Potenciais evocados auditivos de longa latência em adultos com HIV/Aids****

Long latency auditory evoked potentials in adults with HIV/Aids

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Abstract

Background: Long Latency Auditory Evoked Potentials. Aim: to characterize the Long Latency Auditory Evoked Potentials (LLAEP) in individuals with HIV/AIDS in comparison to a control group. Method: the research sample was composed by 21 individuals with HIV/AIDS - research group (14 male and 7 female), with ages ranging from 31 to 48 years, and 21 healthy individuals - control group (5 male and 16 female), with ages ranging from 19 to 36 years. The latency and amplitude values of the P300 wave were analyzed; latency of N1 and P2 waves, and amplitude N1-P2. The electrodes were placed on the following positions: A1, A2, Cz and Fpz. Results: the T-student test was used to analyze the results and the adopted significance level was of 5%. In the analyzes of P300 it was observed that the group with HIV/AIDS presented greater latency values (p-value = 0,010) and lower amplitude values (p-value = 0,021) when compared to the control group. The analysis of the N1-P2 complex revealed that the research group presented higher latency values for both, N1 wave (p-value = 0,035) and P2 wave, however for this last one, there was no significant statistical difference when compared to the control group. Concerning the amplitude analysis of the N1-P2 complex, it was verified that the control group presented significantly higher values when compared to the research group. Conclusion: the findings of this study indicates that individuals with HIV/AIDS present alterations in the Long Latency Auditory Evoked Potentials (higher latencies and lower amplitudes of N1, P2 and P300 waves), suggesting a disorder in the cortical regions of the auditory pathway, and therefore stressing the importance of such tests in the evaluation of these individuals.

Key Words: HIV; Event-Related Potentials P300; Evoked Potentials; Auditory.

Resumo

Tema: potenciais evocados auditivos de longa latência. Objetivo: caracterizar os potenciais evocados auditivos de longa latência (PEALL) de indivíduos com HIV/Aids comparando com os obtidos no grupo controle. Método: a casuística foi composta por 21 indivíduos com HIV/Aids pertencentes ao grupo pesquisa (14 do gênero masculino e sete do gênero feminino) com idade entre 31 e 48 anos e 21 indivíduos saudáveis pertencentes ao grupo controle (cinco do gênero masculino e 16 do gênero feminino) com idade entre 19 e 36 anos. Foram analisados os valores de latência e amplitude da onda P300, latência das ondas N1 e P2 e amplitude N1-P2. Os eletrodos foram colocados nas posições A1, A2, Cz e Fpz. Resultados: no P300 observou-se que o grupo com HIV/Aids apresentou maiores valores de latência (p-valor = 0,010) e menores de amplitude (p-valor = 0,021) quando comparados com o grupo controle. Na análise do complexo N1-P2, ao comparar os grupos, verificou-se que o grupo pesquisa apresentou maiores valores de latência tanto para a onda N1 (p-valor = 0,035) como para a onda P2, porém esta última sem diferença estatisticamente significante. Com relação à análise da amplitude N1-P2, verificou-se que o grupo controle apresentou maiores valores, sendo esta diferença estatisticamente significante quando comparada ao grupo pesquisa. Conclusão: os achados do presente estudo mostraram que indivíduos com HIV/Aids apresentam alterações nos PEALL, sugerindo comprometimento nas áreas corticais do sistema auditivo e mostrando a importância destes testes na avaliação audiológica de indivíduos com HIV/Aids.

Palavras-Chave: HIV; Potencial Evocado P300; Potenciais Evocados Auditivos.

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Introduction

The Human Immunodeficiency Vírus (HIV) is a specific retrovirus that is responsible for the Acquired Immunodeficiency Syndrome (AIDS), which progressively attacks the immunologic system, allowing the occurrence of several opportunistic infections.

According to the literature the incidence of auditory disorders in patients with HIV/AIDS may vary approximately between 20% and 40%. The hearing loss may be due to external, middle or internal ear (1-4).

Studies also show that as the disease progresses there is a progressive damage to the Central Nervous System (CNS) that includes the central nervous auditory system (CNAS) by the direct action of the virus on the CNS structures or due to the opportunistic infections (1, 5-6).

The central nervous auditory system (CNAS) can be assessed by behavioral or electrophysiological techniques. In the behavioral techniques aspects such as type and degree of disorder of auditory abilities are measured. The electrophysiological techniques (auditory evoked potentials) assess the physiology and loci of the lesion or dysfunction (7). The abnormalities in individuals with HIV/AIDS are detected either by the studies that assess the auditory processing as by the one that investigate the electrophysiological abilities (3, 5, 8-11).

