ASSESSMENT OF PREVALENCE OF CONGENITAL HEARING LOSS IN NEONATES BY OTOACOUSTIC EMISSIONS IN KONASEEMA REGION

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ABSTRACT

BACKGROUND

Hearing impairment is one of the commonest congenital disabilities in the world. The prevalence of congenital hearing loss has been estimated to be 1.2-5.7 per 1,000 live births and is more among high risk neonates. Screening is one of the most important methods for early diagnosis of hearing loss. Otoacoustic emission is an easy, cost effective and reliable method of testing of large number of infants for hearing loss. The present study emphasizes the use of otoacoustic emissions as a screening tool to detect hearing loss that would otherwise go unnoticed till 2-3 years.

MATERIALS AND METHODS

This descriptive study was conducted on 1000 neonates during the period August 2015 to August 2016. Neonates were selected from the department of Paediatrics, the department of Obstetrics and OPD of ENT of Konaseema Institute of Medical Sciences, Amalapuram, Andhra Pradesh. Neonates between 24-72 hours of age were screened with DPOAE. Those who failed the first DPOAE screen were subjected to a second DPOAE screening after 2 to 3 months.

RESULTS

Out of 1000 neonates, 0.9% had persistent failure with OAE test. The factors which had significant relationship with hearing loss include prenatal risk factors like foetal distress, eclampsia, maternal infection, low birth weight, ototoxic drugs. Data was statistically analysed by McNemar's test and Chi-square test.

CONCLUSION

The two staged screening protocol with Distortion Product Otoacoustic Emission was found to be a useful tool in detecting hearing loss in newborn. It is important and logical from the point of health and economy that the screening tests should become necessary for all neonates.

KEYWORDS

Distortion Product Otoacoustic Emissions (DPOAE), Neonates, Hearing loss.

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BACKGROUND

The World Health Organization defines health as a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity and includes the ability to lead a socially and economically productive life. Therefore health beyond survival for those infants with hearing loss can only truly be accessed through early identification and intervention. Hearing loss occurs twice as frequently as other congenital abnormalities screened for in newborn, such as congenital hypothyroidism, sickle cell disease, phenylketonuria and galactosemia combined making it most common congenital abnormality in newborns. WHO estimates that globally over 5% of the world population has disabling deafness, thus making this condition the most prevalent sensory deficit in the population. Permanent hearing loss can occur at any age, about 25% of the current burden is of childhood onset.

Speech and language development may begin as early as in the womb and the infant is born with necessary neural substrate to develop speech and language. However the environmental stimulation is of paramount importance to strengthen synaptic connections. In the absence of stimulation as in deafness, the synapses die out. Hence audible speech is an important prerequisite for synaptic maturation. Research has accumulated that early auditory deficiency can hinder the development of neural structures necessary for hearing and lead to extensive interference with the development of linguistic skills. A deaf infant who ages without the ability to hear speech has fewer and fewer synapses available to develop auditory perceptions language skills. Owing to the fact that hearing loss is an invisible

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disability, it may go undetected until school age, especially in children with no additional disabilities.

Speech and hearing are inter-related, i.e., a problem with one could mean problem with the other as speech and language is acquired normally through auditory system. The prevalence of congenital hearing loss has been estimated to be 1.2-5.7 per thousand live births.[1,2] In most countries, new born hearing screening programme 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 new born population with hearing loss. Therefore, hearing screening programmes that screened only high risk neonates missed out 50% of hearing impaired newborn, who are from among infants without any risk factors. Also as hearing loss is an invisible disability it cannot be 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. Early detection and appropriate treatment provides the best choice maximizing the critical period of hearing and thereby availing the resources to improve hearing and oral communication skills. On the other hand late detection and treatment leaves the children with poor speech development and school achievement. If hearing loss is identified early, early intervention services can be provided, in order to prevent developmental delays in children with hearing loss.[3] Otoacoustic emissions (OAE's) reflect the status of the cochlea. A probe microphone similar to that used in acoustic immittance measures the inaudible sounds reflected by vibratory motion in cochlea. Otoacoustic emissions are a by-product of sensory outer hair cell transduction and are reflected as echoes into the external auditory canal. OAE's are preneural in origin and directly dependent on outer hair cell integrity. Brainstem Evoked Response Audiometry (BERA) is an objective test of audiological function which measures activity from the auditory nerve up to the level of brainstem on stimulating with acoustic stimulus. It assesses the neural integrity of auditory pathway up to the brainstem. However, it is an indirect measure of hearing acuity. Thus, the aim of this study is to show the efficacy of Distortion Product Otoacoustic Emissions (DPOAE) as a screening tool to detect hearing loss.

