EEG and MRI findings and their relation with intellectual disability in pervasive developmental disorders

Özlem Ünal, Özlem Özcan, Ö zgür Öner, Melda Akcakin, Ayla Aysev, Gülhis Deda
Ankara, Turkey

Background: The diagnostic category pervasive developmental disorders (PDDs) refer to a group of five disorders: autism, Rett syndrome, childhood disintegrative disorder, Asperger syndrome, and pervasive developmental disorder not otherwise specified (PDD-NOS). EEG abnormalities and seizures are considered much frequent in autistic subjects with comorbid intellectual disability (ID). In this study, we aimed to evaluate the EEG and MRI findings and their relation with ID in pervasive developmental disorder.

Methods: A retrospective, cross-sectional and non-experimental study was performed. Subjects included 81 patients diagnosed with autism or PDD-NOS according to the DSM-IV criteria. The age range of the patients was 2-15 years (mean 6.6 years, SD 3.0). Among them, 21 (25.9%) were girls and 60 boys (74.1%).

Results: Patients with severe ID had a higher rate of EEG abnormalities ($P=0.03$) than patients without ID as well as patients with mild or moderate ID. The association remained significant after the structural MRI abnormalities were controlled ($P=0.04$). The severity of ID was not associated with abnormal MRI. The most frequent EEG and MRI abnormalities were active epileptic anomaly/paroxysmal abnormality and cerebral atrophy/periventricular leukomalacia, respectively. Almost a third of the EEG abnormalities were associated with temporal cortex and adjacent cortical structures.

Conclusions: Consistent with previous studies, almost a fourth of the patients in this relatively large sample of patients with pervasive developmental disorders had EEG and/or MRI abnormalities. EEG results indicate that temporal cortex may play a significant role in pervasive developmental disorders.

Key words: autism; electroencephalography; magnetic resonance imaging; pervasive developmental disorders

Introduction

The diagnostic category pervasive developmental disorders (PDDs) refer to a group of five disorders characterized by delays in the development of multiple basic functions including socialization and communication. PDDs are autism, Rett syndrome, childhood disintegrative disorder, Asperger syndrome, and pervasive developmental disorder not otherwise specified (PDD-NOS), which includes atypical autism. Autism is frequently associated with intellectual disability (ID), electroencephalogram (EEG) abnormalities and seizures. Previous studies indicate that EEG abnormalities and seizures are much frequent in autistic subjects with comorbid ID. The most frequent types of seizures include generalized tonic-clonic, atypical absence, complex partial and myoclonic seizures. Seizures in autistic subjects show two peaks during development, one before 5 years of age and the other after 10 years. Almost 15%-20% of autistic patients without epilepsy show EEG paroxysmal abnormalities. The clinical importance of epileptiform discharges without overt seizures is not clear, but they may cause behavioral and cognitive problems. Epileptiform EEG recordings in other childhood neuropsychiatric disorders, like attention deficit/hyperactivity disorder, may also be increased.
(6.1%) when compared with normal school age children (3.5%).[7] Cumulative risk for epilepsy in patients with ID by 15 years of age was 13%, largely depending on the presence of associated disabilities, like cerebral palsy.[5] In the absence of associated disabilities and postnatal injury, the risk was much lower (3.9%). However, the rate of epilepsy in severe ID was reported to be over 60%.[9] Another study reported that while the risk of developing epilepsy was 7% in children with mild ID, it was 35% in severe ID.[10]

Magnetic resonance imaging (MRI) is a frequently used research tool in autism that yields valuable clinical data. Former studies indicate that MRI abnormalities may occur in 25%-45% of autistic subjects, depending on the nature of the subjects (e.g., presence of macrocrania).[11,12] However, these abnormalities do not always warrant treatment.[11]

Patients who have problems in social interaction, communication and repetitive behavior pattern but enable to fulfill the necessary criteria for a diagnosis of autism may be diagnosed as having PDD-NOS.[13] This disorder may be much more prevalent than classic autism. A recent study indicated that EEG and MRI abnormalities can be as frequent (almost 25%) in patients with PDD-NOS as in those with autism.[10] This study aimed to evaluate EEG and MRI findings and their relation with intellectual disability in pervasive developmental disorders.

Methods
We studied 81 patients with autism or PDD-NOS diagnosed according to the DSM-IV criteria. All the patients were Caucasian children and adolescents recruited from consecutive admissions to a general outpatient clinic in the child psychiatry department of Ankara University School of Medicine. Patients who were diagnosed with neurological or medical conditions were excluded. The age range of the studied patients was 2-15 years (mean 6.6 years, SD 3.0). Among them, 21 (25.9%) were girls and 60 boys (74.1%).

The diagnoses were made by two experienced child psychiatrist and psychologist (Ozgur Oner and Melda Akcakin). All patients fulfilled the DSM-IV criteria for autism or PDD-NOS. The patients varied from severely retarded patients without speech to milder ones with prominent social problems but with better development in other areas. In fact, this was consistent with our objective to reflect the clinical picture. Thus, our sample was heterogeneous.

EEG investigations were recorded according to the 10-20 system. The recordings were interpreted by the same pediatric neurologist. Since all patients were in the autistic spectrum and most of them were intellectually disabled, EEG was performed during sleep, during a monitoring time of 1 hour. Unless the sleep was spontaneous, we used hydroxyzine 10-20 mg per dose. For every patient we collected data about MRI findings with standard 1.5 Tesla equipment.

All patients had an IQ evaluation with one of the following measures: Stanford-Binet Intelligence Scale, Weschler Intelligence Scale for Patients-Revised (WISC-R), or the Ankara Developmental Screening Inventory (ADSI). The ADSI is a 154-item inventory developed for children of Turkish culture. It was used to evaluate the present development and capacity of infants and children at the age of 0-6 years or older children who had equivalent mental development and the total score was used to assess the developmental level of the patients. Clearly, the ADSI has a high internal consistency (Cronbach alpha for different age groups: 0.88-0.98) and test-retest reliability (r=0.88-0.99 for different age groups).[14] A recent study showed that the ADSI shows a close correlation (r=0.95) with the Vineland Adaptive Behavior Checklist.[15]

ID severity was grouped into four categories: average, mild, moderate, and severe disability. For WISC-R and Stanford-Binet tests, the groups were: Non-ID (IQ>70), mild ID (IQ 50-69), moderate ID (IQ 35-49), and severe ID (IQ<35). For the ADSI, the groups were: non-ID (total score above 20% of the population average), mild ID (total score above 20% but below 30% of the population average), moderate ID (total score slightly below 30% of the population average), and severe ID (total score much below the population average).

Information about obstetric complications was also obtained from the parents by a semi-structured interview, which included questions about hypoxic birth injury, birth weight, parental health and drug usage during pregnancy, and history of delivery. All the problems were recorded into a single dichotic variable reflecting obstetric complications. Fifteen patients had such complications.

We used the Chi-square test and Fisher's exact test to evaluate group differences. Two-tailed P values are used for each test and P values <0.05 were considered statistically significant.

Results
EEG was performed in all patients, and 22 (27.2%) of the 81 patients had abnormal EEG recordings. The most frequent abnormalities were active epileptic and paroxysmal abnormalities, which were focal in most of the patients: 4 patients had right temporal-