

Original articles

Relation between auditory abilities in the first year of life and language diagnosis in pre-terms

Relação entre as habilidades auditivas no primeiro ano de vida e o diagnóstico de linguagem em prematuros

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ABSTRACT

Purpose: this article aims at investigating the relation between the hearing abilities in the first year of life and the diagnosis of language between 2 and 4 years of age in preterm infants born weighing less than 2,000 grams.

Methods: the infants were selected from the database of this program composing a group of 54 infants with transient evoked otoacoustic emissions present in the first three months, with an auditory behavior between 6 and 18 months and an evaluation of language between 2 and 4 years of age.

Results: there were no statistically significant differences between the occurrence of cochlear-palpebral reflex and the ability of sound localization between 6 and 18 months regarding result of language assessment. Regarding the ability of recognition of verbal commands for children aged between 12 and 18 months, there was a statistically significant difference. Infants who present alteration on the recognition of verbal commands from 12 to 18 months are 12.25 times more likely to have language alteration at the age between 2 and 4 years.

Conclusion: there is a relation between alteration on the recognition of verbal commands for children aged between 12 and 18 months and the alteration in the result of language evaluation for those aged between 2 and 4 years.

Keywords: Infant; Premature; Hearing; Language

RESUMO

Objetivo: verificar se há relação entre as habilidades auditivas no primeiro ano de vida e o diagnóstico de linguagem entre os 2 e 4 anos de idade em crianças nascidas pré-termo com peso abaixo de 2000 gramas.

Métodos: foram selecionados um grupo de 54 crianças com emissões otoacústicas evocadas por estímulos transientes presentes nos primeiros três meses, com avaliação audiológica comportamental entre os 6 e 18 meses e avaliação de linguagem entre os 2 e 4 anos de idade.

Resultados: não foram observadas diferenças estatisticamente significantes entre a ocorrência de reflexo cócleo palpebral e a habilidade de localização sonora entre 6 e 18 meses com resultado da avaliação de linguagem. Em relação à habilidade de reconhecimento de ordens verbais entre os 12 e 18 meses foi observada diferença estatisticamente significativa. Crianças que apresentam reconhecimento de ordens verbais alterado entre 12 e 18 meses tem 12,25 vezes mais chances de apresentar linguagem alterada entre os 2 e 4 anos.

Conclusão: existe uma relação entre o reconhecimento de ordens verbais alterado entre 12 e 18 meses e a alteração no resultado da avaliação de linguagem entre os 2 e 4 anos.

Descritores: Criança; Prematuro; Audição; Linguagem

INTRODUCTION

Prematurity is one of the risk factors for a delay in child development¹⁻⁹, including auditory development. Both early diagnosis and the development monitoring of these children during the childhood are imperative in this case.¹⁰⁻¹⁷.

In a study¹⁸ assessing the growth and development of preterm infants weighing less than 2,000g it was observed high rates of neurological, motor and phono-audiologic impairment.

An auditory evaluation conducted in the early years of life allows verifying the auditory development of the child, i.e., identifying any delay or disorder, and checking for signs suggesting auditory processing disorders.¹⁹

The anatomic and physiologic integrity of the Auditory System is a requirement for the acquisition and normal language development. The child should be able to pay attention, detect, discriminate and locate sounds as well as to memorize and integrate auditory experiences to achieve speech recognition and understanding²⁰.

The maturation of the central auditory system occurs during the first year of life, thus the first years are regarded as the critical period for the development of hearing and language²¹.

The hypothesis in this study is that there is a relation between the auditory and the language development in preterm infants: those children that present expected responses for their age in the first year of life tend to have normal language between 2 to 4 years while those presenting a change in their development of auditory abilities will present an increased risk of language delay between 2 and 4 years of age.

Based on these assumptions, the aim of this study is to check whether there is a relation between auditory abilities in the first year of life and the diagnosis of language for preterm infants weighing less than 2000 grams aged between 2 and 4 years.

METHODS

This is a retrospective study that analysed 235 medical records of new-borns. The access to medical records was authorized by the responsible for the Neonates at Risk Multidisciplinary Monitoring Program. The study was approved by the Federal University of São Paulo Ethics Committee under the approval number 0946.

A group of 54 preterm children with birth weight of 2000 grams or less were selected from the multidisciplinary neonates at risk monitoring program database in the period between 2004 and 2005.