MATERIALS AND METHODS

This descriptive study was conducted during the period August 2015 to August 2016. A study group consisting of 1000 neonates were selected from the department of Paediatrics, Obstetrics and OPD of ENT of Konaseema Institute of Medical Sciences, Amalapuram. Neonates of same age were selected and were evaluated by means of proper history, clinical examination including general examination and otoscopy.

Distortion Product Otoacoustic Emissions (DPOAE) testing of neonates was done at 24-72 hours. For Pass cases no further testing was done. For Refer cases repeat DPOAE testing was done at 15-30 days. For initial OAE screening MAICO ERO scan machine made in Berlin was used and for DPOAE testing neurosoft, neuroaudio screen (Model TC-9442-057-137218158-2008) made in Russia was used.

Inclusion Criteria

Neonates between 24-72 hrs of age were chosen for the first screening. For subsequent screening neonates who had Refer result in the previous screening were included for DPOAE.

Exclusion Criteria

1. Neonates younger than 24 hrs as they are more probable to give false negatives due to obstruction of EAC by amniotic fluid and debris.
2. Neonates with obvious congenital aural and head and neck deformities.
3. Neonates whose parents did not consent for the procedure.
4. Neonates with acute illness.

Data was processed using Excel software programme. Data obtained was analysed using Mc Nemar's test and Chi-square test.

RESULTS

A total of 1000 neonates were assessed by DPOAE screening. The gender distribution of the study sample is shown in Figure 1.

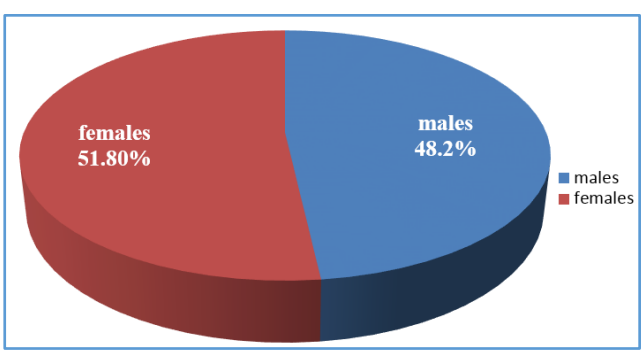

Figure 1. Gender Distribution among the Neonates

Results of the First OAE Screening

The first stage screening was conducted for 1000 neonates with DPOAE, of which 885 passed, while 115 neonates failed the first screening test. Details are shown in Figure 2.

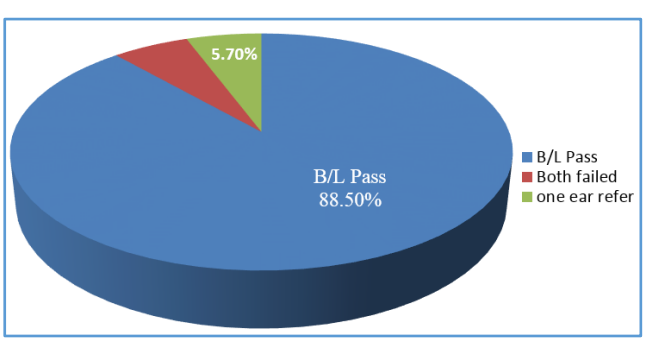

Figure 2. Results of Screening Test

Results of the Second OAE Screening

Second stage DPOAE screening was done for those neonates who failed the first testing, of which 9 failed the test (Figure 3).

