Original article:

The Risk Factors and Hearing Impairment in Infants

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ABSTRACT:

INTRODUCTION: Hearing loss has been reported as the commonest congenital abnormality in newborn.

AIM: To evaluate the risk factors and hearing impairment in infants using otoacoustic emission and Brainstem Evoked Response Audiometry (BERA).

MATERIAL AND METHODS: We conducted a hospital based, observational study on 300 infants during the year 2021 meeting inclusion and exclusion criteria, in department of Paediatrics, Govt S.K. Medical College, Sikar from febuary 2021 to Oct 2021.

RESULTS: A total 300 high risk neonates who fulfil the inclusion criteria were screened. 90 neonates were referred by OAE 1st to OAE 2nd; 56 neonates were referred to BERA by OAE 2nd. These 25 neonates were subjected to BERA of which 15 **(5.0%)** neonates were found to have abnormal BERA i.e. hearing impairment. Hearing impairment increases from cases with one risk factor (0%), 2 risk factors (5.5%), 5 risk factors (8.33%), 6 risk factors (14.6%), 7 risk factors (66.66%) to 8 risk factors (100%).

CONCLUSION: This study shows that early identification of hearing loss can be done by screening tests. Early diagnosis and treatment can prevent a significant hearing loss.

INTRODUCTION:

An important aspect of child's development is the acquisition and production of spoken language. Language is the key to express our thoughts, feelings and needs by which we understand others. According to UNICEF analysis, each year approximately 126,000-500,000 infants are born with significant hearing loss and about 90% of them live in developing countries[1]. Speech and hearing are inter related, i.e., a problem with one could mean a problem with the other as speech and language is acquired normally through auditory system. The prevalence of mild to profound hearing loss is reported to be between 1.1- 6 per 1,000 live-births and with prevalence of hearing loss is estimated to be between 2.5%-10% among high-risk infants[2].

In most countries, newborn hearing screening programmes that screen only high-risk infants have been in existence for more than 20 years. However, this group of infants with hearing loss comprises only 50% of newborn population with hearing loss. Therefore, hearing screening programmes that screened only high-risk infants missed out 50% of hearing-impaired newborns, who are from infants without any risk factors. Also, as hearing loss is an invisible disability it cannot be passively identified until the child fails to develop speech and language. Hearing impairment in infants should be identified as early as possible to enable interventions to take full advantage of the plasticity of developing sensory system. Hearing integrity in the first 3-4 years of life, the 'critical period', is essential for acquisition of speech and language. Technological advancement in screening instrumentation within the last two

decades have resulted in the introduction of two new objective tests namely Otoacoustic Emission and Auditory Brain Stem Response/ Brainstem Evoked Response Audiometry (BERA).

Universal newborn hearing screening; the goal is to achieve the highest possible yield from a wide screening coverage that is associated with a low referral rate. When only OAE is used infants with auditory neuropathy will be missed while ABR may miss infants with mild SNHL or with high-frequency hearing loss. The most preferred option is to combine both the tests in a two-stage screening programme[3]. With the ability to detect and diagnose an infant with hearing loss soon after birth, there is now no reason why any infant born with a hearing loss should experience anything but normal speech and language development as a result of early intervention[4].

AIM:

To evaluate the risk factors and hearing impairment in infants using otoacoustic emission and Brainstem Evoked Response Audiometry (BERA)

METHODS:

We conducted a hospital based, prospective, observational study on 300 high risk infants fulfilling inclusion and exclusion criteria and admitted at NICU and opd, in Department of Paediatrics, Govt.S.K. Medical College, Sikar from Feb 2021 to Oct 2021. Patients fulfilling the inclusion/exclusion criteria were included in the study after obtaining written informed consent from the parents. Infents with congenital genetic disorders, healthy infents and refused to participate infents were excluded from study. Detailed history taking, general and ENT examinations were done. OAE and BERA were done in all high risk infants included in the study. Syrup triclofos sodium 20mg/kg was given to sedate the infant half an hour before BERA. Intelligent hearing system BERA instrument was used. The morphology of the graph was noted until wave V is no longer identifiable. The minimum intensity at which wave V is identifiable was taken as the hearing threshold for that individual. Since threshold estimation was the only aim of the study, latencies and inter peak intervals was not be considered. The child's hearing sensitivity was assessed based on the following: Normal hearing sensitivity $\leq$25dB, Mild hearing impairment 26-40dB, Moderate hearing impairment 41-55dB, Moderately severe impairment 56-70dB, Severe hearing impairment 71-90dB, Profound hearing impairment 91+dB. The continuous variables were presented as mean±SD and dichotomous data as percentage. Appropriate statistical analysis was applied as and when required. A p value of <0.05 was considered as significant.

