

Oral and written language of children seropositive for HIV: a longitudinal follow up

Linguagem oral e escrita de crianças soropositivas para o HIV: um acompanhamento longitudinal

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ABSTRACT

Introduction: The incidence of disorders the Central Nervous System (CNS) in HIV-infected may range from 30 to 90% in pediatric patients, with age, intensity and immunological impairment being important factors. **Purpose:** Evaluate reading and writing of children with HIV and compare with the phonological development and with clinical markers and immunovirological of AIDS. **Methods:** This is a longitudinal study in which 26 children, 12 boys and 14 girls, who had acquired HIV infection by vertical transmission, were assessed regarding the phonological aspects of oral language and reassessed five years later regarding the phonological aspects, and reading and writing skills. The data obtained were assessed according clinical staging of AIDS, viral load and CD4 count, at the two time points. **Results:** There is a relationship between the phonological development and the academic performance in reading and writing of children with HIV and we did not detect relation between the phonological aspects and assessed regarding reading and writing skills with clinical staging and to the immunovirological markers of AIDS. **Conclusion:** HIV-infected children represent a risk group for alterations of oral and written language that do not depend of the severity and clinical picture or the immunovirological profile of AIDS. Moreover, observed relationship between changes in phonological development and further development of reading and writing corroborates the hypothesis of phonological deficit as one of the causes of difficulties in the literacy process.

Keywords: HIV; Acquired Immunodeficiency Syndrome; Child; Language; Speech, Language and Hearing Sciences

RESUMO

Introdução: A incidência de distúrbios do Sistema Nervoso Central (SNC) em portadores de HIV pode variar de 30% a 90% em pacientes pediátricos, sendo a idade, a intensidade e o comprometimento imunológico, fatores importantes. **Objetivo:** Avaliar a leitura e a escrita de crianças com HIV e comparar com o desenvolvimento fonológico e com marcadores clínicos e imunoviológicos da AIDS. **Métodos:** Estudo longitudinal com 26 crianças, 12 meninos e 14 meninas, que haviam contraído a infecção pelo HIV por transmissão vertical. Foram avaliadas quanto aos aspectos fonológicos da linguagem oral e reavaliadas cinco anos depois, quanto aos aspectos fonológicos e de leitura e escrita. Os dados obtidos foram avaliados de acordo com o estadiamento clínico da AIDS, carga viral e contagem de moléculas CD4, nos dois momentos. **Resultados:** Observou-se relação entre o desenvolvimento fonológico e o desempenho acadêmico, na leitura e escrita de crianças com HIV. Não foi detectada relação entre os aspectos fonológicos, quanto às habilidades de leitura e escrita com estadiamento clínico e aos marcadores imunoviológicos da AIDS. **Conclusão:** Crianças infectadas com HIV representam um grupo de risco para alterações da linguagem oral e escrita, que não dependem da gravidade e quadro clínico, ou do perfil imunoviológico da AIDS. Além disso, a relação observada entre as mudanças no desenvolvimento fonológico e o desenvolvimento da leitura e da escrita confirma a hipótese do deficit fonológico como uma das causas das dificuldades no processo de alfabetização.

Palavras-chave: HIV; Síndrome de Imunodeficiência Adquirida; Criança; Linguagem; Fonoaudiologia

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INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS) is a infectious disease that started to be considered a pandemic by the World Health Organization (WHO) in 1993. According to UNAIDS⁽¹⁾ data, the number of HIV-infected persons has been falling over the last decade, with the number of new cases in 2011 being 20% lower than in 2001. Even so, however, in 2015 there were 36.9 million persons living with HIV, with approximately 2.6 million of them are children. This characterizes a serious public health problem and one of the affections that most engage the attention of health professionals and of the general population, representing an enormous challenge for the scientific world.

After the introduction of antiretroviral therapy or HAART (highly active antiretroviral therapy), AIDS is now considered a chronic disease that is managed and treated properly, reduces considerably the probability of disease and death for persons living with HIV / AIDS. In addition, recent studies have shown that treatment is not only effective for disease control and improved quality of life but also to decrease transmission of the virus^(2,3).

Among the forms of HIV transmission to children, the major one is vertical transmission from mother to child. The clinical course of AIDS in the pediatric population differs considerably from that of adults, being more aggressive and with a shorter period of latency between contamination and the onset of symptoms, and with a shorter survival after the onset of symptoms⁽⁴⁾.

Similarly, disorders of the Central Nervous System (CNS) in HIV-infected children differ considerably from those observed in adult patients and their clinical manifestations are quite variable, involving encephalopathies of both a static and progressive nature, neurological dysfunctions and injuries, microcephaly, mental retardation, pyramidal signs, delayed neuropsychomotor development, delayed language acquisition, and hyporeflexia^(5,6,7).

