Yalim SD, J Otolaryng Head Neck Surg 2018, 4: 022
DOI: 10.24966/OHNS-010X/100022

HSOA Journal of Otolaryngology, Head & Neck Surgery

Research Article

The Relation of Hearing Values of Hearing Screening Performed Newborns With Day and Weight

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Abstract

Introduction

Otoacoustic emissions are cochlea originated low grade voices and provide information about the function of cochlea. Otoacoustice missions provide an important information about the cochlear physiology.

Objective

To compare the weights, age at the test day, right and left ear transient otoacoustice mission hearing values of hearing screening performed newborns.

Methods

Newborn hearing screening performed 374 babies at the Otorhinolaryngology Department of Baskent University Adana Training and Research Hospital between April 2010 and October 2010 were enrolled. The weights, the ages at the test day, right and left ear transient otoacoustic emissions of the babies were compared.

Results

As the test day increased right and left ear hearing values increased. Positive relation was found between right and left ear hearing values and the age at the test day ($p<0.05$). According to the weight groups the difference between the right and left ear hearing values are not statistically significant ($p>0.05$).

Conclusion

The hearing values of babies is not related with the weight. As the baby'sage increases hearing values increase.

Keywords: Cochlea; Ear; Hearing; Hearing screening; Newborn; Physiology

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Citation: Yalim SD (2018) The Relation of Hearing Values of Hearing Screening Performed Newborns With Day and Weight. J Otolaryng Head Neck Surg 4: 022.

Received: May 31, 2018; **Accepted:** July 30, 2018; **Published:** August 13, 2018

Introduction

Hearing loss negatively affects the speech and language development and psychological and social development of the children. If the diagnosis of the hearing loss delays the speech and language development of the patient is slower and more insufficient compared to the peers. Whether there are risk factors of hearing loss or not all of the newborns should have hearing screening.

Otoacoustic Emissions (OAE) are the voices that are originated from the cochlea and recorded with a microphone which is placed into the ear canal. They occur because of the movement of the outer hair cells of the cochlea in response to the auditory stimulus. OAE is an easy, effective and non-invasive objective indicator of the healthy cochlea function and screening OAE is being used widespread in newborn hearing screening programmes all over the world [1].

For the childhood hearing problems, in 1994, Joint Committe on Infant Hearing (JCIH) consisting of otolaryngologist, audiogist, pediatrist and language specialist suggested that all of the babies with hearing loss should be diagnosed in first three months and should get supportive therapy in the first six months. This committee determined the risk factors associated with permenant congenital hearing loss [2].

1. History of sensorineural hearing loss in the family
2. Intrauterine infection (TORCH)
3. Presence of craniofacial anomaly
4. Birth weight below 1500 grams
5. Indirect billuribinemia necessitating exchange transfusion
6. Ototoxic drug use (aminoglycosides, loop diuretics)
7. History of bacterial meningitis
8. First minute Apgar score of 0-4 or 5 minute Apgar score of 0-6
9. Mechanic ventillation need of 5 days or more
10. Detection of sensorineural and/or conductive type hearing loss related syndrome findings

4. Materials and Methods

Selection and definition of patients

374 babies who had newborn hearing screening in at the Otorhinolaryngology Department of Baskent University Adana Training and Research Hospital between April 2010 and October 2010. Hearing screening results of newborns were evaluated retrospectively after approval from the hospital's ethics committee. Transient Evoked Otoacoustic Emissions (TEOAE) was measured with the ILO-292

USB II, Otodynamics, Herts, United Kingdom. The weight of 29 babies in our study were <1500 grams, the weight of 57 babies were 1500-2499 grams, the weight of 185 babies were 2500-3499 grams and the weight of 103 babies were 3500-4500 grams. The weights, the age of babies as a day at the test day, the right and the left ear Transient Evoked Otoacoustic Emission (TEOAE) screening method hearing values were compared.

Statistical analysis

SPSS (Statistical Package for Social Sciences) for windows 17.0 programme was used for the statistical analysis of the results. While the study data were analysed definitive statistical methods (frequency, percent, mean, standard deviation) were used. Because the parameters in the study did not show normal distribution, non parametric test methods (Kruskal Wallis, Spearman Correlation, Mann Whithney U test) was used. The results were evaluated in 95% safety difference and significance was evaluated bidirectional in $p<0.05$ level.

Results

The means and Standard Deviations (SD) of the left and the right ear TOAEs of the groups and correlations were given in table 1. The babies ages were between 0 and 100 days in the control group and the experimental group (mean 30±1).

Babies smaller than 1500 grams

There is not a statistically significant difference between the left and right ear TEOAE values and the test day ($p>0.05$). There is not a statistically significant difference between the right ear and the left ear TEOAE values ($p>0.05$).

There was a negative relation between the weight of the baby and the test day in the left ear ($p<0.05$). As the weight of the baby increases left ear hearing values decrease.

