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ORIGINAL ARTICLE

Otoacoutic Emission Testing in Preterm and Term Sick Newborns: A Comparative Analysis

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Abstract In newborns, both term and preterm, cochlear hearing loss is common due to different pathologies. Currently accepted methods for hearing screening in newborns are otoacoustic emission (OAE) and auditory brainstem responses. Among these two, OAE is quicker, economical and more accessible. In the present study we assessed OAEs in sick newborns, both term and preterm, having different pathological conditions. This descriptive study was conducted over 3 months in sick newborn care unit (SNCU) in a tertiary care hospital. All sick newborns admitted to SNCU in the study period were tested for otoacoustic emission. The results were subjected to the Chi square test (test of independence). Among 640 sick newborns, 184 were preterm; the rest being term newborns. Among the term sick newborns, 4.8% of those with birth asphyxia, 8.6% of those having septicaemia, 25% of those with hyperbilirubinemia needing exchange transfusion, 22.9% of those having meningitis and 33.3% of those with major congenital anomalies, had "refer" on OAE. Among preterm sick newborns, 30.8% of those with birth asphyxia, 32.5% of those having septicaemia, 75% of those with hyperbilirubinemia needing exchange transfusion, 41.7% of those having meningitis, 40% of those with major congenital anomalies and 8.7% of those with no co-morbidity had "refer" on OAE. Upon computing the p value of Chi square test performed on the results, the results were not significant ($p = 0.85$). Hence we didn't find any statistically significant difference between term and preterm sick newborns on OAE. The incidence of "refer" result in OAE increases with co-morbidities in both term and preterm sick newborns, somewhat more in preterm newborns. But preterm sick newborns do not seem to have an increased incidence of hearing impairment.

Keywords Hearing impairment · Newborn · Otoacoustic Emission

Introduction

Hearing impairment during early life interferes with the development of verbal language skill. Significantly reduced auditory input adversely affects development of the auditory nervous system and may have deleterious effects on cognitive and academic development. Thus hearing impairment should be recognized as early in life as possible so that remedial measures can take full advantage of the plasticity of developing sensory system and child can enjoy normal social development.

The overall incidence of severe congenital hearing loss is 1–3 in 1000 live births. However, 2–4 per 100 infants surviving neonatal intensive care have some degree of sensorineural hearing loss [1].

Development of the auditory system starts at 3–6 weeks; by 25 weeks all parts are in-place, though adult dimension is not attained until 1 year after birth [2].

Universal newborn hearing screening is recommended to detect hearing loss as early as possible. Earlier ABR

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became the procedure of choice for newborn hearing screening [3]. Currently acceptable methods for physiological hearing screening in newborn are evoked otoacoustic emission and auditory brainstem response [4]. A threshold of > 35 dB has been established as a cut off for an abnormal screening which prompts further testing. OAE is quicker, more affordable and less cumbersome and less demanding procedure.

For newborn sensorineural hearing loss, risk factors are family history of hereditary childhood sensorineural hearing impairment, intrauterine infections (TORCH), craniofacial anomalies, birth weight < 1500 g, hyperbilirubinemia requiring exchange transfusion, ototoxic medication, bacterial meningitis, APGAR score 0–4 at 1 min, mechanical ventilation for 5 days or longer and presence of other findings associated with a syndrome known to include hearing loss [5]. The aim of our study was to compare the results of OAE in term and preterm sicknewborns.

Materials and Method

This descriptive study was conducted in SNCU of a tertiary care hospital over 3 month's period. All newborns (age up to 28 days) admitted to SNCU were included in the study. Newborns with external ear pathology making it difficult to insert a probe were excluded from the study. In the study newborns, distortion product otoacoustic emission (DPOAE) was recorded from both ears at the time of discharge.

Results

In 3 months of the study period, 640 sick newborns were admitted tothe SNCU. Among them 456 were term and 184 preterm. Table 1 shows different pathological conditions in term and preterm babies.

Tables 2 and 3 show number and percentage of "refer" OAE in different pathological conditions in term and preterm newborns respectively.

