Hearing screening of neonates at risk

Alwan M. Maisoun, BSc Aud, Siraj M. Zakzouk, MD, FRCSEd.

ABSTRACT

Objective: The aim of this study is to screen infants admitted to the Neonatal Intensive Care Unit (NICU) for hearing loss

Methods: One hundred and thirty newborns admitted to NICU were screened for hearing loss using otocaustic emission (OAE). Tympanometry was performed using Grason Stadler Incorporation (GSI) 37 and auditory brain response (ABR).

Results: Ninety-six of the infants had known risk factors such as prematurely, low birth weight, hyperbilirubinemia, asphyxia and congenital abnormalities. Out of 130 infants 80 passed the OAE test, 50 had to be rescreened, and 19 had ABR. Only 13 were found with moderate to severe hearing loss, 13.5% of at the risk infants.

Conclusion: Hearing aids were provided from the age of 6 months, for 7 of the hearing impaired children. Parents of other children refused hearing aids and thought the child would talk when older, although they were full informed regading their children's hearing loss. Early identification and early intervention gives chances for infants to acquire speech and language. Parent's awareness will be stressed upon.

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Hearing disorders were observed in 5-60 per 1000 in at risk infants.[1] One to 2 of 1000 newborns suffer from congenital or perinatally acquired hearing disorders.[2,3] All the neonatal intensive care unit (NICU) infants had risk factors for hearing loss.[4] Moderate to severe bilateral hearing loss of 41-90 dB affects the perception of children attempting speech production. If hearing disorder is not detected during the critical period of language acquisition during the first year of life, a profound impairment of receptive and expressive speech and language development will result. This will lead to a decreased acquisition of expected milestone.[5] Early detection of hearing loss up to 6 months of age and therefore, early intervention by giving hearing aid will improve hearing development among hearing impaired. The risk indicators which include hereditary factors, in-utero infection such as rubella, neonatal complications, infection, immaturity, low birth weight, asphyxia, hyperbilirubinemia and ototoxic drugs were described as risk factors of neonatal hearing disorders.[6] Universal newborn hearing screening using physiological tests such as otoacoustic emission (OAE) and automated brain stem evoked response (AABR) is now implemented in some European contries and the United States of America (USA). The screening infant at risk is selective and considered as the first step towards the introduction of universal hearing screening.[7]

The aims of this study are to identify babies (infants) admitted to NICU with congenital anomalies and other risk indicators and to screen them for early onset of hearing impairment that requires intervention and rehabilitation. Also to assess the value, feasibility and practicality of OAE application to include all babies born in the hospital.

Methods. Security Forces Hospital, Riyadh, Kingdom of Saudi Arabia (KSA) is a tertiary, hospital. The NICU is fully equipped, with the capacity of 31 beds. The population for this study is those babies

From the Department of ENT, Security Forces Hospital, Riyadh, *Kingdom of Saudi Arabia*.

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Address correspondence and reprint request to: Dr. Siraj M. Zakzouk, PO Box 3848, Riyadh 11481, *Kingdom of Saudi Arabia*. Tel. +966 (1) 4911374. Fax. +966 (1) 4913634. E-mail: profzakzouk@hotmail.com

admitted to NICU during their first days of life. More attention was given to those neonates who were at risk of hearing impairment; for example premature infant, low birth weight (less than 1500 grams), infants with Apgar score less than 5 at 5 minutes, hyperbilirubinemia (more than 340 umg/L or 20 mgm/100 ml.) and those with severe neonatal asphyxia and meningitis. The babies were examined clinically by a neonatologist and otolaryngologist, and then tympanometry using portable (GSI 37) Autotymp was performed as a first step to rule out any middle ear pathology (infection or otitis media, or both) that might interfere with assessment of cochlear function. When the results suggested conductive interference; for example otitis media with effusion (OME), then the baby was observed, treated by an ear, nose and throat doctor, then rechecked again using the Echo-Screen (Madsen 8-03-470). If the baby passed the OAE, then they were discharged. Babies who failed the OAE were referred back to the program stream to be re-screened. A qualified audiologist conducted the test. **Figure 1** shows the schematic program followed during screening. In the 2nd stage after 3 months, the babies were reexamined and OAE performed. Those who failed were referred for auditory brainstem responses test (ABR).