The electrophysiological abnormalities on the Brainstem Auditory Evoked Potentials (BAEP) and on the Cognitive Potentials (P300) may be early detected (3, 5, 8-11), even before the clinical signs of symptoms as neurological disorders or cognitive deficits, there are part of the AIDS demential complex (12-13).

The assessment of Long Latency Auditory Evoked Potentials (LLAEP) was shown to be an effective method for investigating the CNAS specially of the information auditory processing because the identification of these potentials reflects the cortical activity involved in discrimination, integration and attention abilities (14).

The LLAEP are observed between 80 and 700 milliseconds (ms) after the presentation of an acoustic stimulus (15) and their components are N1 (N100), P2 (P200), N2 (N200), P3 (P300). They are subdivided in exogenous potentials (N1, P2, N2), strongly influenced by the physical characteristics of the stimuli (intensity and frequency, among others); and endogenous potentials (P300) mainly influenced by internal events related to the cognitive abilities.

Some authors(16) state that N1 and P2 waves can be used to examine the cortical auditory processing, as the ability to discriminate sounds according to their acoustic or phonetic features and can be useful to the evaluation of the central auditory integrity.

The purpose of the present study was to characterize the Long Latency Auditory Evoked Potentials in individuals with HIV/AIDS, comparing the findings with the ones obtained with the control group.

Method

The present study was conducted in the Audiology Research Laboratory on Auditory Evoked Potentials of the Speech, Language Pathology and Audiology Course, department of Speech Language Pathology and Audiology, Phisiotherapy and Occupational Therapy of the School of Medicine, University of Sao Paulo. The project was approved by the institution's ethical committee (Cappesq) with number 1026/04.

Subjects were 21 individuals with HIV/AIDS that were included in the research group (14 male and 7 female) with ages varying between 31 and 48 years and 21 healthy individuals included in the control group (5 male and 16 female) with ages varying between 19 and 36 years. The subjects of the research group were referred to the service by specific services (Casa da AIDS - Zerbini Foundation and Specific Public Health Services for STD/AIDS of the city of Sao Paulo).

All participants signed the consent form in which all procedures were described. After the realization of the anamnesis the audiologic evaluation was started. In included the following procedures: visual inspection of the acoustic meatus with a brand Heine otoscope, tonal and vocal audiometry with GSI 61 and GSI 68 Grason-Stadler audiometers and acoustic immitance measurements obtained with a GSI 33 Grason-Stadler immitanciometer.

After that the electrophysiological evaluation of hearing was conducted, determining the LLAEP. In the P300 the stimulus was the tone burst presented in each ear separately at 75dB HL at a speed of 1.1 stimulus per second, with a total of 300 stimuli. The electrode were positioned on the vertex (Cz), on the front (Fpz) and on the right and left ears (A2 and A1).

To the determination of P300 the individual was asked to pay attention to the rare stimuli (1500 Hz) that were randomly presented inside a series of frequent stimuli (1000Hz) and to count the number of times the rare stimulus occurred (16, 17).

The latency and amplitude values of the P300 wave were analyzed on the curve referring to the rare stimulus. The latency of the N1 and P2 waves and amplitude of N1-P2 waves were analyzed over the curve of the frequent stimuli (16) .

To the determination of the LLAEP the skin was cleansed with abrasive paste and the electrodes were fixed to the individual's skin with electrolytic paste and adhesive tape (micropore) in the pre-determined positions.

The impedance values of the electrodes were verified and should be under 5 kOhms. The acoustic stimulus was presented through a pair of TDH 39 headphones, prompting the answers.

The tests were conducted in electric protected and acoustically isolated environment.

Results

The T-Student test with significance level of 5% was used to the analysis of the results.

Data analysis was done one ear at a time with a total of 42 ears in research group and 42 ears in the control group.

In Table 1 it can be seen that the group with HIV/AIDS presented higher values on P300 wave latency (p-value=0.010) and lower amplitude levels (p-value=0.021) when compared to the control group.

In the analysis of the N1-P2 complex, when comparing groups, it was verified that the research group presented higher latency levels either to the N1 wave (p-value=0.035) and to the P2 wave, although there wasn't statistically significant difference for this last one (Table 2).

Table 2 analyzed the complex N1-P2 amplitude and verified that the control group presented the higher levels, with statistically significant difference (p-value=0.003) when comparing to the research group.

TABLE 1. Comparison of the amplitude (in microvolts - µv) and latency (in milisecond - ms) of the P300 waves between control and research groups.