The percentage of observed "refer" results among term and preterm sick newborns were tabulated in Microsoft Excel. Expected values were calculated thereof. p value of Chi square test on these values came to be 0.85.

Discussion

There are several risk factors for hearing impairment in newborns like birth asphyxia, sepsis, meningitis, ototoxic drug use and hyperbilirubinemia needing exchange transfusion [6].

Birth asphyxia is a risk factor for hearing impairment. It can be justified by the fact that due to birth asphyxia there can be intensive para sagittal injury more laterally and posteriorly in the border zone of parieto-occipital lobe which is more severe in pre term newborns [7]. In our study 4.8% term sick newborns and 31.5% preterm sick newborns with birth asphyxia had "refer" on OAE. Septicaemia also causes hearing impairment in newborns. 8.6% term newborns and 32.5% preterm newborns with septicaemia had "refer" on OAE. In newborn hyperbilirubinemia causes hearing loss infrequently due to preventive measures like phototherapy. But newborns who need exchange transfusion are at high risk of hearing loss. Kernicterus causes more damage in asphyxiated, acidotic and premature newborns. They mainly cause high tone loss but less commonly cause profound hearing loss. In our study 25% term and 75% preterm newborns, who received exchange transfusion due to severe hyperbilirubinemia, had "refer" on OAE. Preterm newborns with meningitis also have higher incidence of hearing impairment than term newborns. In our study 22.9% term and 41.7% preterm newborns with meningitis had "refer" on OAE. Premature newborns without other co-morbid conditions have lower risk of hearing impairment. In our study 8.7% got a "refer" on OAE. Prematurity per se is not responsible for hearing

Table 1 Different pathological conditions in term and preterm newborns

Sl. no.	Pathological condition	No. of term newborns (%)	No. of preterm newborns (%)
1.	Birth asphyxia	166(36.4%)	26 (14.1%)
2.	Septicaemia	139 (30.5%)	40 (21.7%)
3.	Hyperbilirubinemia needing exchange transfusion	8 (1.8%)	4 (2.2%)
4.	Meningitis	35(7.7%)	12 (6.5%)
5.	Major congenital anomalies	12(2.6%)	5 (2.7%)
6.	Other pathological conditions not known to cause hearing impairment	96 (21.1%)	74 (40.2%)
7.	Aminoglycoside used for 2 weeks or more	174 (38.2%)	52 (28.2%)
8.	Only prematurity	–	23 (12.5%)

Table 2 Refer OAE in term newborns

Sl. no.	Pathological condition	No. of refer OAE	Percentage (%) of refer OAE among respective pathological condition
1.	Birth asphyxia	8	4.8
2.	Septicemia	12	8.6
3.	Hyperbilirubinemia needing exchange transfusion	2	25
4.	Meningitis	8	22.9
5.	Major congenital anomalies	4	33.3
6.	Other pathological conditions not known to cause hearing impairment	0	0
7.	Aminoglycosides used for minimum 2 weeks	20	11.5

Table 3 Refer OAE in preterm newborns

Sl. no.	Pathological condition	No. of refer OAE	Percentage (%) of refer OAE among respective pathological condition
1.	Birth asphyxia	8	30.8
2.	Other pathological conditions not known to cause hearing impairment	8	10.8
3.	Septicemia	13	32.5
4.	Hyperbillirubinemia needed exchange transfusion	3	75
5.	Meningitis	5	41.7
5.	Major congenital anomalies	2	40
6.	Only prematurity	2	8.7
7.	Aminoglycosides used for minimum 2 weeks	18	34.6

impairment. Because the ears are fully developed at the end of 2nd trimester. Risk of hearing impairment increases with co-morbidity of prematurity [8]. In our study we didn't find any statistically significant difference in the rates of "refer" result on OAE between term and preterm sick newborns. Hence hearing impairment is more of an accompaniment of different pathological conditions but not prematurity.

Conclusion

Sick newborns with co-morbidities like birth asphyxia, sepsis, meningitis, ototoxic drug use and hyperbilirubinemia needing exchange transfusion are more likely to get a "refer" on OAE. But the incidence is not significantly higher in preterm sick newborns with these co-morbidities.

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