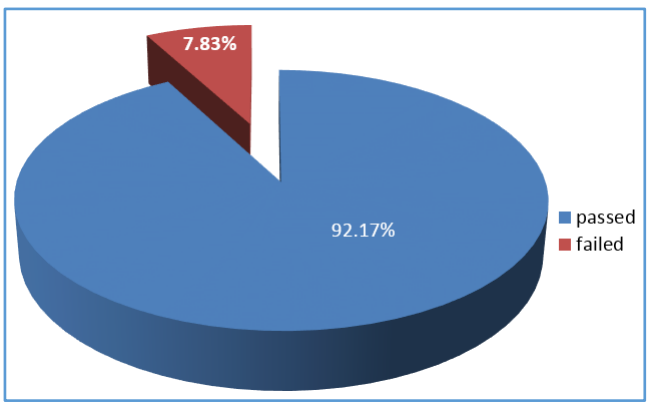

Figure 3. Results of the Second OAE Screening

Factors		DOAE-1		Total	DOAE-2		Total
		B/L PASS	B/L REFER		B/L PASS	B/L REFER	
Gender	Females	457	61	518	0	61	61
	Males	428	54	482	0	54	54
	Total	**885**	**115**	**1000**	**0**	**115**	**115**
Prenatal Risk Factors	Absent	822	35	857	0	35	35
	Present	63	80	143	0	80	80
	Total	**885**	**115**	**1000**	**0**	**115**	**115**
Preterm Details	Preterm	0	28	28	0	28	28
	Term	885	87	972	0	87	87
	Total	**885**	**115**	**1000**	**0**	**115**	**115**
Birth Weight	< 2.5 kg	49	37	86	0	36	36
	>2.5 kg	836	78	914	0	79	79
	Total	**885**	**115**	**1000**	**0**	**115**	**115**
Postnatal Complications	Absent	885	57	942	0	57	57
	Present	0	58	58	0	58	58
	Total	**885**	**115**	**1000**	**0**	**115**	**115**

Table 1. Results of 1st and 2nd DPOAE Screening

DISCUSSION

Hearing loss is referred to as the silent, over looked epidemic of developing countries because of its invisible nature which prevents detection through routine clinical procedures. It is referred to as an epidemic because of its high prevalence, being the most frequently occurring birth defect, and even though it is not a life-threatening condition, failure to intervene in time renders it a severe threat to critical quality of life indications. WHO estimates that globally the number of people with hearing loss, has more than doubled from 120 million in 1995 to at least 278 million in 2005, thus making this condition the most prevalent sensory deficit in the population. In India, it is estimated that 18.49 million persons have disability that equivalents to 1.8 percent of the total population of the country where 10 percent of this figure are likely to go up if we add lower degree of hearing disability. The adverse effects of hearing loss on language and cognitive development, as well as on psychosocial behaviour are widely reported against the established benefits of early intervention. The income of individuals with hearing loss is reported to be 40 to 45 percent less than the hearing population in developed countries and will be even more pronounced in developing countries. The definition of early identification was defined as intervention has evolved over the years. In the past, early identification was defined as intervention before the age of 18 months. However, now early identification is defined as diagnosis as early as 3 months and intervention within 6 months.

Numerous studies demonstrate that early diagnosis and intervention (before 6 months of age) of hearing impairment is effective in allowing children with congenital hearing loss to acquire age appropriate speech and language development, social, emotional and cognitive growth, and academic achievement in the child.[4] In our study we used a two stage DPOAE protocol, wherein neonates were subjected to 2 stages of screening using otoacoustic emission. This protocol was put forward by the Joint committee of Infant Hearing and was also followed by Jhonson JL et al and Arehart KH et al.[5,6] DPOAEs are elicited by asymmetrical protocols (75-65 dB) testing the frequencies 1.5, 2.0, 3.0, 4.0.

