Volume-4, Issue-12, Dec-2015 • ISSN No 2277 - 8160

Research Paper | Medical Science

Teoae Vs Aabr Before the Discharge From Neonatal Hearing Screening

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ABSTRACT

The aim of this study is the comparison of the 2 methods for hearing testing in neonates before they leave the neonatal unit.

What are the results after performing each method of the screening.

Was it successful enough to cover every newborn baby within the period in neonatal unit .

How well are they tolerated by the babies and parents?

Group 1: 1582 newborn babies followed- 1 stage aABR

Group 2: 1633 newborn babies followed two-stage screening :TEOAE+aABR

Pass rate- 1521/1582 (96.1 %) for group 1;

Pass rate- 1490/1633 (91.2%) for group 2 , two-stage screening TEOAE+aABR

Pass rate- 1084/1633 for babies tested only with TEOAE

KEYWORDS :

Neonatal hearing screening is easily applicable and tolerable by babies and their parents.

The use of only TEOAE in the neonatal hearing screening is followed by a high false positive rate.

One stage screening with only aABR resulted in lower false positive rate compared to the two- stage screening method.

Neonatal Hearing Screening enables the early detection of the hearing impairment , making it possible an early diagnosis and treatment . The outcome of such an achievement is the prevention of communicative and speech problems . (Yoshinaga -Itani et al 1998).

Our experience has shown a high number of lost babies in the follow up process of hearing evaluation , after being discharged from the maternities. In the contrary of this , a real success in the coverage of every baby born and screened for hearing loss within the period they are in the neonatal unit of the maternity was observed.

Similar data come from many other centers abroad .

While the optimal model of screening varies in different circumstances , a low grade of false positive cases is the key of success in a Neonatal Hearing Screening Program.

There are two certified and widely applicable methods of hearing screening: TEOAE and aABR.

Their performance in the process of hearing screening has been and continues to be an object of comparison.(Kennedy et al 1991; McNellis &Klein 1997; Vahr et al 1998).

Both methods are estimated as well applicable and very accurate , when used in ideal conditions , eventhough a high false positive rate is noted when TEOAE is applied in the first 48 h of life.

In our maternities the *mean duration time* in hospital stay is 48h. The neonates are kept in the mother's room until the discharge from the hospital.

We are aiming to compare the performance of aABR and TEOAE in such conditions, in order to reflect on the intrahospital hearing screening results.

Methods:

Neonatal Hearing Screening was offered to every newborn baby in a special room during a 3 month period following one of two protocols.

The screening was applied after having taken a prior consent by the parents. The test was performed by a well trained nurse, and the audiologist , both member of the Neonatal Hearing Screening program in Albania. The nurse performed the TEOAEs in the "Koco Gliozheni" Maternity , whereas aABR was performed by an audiologist in the "Queen Geraldine" Maternity of Tirana.

The TEOAE was performed near the mother's bed , with the baby laying in mother's arms or while breastfeeding. The age of the baby and presence of a risk factor was registered at the time of the screening. The duration of the test was measured for every baby tested. The time spent for choosing the right sized ear plug was also measured.

The ABR examination was performed in a special, quiet room in the neonatal unit. The duration of the test , as well as the time it took for the skin preparation was also measured.

The parental consent was taken before each examination. The neonates recovered in the intensive care unit were not included in this study.

Hearing screening equipment

TEOAE was performed using an Otodynamic device, a rechargeable and handheld mobile screening . The device shows in its screen , automatic responses of OAE , in order to obtain an objective report of the normal cochlear function.

The ABR was performed using an AUDERA device.

Hearing screening protocols:

Protocol 1: One- Step

For the first three weeks of the study , ABR screening was done using an *Audera device* The newborn babies who failed in one or both ears underwent a second aABR test before the discharge. Babies with a persistent unilateral or bilateral "refer" result were referred for further audiological assessment.

Protocol 2: Two –Step

During the three months of performing the TEOAE screen with a portable *Otodynamics device*, a "refer" result was recorded after either the absence of a TEOAE response or after an unsuccessful attempt to obtain a result.

Babies with" refer" results in one or both ears underwent repeat TEOAE screening. For persistent "refer" a single aABR rescreen was per-

formed prior to discharge from the hospital. Infants who still have a "refer" result will be suggested to further audiological evaluation.

Statistical analysis
The time required to complete each screening protocol was transformed into logarithm the mean were compared using *Student's t-test*.

Overall pass rate resulting from each of the two protocols were compared by mean of the *chi-squared test* . Analyses were performed using the statistical software package SPSS for windows (version 9.0)

Results
1582 newborn babies were tested in "Mbreteresha Geraldine" Maternity during the period of *march-may* under the protocol 1.

1633 newborns were tested on the same period(*march-may*) in "Koco Gliozheni" Maternity under the protocol 2(two-stage).

	Protocol 1- aABR	Protocol 2 – TEOAE+ABR
Number of infants	1582	1633
Postnatal age	24.2 h	20.94 h
Duration of time to complete the screening protocol	7.8 min	6.3 min
Number passing first screen Number passing second screen	1425/1582 (90.09 %) 98/157 (62.4%)	885/1633 (54.2%) 201/748 (27%)
Number passing ABR rescreen	NA	20/27 (74.1%)
Specificity One –step Two-step Referral rate	93.6%	 59.6% 33% 142(8.69%)

Risk factors for hearing loss
There were 185 babies in each group representing risk factors for congenital hearing loss.

