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Brief Communication

Prevalence of epileptiform discharges in healthy 11- and 12-year-old children

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ABSTRACT

We sought to determine the prevalence of interictal epileptiform discharges (IEDs) in healthy 11- and 12-year-old children. Sixth grade students with no history of seizure, or neurologic or psychiatric disease, were enrolled in a longitudinal physical activity intervention study. Per study protocol, each student had two EEG recordings approximately 6 months apart. Epileptiform discharges were present in 4 (2.9%) of 140 students: centrotemporal in three and generalized in one. In three children, the discharges were still present six months later. None of the children had developed seizures a minimum of one year after the second EEG. These results are consistent with those of two landmark European studies performed nearly a half century ago, before the modern era of digital EEG. Healthy 11- and 12-year-old children with no history of seizure may have centrotemporal or generalized epileptiform discharges on EEG, which can persist for at least 6 months. Based on both our results and those of the two prior European studies, such discharges, if found incidentally in otherwise healthy children in this age group, should not prompt further evaluation or treatment.

1. Introduction

Adolescents may have an EEG study for indications other than high suspicion of seizure. In such instances, interictal epileptiform discharges (IEDs) may be an incidental benign finding that is mistakenly interpreted as suggestive or even diagnostic of epilepsy. Knowing the pretest probability of IEDs in healthy adolescents with no history of seizure would aid in determining the clinical significance of such discharges in EEG studies of adolescent patients with low suspicion for seizure or epilepsy.

The prevalence of abnormal EEG findings in carefully screened healthy children is difficult to determine. By definition, such children are unlikely to undergo an EEG for clinical indications. Electroencephalograms obtained in research laboratories are rarely recorded with standard clinical EEG parameters or electrodes and, being research recordings, are not reviewed for clinical abnormalities. Furthermore, subjects in EEG-related research are usually adults.

We recorded EEGs for research purposes in 140 healthy 6th grade students with no history of seizure or neurologic or psychiatric disease. Each subject had two EEGs, approximately 6 months apart, recorded with a clinical EEG machine and standard international 10–20 system electrode placements.

2. Methods

2.1. Subjects

Subjects consisted of an ethnically diverse sample of 140 adolescents at a public middle school in Southern California. Sixth grade students were recruited through school in four consecutive years (cohorts 1–4) as part of a prospective, longitudinal physical activity intervention study [1]. Exclusion criteria included left-handedness; playing on a sports team; inability to exercise; and history of head injury, neurological disease, seizure, asthma, and depression (a score that corresponded to moderate or severe depression as assessed using the Beck Depression Inventory [2] (cohort 1) or the Child Depression Inventory [3] (cohorts 2–4)). The main purpose of the EEG recordings was to test hypotheses in the biological psychology literature regarding associations between hemispheric asymmetry of frontal EEG power in the alpha band and specific personality traits. Subjects and a parent or legal guardian provided written assent and consent, respectively. The study was approved by the University of California Institutional Review Board.

2.2. EEG data acquisition and review

Electroencephalograms were obtained with a microEEG (BioSignal Group Corp., Brooklyn, NY), a miniature wireless EEG device, using

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all standard 10–20 system electrode placements (except A1 and A2) embedded in a flexible nylon electrode cap (Electro-Cap International, Inc.) [4–6]. The sampling rate was 250 Hz, and all electrode impedances were under 45 kΩ, an acceptable range for clinical recordings with the microEEG device [4]. The EEG studies were reviewed with Persyst Insight II software (Persyst, Solano Beach, CA). The EEG recordings took place in a classroom that was turned into a clinical laboratory for the purposes of the parent physical activity intervention study. Each EEG consisted of four 4-minute segments alternating between eyes open and eyes closed, with 15–45 s for the subject to stretch and review instructions in between each segment, for a total duration of about 18 min. For the eyes-closed condition, subjects were instructed to sit comfortably and think about something interesting to help stay awake, as they were supposed to remain fully awake throughout the study. Each subject had two EEG studies approximately six months apart (EEG1, EEG2). All EEGs were reviewed by a board-certified clinical neurophysiologist (ACG).

2.3. Subjects with abnormal EEG studies

Per study protocol, a letter along with a clinical EEG report was sent to the parents of each subject with an abnormal EEG, encouraging them to have their child evaluated by a pediatric neurologist. These four subjects were followed by research staff for a minimum of one year after the second EEG.

3. Results

3.1. Subject Demographics

Subjects were 50% male and 50% Latino, 27% Caucasian non-Hispanic, 13% African-American, and 10% Asian. Useful EEG data were not available for 13 EEG1 studies (hair styles incompatible with using an electrode cap [n = 7], technically compromised studies [n = 6]) and 15 EEG2 studies (hair styles incompatible with using an electrode cap [n = 6], technically compromised studies [n = 5], subject moved out of school district [n = 3], subject removed from study [n = 1]).