Results. This is a prospective study, 130 babies were admitted to NICU during the periods 1 May to 31 July 2000, 96 babies were considered at risk of hearing impairment. **(Table 1)** Eighty babies passed the tests and did not stay long in the unit including 46 babies with low birth weight and mild bilirubinemia. There remained 50 babies who stayed long in the NICU, 25 of them with type A tympanogram and 9 with type B one of them with unilateral (total 17 ears). Those with type A, 7 of them passed the OAE screening and 18 failed, and were referred for re-screening within 3 months. Sixteen babies could not be tested as they were very sick or on ventilators. They were referred for the 2nd stage. On the 2nd stage after 2-3 months, the 34 babies were reexamined and OAE was performed. Fifteen of those passed the test and were discharged, and 19 were referred for ABR. They form 19.8% of the total at risk. Those with cleft palate were referred for surgery (repair of cleft palate and myringotomy and tubing). Auditory brain response results showed that 6 with normal hearing and 5 infants with moderate hearing loss (>41dB) and 8 with severe to profound hearing loss. These 13 infants are the one who need aural rehabilitation and follow-up in the audiology unit. The parents were advised regarding hearing aid and rehabilitation and that they should be followed up regularly. Parents of 7 of the children accepted hearing aids for example 54%. The rest did not show up and refused hearing aids.

Discussion. The impact of undetected hearing loss in a child is life long, in that it interferes with normal development for communication skills. Preschool

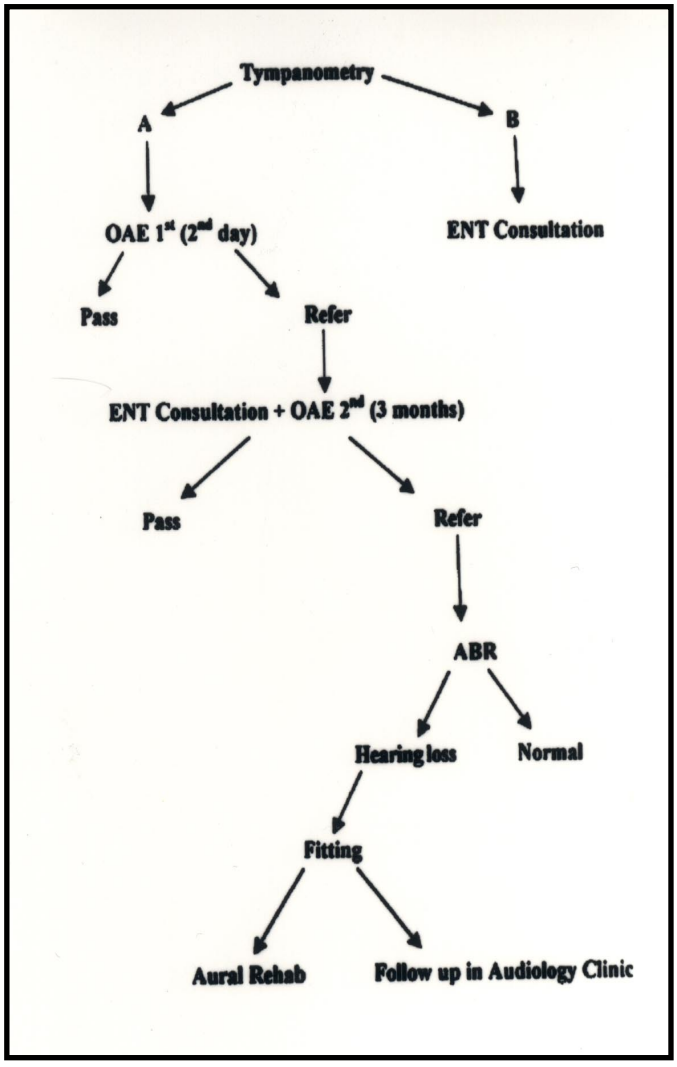

Figure 1 - Schematic program followed during screening. ENT - ear, nose and throat, OAE - otocaustic emission, ABR - auditory brain response

Table 1 - Shows the types of risk factors and number affected with percentages.