Babies weighing between 1500 and 2499 grams

We found a positive correlation between the left ear TEOAE values and the test day ($p<0.05$). As the test day increases left ear hearing values increase. We did not find a statistically significant difference between the right ear hearing values and the test day ($p>0.05$). There wasn't a statistically significant difference between the right ear and the left ear TEOAE values ($p>0.05$). We didn't find a significant difference betwen the weight and the right and left ear TEOAE values ($p>0.05$).

Babies weighing between 2500 and 3499 grams

We did not find a significant difference between left and right ear TEOAE values and the test day ($p>0.05$). There was a positive correlation between the right ear and the left ear TEOAE values ($p<0.05$). As the right ear hearing value increases the left ear hearing value increases.

Babies weighing between 3500 and 4500 grams

There was not a significant difference between the left ear and right ear TEOAE values and the test day ($p>0.05$). There was a statistically significant difference between the right ear and the left ear TEOAE values ($p<0.05$). As the right ear hearing values increase the left ear values also increase.

We did not find a statistically significant difference between the weight and the left ear TEOAE values but we found a positive relation between the weight of the baby and the right ear TEOAE values ($p>0.05$). As the weight of the baby increases the left ear hearing values increases.

All babies weighing from 0 to 4500 grams

A positive relation was found between both the left ear and the right ear TEOAE values and the test day ($p<0.05$). As the test day increases the right and the left ear hearing values increases (Table 2).

According to the weight groups there was not a statistically significant difference between the TEOAE values of the left and the right ear ($p>0.05$) (Table 2). According to the gender the left ear TEOAE values were found statistically significant ($p<0.05$). The hearing values of the male babies were significantly higher than the female babies. The right ear TEOAE values of the babies were not statistically significant when compared according to the gender ($p>0.05$).

Discussion

Hearing has an important place for the continuity of the speech and language. The birth weight is the indicator of biologic development of the newborn. Very low birth weight infants (<1500 grams) are the group with the highest risk of sensorineural hearing loss [3].

When we look at the literature in the study of Borkoski-Barreiro et al., all of the patients with sensorineural hearing loss were premature and had one or two risk factors associated with very low birth weight [3]. Similarly in Ohl et al.,'s study extremely low birth weight (birth weight<1000grams) infants were found to have very high risk both for auditory neuropathy and sensorineural hearing loss [4]. In our study when the groups were compared according to the weight both the right and the left ear TEOAE values were not found statistically significant ($p>0.05$).

OAEs were used to investigate the active processes in the cochlea and its maturation. It is thought that the cause of increased latency in the immature ear may be due to middle ear transfer dysfunction. In the study conducted by Tognola et al., TOAE levels increased with age and latency decreased with age [5].

Abdala et al., in 2012 stated that cochlear functions have changed throughout life. In the newborns the apical phase delay was found to be significantly longer, suggesting that the apical half of the cochlea supports membrane movement to be immune at birth [6]. In our study there was a statistically significant relation between the left ear TEOAE values of the babies who had weights between 1500 and 2499 grams with the age as a day at the test day ($p>0.05$). As the day increases the left ear hearing values increases. This may be related to the cochlea maturation.

Groups	<1500	1500-2499	2500-3499	3500-4500	p value
Left ear TEOAE	17.172±11.206	18.175±18.168	15.886±12.074	16.515±13.713	0.524
Right ear TEOAE	18.310±17.609	17.123±15.438	15.930±12.901	15.757±13.787	0.836

Table 1: Mean±standard deviations of the left and the right ear TEOAEs of the groups and p values.

Correlation	p value
Right ear hearing value and test day	0.001*
Left ear hearing value and test day	0.015*
Weight and left ear hearing value	0.000*
Weight and right ear hearing value	0.503

Table 2: The correlation of hearing values of 0-4500 gram babies with the test day and weight.

Note: *p<0.01

Van Dommelen et al., in 2015 assessed the prevelance of Neonatal Hearing Loss (NHL) by week of gestation and categories of birth weight in very preterm neonates according to the results of the two stage automated auditory brainstem response nationwide newborn hearing screening programme in Dutch neonatal intensive care units between October 1998 and December 2012 [7]. Birthweight was classified into <750g, 750-999g, 1000-1249g, 1250-1499g and ≥1500g, and small for gestational age (SGA<10th percentile vs appropriate for gestational age. Their study included 18564 very preterm neonates. They reported that the prevelance of NHL consistently increased with decreasing week of gestation and decreasing birthweight. The girls <28 weeks, boys <30 weeks and SGA were reported to be the most vulnerable to NHL. They reported that the SGA effect started at 27 weeks. They concluded that both the gestational age and the birthweight quantify the risk of NHL [7].

Wroblewska-Seniuk et al., in 2017 analyzed the database of the Polish universal newborns hearing screening programme by means of TEOAEs from 2010 to 2013 [8]. Their study group involved 11438 infants who were born ≤33 weeks of gestational age and control group consisted of 1,487,730 infants. They reported that hearing impairment is a severe consequence of prematurity and its prevelance is inversely related to the maturity of the baby [8].

As a conclusion, the hearing values of the babies are not related to the weight, it is related to the development of the baby. As the baby grows older the hearing values increases. Further studies especially at the cellular level are needed in order to investigate the cochlear development.

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