Pediatric Neurology 57 (2016) 56–63

Contents lists available at ScienceDirect

Pediatric Neurology

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

Original Article

Attention Deficit Hyperactivity Disorder in Adolescents With Epilepsy

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ABSTRACT

BACKGROUND: We examined attention-deficit hyperactivity disorder in adolescents with epilepsy and the association with seizure-related and sociodemographic variables. **METHODS:** Strengths and Weakness of Attention-Deficit Hyperactivity Disorder Symptoms and Normal Behaviors rating scale was administered to 122 children with epilepsy and 50 children with asthma, aged 10 to 18 years attending mainstream schools. **RESULTS:** Twenty-nine (23.7%) adolescents with epilepsy compared with five (10%) with asthma had attention deficit hyperactivity disorder ($P = 0.037$). Adolescents with epilepsy had a significantly higher score in the inattention subscale when compared with those with asthma (-0.25 ± 1.2 vs -0.64 ± 1.07, $P = 0.049$). Combined subtype was most frequent in the epilepsy group. Oppositional defiant disorders were more prevalent in those having attention deficit hyperactivity disorder. Psychiatric assistance had only been provided to one third of our patients with epilepsy and attention deficit hyperactivity disorder at the time of study. There was a negative correlation between attention deficit hyperactivity disorder scores and age of seizure onset. A positive correlation was observed between the number of antiepileptic drugs and the inattentive subscale score. The impact of various correlates on individual subtypes was not identical. Independent risk factors associated with attention deficit hyperactivity disorder were medical comorbidities (odds ratio = 12.82, 95% confidence interval 4.44, 37.03, $P < 0.0001$) and age at seizure onset (odds ratio = 0.73, 95% confidence interval 0.56, 0.94, $P = 0.016$). **CONCLUSIONS:** Attention deficit hyperactivity disorder is overrepresented in adolescents with epilepsy; screening for its symptoms should be an integral part of management in adolescents with epilepsy.

Keywords: epilepsy, adolescents, attention deficit hyperactivity disorders, oppositional defiant disorders

Pediatr Neurol 2016; 57: 56-63

Introduction

Epilepsy is one of the most common chronic neurological disorders having potential negative impact on psychosocial outcomes. Attention deficit hyperactivity disorder (ADHD) is overrepresented in epilepsy; a diagnosis of epilepsy has been associated with a 2.5-5.5 times higher chance of having co-occurring ADHD.[1] A recent national health survey involving 91,605 children reported that children with epilepsy were significantly more likely than those never diagnosed to experience attention-deficit hyperactivity disorder and conduct problems.[2] Sherman et al.[3] reported that children with epilepsy and coexisting ADHD had a significant greater likelihood of low health-related quality of life than those without ADHD. Adolescence is a particularly vulnerable period marked by profound developmental changes in the biologic, social, and psychological domains. Adolescents with ADHD are at greater risk of substance, cigarette, and alcohol abuse.[4] Optimal outcomes may be promoted by ameliorating social functioning, diminishing aggression, and improving family situations as early as possible.[5] Use of central nervous system stimulants in children with epilepsy and ADHD has been reported to

Article History:
Received November 21, 2015; Accepted in final form December 24, 2015

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http://dx.doi.org/10.1016/j.pediatrneurol.2015.12.022

improve health-related quality of life.[6] Screening for neurobehavioral comorbidities is thus crucial in the management of children and adolescents with epilepsy.

Despite the relatively high incidence of ADHD and epilepsy, their possible relationship is not completely understood. Studies addressing ADHD in patients with epilepsy showed great heterogeneity concerning design, inclusion criteria, and assessment methodologies. Epilepsy is characterized by recurrent unprovoked seizures with a specific pattern caused by sudden uncontrolled bursts of electrical activity in the brain, which is in line with the concept of a dysfunction of the neural circuitry; it is thus reasonable to hypothesize that adolescents with epilepsy would have significantly higher rates of ADHD than do adolescents with other chronic non-neurological diseases. The etiology of ADHD is not completely understood; we postulate that adolescents with epilepsy were vulnerable to multi-etiologic risk factors including biologic, social, seizure, and treatment-related risk factors for ADHD. In this study, we assessed the rates and symptoms of ADHD in adolescents with epilepsy and compared them to individuals with asthma, one of the most common chronic childhood illness. Within the epilepsy group, we sought to evaluate the relationship between ADHD and seizure-related and sociodemographic variables.

Methods

This was a cross-sectional study with patients enrolled between January and June 2010. The regional hospital ethics committee approved the study. Written informed consent was obtained from all participants. Patients aged 10-18 years attending neurology outpatient clinics in Tuen Mun Hospital were recruited. Inclusion criteria were diagnosis of epilepsy whether or not treated with antiepileptic drugs, attending mainstream schools, and literate in Chinese. Patients who had experienced a seizure within the previous 24 hours, attending schools with special needs, with progressive structural brain abnormalities such as malignancy or neurodegenerative disorders, surgery in past 4 weeks, or pseudoseizures were excluded. Adolescents, aged 10 to 18 years, with asthma attending mainstream schools were recruited in our respiratory clinic for comparison.