The incidence of these disorders may range from 30 to 90% in pediatric patients, with age, intensity and immunological impairment being important factors. Thus, the impairment of the motor, cognitive and behavioral levels varies according to brain maturation and time since the onset of the neurological disease, often representing the initial manifestation of AIDS in up to 18% of infected children⁽⁸⁾. Evidence suggests that this vulnerability is due to the fact that the brain of children, in being in constant development and therefore being more vulnerable to complications, also has immature neurons and glial cell with a greater ability to replicate and to undergo HIV infection compared to the adult brain⁽⁴⁾. On this basis, the virus frequently reaches its major target, the brain, producing tissue injury that results in a decline of neuropsychomotor development⁽⁹⁾.

However studies observe that the effects of HIV on neurodevelopment not act only in a direct manner on the

CNS. Several adjuvant factors related to AIDS can interfere in the neurological condition as the stage of maternal disease, presence of opportunistic infection (eg.: toxoplasmosis, cytomegalovirus), nutritional status, use of drugs and alcohol in pregnancy; perinatal factors such as prematurity, neonatal anoxia, intrauterine malnutrition and congenital infections; and environmental factors such as poor socio-economic status, family disturbances, orphanhood and frequent hospitalizations. These factors can interfere in mothering condition leading to difficulties in affective and cognitive changes with the environment and, consequently, and consequently in the development of language^(10,11).

Language is one of the higher mental functions of the cerebral cortex which is based on the genetic expression of certain characteristics of the CNS and is subordinate to biological factors shared by the human species. However, at the beginning of development, the biological potential of children undergoes differentiation and is molded according to the environment to which the individual belongs. Thus, language is closely related to the social and family environment in which the child lives and to brain maturation⁽¹²⁾.

At the beginning of the process of acquiring literacy, the child, because of its experience with oral language, has already internalized the grammar of the language and is properly using the linguistic knowledge acquired during the learning of its maternal language, although without operating voluntarily with it. Thus, at the time when the child starts the formal learning of the written code, he is expected to be a successful speaker since the development of the written language can be seen as an extension of the development of the oral language. Therefore, the grapho-phonological associations provide a true understanding of the relation between the written and oral language, mainly considering that, in the case of Brazilian children, the Portuguese language is an alphabetic language⁽¹³⁾.

In recent years, there has been increasing interest in investigating the long-term effects of HIV infection in school children emphasizing the cognitive alterations. As mentioned in the literature as areas damaged intelligence, executive function, working memory, episodic memory, language, processing speed, attention, and motor skills. In addition, other factors concur and contribute to changes in the development of HIV-infected children such as psychological and social factors due to the impact of the disease on the family and social environment^(14,15).

Therefore, considering the cognitive alterations, social and in language development that can affect HIV-infected children and the important relationship of these factors with the reading and writing learning and still knowing that learning the written language is a complex process that requires the integrity of multiple cognitive abilities, the objective of this study was to evaluate reading and writing of children with HIV and compare with the phonological development and with clinical markers and immunovirological of AIDS.

METHODS

This study was approved by the Research Ethics Committee of the Ribeirão Preto Medical School, *Universidade de São Paulo*. The concerns of parents and guardians were solved and, later on, after voluntary acquiescence and signing of the informed consent form according to Resolution 196/96-CNS/MS.

The study was conducted on 26 children, 12 boys and 14 girls, who had acquired HIV infection by vertical transmission and who were being followed up at the Special Unit of Infectious-Contagious Diseases in a University Hospital.

Inclusion criteria were: viral load and CD4 count exams in the year of the two assessments, normal hearing thresholds, absence of behavioral or emotional problems, absence of classical neurological symptoms such as cerebral palsy, mental deficiency, and acquired childhood aphasia, no interruption of medical follow-up and not having speech therapy in the period between assessments.

The age of the children on the occasion of the first evaluation corresponds to the period of acquisition of the phonological system, ranged from three to six years, with a mean age of five years and eight months. The time for the second evaluation, four years later, reflects the time required for stabilization of phonological development and also the beginning of the literacy process.

Thus, the first time was assessed phonological structure of oral language and the second moment reading and writing, in addition to the reassessment of the phonological system.

