Hearing Assessment in Infants : A Retrospective Institutional Study

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ABSTRACT

Introduction

Disorders of hearing are one of the most common disabilities in the country, especially in children. Hearing impairment is the most common congenital disease (3.5–9%) considering all degrees of permanent unilateral or bilateral deafness. Hearing disability can further lead to lifestyle difficulties later on in life. Early identification and a comprehensive treatment can help these people lead a better and productive life.

Materials and Methods

A retrospective study from the hospital records was done of infants admitted in NICU/PICU in a rural setting in, Davangere, Karnataka from January 2017 to January 2021 who had undergone Oto-acoustic emission (OAE) upon discharge, with a Brainstem Evoked Response Audiometry (BERA) test done in cases that failed the initial test after 3 months.

Results

Out of the 1115 cases that was included 213(19.1%) cases were found to have hearing disability with low birth weight and hyperbilirubinemia counting for most of the cases with 326(29.2%) and 301(27.0%) cases respectively.

Conclusion

The findings of our study suggest that an early investigation for hearing disability in high-risk infants for early detection and comprehensive management of hearing disorders. It also points towards a further need for advocating a universal screening of neonates for detecting hearing disability when feasible.

Keywords

Hearing Loss, Bilateral; Universal Infant Hearing Screening; Oto-Acoustic Emission (OAE); Audiometry, Evoked Response.

Hearing disorders is one of the common reasons for disabilities in the country. Approximately 1–3 infants per 1000 are being identified with permanent hearing loss.[1] Hearing impairment is the most common congenital disease (3.5–9%) considering all degrees of permanent unilateral or bilateral deafness.[1] Hearing disability can further lead to lifestyle difficulties later on in life. With a birth rate of 25 million babies in the country as per UNICEF, this approximately accounts for about 250,000-750,000 infants that can later on develop permanent hearing loss. This hearing loss can be hard to pick up early in their lives, which again can lead to delays in language development and later affect their life. Thus an early identification and a comprehensive treatment can help these individuals lead a full life.

By using methods like OAE/BERA, these infants can therefore be identified early in their life and a comprehensive treatment and support plan can be established to help both the infant and parents lead a fulfilling life.

Therefore this study attains importance in ascertaining

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the prevalence of hearing loss among children, high risk factors predisposing to the condition and to see if a universal screening for hearing assessment is warranted in such individuals.

Materials and Methods

This study was done in a retrospective fashion from the hospital data made available from the records section of cases from January 2017 to January 2021, 1115 cases that were referred for OAE screening upon discharge from NICU/PICU

The infants underwent an initial OAE screening upon discharge and those who failed the test were then followed up after 1 month for a repeat confirmatory BERA test. The diagnosis, age, sex and test reports were collected from the hospital records and the data analyzed.

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0.

Results

In this study a total of 1115 cases were found from the hospital records. (Table I) Of which 629(56.4%) were males and 486(43.6%) were females. Among these a total of 213(19.1%) cases were found to have failed the final BERA test and was diagnosed to have hearing impairment.

Table I: Total number of cases and sex distribution

GENDER	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Male	629	56.4	56.4	56.4
Valid Female	486	43.6	43.6	100.0
Total	1115	100.0	100.0	

Among the various diagnoses for which the infants were admitted to the ICU the most common ones were Low birth weight and Hyperbilirubinemia with the number of cases being 326(29.2%) and 301(27.0%) respectively. This was followed by birth asphyxia at 175(15.7%) cases. (Table II).

Among the cases diagnosed to have hearing impairment, the most common causes were found to be Low birth weight with a total of 71(21.8%) cases followed by hyper bilirubinemia with 41(13.6%) cases.

Table II: Diagnoses

	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Birth Asphyxia	175	15.7	15.7	15.7
Respiratory distress syndrome	102	9.1	9.1	24.8
Low birth weight	326	29.2	29.2	54.1
Hyper bilirubinemia	301	27.0	27.0	81.1
Failure to thrive	21	1.9	1.9	83.0
seizures	37	3.3	3.3	86.3
pneumonia	25	2.2	2.2	88.5
others	128	11.5	11.5	100.0
Total	1115	100.0	100.0	

Table III: Final BERA results

		DIAGNOSIS								
		BIRTH ASPHYXIA	RESPIRATORY DISTRESS SYNDROME	LOW BIRTH WEIGHT	HYPERBILI-RUBI-NEMIA	FAILURE TO THRIVE	SEIZURES	PNEUMONIA	OTHERS	TOTAL
Final results after test	Pass count	147	79	255	260	14	29	16	102	902
	% With diagnosis	84.0%	77.5%	78.2%	86.4%	66.7%	78.4%	64.0%	79.7%	80.9%
	Fail count	28	23	71	41	7	8	9	26	213
	% With diagnosis	16.0%	22.5%	21.8%	13.6%	33.3%	21.6%	36.0%	20.3%	19.1%
Total	count	175	102	326	301	21	37	25	128	1115
	% With diagnosis	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

