



Efficacy of Transient Evoked Otoacoustic Emissions (TEOAE) in neonatal hearing screening

Prasanth N P, Dr. Ramanan M P, Deepak Raj P V

Abstract

This study was done to find out the role and sensitivity of Transient Evoked Otoacoustic Emission (TEOAE) test in universal hearing screening program. The study was conducted at a multispecialty hospital in north Kerala. In this study a total of 1000 infants below one month of age was taken as subject. All the subjects in this study were brought to Audiology department for their neonatal hearing screening and the data obtained was used for the study with consent of their parents. Hearing screening was conducted with TEOAE in 3 steps. The first stage screening was conducted soon after birth. Only those infants who got TEOAE absent in first screening were called for second screening after one month. Those who got TEOAE absent during second screening participated in the third stage of screening. Out of the 1000 infants 5 infants had sensory neural hearing loss. A false positive finding was found in one infant who got normal hearing during detailed Audiological investigations, but TEOAE was still absent for her. Based on the clinical findings TEOAE was found to be 99.9% accurate, 100% sensitive and with 99.89% specificity in detecting hearing loss. So this study concluded TEOAE as a successful tool in new born hearing screening.

Introduction

Hearing loss is a common sensory impairment occurring in around 2-4 infants per 1000. (1,3,8). Before universal newborn hearing screening was introduced, hearing evaluation was done only in some high risk infants or when child showed clear signs and symptoms of speech, language and hearing impairment. (7,12), now universal screening programs are being implemented across India. The High-Risk Register includes the conditions such as viral infections, birth asphyxia, congenital malformations of head and neck, family history of hearing loss, Preterm birth, low birth

weight, hyperbilirubinemia, meningitis, ototoxic medications, and severe depression of central nervous system activity at birth. Presence of hearing loss at birth also leads to significant impairment in speech language and auditory skills ranging from misarticulation to profound deaf mutism. (2,4,6). It is a well known fact that hearing loss if properly diagnosed and treated before 6 months of age, will lead to significant progress in speech and language development.(5,11)

Oto Acoustic Emissions (OAE) is potentials generated from the outer hair cells inside the cochlea. 2 types of otoacoustic emissions are in clinical use: Transient evoked otoacoustic emissions (TEOAEs) - potentials emitted in response to sound stimuli of very short duration; usually clicks or tone-bursts and Distortion Product Otoacoustic Emissions (DPOAEs) – potentials emitted in response to 2 simultaneous stimuli of different frequencies. (9,10,14) Outer hair cell dysfunction can be assessed with absence of OAE.(13,15)

Aims and objectives

To study the efficacy of DPOAEs in universal newborn hearing screening.

Materials and methods

The study was conducted in the Audiology department at a multispecialty hospital in north Kerala. The 1000 participants in this study were newborn babies brought to the clinic by their parents for the purpose of hearing screening and that data was taken for this study with their consent. Maico Erosan otoacoustic emission machine was used for this study .The study was conducted from a sound proof Audiology room built according to ANSI Standards.

Results and discussion

In this study, OAE Hearing screening was conducted in 3 steps. The first stage screening was conducted soon after birth. The average age of infants at the time of 1st screening was 48 hours. The subjects who got failed in the 1st screening test were subjected to 2nd screening after 1 month. And those who got failed in the second screening were subjected to 3rd screening at 2 months of age. Candidates who got their OAE screening failed even after the 3rd screening was subjected to detailed Audiological investigations such as ABR, ASSR, Tone Burst ABR and BOA for threshold estimation.

The study was conducted from a period of 1st May 2021 to 30th may 2022. During the 1st screening, out of the 1000 participants 938 infants got TEOAE present in both ears(93.8%) and TEOAE were absent in 62 (6.2%) infants. TEOAE test was conducted again in these 62 infants who got OAE absent during the 1st screening. Among the 62 infants 50 infants got TEOAE

present(80.64%) during the 2nd screening and OAE were still absent for 12(19.35%) infants. These infants were evaluated with tympanometry and 6 infants who got abnormal tympanometry findings was referred for ENT evaluation and the wax and debris present in the ear canal was removed. The 12 infants who got OAE absent during 2nd screening were then subjected for the 3rd stage of screening. Out of the 12 infants TEOAE was present in 6 subjects (50%) and TEOAE was absent in remaining 6 infants (50%).

