

ORIGINAL RESEARCH

A study on associations between risk factors and hearing loss among newborns

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Received: 02Sept, 2023

Accepted: 25Sept, 2023

ABSTRACT

In approximately 25% of childhood hearing loss, a non-genetic cause is identified. Hearing loss is thought to be secondary to injury to the developing auditory system in the intrapartum or perinatal period. This injury may be due to infection, hypoxia, ischemia, metabolic disease, ototoxic medication, or hyperbilirubinemia. Before the test it must be ensured that external auditory canal is free of debris and also middle ear pathology is ruled out. The test is conducted by a trained audiologist in a noise free room. In our hospital 'OTOREAD', an automatic hand held device was used to screen the newborns. DPOAE test protocols can be set up with standard 'pass' or 'refer' criteria. The result is displayed on the screen, which is quick and accurate. Significant association was found between sepsis, perinatal depression, low birth weight, prematurity, aminoglycoside usage with hearing loss.

Key words: Risk factors, hearing loss, newborns

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INTRODUCTION

The overall incidence of severe congenital hearing loss is 1 to 3 in 1,000 live births. However, 2 to 4 per 100 infants surviving neonatal intensive care have some degree of sensorineural hearing loss.

Approximately 50% of congenital hearing loss is thought to be of genetic origin, 70% recessive, 15% autosomal dominant and 15% with other types of genetic transmission.¹

The most common genetic cause of hearing loss is a mutation in the connexin 26 (Cx26) genes, located on chromosome 13q.

Approximately 30% of infants are syndromic (e.g., Alport, Pierre Robin, Usher, Waardenburg Syndrome, Trisomy 21).

In approximately 25% of childhood hearing loss, a non-genetic cause is identified. Hearing loss is thought to be secondary to injury to the developing auditory system in the intrapartum or perinatal period. This injury may be due to infection, hypoxia, ischemia, metabolic disease, ototoxic medication, or hyperbilirubinemia.²

Once a hearing loss is identified, a full developmental and speech and language evaluation is needed.

CHL often can be corrected through treatment of a middle-ear effusion (i.e., ear tube placement) or surgical correction of the abnormal sound-conducting mechanism.

Profound congenital or pre-lingual onset of deafness have benefited from multichannel cochlear implants. Cochlear implants share key components, including a microphone, speech processor, and transmitter coil.³

The prognosis depends largely on the extent of hearing loss, as well as on the time of diagnosis and treatment. For optimal auditory brain development, normal maturation of the central auditory pathways depends on the early maximizing of auditory input, the language and communication skills.⁴

Fitting of hearing aids by the age of 6 months has been associated with improved speech outcome. Initiation of early intervention services before 3 months of age has been associated with improved cognitive developmental outcome at 3 years.⁵

Language and communication outcomes for children receiving early cochlear implants and the accompanying intensive multidisciplinary team therapy are also extremely promising.⁶

METHODOLOGY

STUDY SITE: The study was conducted in the Department of Pediatrics and ENT department.

STUDY POPULATION: The study group comprised of all newborns at Hospital during study period.

STUDY DESIGN: Prospective study.

SAMPLE SIZE: 1380

STATISTICAL FORMULA: $n = [(Z_{21-\alpha/2})(1-p)]/\xi^2 p$

EXCLUSION CRITERIA: Infants with atresia of

External Auditory Canal.

INFANTS WITH MIDDLE EAR PATHOLOGY

Before the test it must be ensured that external auditory canal is free of debris and also middle ear pathology is ruled out. The test is conducted by a trained audiologist in a noise free room.

In our hospital 'OTOREAD', an automatic hand held device was used to screen the newborns. DPOAE test protocols can be set up with standard 'pass' or 'refer' criteria. The result is displayed on the screen, which is quick and accurate. A cradle is used to store the instrument and transfer the data to PC or thermal printer.

RESULTS**Table 1: Sepsis in the Neonates Studied**

Sepsis	Number	Percentage (%)
Diagnosed of Sepsis	18	1.3
Not Diagnosed of Sepsis	1362	98.7
Total	1380	100

18 of the babies (1.3%) had sepsis and one of them had meningitis.

Table 2: Hyper Bilirubinemia in the Neonates Studied

Hyperbilirubinemia	Number	Percentage (%)
Diagnosed of Hyperbilirubinemia	205	15
Not Diagnosed of Hyperbilirubinemia	1175	85
Total	1380	100

205 babies had hyperbilirubinemia i.e. 15% of newborns, two of them required exchange transfusion and both of them passed initial screening.

Table 3: Use of Aminoglycosides in the Neonates Studied

Aminoglycoside use	Number	Percentage (%)
Used aminoglycoside in early neonatal period	33	2.4
Not used aminoglycoside in early neonatal period	1337	97.6
Total	1380	100

33 babies (2.4%) had aminoglycoside usage in early newborn period. Commonly used antibiotic in our set up was Amikacin and Netilmycin. 4 of 5 babies with hearing loss have received aminoglycosides.

Proportion of neonates who were Pre-term among those studied

Table 4: Prematurity among Neonates

	Number	Percentage (%)
Pre-term	49	3.5
Term	1331	96.5
Total	1380	100

49 babies (3.5%) were found to be preterm.

