1740	Prete	AGA	2	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
166	Rajashre	5	Fem	18647	MAS	38	2560	Term	SGA	2	Uneventful	lower	normal	Negative	Not applica	Normal	Nasal / Hood	Piptaz	Pass	Pass		
167	Yamuna	5	Fem	18656	NNHB	39	2600	Term	AGA	1	Uneventful	lower	photothe	Negative	Not done	Not applica	None	none	Pass	Pass		
168	Pooja	13	Male	18202	Birth Asphyxia/ Dela	36	2400	Late (	AGA	2	Uneventful	lower	photothe	Positive	Not applica	Normal	Mechanical V	Piptaz, Am	Pass	Pass		
169	Pooja ch	8	Fem	18428	RDS	35	2000	Late (	AGA	3	Uneventful	lower	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
170	Savitri R	12	Fem	18828	HIE 1	38	2800	Term	AGA	1	Uneventful	lower	photothe	Positive	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
171	Roopa E	29	Fem	166325	RDS, Anemia	32	2200	Prete	AGA	1	Uneventful	upper	normal	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
172	Deepa K	15	Male	16832	RDS	34	2000	Late (	AGA	2	Uneventful	upper	normal	Negative	Normal	Not applica	Nasal / Hood	Piptaz	Pass	Pass		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
173	Sunitha	25	Fem	166299	RDS	35	2300	Late	AGA	1	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
174	Jyothi H	32	Male	166325	RDS	32	1900	Prete	AGA	2	Twin gesta	upper	normal	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
175	Jyothi H	32	Fem	166324	RDS	32	1560	Prete	AGA	2	Twin gesta	upper	normal	Positive	Normal	Normal	CPAP	Piptaz, Am	Pass	Refer	Pass	Pass
176	Ayesha S	50	Male	166333	Sepsis: EOS/LOS, M	39	3200	Term	AGA	2	Uneventful	upper	normal	Positive	Not done	Not applica	Nasal / Hood	Piptaz	Pass	Pass		
177	Ashwini	41	Male	166254	Birth Asphyxia/ Dela	41	3400	Term	AGA	1	Uneventful	lower	not applic	Negative	Normal	Not applica	Nasal / Hood	Piptaz	Refer	Refer	Pass	Pass
178	Kamala	12	Fem	166320	NNHB	39	3200	Term	AGA	2	Uneventful	upper	not applic	Negative	Normal	Not applica	Nasal / Hood	Piptaz	Pass	Pass		
179	Ayesha	5	Male	15165	NNHB	37	2770	Term	AGA	1	Uneventful	upper	photothe	Negative	Normal	Not applica	None	none	Pass	Pass		
180	Sangam	17	Male	15326	RDS	35	2200	Late	AGA	1	Uneventful	upper	normal	Positive	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
181	Bhagyas	23	Male	15296	NNHB	39	2800	Term	AGA	4	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Refer	Refer		
182	Roopa B	14	Male	16585	RDS	33	1980	Late	AGA	1	GDM	upper	photothe	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
183	Maimun	6	Male	15562	Cleft lip and cleft pa	37	3000	Term	AGA	###	Uneventful	lower	not applic	Positive	Normal	Not done	Nasal / Hood	Piptaz, Am	Refer	Refer		
184	Prabhav	12	Fem	15438	TTNB	34	2100	Late	AGA	2	Twin gesta	upper	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
185	Prabhav	12	Fem	15437	TTNB	34	2120	Late	AGA	2	Twin gesta	upper	photothe	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
186	Archana	7	Male	15361	TTNB	35	2100	Late	AGA	1	PIH/ Pre ec	lower	normal	Negative	Not done	PFO	Nasal / Hood	Piptaz, Am	Pass	Refer	Pass	Pass
187	Sadiya S	20	Fem	13649	Birth Asphyxia/ Dela	28	1100	Prete	AGA	1	PIH/ Pre ec	lower	photothe	Positive	Normal	PFO	Mechanical V	Piptaz, Am	Pass	Pass		
