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Timing in auditory processing in children with ADHD with sleep disorder

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Abstract

We aimed to characterize the impact of obstructive sleep apnoea (OSA) over cerebral correlates of attention and categorization timing in children with attention deficit hyperactivity disorder (ADHD) and OSA. 61 participants aged 6 to 17 years with ADHD underwent one overnight polysomnography and daytime P300 auditory evoked potential test divided into three repeated series. OSA was present in 42.6% of the sample and correlated to three auditory evoked potential tests by lower amplitudes (r=.79; r=.77, r=.81, p<.000) and longer latencies (r=.60; r=.57; r=.76, p<.000). This study has found evidence of an association between OSA and timing processing to auditory stimuli.

Keywords: Obstructive sleep apnoea; Timing; Auditory evoked potential; Attention deficit hyperactivity disorder

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is a common psychiatric disorder with a childhood onset that affects between 8 to 12% of children worldwide (Biederman & Faraone, 2005; Faraone et al., 2003). Although ADHD is generally diagnosed during school years there is an increased tendency for it to be identified in preschool children as abnormal behavioural manifestations characterized by short attention span, impulsivity, high activity levels and poor inhibitory control that albeit can be considered to some degree normative in toddlers are more pronounced in ADHD children and result in uncontrollable conduct in many settings including home and classroom...
(Cherkasova et al., 2013). Among a great variety of sleep disorders, the obstructive sleep apnoea (OSA) causes abnormal breathing or chronic intermittent hypoxia during sleep that leads to attention and working memory deficits. These deficits might be related to attention impairment throughout the developing nervous system.

P300 evoked potentials, since its description by Sutton in 1965, have proved to be very useful in the evaluation of behavioural disturbances and effective in the assessment of cognitive impairment and timing perception in individuals with different disorders that impair cognition (Thakur et al., 2011; Vázquez-Marrufo et al., 2009). P300 alterations, such as the increased or reduced amplitude and latency, indicate general slowing of attention and working memory processes and may help to understand neurodegenerative processes or other neurologic dysfunctions rather than characterize features that are specific for any particular disorder (Linden, 2005). To characterize the impact of OSA over cerebral correlates of attention and categorization response speed in children diagnosed with ADHD and OSA comparing to those with ADHD without OSA. This study aims specifically to investigate the prevalence of OSA in a group of children with ADHD, and poor school performance and to assess changes in timing at the auditory processing.

2. Methods

We assessed 61 children clinically diagnosed with ADHD according to the DSM-IV (APA, 2000) by the corresponding author at the mean age of 10.85 (± 2.25), ranging from 6 to 17 years. All students belonged to low-middle income families, whose parents were both full day workers. Children with normal intelligence were included with IQ at least 80 as assessed by subtests of the WISC-III (Wechsler, 2001). The exclusion criteria were: (a) hearing and visual disorder; learning developmental disorder; (b) use of drugs that could interfere with auditory function; attentive or cognitive process as hypnotics, sedatives, antihistamines, antidepressants, antiepileptic, or opioids.

Prior to the assessment, mothers were asked to take their children off psychostimulant medication if they were comfortable with doing so. The entire sample has complied with this. The children and their caregivers give their consent to participate of the study and were submitted to polysomnography (PSG) of full night and auditory P300 evoked potentials. All children and their parents were instructed about the study objectives and written informed consent was obtained from the parents for their children. The study was conducted according to the Declaration of Helsinki on Biomedical research involving human subjects (2008) and the protocol was approved by the University of Brasilia Ethics Committee in Medical Sciences.

3. Results

OSA condition was present in 26 children of the sample (42.6%), 61.5% were boys, and was significantly correlated to lower amplitudes (r=.79; r=.77; r=.81, *p<.000*) and longer latencies (r=.60; r=.57; r=.76, *p<.000*) to all three tests of P300, respectively. Repeated measures analyses showed no effect of age and gender on the P300 auditory evoked potential, though boys had a greater variability in all values. The apnoea and hypoapnea index (AHI) had mainly effect on amplitudes of all tests, specially at latency of test 3 [F(1,3)=2.23, *p<.010*]. OSA diagnosis had effect all over P300 variables [F(1,3)=34.39, *p<.000*]. The group with OSA also presented significant decay in amplitude along the three P300 amplitude measures [F(1,3)=297.57, *p<.000*], but not to latency, differently to the group without OSA that kept the values at the same levels during the three tests.

3. Conclusion

This study has found evidences of the relationship between OSA and P300 evoked potentials, amplitudes and latencies. These findings are in accordance to the literature showing that sleep disturbances might disrupt sustained attention abilities related to altered timing in auditory processing. The data poses questions about sleep disorder being considered as differential diagnosis for ADHD.
References