Tuen Mun Hospital is the only hospital that serves the northwest section of Hong Kong. Patients were referred from various sources including Maternal and Child Centers, Student Health Services, general practitioners, and Accident and Emergency Departments. There is no private pediatric neurologist in the study district. Therefore it is safe to assume our study population represents an unbiased pediatric population with epilepsy.

We used the Strengths and Weakness of ADHD Symptoms and Normal Behaviors (SWAN) rating scale that has been validated and applied locally.[7] The scale contains 28 items that correlate with the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition criteria for ADHD (predominantly inattentive, predominantly hyperactive, and combined types) and oppositional defiant disorder (ODD)[8-10] The scale was scored by parents; questions 1-10 constitute the ADHD-Inattentive (ADHD-I) score, questions 11-19 the ADHD-Hyperactivity/Impulsivity (ADHD-HI) score, and questions 20-28 assess the oppositional symptoms. Score of the first 19 items provides the ADHD-Combined (ADHD-C) score. A seven-point response ranging from +3 (far below average) to −3 (far above average) was obtained. The SWAN rating scale was found to have good internal consistency with alpha coefficient value >0.8, and optimal sensitivity of 0.86 and specificity of 0.88.[11] Medical records were reviewed to collect the following information: details of seizures, age of seizure onset, etiologies of epilepsy, current antiepileptic drugs, electroencephalogram (EEG), neuroimaging findings, and seizure outcome. We identified a number of potential sociodemographic and health confounders; these included age, gender, parental education qualification, parental employment status, tenure of accommodation, need for Comprehensive Social Security Assistance, psychiatric illness of first-degree relatives, and other medical comorbidities.

Revised terminology and concepts for organization of seizures and epilepsies based on the Report of the International League Against Epilepsy Commission on Classification and Terminology, 2005-2009 was used.[12] Classification of epilepsy was based on seizure descriptions, physical examination, and relevant investigations. Epilepsy was defined as two or more unprovoked seizures more than 24 hours apart in a child over age 1 month. Seizure-free status was defined as no seizure for at least 12 months at the time of study.

In order to evaluate sociodemographic and seizure-related variables, children with ADHD were included as cases; children without ADHD were included as control subjects. Statistical cutoffs of 1.65 S.D. above the mean were used.[7,10,13]

Data were analyzed with SPSS (version 21). Parametric and nonparametric tests were used to evaluate the effects of a variety of demographic and disease-related factors. χ^2 and Fisher test were used to compare categorical variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. Forward logistic regression was used for multivariate analysis; values of $P \leq 0.05$ were considered significant.

Results

A total of 140 adolescents with epilepsy participated and 122 (63 boys, 59 girls) completed the SWAN rating scale. Fifty children with asthma were recruited for comparison. There was no sociodemographic difference between the two groups (Table 1). The ADHD-I score was higher in adolescents with epilepsy than in those with asthma, -0.25 ± 1.2 vs -0.64 ± 1.07, respectively ($P = 0.049$). The ADHD-H/I score was -0.77 ± 1.32 in children with epilepsy and -1.05 ± 1.21 in children with asthma (P = NS). The ADHD-C score was -1.03 ± 2.34 in children with epilepsy and -1.63 ± 2.16 in children with asthma (P = NS). The oppositional score was -0.31 ± 1.32 in children with epilepsy and -0.59 ± 1.24 in children with asthma (P = NS). Twenty-eight (23%) children with epilepsy compared with five (10%) with asthma had an ADHD-C score above cutoff ($P = 0.048$). Regarding individual subscale, 19 (15.8%) children with epilepsy compared with four (8%) with asthma had an ADHD-I score above cutoff (P = NS); 17 (13.9%) children of the epilepsy group versus three (6%) of the asthma group had ADHD-H/I above cutoff (P = NS) and 20 (16.4%) children with epilepsy compared with seven (14%) with asthma had an oppositional score above cutoff (P = NS). Twenty-nine (23.7%) adolescents with epilepsy compared with five (10%) with asthma had ADHD ($P = 0.037$). Inattentive subtype accounted for 8.3%, hyperactivity/impulsivity subtype for 5.8%, and combined subtype for 9.9% in the epilepsy group compared with 4% inattentive subtype, 2% hyperactivity/impulsivity subtype, and 4%combined subtype in the asthma group (P = NS).

In the epilepsy group, 58.6% of adolescents with ADHD versus 1% without ADHD had ODD ($P < 0.0001$). Psychiatric service had been provided for 37.9% of patients with epilepsy and ADHD at the time of study. Majority (67.2%) had focal seizures, and structural or metabolic causes accounted for 27% of etiology. Seventy-nine (64.8%) children were seizure free for over 12 months and antiepileptic drug was discontinued in 28 (23%).

Table 2 lists the correlation between SWAN scale scores and different variables in patients with epilepsy. The effect of various correlates on the individual subscale was not