The inclusion criteria were: preterm neonates weighting 2000 grams or less, transient evoked otoacoustic emissions (TEOAE) present in the first three months (the pass/fail criterion used the one given by the equipment, i.e. , TEOAE present when they are 6 dB above the noise for the frequencies between 1.6 and 3.2 KHz indicating normal cochlear function); visual reinforcement audiometry held between 6 and 18 months with minimum levels of normal responses indicating normal hearing; behavioural hearing tests between six and 18 months of chronological age and language evaluation between 2 and 4 years of chronological age in the child's medical records. The exclusion criteria were: absence of otoacoustic emissions responses, visual reinforcement audiometry with minimum levels of high responses for age suggesting hearing loss, altered otoscopy, genetic syndromes and/or severe encephalopathy (children with cerebral palsy).

The results for the auditory and language skills evaluations found in the medical records of the child were registered in a specific form.

The Hearing (or auditory) Evaluation and Monitoring protocol with the Neonates at Risk Multidisciplinary Monitoring Program used the following procedures:

1) cochlear-palpebral reflex (CPR) was performed with intense sound stimulus (agogo - 100 dB SPL) and the response was considered present when there was contraction of the orbicularis oculi muscle, observed by eyelid movement.

2) auditory behaviour present to instrumental sound stimuli was performed according to the procedure described²². The expected responses for each age group are shown below:

Age	Expected responses
0-3 months	Attention to the sound
3-6 months	Attention to the sound Tries to find the sound source Lateral localization
6-9 months	Lateral localization, indirectly below ear level and indirectly above ear level
9-13 months	Lateral localization, indirectly below ear level and indirectly above ear level
13-18 months	Lateral localization, indirectly below ear level and indirectly above ear level

3) the commands recognition which consisted of verifying the occurrence of recognition and the level of recognized verbal command level described²²: Level I (9-12 months): Wave goodbye! Blow a kiss! - Clap your hands! ; Level II (12-15 months): Where is the pacifier? - Where's Mom? Where are your shoes? ; Level III (15-18 months): Where's your hair? - Where's your hand? - Where's your foot?

The language diagnosis for children aged between 2 and 4 years was obtained from medical records of the Multidisciplinary Program for risk Neonates. The PLS-3 Preschool Language Scale 3 third edition test was used²³. This test aims at evaluating the language skills, especially for babies and young children, considering the aspects of reception and transmission, allowing to compare the performance of these aspects and identifying losses. It is organized in two standardized subscales: Listening (L) and Expressive Communication (EC), and the total score is composed by the results obtained in these two subscales.

The PLS-3 is standardized for children from two weeks to six years and 11 months old of age. The scale proposes standardized scores for age, percentiles ranges, and equivalent age to the total scores, auditory comprehension and expressive communication. This test was used routinely in children up to six years of the Multidisciplinary Program Risk Neonates.

The test was initiated by the expected behaviors corresponding to the age of 12 months prior to the child's chronological age. Based on these results, the

test base is obtained, that is, when the child responds properly to three consecutive behaviors, obtaining a point in each. The test top was obtained when the child is not properly held five behaviors consecutively. The test was ended when the top was obtained.

At the end of the tests application the points for each behavior properly performed by the child were added. The points corresponding to the behavior previous to based were added to this sum.

The PLS-3 presents conversion tables based on mean score obtained by standard sample for different age groups, these tables follow the normal values found in the test standardization sample. Thus it is possible to classify the child's performance in normal (over 85 points) and behind the development of language (below 85 points).

The records of the results obtained for children from 2 to 4 years of age were used in this study.

For the Statistical analysis of this study it was used the Chi -square and Odds Ratio (OR) to determine the association between auditory skills and language evaluation. It has been set for this work a 0.05 significance level.

RESULTS

The association of the cochlear-palpebral reflex analysis of the occurrence and outcome of the language evaluation between 2 and 4 is presented in Table 1.

Table 1. Association between the Cochleopalpebral reflex occurrence and the result of language evaluation.

Language	CPR		Total
	Present	Absent	
Normal	26(96%)	1(4%)	27(100%)
Altered	23(85%)	4(15%)	27(100%)
Total	49(91%)	5(9%)	54(100%)

p-value =0,159

Caption: CPR= Cochleopalpebral reflex

From the 27 (children) with result of evaluating the language altered between 2 and 4 years, 15% presented absent CPR but there was no statistically significant difference between these variables.

The analysis of association of the results of sound localization hearing ability for children between 6 and 18 months of age and the result of language assessment between 2 and 4 years is shown in Table 2.

Table 2. Association between the sound localization ability and the results for the language assessment

Language	Sound location		Total
	Normal	Altered	
Normal	20(74%)	7(26%)	27(100%)
Altered	17(63%)	10(37%)	27(100%)
Total	37(69%)	17(31%)	54(100%)

p- value= 0,379

From the 27 children that obtained the language assessment altered between 2 and 4 years, 37% presented an alteration in the sound localization ability between 6 and 18 months, but there was no statistically significant difference.

