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Original article

Electroencephalographic profile of children with autism spectrum disorders in Abidjan, Côte d'Ivoire

Profil électroencéphalographique des enfants porteurs de troubles du spectre de l'autisme à Abidjan en côte d'ivoire

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Résumé

Introduction : Les troubles du spectre de l'autisme (TSA) sont caractérisés par une déficience des interactions sociales, du langage et de la communication, ainsi que des comportements stéréotypés. La question de la réalisation d'un EEG dans la démarche clinique est fréquemment envisagée du fait de l'association significative entre épilepsie et autisme. En Côte d'Ivoire, aucune étude n'a été réalisée sur l'autisme et ses caractéristiques électroencéphalographiques. Notre travail avait pour but de contribuer à une meilleure appréciation des profils électroencéphalographiques rencontrés chez les enfants autistes dans trois structures sanitaires, à Abidjan, en Côte d'Ivoire.

Méthodologie : Il s'est agi d'une étude transversale, à visée descriptive qui s'est déroulée, sur une période de sept (07) mois, de janvier à juillet 2022, dans trois unités de consultation de neuropédiatrie à Abidjan. Ont été inclus dans notre étude, les patients de 0 à 15 ans, vus dans ces unités de consultation, durant la période d'étude, avec un diagnostic d'autisme selon le DSM-V et ayant réalisé un EEG.

Résultats : Nous avons colligé 48 patients qui répondaient aux critères d'inclusion.L'âge moyen était de 7 ans. La tranche d'âge la plus fréquente était celle des 6-9 ans (68%) .Il y avait une prédominance masculine (73%) avec un sex-ratio (H/F) de 2,7.. Les stéréotypies gestuelles étaient fréquemment rencontrées (77,08%). Les motifs de consultation étaient dominés par le retard de langage (41,67%), suivi des troubles du comportement (27,08%). L'EEG de sommeil était normal chez 73% des enfants. Les différentes anomalies retrouvées chez les autres enfants étaient dans la majorité des cas (30,77%) des pointes, pointes–ondes et polypointes. Les anomalies EEG étaient généralisées et fronto-temporales dans respectivement, 53,85% et 30,77% des cas.

Conclusion : Cette étude a mis en évidence des anomalies EEG fréquentes chez les enfants atteints de TSA, même en l'absence de crises d'épilepsie cliniquement signalées. Des études prospectives devraient explorer davantage cette association et évaluer sa signification clinique. En outre, un historique détaillé de l'épilepsie devrait être inclus dans la consultation médicale pour les enfants atteints

de TSA.

Mots-clés : Autisme, Enfant, EEG, Abidjan.

Abstract

Introduction: Autism spectrum disorders (ASD) are characterized by impaired social interaction, language and communication, and stereotyped behavior. The question of performing an EEG as part of the clinical approach is frequently raised because of the significant association between epilepsy and autism. In Côte d'Ivoire, no studies have been conducted on autism and its electroencephalographic characteristics. The aim of our work was to contribute to a better appreciation of the electroencephalographic profiles encountered in autistic children in three health facilities in Abidjan, Côte d'Ivoire.

Methodology: This was a descriptive cross-sectional study conducted over a period of seven (07) months, from January to July 2022, in three child neurology consultation units in Abidjan. Our study included patients aged from 0 to 15 years, seen in these consultation units during the study period, with a DSM-V diagnosis of autism and who had undergone an EEG.

Results: We enrolled 48 patients who met the inclusion criteria, with an average age of 7 years. The most frequent age group was 6-9 years (68%), with a predominance of males (73%) and a sex ratio (M/F) of 2.7. Gestural stereotypes were frequently encountered (77.08%). The reasons for consultation were dominated by language delay (41.67%), followed by behavioural disorders (27.08%). The sleep EEG was normal in 73% of the children. The various abnormalities found in the other children were, in most cases (30.77%), spikes, spike-waves and poly-spikes. The EEG anomalies were generalized and frontotemporal in 53.85% and 30.77% of cases respectively.

Conclusion : This study found frequent EEG abnormalities in children with ASD, even without clinically reported seizures. Prospective studies should explore this association further and assess its clinical significance. Additionally, a detailed epilepsy history should be included in the medical consultation for children with ASD.

Keywords: Autism, Child, EEG, Abidjan.

