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Original article

Electrical status epilepticus during sleep: A study of 22 patients

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Abstract

Objective: The aim of this study was to evaluate the clinical and imaging characteristics, treatment results, and prognosis of patients with electrical status epilepticus during sleep (ESES). *Method:* A total of 22 patients with ESES pattern on EEG were retrospectively studied. *Results:* The first neurological symptoms were seen at a mean age of 4.4 years. The first symptoms in 77% of the patients were seizures. Other symptoms were hyperactivity, restlessness, insomnia, disinhibition, autistic behavior, speech retardation and deterioration in school performance. Diagnosis of ESES was made at a mean age of 7.45 years, approximately 3 years after the first symptom. Magnetic resonance imaging (MRI) was abnormal in 36% of the patients. Single photon emission computed tomography (SPECT) showed focal hypoperfusion after resolution of ESES involving left temporoparietal and right posterior temporal areas in four patients including three with normal MRI, and one with periventricular leukomalacia without focal cortical lesion. First line treatment with valproic acid monotherapy was not effective. Electrical status epilepticus during sleep disappeared in 82% of the patients on clobazam and 70% of the patients on clonazepam in combination with valproic acid within a few months. Topiramate was not found to be effective. A significant decrease in intelligence quotient (IQ) scores was found in 66% of the patients compared to the baseline. *Conclusions:* ESES should be considered in children with new onset behavioral, cognitive, and speech problems with or without seizures. The high frequency of focal seizures and focal findings on SPECT suggest a focal origin. Clonazepam and clobazam were most effective in our cohort.

Keywords: Electrical status epilepticus during sleep; Continuous spikes and waves during slow wave sleep; Epileptic encephalopathy

1. Introduction

Electrical status epilepticus during sleep or ESES, is a term that describes an EEG pattern where epileptiform discharges show a significant increase during sleep associated with representative clinical signs [1]. It is seen in epileptic syndromes such as atypical rolandic epilepsy, acquired opercular syndrome, Landau–Kleffner syndrome (LKS), and continuous spikes and waves during slow wave sleep (CSWS) [2]. Although CSWS and ESES are used interchangeably in the literature, some authors prefer ESES to describe the electrographic pattern and CSWS to describe the clinical syndrome [1,3–6]. This distinction appears appropriate to prevent terminological confusion of the EEG pattern (i.e. ESES) seen in LKS, with the epileptic encephalopathy seen with global regression in cognitive functions (i.e. CSWS).

Electrical status epilepticus during sleep shows almost near-continuous spike-waves discharges with marked activation in slow sleep that are generally diffuse and bilateral at a frequency of 1.5–3 Hz and is associated with various types of seizures together with

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neuropsychological regression. Although spike-waves activities are suggested to occur during at least 85% of non-REM sleep in the classic definition, lower threshold values have been accepted in subsequent studies if together with an appropriate clinical picture [2,5]. It is considered to be age related and self-limited with an uncertain etiology, and although rare it is probably underrecognized [1,7]. Continuous spikes and waves in slow-wave sleep and LKS are epileptic encephalopathies of childhood that have many common features and pathophysiological mechanisms [8]. It has been hypothesized that frequent interictal epileptiform discharges developing in the critical period may strengthen the synaptic contacts that are supposed to disappear in the normal developing brain, and may eventually cause deterioration of the functions in a given region [8]. It still remains unknown if interictal discharges are the direct cause of developmental deterioration or the epiphenomenon mirroring the underlying brain pathology. Much of the evidence is needed to declare the causal relationship between 'EEG findings' and abnormal development [9]. Executive functions, and memory loss, neuropsychiatric symptoms in the form of autistic-like or psychotic behaviors and more global regression are seen together with epileptiform activities affecting the frontal region in CSWS while there is a paroxysmal disorder that develops from the posterior temporal area and causes auditory agnosia and language deficits in LKS [10].

The purpose of the study was to examine the clinical picture, imaging characteristics, and psychometric assessment of patients with an ESES pattern on EEG and their responses to treatment.

2. Patients and methods

The study was approved by Hacettepe University Medical Faculty Department of Pediatrics Board. Medical records of twenty two consecutive patients with ESES pattern on EEG followed at the department of pediatric neurology between April 2000 and April 2002 were studied retrospectively. Inclusion criteria were as follows [11,12]: (1) Seizures with focal or apparently generalized onset (atypical absences, myoclonic, atonic or generalized seizures, focal motor, complex-partial); (2) global or selective cognitive or language regression and/or behavioral disturbances connected to the ESES period; (3) motor impairments (such as ataxia, dyspraxia, dystonia or unilateral motor deficits) related to the ESES period and (4) typical EEG findings characterized by spike wave discharges occupying more than 85% of non-REM sleep. The patients with CSWS, LKS, and rolandic epilepsy who had the criteria were included in the study. The spike-wave index was visually counted based on the total number of the spike-waves per second. All patients underwent a clinical evaluation including history, physical and neurological examinations, sleep and awake EEGs, psychometric tests and brain MRI results. Single photon emission computed tomography was available in 12 patients. SPECT was performed after obtaining verbal consent. Patients with an underlying etiology were classified as symptomatic while others were classified as cryptogenic. Follow up EEGs under different treatment regimens were evaluated along with neuropsychological data. Cognitive functions of the patients were evaluated with the WISC-R test, or the Stanford–Binet scale when the WISC-R test could not be administered.

The Wilcoxon test was utilized to determine the significance of the difference between the first and last total IQs, first and last verbal IQs, and first and last performance IQs.

3. Results

3.1. Clinical characteristics

Clinical characteristics of the patients were shown in Table 1. There was a total of 22 patients (16 males, 6 females). Parents were relatives in seven patients. Seven patients (32%) had a family history of epilepsy. Ten patients (45.4%) were classified as symptomatic and three as idiopathic partial epilepsy of childhood (all of them had rolandic epilepsy), and 9 as cryptogenic. Eight patients had perinatal insult (4 perinatal asphyxia, two intrauterine infection, that one of them had bilateral polymicrogyria associated with intrauterine cytomegalovirus infection, one meconium aspiration and neonatal hypoglycemia, one neonatal hypoglycemia). One patient had an arachnoid cyst and one had mental retardation in the symptomatic group.

The first neurological symptoms of the patients had emerged at a mean age of 4.4 years (10 months–13 years). The diagnosis of ESES on EEG was made at an average of 3 years (0–13.5 years) after the initial neurological symptom. Onset of ESES was at a mean age of 7.45 years (2 years 10 months–17 years). The mean ESES duration was 22.4 months.

In 17 patients (77%) the first neurological symptom was seizures. Three patients (13%) presented with problems such as hyperactivity, restlessness, insomnia, behavioral problems at school and autistic behavior, one had delayed speech (4.5%), one had deterioration in school performance (4.5%). All patients had seizures except one (patient 3). While two of them had merely seizures (patients 4 and 22), the rest of the patients had learning, behavior, or attention problems at varying degrees. According to syndromic classification, one patient was diagnosed with Landau–Kleffner syndrome. The other three patients had rolandic epilepsy, and the remaining 18 patients were classified as CSWS.