188	Savitha I	13	Fem	14960	MAS	40	3500	Term	AGA	2	Uneventful	lower	not applic	Positive	Normal	ASD	Nasal / Hood	Piptaz	Pass	Pass		
189	Sangeeth	9	Fem	14928	TTNB, NNHB	38	3000	Term	AGA	2	Uneventful	lower	photothe	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
190	Misba A	17	Fem	166836	RDS, Birth Asphyxia	30	1300	Prete	AGA	2	Established	lower	normal	Positive	Normal	Normal	Mechanical V	Piptaz, Am	Pass	Pass		
191	Shoba c	7	Fem	13997	NNHB	40	2800	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
192	Keerthi	5	Male	14171	NNHB	39	3500	Term	AGA	2	Uneventful	lower	photothe	Negative	Not done	Not done	None	none	Pass	Pass		
193	Renuka	73	Male	16830	RDS	31	1400	Prete	SGA	2	PIH/ Pre ec	upper	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
194	Vaishali	42	Male	15944	MAS	36	2300	Late	AGA	3	Uneventful	lower	normal	Positive	Not done	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
195	Fathima	32	Fem	13596	TTNB	39	2100	Term	SGA	3	Uneventful	lower	not applic	Positive	Normal	PFO, PDA	Mechanical V	Piptaz, Am	Pass	Pass		
196	Bhagyas	8	Male	13545	RDS	33	2000	Prete	AGA	2	PIH/ Pre ec	lower	not applic	Positive	Not done	Not done	Nasal / Hood	Piptaz	Pass	Refer		
197	Bhagyas	5	Fem	15450	RDS	35	2200	Late	AGA	1	GDM	lower	not applic	Positive	Not done	PFO, PDA	Nasal / Hood	Piptaz	Pass	Pass		
198	Sunitha	5	Male	15457	TTNB	38	2700	Term	AGA	1	Uneventful	lower	not applic	Positive	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
199	Sushma	12	Fem	4842	RDS	31	1980	Prete	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Normal	PFO, PDA	Nasal / Hood	Piptaz, Am	Pass	Pass		
200	Bharath	12	Fem	4853	RDS	36	2300	Late	AGA	2	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
201	Shabeer	8	Male	5424	RDS	34	2100	Prete	AGA	2	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
202	Sudhara	5	Male	6186	NNHB	38	2790	Term	AGA	1	Uneventful	lower	not applic	Positive	Not Done	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
203	Bhagyas	9	Male	5775	NNHB	38	2560	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
204	Shaila B	8	Male	5847	TTNB	39	2340	Term	AGA	1	Uneventful	lower	not applic	Negative	Not Done	Not Done	Nasal / Hood	Piptaz	Pass	Pass		
205	Deepa B	10	Male	5678	RDS	34	2000	Prete	AGA	1	Uneventful	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
206	Akshath	9	Male	5751	MAS	40	3200	Term	AGA	1	Uneventful	lower	not applic	Negative	Not Done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
207	Laxmi m	11	Male	15040	RDS	32	1990	Prete	AGA	4	Uneventful	lower	not applic	Positive	Not done	PFO	Nasal / Hood	Piptaz	Pass	Pass		
208	Kaveri	9	Fem	15195	Bacterial meningitis	38	2360	Term	AGA	1	Uneventful	lower	not applic	Positive	Normal	PFO	Nasal / Hood	Piptaz, Am	Pass	Pass		
209	Shilpa Ju	6	Male	15397	MAS	37	2600	Term	AGA	1	Uneventful	lower	not applic	Positive	Not done	ASD	Nasal / Hood	Piptaz	Refer	Refer	Pass	Pass
210	Lakshmi	11	Fem	6010	NNHB	39	2900	Term	AGA	1	Uneventful	lower	photothe	Negative	Not Done	Not Done	None	Piptaz	Pass	Pass		