Variable	Group	N	Average	Standard Deviation	Significance (p)
P300 latency	Research	42	342	46,7	**0,010***
	Control	42	320,6	25,1	
P300 amplitude	Research	42	8,9	3,5	**0,021***
	Control	42	10,9	4,6	

Legend: * statistically significant p-value.

TABLE 2. Comparison of N1 and P2 wave latencies (in miliseconds - ms) and N1-P2 complex's amplitude (in microvolts - µv) between control and research groups.

Variable	Group	N	Average	Standar Deviation	Significance (p)
N1 latency	Research	42	98,8	17,1	**0,035***
	Control	42	91,9	11,8	
P2 latency	Research	42	167,1	20,5	0,081
	Controle	42	158,3	25,3	
N1P2 amplitude	Research	42	8,2	3,5	**0,003***
	Controle	42	10,6	3,7	

Legend: * statistically significant p-value .

Discussion

Due to the CNS impairment, including the CNAS, in patients with HIV/AIDS, the auditory evoked potentials have been an important research tool to the assessment of the CNS of this population. According to Picton (18) the increase in latency or the decrease in amplitude of auditory evoked potential waves are evidence of clinical and/or sub-clinical problems.

The comparison of P300 waves of control and research groups was done in Table 1. It can be verified that there was statistically significant difference between groups with the control group with smaller latencies, which agrees to previous studies (11, 19-23) that also found disorders in the P300 latencies of individuals with HIV/AIDS.

According to Tartar et al. (22) the P300 is a suplementar exam that is useful to identify cognitive disorders in patients with HIV/AIDS.

Studies by Fein et al. (20) e Polich et al. (21) suggest that the delay of P300 wave may be linked to the disease's progression. The increase in P300 latency and even the absence of this wave in HIV positive patients without clinical signs of neurological impairment was observed by Birdsall et al. (24).

In Table 1 it can be observed that the control group presented larger P300 wave amplitudes when compared to the research group and this difference is statistically significant. This data agrees with the research by Chao et al. (25) that also found disorders in this potential with HIV/AIDS individuals. According to Picton (18) the P300 amplitude is not a reliable parameter to compare the potentials between two groups because it may influenced by attention factors.

Table 2 compared the latencies of N1 and P2 waves of both groups. It can be verified that there was statistically significant difference only to the latency of N1 wave, with the control group presenting the smaller values. In relation to the latency of P2 wave, the values were also smaller to the control group but the difference to the research group was not statistically significant.

The analysis of the amplitude of N1-P2 complex, presented in Table 2, determined that the control group presented larger values, with statistically significant difference when compared to the research group.

The findings described above agree with the ones obtained by Chao et al. (25) that also found larger latency values and smaller amplitude values in individuals with HIV/AIDS when analyzed the N1 and P2 waves. The results of the present study also agree with the ones obtained by Goodin et al. (26) in their research that verified delay in N1, P1, N2, P2 and P300 waves in HIV positive individuals. According to the authors, these alterations were more evident in symptomatic's individuals, that is, with AIDS.

In the study by Galicia et al. (27) with HIV infected rats, the authors verified the reduction of the P300 amplitude in the first 24 hours after contamination. From the seventh to the 21st day the P2 and N2 components were also absent and just the N1 could be observed. According to the authors these findings suggest cognitive processing impairment. Despite the etiology of the association between HIV and demency is still unknown, the P300 seems to be a reliable indicator of cognitive impairments in HIV patients and disorders in this potential suggest neurological damage.

The results of the present study agree with the findings of Matas et al (23), which evaluated 8 HIV/AIDS by means of the Auditory Middle Latency Evoked Potential and the P300 and compared the results to the ones of the control group. The authors verified the increase of the latency of P300 wave in the research group, suggesting the impairment of the auditory path in cortical regions and a deficit on the cognitive processing of the auditory information, stressing the importance of the careful assessment of the auditory function in individuals with AIDS.

Chow et al. (28) found in positive HIV patients progressive CNS impairment, including the CNAS. According to them this impairment may be due to the direct virus action or to the opportunistic infections.

Conclusion

A significant difference on P300 was found in HIV/AIDS individuals that refer to the parameters of amplitude and latency. In the N1-P2 complex it was verified that the amplitude was significantly reduced and the latency of wave N1 increased in individuals with HIV/AIDS.

The detection of neuro-physiological disorders in individuals with HIV/AIDS is important because the more sensitive is the procedure to early detection of these changes the greater the possibility of treatment aiming to minimize, reduce or revert the cognitive deficits associated to the infection (Tartar et. al, 2004). This way, the findings of this study emphasize that the auditory evoked potentials are a fundamental tool to the assessment of the central nervous auditory system and very important to the audiologic assessment of individuals with HIV/AIDS.

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