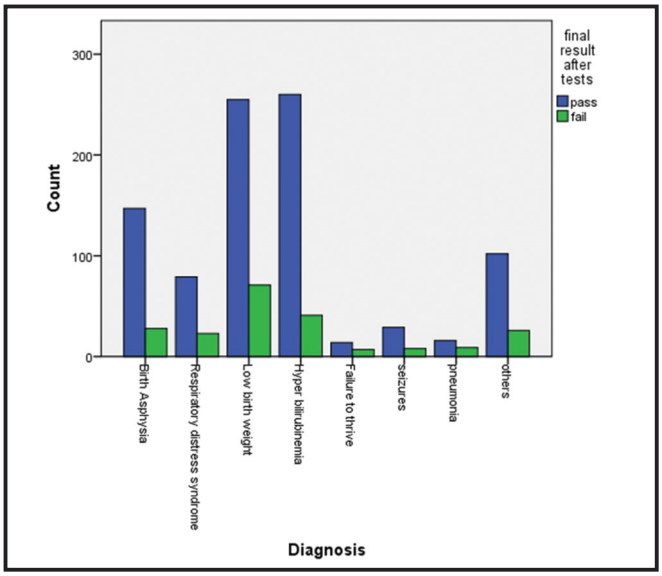

Fig. 1. Final BERA results

(Table III) Proportional to the total number of cases per diagnosis however, among the number of cases diagnosed to have failed the BERA test, the most common cause of hearing disability was found to be among the cases of Pneumonia and Failure to thrive which were 36.0% (9 of the 25 diagnosed cases) and 33.3%(7 out of the 21 diagnosed cases). (Fig.1)

Discussion

With hearing disability being one of the most common disabilities in India, and a prevalence of approximately 1–3 infants per 1000, its early detection and management is imperative in helping the infants develop and lead a normal life. These individuals even though they might have an average non verbal IQ, hearing disabilities can lead to linguistic, educational and vocational

deficiencies.[2] So early detection, especially in infants, become important before the development of language starts by at least 2 years of age. This also gives rise to the need for identifying the infants who are at a higher risk of developing the same, and possibly show a need for a Universal hearing screening program.

In our study, done in a retrospective fashion from the hospital records in a rural area in Karnataka, India, a total of 1115 cases were taken from the span of January 2017 to January 2021. These were infants who were admitted to the NICU/PICU in the hospitals and who were referred for screening for hearing loss. These infants underwent an initial OAE test upon discharge and those who were found to have a failed test, were then followed up after 1 month for a repeat BERA test for confirmation.

OAE and BERA have been ideal in testing for hearing disability as they are both non invasive and fairly inexpensive to do. There are multiple challenges in conducting these tests in infants and especially in neonates. The main is the requirement of a noiseless environment, which meant that the infants had to undergo the test in a different testing location other than the nursery.[3] One of the other main other hurdles in conducting these tests was that if the infant moves or wakes up during the procedure the test could not be conducted and would have to be re-planned.

Study done by Satish et al,[1] showed that during the study period, 26,487 newborns, 2705 newborns who were referred following the 1st OAE. 19 babies had bilateral permanent hearing loss with incidence of hearing loss among high risk group was 0.188/1000, and among the non-risk group was 0.528/1000. They also have advocated the need for a universal hearing screening protocol to be established.

In the study done by Bishnoi et al,[4] of the 2000 infants screened, among which 1594 infants (79.7%) were without risk factors and 406 infants (20.3%) had risk factors. 30 (1.5%) infants were subjected to BERA who had failed initial 2 OAE tests in which 7 (0.35%) infants failed—2 were from the group of without risk factors and rest 5 with risk factors. And they had concluded that three stage UNHS (Universal Neonatal Hearing Screening) protocol using OAE and BERA showed that the implementation of UNHS for congenital childhood hearing loss for all neonates would be beneficial

Similarly in the study done by Maqbool et al[5] showed that the incidence of hearing disability increases with increase in the number of risk factors, from 4.2% to 33.3% with an increase of one risk factor to 3 risk factors.

In the study done by Soni et al[6] showed that there is a high prevalence of hearing disability among the neonates who were diagnosed with hyper bilirubinemia with 10 of the 30 cases screened showing changes in BERA study.

Our study showed a higher prevalence in hearing disability of 19.1% among the tested individuals as compared to the national average. This could be attributed to the focused study group involving only the infants who were admitted to the NICU/PICU as compared to the general population and absence of a control group.

The various cases for NICU/PICU admissions in the hospital seen among the study population was found to be birth asphyxia, respiratory distress syndrome (RDS), low birth weight, hyper bilirubinemia, failure to thrive, seizures, pneumonia etc. Among which the most common diagnoses were Low birth weight and Hyper bilirubinemia, and it was also these cases that had the most number of cases which were found to have hearing disability at the end of the confirmatory BERA test with 71(21.8%) cases of low birth weight and 41(13.6%) cases of hyper bilirubinemia respectively . But the diagnoses with the higher proportional number of cases that had hearing disability were Pneumonia and Failure to thrive with 36.0% (9 of the 25 diagnosed cases) and 33.3%(7 out of the 21 diagnosed cases) respectively.

This study therefore shows infants with a history of risk factors like those mentioned being at a higher risk for developing hearing disability. It is also in agreement with the other studies in pointing towards a further need for a universal screening for hearing in order to diagnose any potential risk of developing hearing disability, even among those without any risk factors when feasible, so that it can be diagnosed and managed early so as the infant can lead a fulfilling life.

Conclusion

There is a high incidence of hearing disability among the newborns that are diagnosed with various risk factors and as studies have shown, those with multiple risk factors are at an even increasing risk for the same.

Therefore it is our recommendation that screening for hearing disability should be at least done in all at risk cases and in the future a Universal Neonatal Hearing Screening protocol should be set up and implemented as when it is feasible.

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