The ABFW - Child Language Test⁽¹⁶⁾ was used as the instrument for the assessment of the phonological system. The test consists of an imitation test and a naming test that can determine the phonetic inventory as well as the phonological processes used. The imitation test includes 39 words, with the examiner asking the child to repeat the word spoken, and the naming test consisted of 34 figures presented as plates measuring 12 x 21 cm, with the examiner asking the child to tell the name of the figure. In the naming test, the evaluator asked the child to name the presented figures and if the child did not know any of them, the evaluator named the figure and showed it again after a sequence of 5 figures. If after the second attempt the child did not name the figure or named it incorrectly, it was recorded. In the imitation test the children should repeat the words spoken by the evaluator and if they could not do it in an intelligible form, they were requested to repeat the word at the end of the 39 words. The responses were audio recorded for analysis, and phonetically transcribed in the naming and imitation record protocols and in the analysis sheets of the phonological processes of the test. For the analysis of each test, the productivity was later calculate, with a process being considered productive when it appeared in 25% of the total possibilities of its occurrence. The phonologic processes considered to be productive were compared to normal

parameters as established by the test, according to the age of the child and classified as adequate or inadequate.

The Academic Performance Test⁽¹⁷⁾ (TDE in the Portuguese version) was used to assess reading and writing. In the writing subtests, the child is first asked to write his/her name and words were then dictated followed by a sentence, until the time when the child made mistakes in the writing of ten consecutive words. In the reading subtest, the examiner presented a Stimulus Sheet containing the words to be read by the child, whose replies were recorded in the TDE notebook. To consider performance the as adequate or inadequate, each child's TDE results were compared with the standardized test score for the 2nd and 7th grades of elementary school.

The data regarding the clinical classification of AIDS⁽⁸⁾, which characterizes HIV infection as type A (mild signs and symptoms), type B (moderate signs and symptoms), type C (severe signs and symptoms), and type N (asymptomatic subjects), and the viral load and CD4 count exams were obtained from the hospital medical records.

For statistical analysis, the Wilcoxon test was used for continuous variables and the Chi-square test for the categorical variables, with the level of significance set at $p \leq 0.05$.

RESULTS

Analysis of the medical records revealed that, on the occasion of the first assessment, 65.4% (17) of the children had already been assigned to category C (severe signs and symptoms) and only 8% (2) were asymptomatic. On the occasion of the second assessment, no child was asymptomatic and assignment to category C had increased to 77% (20). However, when we compared this classification ($p=0.173$), the immunological ($p=0.313$) and virological ($p=0.108$) profile of the children at the two time points, we observed stability of the signs and symptoms and immunovirological profile of AIDS.

Phonological assessment revealed that the number of children with disorders of phonological development at first assessment was significantly higher than the number at second assessment. However, we did not detect a statistically significant relation between the presence of phonological disorder and the classification of AIDS ($p=0.120$), CD4 count ($p=0.112$) or viral load ($p=0.908$).

In the assessment of reading, only four children (15%) showed appropriate performance for their school grade, whereas twenty-two children (84.6%) showed poorer, altered performance.

When we compared the results obtained in the assessment of reading to those obtained in the first phonological assessment we observed that all the children who showed a previous phonological disorder also showed reading difficulties, as confirmed by the statistically significant difference ($p=0.005$). The same was not observed when the results were compared to those of the second phonological assessment ($p=0.59$). When

Table 1. Percentage of co-occurrence of results of reading and writing with the assessment in two different times

		Reading		Writing	
		Normal	Altered	Normal	Altered
First phonological assessment	Altered	0	18 (69.2%)**	0	18 (69.2%)*
	Normal	4 (15.4%)	4 (15.4%)	3	5 (19.2%)
Second phonological assessment	Altered	0	4 (15.4%)	0	4 (15.4%)
	Normal	4 (15.4%)	18 (69.2%)	3	19 (73%)

* $p < 0.05$; ** $p < 0.01$ – Chi-square test

we compared the results obtained to the clinical characteristics ($p=0.120$), immunological status ($p=0.11$) and viral load ($p=0.24$), we detected no significant difference (Table 1).

In the assessment of writing, only three (11.5%) children showed adequate performance, all of them also showing adequate responses in the reading test. In contrast, the other twenty-three children (88.5%) showed poorer than expected reading performance, although one of them had shown an adequate response in the writing test.

When we compared the performance of the children in the writing test to that of the first phonological assessment, we observed that children with phonological disorder also showed writing changes ($p=0.022$), demonstrating a close relationship between previous phonological disorder and difficulty in the acquisition of writing. Conversely, there was no significant difference between the result of writing assessment and current phonological assessment (Table 1).

No significant difference was detected when writing performance was analyzed according to clinical classification of AIDS ($p=0.129$), immunological profile ($p=0.112$) or viral load ($p=0.209$).

DISCUSSION

The change in the epidemiological profile of AIDS after the feminization of the epidemic and the consequent increase in the number of affected children, as well as the later introduction of antiretrovirals, has led to a longer survival of this population, with a better quality of life^(8,18). Thus, a different and multiprofessional approach to AIDS is being required from the scientific community, motivating research directed at the prevention and treatment of various manifestations present in infected children.