211	Kavitha	18	Male	14663	Bacterial meningitis	38	2400	Term	AGA	3	Uneventful	lower	not applic	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Refer	Pass	Pass
212	Akshath	9	Fem	6318	NNHB	38	2600	Term	AGA	1	Uneventful	lower	photothe	Not app	Not Done	Not Done	None	none	Pass	Pass		
213	Savitha	22	Fem	13112	NNHB, MAS	40	2360	Term	AGA	1	Uneventful	lower	photothe	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
214	Jyothi B	40	Male	1594	Birth Asphyxia/ Dela	40	3300	Term	AGA	1	Uneventful	lower	photothe	Positive	HIE	Normal	Mechanical V	Piptaz, Am	Refer	Refer	Pass	Pass
215	Bhagyas	7	Fem	13962	Birth Asphyxia/ Dela	38	2600	Term	AGA	2	Uneventful	lower	photothe	Negative	Normal	PAH	Nasal / Hood	Piptaz	Pass	Pass		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
216	Bibihasa	4	Male	6857	MAS	40	3200	Term	AGA	1	Uneventful	lower	not applic	Positive	Not Done	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
217	Bhagyas	9	Fem	13753	Sepsis: EOS/LOS, NN	38	2700	Term	AGA	1	Uneventful	lower	photothe	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
218	Ashwini	4	Fem	6885	RDS	30	1650	Prete	AGA	2	PIH/ Pre ec	lower	not applic	Negative	Normal	Normal	Nasal / Hood	Piptaz	Pass	Pass		
219	Sarswat	9	Male	13828	RDS	35	2400	Late (	AGA	2	Uneventful	lower	normal	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
220	Anitha E	8	Male	6918	TTNB	39	3000	Term	AGA	1	Uneventful	upper	not applic	Negative	Not Done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
221	Pallavi	17	Fem	13088	Birth Asphyxia/ Dela	40	2760	Term	AGA	1	Uneventful	upper	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz, Am	Pass	Pass		
222	Gayathr	8	Male	7000	RDS	33	1900	Prete	AGA	1	Uneventful	lower	not applic	Negative	Normal	PFO	Nasal / Hood	Piptaz	Pass	Pass		
223	Akshath	7	Male	13781	TTNB	40	2800	Term	AGA	1	Uneventful	lower	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
224	Pavan L	12	Fem	13425	NNHB, Dehydration	39	2900	Term	AGA	1	Uneventful	lower	photothe	Negative	Normal	Not done	None	Piptaz	Pass	Pass		
225	Madhur	5	Male	7399	NNHB	40	3200	Term	AGA	1	Uneventful	upper	exchange	Negative	Normal	Normal	None	none	Pass	Pass		
226	Iramma	8	Male	13073	TTNB	38	2500	Term	AGA	1	Uneventful	lower	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Pass		
227	Nazmee	9	Fem	8135	Birth Asphyxia/ Dela	39	3200	Term	AGA	1	Uneventful	lower	normal	Negative	Normal	Normal	Mechanical V	Piptaz	Pass	Pass		
228	Anjali Sa	7	Fem	8472	NNHB	40	2600	Term	AGA	2	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
229	Bismilla	9	Male	8238	NNHB	39	2950	Term	AGA	1	Uneventful	lower	photothe	Not app	Not done	Not done	None	none	Pass	Pass		
230	Renuka	12	Male	7813	Birth Asphyxia/ Dela	39	3100	Term	AGA	2	Uneventful	upper	not applic	Positive	Normal	Normal	HHHFNC	Piptaz, Am	Pass	Pass		
231	Sunanda	33	Fem	31443	RDS, Sepsis: EOS/LO	33	1170	Prete	SGA	1	Twin gesta	upper	not applic	Positive	Grade 1 IV	Not done	Nasal / Hood	Piptaz, Am	Pass	Refer	Pass	Pass
232	Lakshmi	14	Male	33332	MAS	38	2200	Term	AGA	3	Uneventful	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