These 6 infants were subjected to detailed Audiological evaluation with auditory evoked potentials (BERA & ASSR), one child had bilateral profound hearing loss, other two infants had bilateral severe hearing loss and other child had mild hearing loss in right ear and moderately severe hearing loss in left ear. One infant had profound hearing loss in right ear and mild hearing loss in left ear. For one infant BERA & ASSR showed normal hearing sensitivity with absent OAE. All the 5 infants with sensory neural deafness were referred for intervention with hearing aids, cochlear implants and speech and language therapy.

Conclusion

The study showed that TEOAE had 99.9% accuracy and 100% sensitivity in detecting hearing loss. The specificity of TEOAE was found to be 99.89%. Thus it can be concluded that TEOAE is an effective tool in new born hearing screening.

References

1. Hayes D. Newborn hearing screening: selected experience in the United States. *Scand Audiol* 2001;30(2):29–32. DOI: 10.1080/010503901750166583.
2. Kamal N (2013) Newborn hearing screening: opportunities and challenges. *Egypt J Ear Nose Throat Allied Sci* 14(2):55–58
3. Garg S, Singh R, Khurana D. Infant hearing screening in India: current status and way forward. *Int J Prev Med* 2015;6:113. DOI: 10.4103/2008- 7802.170027
4. Cavalcante JMS, Isaac MDL (2013) Analysis of otoacoustic emissions in neonates at term and preterm. *Brazil J Otorhinolaryngol* 79(5):582–588
5. Molini E, Ricci G, Baroni S, et al. Identifying congenital hearing impairment. Personal experience based on selective hearing screening. *Acta Otorhinolaryngol Ital* 2004;24(3):109–116. PMID: 15584580.
6. Barsky-Firkser L, Sun S (1997) Universal newborn hearing screenings: a three-year experience. *Pediatrics* 99(6):133–138
7. Finitzo T, Crumley WG (1999) The role of the pediatrician in hearing loss from detection to connection. *Pediatr Clin N Am* 9(10):15–34

8. Abdullah A, Hazim MYS, Almyzan A, et al. Newborn hearing screening: experience in a Malaysian hospital. *Singapore Med J* 2006;47(1): 60–64. PMID: 16397723.
9. Van Straaten HL, Tibosch CH, Dorrepaal C, Dekker FW, Kok JH (2001) Efficacy of automated auditory brainstem response hearing screening in very preterm newborns. *J Pediatr* 138:674–678
10. Lotfi Y, Movallali G (2007) A universal newborn hearing screening in Iran. *Iran Rehabil J* 5(5–6):8–11
11. Joint Committee on Infant Hearing, American Academy of Audiology, American Academy of Pediatrics, American Speech-LanguageHearing Association, Directors of Speech and Hearing Programs in State Health and Welfare Agencies. Position statement: principles and guidelines for early hearing detection and intervention program. *Pediatrics* 2000;106(4):798–817. PMID: 11015525
12. Taghdiri M, Eghbalian F, Emami F et al (2008) Auditory evaluation of high risk newborns by automated auditory brain stem response. *Iran J Pediatr* 18(4):330–334
13. Wrightson AS (2007) Universal newborn hearing screening. *Am Fam Physician* 75(9):1349–1352
14. De Michele AM, Ruth RA (2010). Newborn hearing screening. <http://www.emedicine.com/ent/topic576.htm>. Accessed 15 Jun 2010
15. Ghasemi MM, Zamanian A, Tale MR et al (2006) Neonatal hearing screening with TEOAE in mashhad city. Iran. *Iran J Otorhinolaryngol* 18(1):15–21 (in Persian)