The study population demonstrates the importance of antiretroviral drugs in clinical stabilization has not found detect a significant difference between degree of clinical and immunovirological involvement in children assessed over the years, however it is important to point out that some children were still asymptomatic on the occasion of the first assessment, a fact that was not observed later, and that there was an increase in the number of children with severe signs and symptoms, in others words, in a more advance stage of the disease: These data confirm literature reports stating that, in younger children,

pediatric AIDS is a disease more aggressive than the adult infection⁽¹⁹⁾.

The first cases of neurological manifestations in HIV-seropositive children were reported in 1988, and several other studies later investigated the direct and indirect effects of HIV on the CNS and detected delayed neuropsychomotor development, delayed language development and cognitive alterations as important manifestations^(7,8,9,10).

In a longitudinal study⁽²⁰⁾ reported that expressive language was more impaired than receptive language in children with HIV at all time points analyzed and that, even with the introduction of ARVT, there was a significant worsening between the sixth and the 24th month, suggesting that some CNS areas may be more compromised by HIV than others. In addition, the cited authors observed that the children with greater language impairment were those in a more advanced disease stage and with encephalopathy due to infection.

The relation between a more advanced disease stage and changes in various cognitive function has been reported in other studies^(15,21). In contrast, we did not detect a relation between the clinical, immunological and virological parameters of AIDS and reading and writing performance. Similarly⁽²²⁾, did not find a relation between CD4 count and neuropsychological changes, a fact possibly explained by the high incidence of changes and the large number of children assessed in an advanced stage of the disease.

In a study⁽²³⁾ detected a relation between a higher percentage of CD4 cells and a longer period of ARVT with better functioning of working memory and time of attention, factors directly related to the development of language. In an article⁽²⁴⁾ detected improved language in 43% of the children studied after the introduction of ARVT and no changes in imaging neurological exams when the children were assessed between the sixth week and the 36th month of life with an interval of one year.

Although we detected a large number of children with changes in oral and written language, we could not draw conclusions about the use of medication and the changes observed since all children studied were already using ARVT since the first assessment.

A single study in the literature specifically dealt with the school performance of HIV-positive children. Was observed in a study⁽²⁵⁾ a poor performance for age in verbal and reading

skills and found no relation between changes in language and disease severity.

In the present study we observed a similar fact, i.e., although we detected significant changes in reading and writing skills and in phonological awareness, we did not detect a relation of these changes with the clinical classification and the immunovirological factors of the disease. Some authors speculate that the lack of association of these changes with viral load may be due to the fact that viral load may be more variable and may fluctuate with changes in adhesion to treatment⁽²⁶⁾. Further studies are needed to continue to analyze the relation between markers of disease severity and language alterations.

Several cross-sectional studies in population not infected with HIV, have been conducted showing that when there is damage in different oral language skills, especially in phonological structure, called phonological disorder, the probability of difficulties occur in written language acquisition is higher when compared to situations where no such damage^(27,28). In this study, it was observed a significant association between the alterations of oral and written language, demonstrating that the influence of disorders of phonological development in the acquisition of written language. The same was observed^(29,30), with emphasis on the fact that in the latter study the children had received phonotherapy before starting to learn to read and write.

Regardless of immunovirological condition of the children, this study become even more relevant by its longitudinal character which allowed to observe the influence of phonological disorder in the acquisition of written language even when these changes have already been overcome, thus supporting the hypothesis of phonological deficit as a cause of difficulties in literacy.

The high incidence of changes observed in this study suggests that HIV-infected children are a risk group for changes in oral and written language development. Therefore, the frequent monitoring of HIV-infected children by a speech and language therapist as the professional qualified to detect language changes permits an early identification of these problems with the intention of intervening and rehabilitating in parallel to the use of pharmacological treatment. Indeed, the sooner the changes can be detected and treated, the greater the possibilities of overcoming them, preventing the future installation of reading and writing difficulties which would interfere with the professionalization and future insertion of these children and adolescents on the job market.

However, it is important to observe that many factors can influence the development of language in children with HIV as impairment of the CNS by HIV infection, negative environmental and social factors, and other unfavorable comorbidities that may occur during the prenatal period, perinatal and postnatal. Future studies should be conducted to elucidate the participation of each of these factors using appropriate methodology with a higher number of infected children and a control group.

CONCLUSION

HIV-infected children represent a risk group for alterations of oral and written language, and these alterations do not depend of the severity and clinical picture or the immunovirological profile of AIDS. Moreover, observed relationship between changes in phonological development and further development of reading and writing corroborates the hypothesis of phonological deficit as one of the causes of difficulties in the literacy process.

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