In the present study the first DPOAE was done after 24 hours as it has been seen that testing neonates earlier than 24 hours had tendency to give higher fail results due to occlusion of EAC with debris, amniotic fluid. Neonates who had failed the first DPOAE screen were subjected to a second DPOAE screening after 2-3 months. A total of 1000 neonates were screened by DPOAE screening of which 115 failed the initial screen. Those who failed were rescreened using DPOAE at 8 weeks. In the 2nd DPOAE screening of 115 neonates, 9 failed the test. These findings were in concordance with other studies conducted by P Torrico and co-workers from June 1999 to June 2000.[7] In the present study, an incidence of hearing loss of 9 per 1000 infants was detected which is in the line with the published literature. According to WHO estimates globally up to 6 per 1000 live born infants annually or 7,98,000 babies worldwide suffer permanent hearing loss at birth or within the neonatal period.[8] Studies done in India using different screening protocols for neonatal hearing loss have estimated the prevalence to vary between 1 and 8 per 1000 babies screened.[9,10]

Among the babies screened in our study, 48.2% were males and 51.8% were female babies. The p value is 0.77 suggesting that there is no statistically significant difference between genders, but there was a significant association between prenatal risk factors and hearing loss. The history of prenatal risk factors revealed factors such as foetal distress, eclampsia, family history of deafness, maternal infection, low birth weight, ototoxic drugs and small for gestational age. These factors were similarly found to be present in a study conducted in Sao Paulo Hospital study in Brazil. It was seen that parity of the mother had no association on the hearing loss of the neonate. Increased hearing loss was detected in preterm babies compared to normal neonates on initial DPOAE screen test. On rescreening no significant association was demonstrated in the study. Presence of postnatal complications was seen to be associated with hearing loss on initial screen with a p value of 0.0000. However, on rescreen no such association was seen. History revealed that 400 neonates were born to parents who had a consanguineous marriage (40%). The p value obtained was 0.00 which is significant. The percentage of consanguineous marriages obtained in other studies was variable ranging from the lowest of 28.5% to highest of 78%.

CONCLUSION

As it has been aptly said by Ralph Waldo Emmerson, that "a hearing ear is close to a speaking tongue", the importance of infant hearing screening before the 'critical period' of first 3-4 years cannot be over emphasized. It was observed that 9 neonates per thousand (0.9%) had hearing loss.

This value is slightly higher to the WHO incidence of 4 to 6 neonates per thousand newborns (0.4% to 0.6%). This value probably could be attributed to the custom of consanguinity of marriages in this region as noticed in our incidence findings. This study was to show the importance of developing a hearing screen with the help of otoacoustic emissions. OAE is an easy, cost effective and reliable method of testing of large number of neonates for hearing loss. Thus, OAE's as a screening test holds a good promise in hearing screening.

REFERENCES

[1] Parving A. Congenital hearing disability: epidemiology and identification: a comparison between two health authority districts. Int J Pediatr Otorhinolaryngol 1993;27(1):29-46.
[2] Kim SY, Bothwell NE, Backous DD. The expanding role of the otolaryngologist in managing infants and children with hearing loss. Otolaryngol Clin North Am 2002;35(4):699-710.
[3] Yoshinaga-Itano C. Levels of evidence: universal newborn hearing screening (UNHS) and early hearing detection and intervention systems (EHDI). J Commun Disord 2004;37(5):451-465.
[4] Carney AE, Moeller MP. Treatment efficacy: hearing loss in children. J Speech Lang Hear Res 1998;41(1):S61-S84.
[5] Johnson JL, White KR, Widen JE, et al. A multicenter evaluation of how many infants with permanent hearing loss pass a two-stage otoacoustic emissions/automated auditory brainstem response newborn hearing screening protocol. Pediatrics 2005;116(3):663-672.
[6] Arehart KH, Yoshinaga-Itano C, Thomson V, et al. State of the states: the status of universal newborn screening, assessment, and intervention systems in 16 states. Am J Audiol 1998;7(2):101-114.
[7] Torrico P, Gomez C, Lopez-Rios J, et al. Age influence in otoacoustic emissions for hearing loss screening in infants. Acta Otorhinolaryngol Esp 2004;55(4):153-159.
[8] Olusanya BO, Newton VE. Global burden of childhood hearing impairment and disease control priorities for developing countries. Lancet 2007;369(9569):1314-1317.
[9] Bachmann KR, Arvedson JC. Early identification and intervention for children who are hearing impaired. Pediatr Rev 1998;19(5):155-165.
[10] Nagapoornima P, Ramesh A, Srilakshmi, et al. Universal hearing screening. Indian J Pediatr 2007;74(6):545-549.