RESULTS

A total 300 high risk neonates who fulfil the inclusion criteria were screened. Male infant (55%) while remaining 45% cases were female, 75% from rural area. 90 neonates were referred by OAE 1st to OAE 2nd; 25 neonates were referred to BERA by OAE 2nd. These 25 neonates were subjected to BERA of which 15 **(5.0%)** neonates were found to have abnormal BERA i.e. hearing impairment. Out off 15 infants maximum 60% had bilateral failed on BERA.

Table: 1. sociodemographic profile

Gender	No.	%
Male	165	55
Female	135	45
Total	300	100

Table 2 : Comparison of frequency of occurrence of hearing loss in each risk factor group
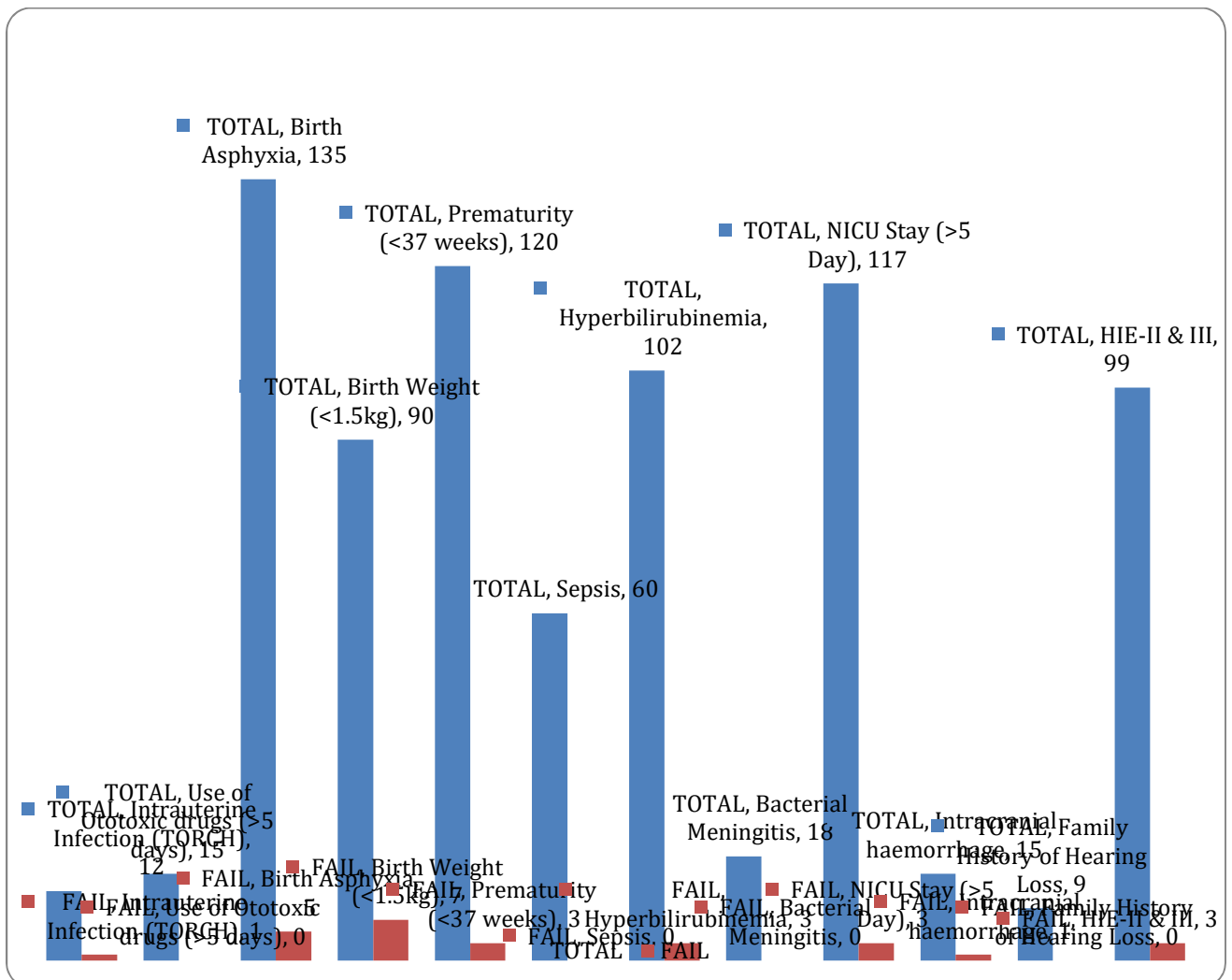
Graph shows risk factors for hearing impairment in infants. It shows that Birth Asphyxia (45%) has highest number

of cases followed by Prematurity (<37 weeks), (40%), NICU Stay (>5 Day), (39%), Hyperbilirubinemia (34%),

HIE-II &III (33%), Birth Weight (<1.5kg), (30%) and others.