233	Savitha	22	Fem	32863	RDS, Sepsis: EOS/LO	28	950	Prete	AGA	2	PIH/ Pre ec	lower	photothe	Negative	Normal	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
234	Savitha	22	Male	33128	RDS	28	1200	Prete	AGA	3	PIH/ Pre ec	lower	normal	Negative	Normal	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
235	Sumithra	9	Male	31192	RDS	34	2040	Late (	SGA	2	PIH/ Pre ec	lower	photothe	Negative	Normal	Not done	Nasal / Hood	Piptaz	Pass	Pass		
236	Ghousia	28	Male	27220	RDS, Birth Asphyxia	29	810	Prete	AGA	3	PIH/ Pre ec	lower	photothe	Negative	Normal	Normal	CPAP	Piptaz, Am	Pass	Pass		
237	Nilofer	60	Fem	22307	Birth Asphyxia/ Dela	39	3000	Term	AGA	2	Hypothyro	lower	normal	Negative	Normal	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
238	Renuka	30	Fem	23856	TTNB, Sepsis: EOS/L	39	2640	Term	AGA	1	Uneventful	lower	normal	Positive	Normal	Normal	Nasal / Hood	Piptaz, Am	Pass	Refer		
239	Boramm	21	Male	296990	RDS	32	1200	Prete	AGA	1	Anaemia	lower	not applic	Negative	Normal	Normal	CPAP	Piptaz	Refer	Refer		
240	Deepa	45	Fem	295403	RDS	33	1600	Prete	AGA	2	Uneventful	lower	not applic	Negative	Not done	Not done	Nasal / Hood	Piptaz	Pass	Pass		
241	Shravan	25	Fem	287562	Sepsis: EOS/LOS, Co	37	2000	Term	SGA	2	PPROM or	lower	normal	Positive	Not done	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
242	Sharany	25	Fem	287560	Birth Asphyxia/ Dela	37	1700	Term	SGA	2	PIH/ Pre ec	lower	normal	Negative	Not done	Not done	Nasal / Hood	Piptaz, Am	Pass	Refer	Pass	Pass
243	Lakshmi	30	Male	24358	RDS, Birth Asphyxia	34	2000	Prete	AGA	1	PIH/ Pre ec	lower	normal	Negative	Normal	Normal	Nasal / Hood	Piptaz	Refer	Refer	Refer	Refer
244	Devaki	6	Fem	24051	RDS	33	1600	Prete	AGA	1	Established	lower	normal	Negative	Normal	Not done	Nasal / Hood	Piptaz	Refer	Pass		
245	Shipa Ba	88	Fem	286209	Birth Asphyxia/ Dela	39	3000	Term	AGA	2	Uneventful	lower	photothe	Negative	Normal	Not done	Nasal / Hood	Piptaz, Am	Pass	Pass		
246	Heggars	32	Male	252053	RDS, PPHN	36	1900	Late (	AGA	1	PIH/ Pre ec	lower	not applic	Negative	Not done	Normal	Nasal / Hood	Piptaz	Pass	Refer		
247	Kousarb	14	Fem	21602	RDS, Sepsis: EOS/LO	31	1080	Prete	AGA	2	PIH/ Pre ec	lower	photothe	Positive	Normal	Not done	CPAP	Piptaz, Am	Refer	Refer	Pass	Pass
248	Soumya	20	Male	252165	Birth Asphyxia/ Dela	38	2600	Term	AGA	2	Uneventful	lower	normal	Positive	Normal	Not done	Mechanical V	Piptaz, Am	Refer	Refer	Refer	Pass
249	Sunanda	33	Fem	31441	RDS, PPHN	35	1570	Late (	SGA	1	Elderly prir	lower	photothe	Negative	Grade 1 IV	PDA, PAH	Nasal / Hood	Piptaz, Am	Pass	Pass		
250	Deepa	90	Male	33428	RDS, Birth Asphyxia	28	800	Prete	SGA	2	PIH/ Pre ec	lower	normal	Negative	Normal	Normal	CPAP	Piptaz	Pass	Pass		
251	Shashika	20	Male	19955	RDS, NNHB	33	1300	Prete	AGA	2	PIH/ Pre ec	lower	photothe	Negative	Normal	Not done	CPAP	Piptaz	Refer	Refer	Pass	Pass
252	Bhuvane	22	Male	18840	Birth Asphyxia/ Dela	39	2660	Term	AGA	2	Uneventful	lower	normal	Positive	Normal	Not done	Nasal / Hood	Piptaz, Am	Refer	Refer	Pass	Pass