Risk Factor	n	(%)
Hyperbilirubinemia	32	(33.3)
Low birth weight	27	(28.1)
Exposed to drug for example Gentamycin, Lasix	33	(34.5)
Asphyxia	2	(2.1)
Cleft Palate	2	(2.1)
Total	**96**	**(100)**

screening was first developed in the 1950s to be administered at the age of 9 months by using simple distraction test (Infant distraction test IDT) Ewing and Ewing,[8] however, doubts have been expressed regarding the efficacy of the distraction test. With up to 20-25% of hearing impaired children not benefiting from hearing aids before school age in the late 1980s to the early 1990s. Haggard[9] considered that the main objective of early infant screening should be to detect severe and profound prelingual deafness, Kemp[10] introduced OAE and by this technology children could be screened for hearing, early in the first day or so after birth. Commercial TEOAE became available in early 1990s. Haggard[9] predicted that it would take 10 years before universal neonatal hearing screening using the OAE recording is implemented in some hospitals in Europe and USA. Recently, the World Health Organization[11] recommended the use of otoacoustic emission for neonatal screening. It was reported that 13% of children under 12 years of age suffered from hearing impairment in KSA.[12] One point five percent was found with sensorineural hearing loss.

Our results showed that approximately 13.5% of at risk infants acutally suffered from moderate to severe and profound bilateral hearing loss. Hereditary factors, meningitis and congenital malformation are independent risk factors. Improvement of perinatal and neonatal care will reduce the occurrence of complications and therefore, the rate of hearing impairment. In our hospital OAE for screening babies was recently introduced and our study was planned to demonstrate its practicality for screening babies. We started with high-risk babies in the NICU, our results demonstrated clearly the efficacy of this procedure and it is possible to apply this as a routine procedure for all neonates born in the hospital and especially those in NICU or nursery. It should be compulsory. Selective screening restricted to those at risk of deafness should be carried out and continued even with universal newborn hearing screening program.[13] Hearing aids using and auditory training should be carried as early as possible within the first 6 months of age. Sancho et al[14] noted that hearing aids should be fitted early for children with moderate degrees of hearing loss. Robinshow[15] reported case studies of congenital profoundly deaf infants given hearing aids between 3 and 6 months of age. The conclusion was that variables in addition to auditory stimulation should be examined, and different programs of rehabilitation explored.

Our study confirmed that neonatal screening is a worth program to be applied for all babies born in hospitals. Screening should be performed in the nursery and well baby clinic during immunization in the first year or better in the first 6 months of age to avoid the harm effect on speech and language development. Ear, nose and throat specialists or general practioners and nurses in birthing hospital and health centers should be trained to carry out otoscopy and the use of OAE equipment in order to be able to screen babies and children attending health centers. The presence of audiologist among staff will help a lot. Our result indicated that approximately 13.4% of infant in NICU suffered from hearing impairment. Public awareness of the problem of hearing impairment and parents education should be stressed upon. Despite the fact that 13 children were discovered with hearing impairment only 7 accepted rehabilitation and hearing aids. This means that 63% of parent of hearing impaired children do not anticipate the bad effect of hearing impairment and its consequences on speech and language development. There should be more Hearing and Speech centers in KSA to be able to cope with the increasing number of children needing rehabilitation. Audiologists and Speech Pathologists are badly needed in this country as their role in diagnosis and rehabilitation cannot be ignored. Identification of hearing impairment is worthless without the availability of rehabilitation programs.

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