Table 5: Perinatal Depression among the Neonates

	Number	Percentage (%)
No Perinatal depression	1343	97
Perinatal depression	37	3
Total	1380	100

37 babies (2.7%) had perinatal depression of which 5 babies were mechanically ventilated. One of the

babies with hearing loss was mechanically ventilated for more than 5 days.

Table 6: Presence of family history of hearing loss

	Number	Percentage (%)
Nofamilyhistoryofhearing loss	1380	100
Familyhistoryofhearingloss present	0	0
Total	1380	100

Table 7: Use of Mechanical ventilation in neonates

	Number	Percentage (%)
Mechanicalventilationnot used	1375	0.3
Mechanical ventilation used	5	99.7
Total	1380	100

Table 8: Presence of Intra uterine infections

	Number	Percentage (%)
Intra uterine infection absent	1380	100
Intra uterine infections present	0	0
Total	1380	100

Table 9: Associations between Risk factors and hearing loss

Category	Subcategory	BERA normal	BERA abnormal	BERA not done	Chi square	P value
Hyperbilirubinemia	Absent	2(0.2%)	3(0.3%)	1170(99.6%)	2.854	0.240
	Present	0(0%)	2(1%)	203(99%)		
Sepsis	Absent	2(0.1%)	3(0.2%)	1357(99.6%)	58.39	<0.0005
	Present	0(0%)	2(11.1%)	16(88.9%)		
Aminoglycoside use	Not used	2(0.1%)	1(0.1%)	1344(99.8%)	129.5	<0.0005
	used	0(0%)	4(12.1%)	29(87.9%)		
Prematurity	Premature	1(0.1%)	2(0.2%)	1328(99.8%)	59.423	<0.0005
	Not premature	1(2%)	3(6.1%)	45(91.8%)		
Birthweight (BW)	Normal BW	1(0.1%)	2(0.2%)	1288(99.8%)	99.294	<0.0005
	LBW	1(1.3%)	1(1.3%)	75(97.4%)		
	VLBW	0(0%)	2(16.7%)	10(83.3%)		
Perinatal depression	Absent	1(0.1%)	4(0.3%)	1338(99.6%)	23.002	<0.0005
	Present	1(2.7%)	1(2.7%)	35(94.6%)		
Mechanical Ventilator use	Not required	2(0.1%)	4(0.3%)	1369(99.6%)	53.611	<0.0005
	required	0(0%)	1(20%)	4(80%)		

DISCUSSION

This was a prospective study done to evaluate the validity of otoacoustic emission study in newborn hearing screening.

1380 babies were included in the study, of which 628(46%) were female and 752(54%) were male.

Of the total babies, 326(23.6%) babies had one or more risk factors and rest 1054(76.4%) were well babies.

In our study, 1331 babies were term and 49 babies were preterm. 3 of the 5 babies with hearing loss were preterm. Prematurity and low birth weight are found to be the most common cause for hearing loss in Indian set up. Significant association was found between prematurity and hearing loss as p value was <0.005.

Proportion of very low birth weight babies is increased in recent times because of better and advanced neonatal intensive care units (NICU) provided to preterm and low birth weight babies now a days, which has improved the survival rate in them. The risk factors for hearing loss are well established

now. 89 babies (7%) were found to have low birth weight, of which 12 babies (1%) weighed less than 1500g. According to John *et al.*, 2009, low birth weight was the most common risk factor in high risk babies, which accounted for 56.52% of high risk babies. Of the 3 babies with SNHL, 5 babies had LBW. 2 of them weighed <1500g, which is a known risk factor for hearing loss. Significant association was found between low birth weight and hearing loss as p value was <0.005.^{7,8}

Of 1380 babies 17 babies had sepsis, which is 1% of total. Two of the babies with abnormal BERA were found to have sepsis. One of them had meningitis. Significant association was found between sepsis and hearing loss as p value was <0.005.

Of the total sample, 205 babies (14.8%) had hyperbilirubinemia. Literature mentions that hyperbilirubinemia requiring exchange transfusion is major risk factor for hearing loss. 2 of the babies had received exchange transfusion, both of them passed in initial screening. Screening on further follow up is advised for them. No Significant association was

found between hyperbilirubinemia and hearing loss as p value was >0.005 .⁹

Aminoglycosides are the most common ototoxic agents used in neonates. Other ototoxic drugs are loop diuretics, cisplatin, carboplatin, salicylates, Quinine. Among the study sample 32 babies had received aminoglycosides, amikacin or netilmycin the common ototoxic drug used in our set up for treatment for sepsis and empirically in few preterm and high risk neonates. One of the babies with SNHL had usage of amikacin for 10 days, along with other risk factors.

Significant association was found between Aminoglycosides usage and hearing loss as p value was <0.005 .¹⁰

37 babies were noted to have perinatal depression, of which 5 babies were mechanically ventilated. 3 of them were ventilated for more than 5 days. One of them had SNHL. Mechanical ventilation for more than 5 days is a known risk factor in hearing loss. Significant association was found between perinatal depression and hearing loss as p value was <0.005 .

None of the babies had family history of hearing loss or intrauterine infection which are the known risk factors for hearing loss.

Conclusion

Significant association was found between sepsis, perinatal depression, low birth weight, prematurity, aminoglycoside usage with hearing loss.

No significant association was found between hyperbilirubinemia and hearing loss.

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