International Journal of Pediatric Otorhinolaryngology 77 (2013) 932–935

Contents lists available at SciVerse ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Time after birth in relation to failure rate in newborn hearing screening

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ARTICLE INFO

Article history:
Received 19 December 2012
Received in revised form 1 March 2013
Accepted 7 March 2013
Available online 3 April 2013

Keywords:
Neonatal screening
Hearing
Newborn

ABSTRACT

Objective: To verify and correlate the rate of failure in the newborn hearing screening in relation to the time of life of the newborn when the procedure is carried out.
Methods: The study focused on babies born on a maternity, from October/2010 to March/2011. Newborns possessing one or more risk indicators for auditory impairment as described by the JCIH, 2007 or with time of life longer than 60 h were excluded. An automated transient evoked otoacoustic emission equipment was used. The "pass" criterion adopted was: signal to noise ratio greater than 6 dB and a minimum signal level of −5 dbNPS in at least three frequencies. Babies were divided in three groups: GI: fewer than 24 h old, GII: between 24 and 36 h, and GIII: more than 36 h.
Results: 890 babies were included, 52% male and 48% female. Of all newborns, 70% passed the test and 30% failed. Regarding gender, 30% female and 31% male failed the test. 35% of the newborns were in GI, 53% in GII and 12% in GIII. Comparing the three groups simultaneously, we conclude that there is evidence of differences between them (P value <0.001). When compared two by two, we conclude that the distributions of GII and GIII may be considered the same ($P = 0.443$), but both are different from GI ($P < 0.001$). We noticed that in GII and GIII, the proportion of patients who presented de "pass" result is much higher than that of patients who presented this result in GI. The result of logistic regression shows that with the passing of each hour after birth, a newborn's chance of failing the test decreases by 5%.
Conclusion: We have concluded that the failure rate in the newborn hearing screening was much higher in the newborns screened within 24 h from birth, deviating statistically from the newborns screened between 24 and 36 h. There was no statistically significant difference between the latter two time brackets.

1. Introduction

Hearing is essential for the acquisition of spoken language since it is through the interaction with individuals who already have the command of language that the child is able to understand his/her universe, comprehend his/her counterparts, develop and organize thoughts and feelings, and acquire knowledge. [1].

For the hearing-impaired child, the first six months of life are decisive. Therefore, measures must be taken as soon as possible as to minimize the difficulties arising from sensory deprivation. To accomplish that, it is necessary that the newborn with a hearing impairment be identified still in his first month of life [2].

In Brazil, the importance of Universal Newborn Screening has been emphasized for more than 10 years, and on August 10th 2010, federal law 12.303 has made the gratuitous utilization of the "newborn hearing screening", conducted by means of Evoked Otoacoustic Emissions, mandatory at all hospitals and maternities for the children born within their premises.

Otoacoustic Emissions constitute sounds which can be registered in the outer acoustic meatus spontaneously or evoked by acoustic stimulation. When evoked, they are classified according to the stimuli utilized to generate them: transient, frequency stimulus, or distortion product [3].

Otoacoustic emissions evoked by Transient Stimulus are the most commonly utilized as a method for hearing screening for its use of low intensity stimuli encompassing a vast range of frequencies, and for its quick registration [3]. It does not quantify hearing losses, but do detect their presence, and constitute a fast, objective, sensitive, and non-invasive instrument for newborn's screening [2].

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http://dx.doi.org/10.1016/j.ijporl.2013.03.010

The failure rates for screening conducted by means of OAE may vary from 5 to 20% when the triage is conducted in the first 24 h of life, dropping to 3% when conducted between 24 and 48 h of life [4].

The time of hospital stay has been decreasing in different countries, and this trend has been incorporated in Brazil, especially in Obstetrics. The defenders of early discharges state the practice is safe and advantageous from the medical, social, and economical perspectives by reducing the number of hospital infections, complying with the parents desire for shorter periods of hospitalization, and decreasing hospital expenses [5].

The disadvantages of early hospital discharge for universal newborn hearing screening, however, are many. As a result of the early discharge, the screening is now carried out in newborns before within 24 h of life. Early discharge from hospital also prevents a new screening attempt [5]. Studies show that triage failures decrease as the time of life of the newborn increases [6]. Utilization of the screening procedure after the first 24 h of life seems to be an important factor for a hearing newborn not to fail the triage [5].

One factor that interferes with the registration of Otoacoustic Emissions evoked by Transient Stimuli, especially in the first hours of life, is the presence of vernix in the outer auditory canal [7]. Vernix caseosa, which covers the skin of the fetus, is a fatty substance produced by the sebaceous glands and is also present on the skin of the newborn [8].