Mean subject age at first EEG was 11.5 years (SD: 0.41) and, at second EEG, was 12.0 years (SD: 0.40). Although subjects were instructed to remain awake, a substantial fraction had EEG patterns consistent with intermittent drowsiness. None of the subjects entered stage 2 sleep.

3.2. Abnormal EEG studies

Four subjects (2.9%) had abnormal EEG findings. Other than the abnormalities, all 8 EEGs included normal wake and drowsy patterns for age.

S1 (11.5-year-old boy): Occasional 0.5- to 2-second bursts of generalized ~4-Hz spike or polyspike–wave discharges (Fig. 1a), increasing significantly in drowsiness. Occasional 2- to 5-second

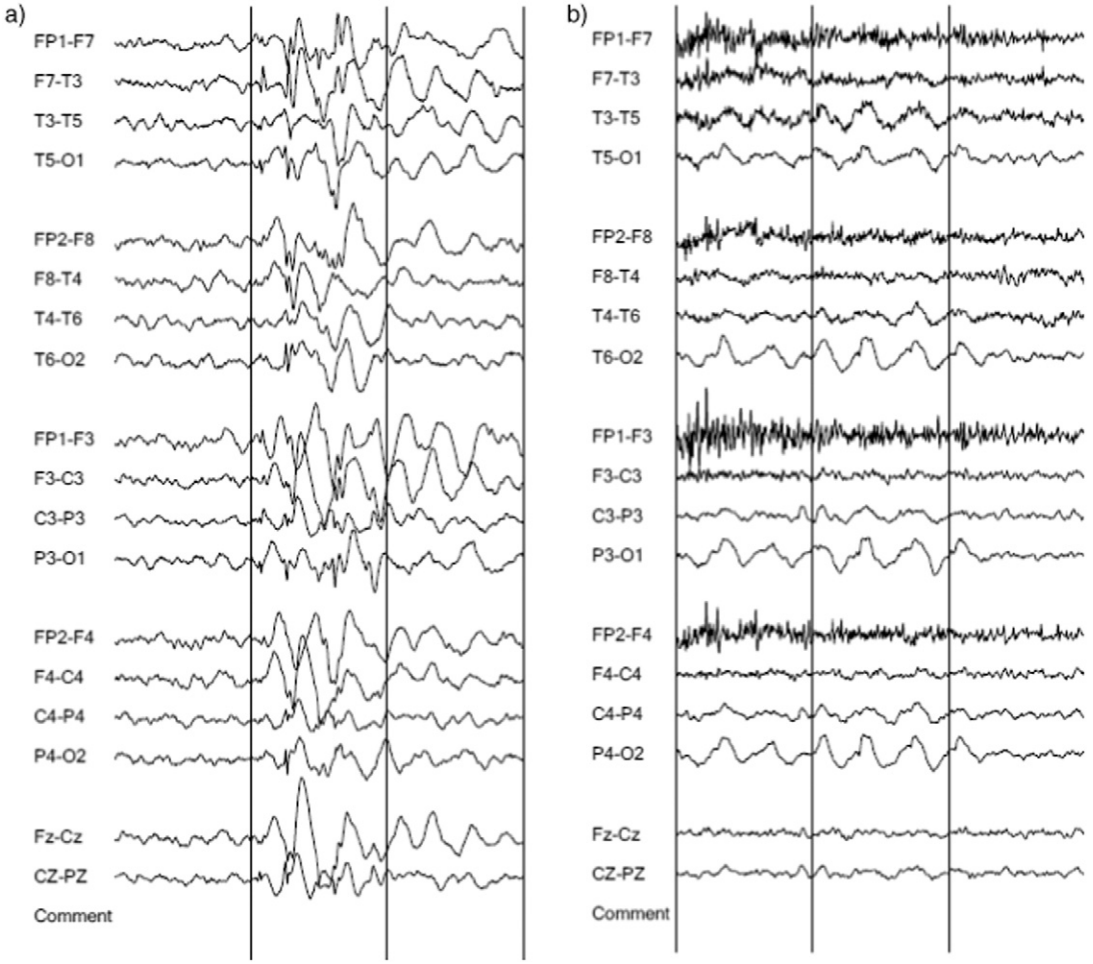

Fig. 1. Subject 1. a) One-second burst of generalized 3- to 4-Hz spike–wave. b) Two-second interval of OIRDA. Solid vertical lines equal one second.