The analysis for the association of the recognition of verbal commands between 12 and 18 months and results of the language evaluation is shown in Table 3. recognition of verbal orders

Table 3. Occurrence of auditory ability of recognition of verbal commands in relation to the variable and the result of language evaluation

Language	CR		Total
	Normal	Altered	
Normal	21(78%)	6(22%)	27(100%)
Altered	6(22%)	21(78%)	27(100%)
Total	27(50%)	27(50%)	54(100%)

p-value=0,001*

Caption: CR=command recognition

There was a statistically significant association between language and recognition of verbal commands. From the children with normal language, 78% presented commands recognition between 12 and 18 months normal and, among those with impaired language, 78% presented recognized commands altered between 12 and 18 months.

The analysis of the odds ratio between absent CPR, altered recognition of verbal commands for children between 12 and 18 months, sound localization ability for children between 6 and 18 months changed and the alteration in the result of language from 2 to 4 years is shown in Table 4.

Table 4. Odds ratio (OR) for individual with altered language

Variables	Odds Ratio(OR)
CPR	Absent 4,52
CO	Altered 12,25
Sound localization	Altered 1,68

Caption: RCP=reflexo cócleo palpebral; CR=Command recognition; OR= Odds Ratio

Table 4 shows that the Odds Ratio (OR) presents values greater than 1, with emphasis in OR for commands recognition language, where the value is 12.25, indicating that children presenting altered orders recognition between 12 and 18 months are 12.25 times more likely to have language altered between 2 to 4 years of age. And children with absent CPR are 4.52 times more likely to have alterations of language between 2 and 4 years of age and children who do not have sound localization response between 6 and 18 months is 1.68 times more likely to present language alteration between 2 and 4 years.

DISCUSSION

In the present study statistically significant differences were not observed between the occurrence of the cochlear-palpebral reflex and the evaluation result of language alteration. This result was unexpected since in the literature there are references to alteration in auditory behavior as a risk for language disorders. Study on high-risk children where the auditory development of the population was followed, the absence of cochlear-palpebral reflex with normal hearing one of the responses suggesting changing the hearing processing²⁰. Previous studies have found that children with change in the quality of the acoustic stimuli response should be considered as a risk group for auditory processing disorder and consequently of language and learning²⁰⁻²². However, it was observed in this study that children with absent CPR are 4.52 times more likely to have the language changed between 2 and 4 years (Table 4). These findings support the authors that relate the acquisition and/or impaired communication development with impaired hearing abilities²⁰. Such differences may be a result attributed to the limited sample size.

From the 27 children who had an altered result for the language evaluation performed between 2 and 4 years of age, 37% had an alteration in sound localization ability, but there was no statistically significant difference (Table 2). These findings contrast to those obtained by the authors in studies where 70% of children had altered sound localization responses between 6 and 9 months of age who were evaluated at four years of age, and had language impairments²⁴. The authors concluded that children with altered sound localization should be considered as a risk group for language alteration. It has been observed that children with difficulty in sound localization with normal following acuity for presented auditory processing disorder and

delay in the acquisition and development of language²⁰. According to the literature there is a strong relation between the sound localization ability and the children overall development. However it was observed in this study that children who did not have sound localization response between 6 and 18 months are 1.68 times more likely to have the language alteration between 2 and 4 years (Table 4).

Regarding the results of the altered language assessment for children between 2 to 4 years of age, 78% of the children had an alteration in the recognition of verbal commands between 12 and 18 months, showing a statistically significant association (Table 3). Children with impaired recognition of verbal commands between 12 and 18 months are 12.25 times more likely to have alteration in language between 2 and 4 years (Table 4). The ability to recognize verbal commands is one of the steps of evaluation of auditory development directly related to language, since the ability to understand commands involves aspects related to receptive language. According to a study, there is a relation between language assessments with abnormal results held between 12 and 24 months and language delay in children at 3 years of age²⁶. Reception disabilities and processing of verbal information, as well as the integration of this information can be observed very early in children²⁷. Thus the authors report the importance of monitoring the pre-term and low birth weight of children development, especially regarding the auditory-verbal aspects. And they mention as an example the importance of evaluating the child from 12 to 18 months, since the signs of communicative behavior present in children at this age are considered predictive of linguistic emergency^{27,28}.

CONCLUSION

There was a significant relation between command recognition ability between 12 and 18 months and the result of the evaluation of the language for children from 2 to 4 years in preterm infants weighing less than 2000 grams. Children with alteration in commands recognition between 12 and 18 months are 12.25 times more likely to have language alteration between 2 to 4 years of age.

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