In this manner, due to the growing need to conduct the screening within the first 24 h of life, in the presence of vernix and additional factors that may directly interfere with the result of the universal newborn hearing screening (UNHS), the objective of this study was to verify and correlate the rate of failure in the newborn hearing screening (NHS) in relation to the time of life of the newborn when the procedure is carried out.

2. Methodology

The study was retrospective, descriptive and exploratory and has been conducted by means of a survey of results from screenings conducted at the *Centro de Referência de Saúde da Mulher de Ribeirão Preto* – CRSM-Mater (Health Reference Center for Women in Ribeirão Preto), in the period from October 2010 to March 2011.

The project was approved by the Commission on Ethics in Research from CEFAC (Center of Specialization in Clinical Phonoaudiology) under number 088/11, with a dispensation for the Term of Free and Understood Consent.

The study focused on babies born at the CRSM-Mater, in the period between October 2010 to March 2011 and screened before being discharged from the hospital. Results from 1290 newborns were surveyed.

402 newborns were excluded for possessing one or more risk indicators for auditory impairment as described by the JCIH, 2007 [9], for lack of data in the database or because of an interval greater than 60 h from birth.

The screening was conducted by two of the authors, utilizing Otodynamics' *Otoport Lite*, an equipment of Otoacoustic Emissions by Transient Stimulus. Screenings were carried out before discharge from the hospital, mostly on the day following the birth of the baby, whenever health conditions allowed. The newborn at the time of the screening was positioned on the mother's lap in a separate room.

The utilized equipment tests the frequency ranges of 1 kHz, 1.5 kHz, 2 kHz, 3 kHz and 4 kHz. The adopted "pass" criterion was of a signal-to-noise ratio greater than 6 dB and a minimum signal level of −5 dbNPS in at least three frequencies. The patient meeting these requirements in both ears was considered as having passed the screening. Otherwise, the patient considered as having failed was rescheduled to retest after 30 days. In this study only the results of the screening were considered.

Babies were divided in three groups:

- GI: Newborns with fewer than 24 h;
- GII: Newborns between 24 and 36 h;
- GIII: Newborns with more than 36 h.

Subsequently, a survey of the number of newborns who had passed and failed the screening for each of the groups was conducted.

A descriptive analysis was conducted by means of percentages for the purpose of case-by-case characterization. The following tests were applied for statistical data analysis: homogeneity chi-square test to compare the distribution of the variable "Result" (pass, fail) among groups GI, GII and GIII; Fischer's exact test to compare the distribution of the variable "Result" in each pair of groups, and a model of Logistic Regression to explain the variable "Result" as a function of "Time of Life". The Homer and Lemeshow test was applied to verify whether the model of logistic regression is well adjusted. The value *P* in this test has resulted in 0.187 (>5%), showing a good adjustment of the model of logistic regression.

The level of significance adopted in the conclusion of the tests was equal to 5%. The results marked with asterisks are considered statistically significant.

3. Results

890 babies were included in the study, 466 (52%) male and 424 (48%) female. From the total number of newborns, 620 (70%) passed the test and 270 (30%) failed. The result of the screening in relation to gender may be observed in Fig. 1.

In regard to the groups, 314 babies (35%) were in GI, 474 (53%) in GII and 102 (12%) in GIII.

Table 1 shows the variation in time after birth for the babies by corresponding life groups.

Table 2 shows the distribution of frequencies of the variable Result by group. When comparing the three groups simultaneously by means of the chi-square test for homogeneity, we conclude that there is evidence of differences between them (P value < 0.001).

When compared two by two, by means of Fischer's exact test (Tables 3–5), we conclude that the distributions of groups GII and GIII may be considered the same (P value = 0.443), but both are different from group GI (P values < 0.001). We noticed that in groups GII and GIII, the proportion of patients who presented the "pass" result is much higher than that of patients who presented this result in group GI.

By applying the model of Logistic Regression, we concluded that with the passing of each hour after birth, a newborn's chance of failing the test decreases by 5%. (Table 6).

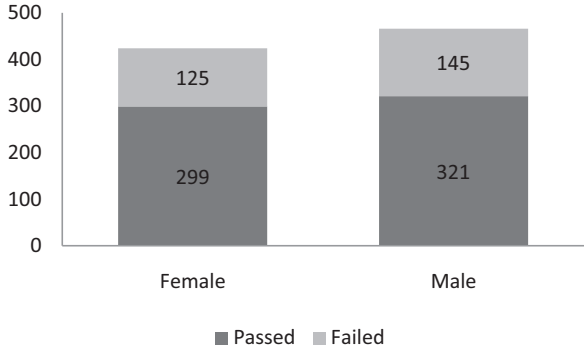

Fig. 1. Test result by gender.