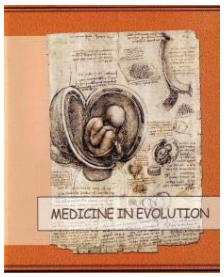
Neonatal auditory screening – essential public health measure



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Abstract

Aim and objective: Our Hospital is part of the National Program VI.1.5 "Prevention of hearing impairments through neonatal screening" from 2019.

This study aims to present a statistic obtained on the group of children tested by auditory screening in the period 2019-2020 in our institution.

Materials and methods: Between January 2019 and October 2020, 753 children aged between 0 months and 18 months were tested in our clinic. The testing consisted in determining the presence or absence of acoustic otoemissions (TOAE) with the SERA-Interacoustics equipment. The children were examined before testing according to a standard protocol. Only children with normal otoscopy and physiological tympanogram (type A curve) were selected for further testing. The test was performed respecting the conditions of environmental quiet, the children being in natural sleep.

Results: Testing the 753 children with acoustic otoemissions, we identified 20 children with profound neurosensory hearing loss, 2 children with moderate neurosensory hearing loss and 2 children with severe neurosensory hearing loss (these children did not have a diagnosis of genetic syndrome). These last 4 children received an indication for a hearing aid, while the rest (20) received an indication for a cochlear implant.

Conclusions: Auditory screening is essential in the early detection of hearing loss in the newborn. The diagnosis of hearing loss made in the first year of life allows the effective rehabilitation of the child. In this way the child manages to acquire the language, to integrate in the community and to develop harmoniously from both auditory and psychoemotional point of view.

Keywords: neonatal screening, pediatric deafness, acoustic otoemission, TOAE, ABR

INTRODUCTION

Our Hospital is part of the National Program VI.1.5 "Prevention of hearing impairments through neonatal screening" from 2019.

The history of the neonatal auditory screening begins in the 60s, when the audiological community became aware that the incidence of deafness in newborns is 1/1000 and that there are non-invasive tests that can detect this pathology from birth. In the past decade, universal newborn hearing screening has been widely adopted throughout North America, Europe (1),(2),(3),(4),(5),(6),(7),(8). For risk stratification, screeining protocols take into account the following risk factors for hearing loss: family history of permanent hearing loss, craniofacial abnormalities including those involving the external ear, congenital infections including bacterial meningitis, cytomegalovirus, toxoplasmosis, rubella, herpes and syphilis, physical findings consistent with an underlying syndrome associated with hearing loss, neonatal intensive care unit stay >2 days or with any of the following regardless of the duration of stay: assisted ventilation, ototoxic drug use, hyperbilirubinemia requiring exchange transfusion, extracorporeal membrane oxygenation (9),(10),(11),(12).

There are two screening tests that are used to detect hearing loss: recording acoustic otoemissions and screening ABR. How these tests are used can lead to different hearing screening protocols:

- AABR only—can be used in NICU and in well-infant nursery
- OAEs only—recommended for use in well-infant nursery
- OAE followed by AABR when the OAE is not passed—OAE screening is completed on both ears first, AABR is only done for those newborns that do not pass the OAE screen. If one or both ears do not pass the AABR, the infant is referred for outpatient diagnostic testing
- Both AABR and OAE—newborns must pass both an OAE and an AABR screening. The newborn who fails one or both screenings in one or both ears, is referred for outpatient diagnostic testing. The most precise but also the most expensive protocol (13),(14)

The importance of early diagnosis of hearing loss is supported by the fact that verbal auditory rehabilitation is possible only with the help of neural plasticity, a process that we benefit fully in the first years of life.

The child with hearing loss, with a late diagnosis, is much more difficult to rehabilitate. The degree of disability may have an important emotional impact and may have consequences on the quality of social life (15),(10),(16),(17).

Aim and objectives

This study aims to present a statistic obtained on the group of children tested by auditory screening in the period 2019-2020 in our institution.

Abbreviations:
TOAE – transient acoustic otoemissions
ABR – auditory brain response
ASSR-auditory steady state response
NICU-neonatal intensive care unit

MATERIAL AND METHODS

Between January 2019 and October 2020, 753 children aged between 0 months and 18 months were tested in our clinic. The testing consisted in determining the presence or absence of acoustic otoemissions (TOAE) with the SERA-Interacoustics equipment. The children were

examined before testing according to a standard protocol. The protocol included otoscopic examination and tympanometry with a 1000 kHz probe for the children. Only children with normal otoscopy and physiological tympanogram (type A curve) were selected for further testing. Children with external / middle ear malformations who will form the working group for another study were excluded from the study. Children with inflammatory diseases of the middle ear and pathological tympanogram were treated and after remission of the acute episode, were audiologically retested.

The TOAE test was performed respecting the conditions of environmental quiet, the children being in natural sleep.

Children without risk factors for deafness, having auto-emissions present will return to control only if necessary, the national protocol recommending a reassessment before starting school.