Table: 3. **Distribution of cases according to number of risk factors involved**

No. of Risk Factor Involved	BERA				Total	
	Pass		Fail			
	No.	%	No.	%	No.	%
1	147	100	0	-	147	49.0
2	51	94.45	3	5.55	54	18.0
3	32	100	0	-	45	15.0
4	12	100	0	-	12	4.0
5	11	91.67	1	8.33	12	4.0
6	18	85.71	3	14.29	21	7.0
7	2	33.34	4	66.66	6	2.0
8	0	0	3	100	3	1.0
Total	285	95.0	15	5.0	300	100

Hearing impairment increases from cases with one risk factor (0%), 2 risk factors (5.5%), 5 risk factors (8.33%), 6 risk factors (14.29%), 7 risk factors (66.66%) to 8 risk factors (100%).

DISCUSSION:

The prevalence of bilateral hearing loss is substantial, particularly in infants admitted to the NICU who frequently present with risk factors for hearing loss. The prevalence of significant bilateral hearing loss in this group is 1%–3%, which is 10 times higher than that in the well-infant nursery population. Furthermore, early intervention in hearing-impaired children (aged 6 months or earlier) improved their language and speech outcomes as well as their socio-emotional development. It seems reasonable to include hearing screening into routine programmes. Thus, screening in a population at risk as performed in the present study can only be regarded to be the first step toward a universal screening. This study was conducted at Govt S.K.Medical College and attached group of S.K. Hospital Sikar, where 300 high risk infants were enrolled and evaluated by two stage OAE followed by BERA.

In our study, out of 300 high risk infants 165(55%) were male and 135(45%) were female and the male female ratio was 1.22:1. whereas Bhat et al[5] has 95(48.7%) male and 100 (51.3%) female. Maqbool et al[6] also enrolled 200 cases comprising 118 males (59%) and 82 females (41%).

In this study Birth Asphyxia (41%) has highest number of cases followed by Prematurity (<37 weeks), (39%), NICU Stay (>5 Day) (38%), HIE-II & III (34%), Birth Weight (<1.5kg) (32%), Hyperbiliru-binemia (32%) and others which is consistent with the study conducted by Bhat et al[5], Zamani et al[7], Meyer et al[8] and Maqbool et al[6] had use of ototoxic medications, hyperbilirubinemia requiring exchange transfusion and perinatal asphyxia cases occurring in 45%, 30% and 26% at risk infants respectively; bacterial meningitis was present in 10% of infants. None of the study infants had family history of hearing loss.

In this study, 300 at risk infants were screened for hearing impairment using OAE and who fail the OAE test were screened by BERA. In OAE 1st 90 infants were referred to OAE 2nd and after OAE 2nd 25 infants were referred for BERA. BERA showed 15 cases (5%) had hearing impairment. Similar results have been obtained in the studies done by Zamani et al[7] (8%), Bhat et al[5] (6.5%) and Maisoun and Zakzouk[9] (13.5%). Out of total 15 cases who failed in BERA examination, 9 (60%) had bilateral fail, 3 (20%) each had right and left fail. Labaeka et al[10] study showed out of total 19 cases who failed in BERA examination, 18 (94.7%) had bilateral fail, 1 (5.3%) each had unilateral fail.

In our study as the number of risk factors increases from 1 to 8, the cases with failure to BERA i.e. hearing loss cases increases. Bhat et al[5] also showed similar results i.e.hearing impairment increased from 0.917% for one risk factor, 6.66% for two risk factors, 10.52% with three risk factors, 28.57% with four risk factors, and 25% with five risk factors. Maqbool et al[6] study showed Infants with single, two and three risk factors had BAER abnormality rate of 4.28%, 22.2% and 33.3% respectively. Srisuparp et al[11] and Zamani et al[7] studies were also in accordance to our study.

CONCLUSION:

This study shows that early identification of hearing loss can be done by screening tests. Early diagnosis and treatment can prevent a significant hearing loss.

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