Age at screening
The median age of infants at screening was 24.2h (3.4h - 100.8h) in protocol 1, and 20.9h (1.9h – 107.7h) in protocol 2.

The postnatal age of infants at commencement of screening was comparable between the groups (*p=0.19, Mann-Whitney test*)

Screening times and duration of screening by protocols
The mean time required to carry out initial aABR screening with Audera device was 10.7 min, compared to 6.0 min for the initial TEOA screen (p<0.0001). The median times required to complete the screening by protocol were 7.8 and 6.3 min for protocols 1 and 2 respectively, a statistically non significant difference (p=0.071).

Referral rates
Protocol 1: aABR
59 of 1582 infants failed after a maximum of two screens with Audera device. The referral rate was 3.72%

TEOAE – considering TEOAE screening alone , 547 of 1582 infants (33.3%) failed after a maximum of two screens .

The referral rate after two TEOAE screens was significantly higher than that obtained by using a single aABR screen(p<0.001).

Protocol 2 : Teoae followed by aABR
After the two step screening (protocol 2), 142 of 1633 infants failed. The referral rate for the two stage screening was 8.69%.

Pass rate by age at screening:
Table 2 shows the pass rates for the tested babies before or after 24h of birth: 518/596 (97.6%) of babies passed the test in the first 24h of life. (p>0.99)

In the TEOAE screening we noticed a lower pass rate in the first 24h of life , 769/1095(70.45%), compared to 56/64 (87.5%) pass rate after the first 24h of life. (p=0.01).

Age at test	< 24 h	24 h	
aABR / Pass	518/596(97.48%)	962/986(97.62%)	p>0.99
TEOAE/Pass	769/1095(70.38%)	474/538(88.2%)	P=0.01

Discussions:
In this study we found that "pass"rate for the screening with ABR was 90.1% after the first test and 96.3% after 2 tests .

A much lower "pass" rate was found in the screening with TEOAE. Only 54.3% passed the first test, while 66.6% passed the second one.

Other audiological centres's studies refer similar data of "pass" rate after screening with TEOAE in the first 48h :61%(McNellis&Klein, 1997); 70%(Doyle et al, 1998).

When applying ABR after firstly tested with TEOAE, in the Protocol 2, the overall referral rate was 86%, much higher than in the protocol 1(only with ABR) – 3.7%.

Despite the excess in overall referral rates seen in this study with two step approach the difference did not reach statistical significance.

We noticed that referral rate in ABR after a first test with TEOAE was higher 25.9% than that found when tested firstly with ABR , 9.9%.

The poorer specificity of aABR in this situation cannot be wholly explained by the TEOAE-screened infants being a pre-selected cohort at higher risk of hearing loss. A possible explanation would be the impaction of cerumen , vernix or other perinatal debris ,when applying a TEOAE test before.

We found a lower "pass" rate for TEOAE taken during the first 24h. The results were 70.38% of ears passed the test in the first 24h , whether 88.2% passed the TEOAE after 24h.

No essential change in connection with time in test specificity of ABR , except a high rate of "pass" was noted. 97% of ears passed the ABR whether before or after 24 h of life.

The neonates were submitted to the protocols in a sequential not in a randomized manner represents a restriction in this study's conclusions. This means that after 3 months of applying the protocol 1 the time of performing an ABR decreases because the staff gets better trained.

The difference in the age at test could have contributed to a higher "refer" rate in protocol 2. The mean age was 0.6h for protocol 1 and 27.3 h for protocol 2. Eventhough this difference is not statistically significant , it can be clinically significant as more babies were tested before the 24h with the protocol 2(n=49) than with protocol 1 (n=40) and TEOAE has a higher referral rate in the first 24h. Nevertheless the aim of this study was the comparison of the two different strategies of hearing screening within the period they are at neonatal unit

The efficient coverage before discharge means they need to be tested the first 24h of life.

Test specificity values (true negative rate) –(the proportion of neonates that have no hearing problems and are correctly identified as such by the test), shown in the table 1 was calculated for each step of the screening protocol by making the assumption that aABR is 100% sensitive.

Because of non respecting the further consults with the specialist for audiological followup the results may not be complete.

An accurate specificity value of the screening depends also on the complete audiological followup data . So the true specificity cannot be calculated.

The neonatal ward is usually a noisy environment . Nevertheless, we

demonstrated through this study that predischarge neonatal hearing screening is fully possible whether a one-step or two-step approach is adopted. Parental acceptance of TEOAE and ABR screening was not the aim of this study. But our impression was that satisfaction with both tests was similar.

The benefits of pre-discharge hearing screening include:

- Early identification and referral of the neonates with hearing loss, leading to improved prognosis for communication(Yoshinaga-Itano et al, 1998)
- Great coverage of cases ,up to 100%
- Early reassurance for the parents whose babies have no hearing problem.

Conclusions: In our institution , the one step screening(protocol 1) using only ABR was associated with a lower overall referral rate compared to two-step screening(protocol 2).

The overall duration of screening was comparable for both protocols. Our data confirmed a higher *"refer"* rate and lower *specificity value* in the TEOAE predischarge screening .

The higher referral rate in the two step screening , was caused by the poor performance of ABR after applying an TEOAE test before. Further studies of predischarge hearing screening with larger number of neonates are recommended for a better view of such an important issue.

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