Children with or without risk factors for hearing loss, who had absent acoustic otoemissions on the first postpartum test, were examined on the second test and with screening ABR until the age of 6 months, in order to be able to schedule the diagnostic tests (ABR and ASSR) and to confirm the possible diagnosis of hearing loss no later than the age of 6 months.

Children with risk factors for hearing loss are evaluated every 6 months until the age of 2, according to the national protocol. In these cases, even in the constant presence of otoemissions, screening ABR is performed at least once during the evaluations. This attitude is meant to discover those cases of auditory neuropathy that initially manifest with the presence of acoustic otoemissions, but with a pathological ABR threshold.

The screening ABR is also performed in conditions of environmental quiet and relaxation of the child (natural sleep) taking care of all aspects related to the methodology (choosing olive to ensure tightness, proper skin degreasing, checking electrode impedances). To perform this test, Natus equipment was used, with the possibility of testing at 4 intensities: 30 dB, 35 dB, 40 dB, 45 dB.

RESULTS

The study group included 753 children. Of these, 250 (33,2%) presented in the anamnesis risk factors for deafness, and 503 (66,7%) did not present risk factors for hearing loss.

We diagnosed 49 (6,5%) children with pathological hearing tests (TOAE refer, ABR screening refer to 45 dB). Profound neurosensorial hearing loss was confirmed in 20 children, and severe or moderate neurosensory hearing loss was observed in 4 children. 10 children (under 6 month of age) are still being diagnosed with scheduled follow-up tests with ABR and ASSR. 15 children came out of our records probably by addressing other territorial centers.

In the subgroup formed by children with risk factors for deafness (250), 20 (8%) had pathological TOAE and screening ABR.

In the subgroup of children without risk factors for NHS (503), 29 (5,76%) showed pathological TOAE and screening ABR.

A special group consists of 15 children diagnosed with genetic syndromes: Down syndrome (5 pacients), Myhre syndrome (1 patient), oculo-dental syndrome (1 patient), Duchenne distrophy (1 patient), Antley Bixler syndrome (1 patient), Binder syndrome (1 patient), sindrom Wolf Hirhhorn (1 patient), 4 patients with possible genetic abnormalities, but no confirmation yet. Children with Down syndrome presented with moderate hearing loss in 3 cases, 2 cases of normal hearing. In the case of one of the unspecified genetic syndromes and in the case of Antley Bixler syndrome we identified deep and severe neurosensory hearing loss. Another case of unspecified genetic syndrome (with bilateral

anophthalmia) presented a severe neurosensory hearing loss, with possible auditory neuropathy.

In the case of the patient with Myhre syndrome, we identified a moderate neurosensorial hearing loss associated with chronic serous otitis, for which the child was scheduled for the insertion of aerators, as well as the 3 children with Down syndrome.

DISCUSSIONS

This study shows that patients with perinatal risk factors for hearing loss, in our case 33% of the group, should be tested by audiological screening, because their risk of developing hearing loss is higher than in the category of children who do not have perinatal risk factors. In our case, in the group of children with risk factors 8% presented pathological screening tests, compared to 5% in the group of those without risk factors.

Of the total number of patients with screening tests with pathological results (6.5%), the majority were subsequently diagnosed with deep neurosensory hearing loss, only 4 children presenting with moderate or severe neurosensory hearing loss.

Patients with genetic pathologies form a category at risk of developing hearing loss, in our case 5 patients out of a total of 15, more precisely 30% were subsequently diagnosed with hearing loss.

The use of tympanometry with a 1 Hz probe helps in the evaluation process, to select the cases in which the presence of serous otitis is present, especially frequent in the cases of children diagnosed with genetic syndrome.

The incidence of hearing loss in our group is higher than in the study conducted by Cianfrone et al. (18), This difference is probably due to the difference between the study populations, our group being considerably smaller.

There are limitations of the screening protocol, more precisely there is a risk that mild hearing loss (below 30 dB) will not be identified and also, progressive hearing loss in children without risk factors, examined only with TOAE at birth, can be diagnosed later with delay. Also, in the case of auditory neuropathy, children may initially have TOAE present, thus escaping the diagnosis of hearing loss. Consequently, we established that in our protocol we should also use ABR screening in children with risk factors for hearing loss, at least once during follow-up evaluations, even if the TOAE result is ”pass” bilaterally (13).

CONCLUSIONS

Auditory screening is a procedure that has shown over time that false-positive rates, indicating the proportion of normally hearing children who are referred for diagnostic testing, are reported to be between 2% and 4% in most UNHS programs, with well-established programs reporting rates of 0.5% to 1.0%. Comparatively, the false-positive rates for newborn thyroid screening are approximately 2% (9),(19),(20).

It is essential that national hearing screening programs work everywhere in order to identify children at risk for hearing loss. Early verbal auditory rehabilitation of children, offers them the chance to develop and integrate into society, increasing their quality of life.

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