Introduction

Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) as deficits in communication and social interaction, and repetitive, stereotyped and restricted behaviours or interests [1], and is associated with several co-morbidities including anxiety, mood, and sleep disorders, and epilepsy. Given the significant association between epilepsy and autism, with around 30% of children diagnosed with autism presenting with epilepsy [2] and conversely, up to a third of children with epilepsy in tertiary assessment centers have autistic features, the question of an EEG in the clinical approach should be considered [3]. Epileptic manifestations are variable, and can be subtle and confused with behavioural manifestations, which is why an EEG is legitimate in case of clinical suspicion [4]. On the other hand, the existence of abnormalities in the anterior territories on the EEG, which are not epileptic in nature, may result in neuropsychiatric and neurobehavioural signs [5], i.e., cognitive, language or behavioural changes, including high levels of irritability and aggression in young autistic children with persistent epileptiform activity on the EEG [6,7]. In Africa, there is very little data on autism and its electroencephalographic characteristics, with the corollary of a lack of harmonisation in the management of electroencephalographic abnormalities. In Côte d'Ivoire, no study has been conducted. The aim of our work was to contribute to a better appreciation of the electroencephalographic profiles encountered in patients with autism in three health facilities in Côte d'Ivoire, to optimize the management of patients with autism spectrum disorders.

Methodology

This was a descriptive cross-sectional study conducted over a period of seven (07) months, from January to July 2022. It took place in the child neurology consultation units of the Mother-Child Hospital Dominique OUATTARA in Bingerville and the Sainte Thérèse medical office, as well as in a center for the management of autism, the Center Marguerite TE BONLE of the National Institute of Public Health in Adjamé. Our study focused on children received in these facilities during this period. We included all patients from 0 to 15 years of age seen in these units who had a diagnosis of autism according to the DSM-V and who had an EEG during the study period. Patients whose parents refused to participate in the study were excluded. Parameters studied were sociodemographic, clinical, and electroencephalographic data of children identified. Data were collected from the patients' medical records and an interview with their parents. All medical records with multiple entry dates were analyzed only once, corresponding to the first entry date. Data were collected using a computerized survey form. The data collected were analyzed and then processed using CSPRO7, STATA, Excel and Word 2013.

Ethical considerations

The anonymity and confidentiality of the data were guaranteed in accordance with the laws on individual data protection [8]. Administrative authorities (heads of department) were informed of the study and gave their consent.

Results

- Sociodemographic characteristics

In our study, which covered a period of 7 months (January to July 2022), we enrolled 48 patients, including 31 at the Marguérite Té BONLE center, 09 at the Sainte Thérèse medical office and 08 at the mother and Child Hospital of Bingerville. All patients met the inclusion criteria for our study. The mean age of the study population was 7 years, with extremes ranging from 03 to 12 years. The most represented age group was 6 to 9 years (68%).73% of the study population were boys and 27% girls, with a sex ratio of 2.7. 98% of our patients were Ivorian. No children were from consanguineous couples. 46% of the children did not attend school.

- Clinical and radiological characteristics

In terms of medical history, 8 out of 10 patients had no personal or family history. Among the remaining 20%, neonatal distress was significant and accounted for 14.6%. As for psychomotor development, motor acquisitions occurred within the norms for 94% of the children and 6% were delayed. Sphincter cleanliness was acquired for 35% of the patients. Language was acquired in 46% of the children, 91% of whom had a speech delay. A bilingual environment was found in 4% of the children, and the languages spoken in addition to French were Agni and Malinké. Regarding the mode of care, children were largely cared for by parents (81%). Grandparents had the care of 13% of children and nannies of 6%. Only one child was a victim of socio-emotional conflict. In terms of behavior, 29% of the children were sociable, while 48% were aggressive. Gestural stereotypes were encountered in 77.88% of the children compared with 14.58% for verbal stereotypies. The children exhibited both types in 8.33% of cases. As for the reason for consultation, it was dominated by language delay in 41.67% of cases, followed by behavioral disorders (27.08%). In 20.83% of children, the 2 main reasons were associated. Suspicion of ASD also appeared occasionally (6.25%) as a reason. The neurological examination was abnormal in 10% of the children. All the children underwent a child psychiatric assessment, which led to a diagnosis of autism. The average age at diagnosis of autism was 5 years. The CARS test was used in all cases. Three types of abnormalities were found, as shown in Figure 1.

All 3 types of disorders were present in 42% of the children. Communication disorders were present in all children.

Radiologically, only 17% of the children had a cranioencephalic CT scan and all the results were

normal. Brain MRI was performed in 40% (19) of the children. Only one had a leukodystrophic abnormality.

- Electroencephalographic data

Twenty-seven percent of our respondents had an abnormal EEG. The various abnormalities found are shown in the following graph (figure 2).

Spikes, spike-waves, and poly-spikes were encountered in 30.77% of cases. Other abnormalities were found in the same proportions (7.69%). 8.33% of EEGs were in favor of epilepsy.

In terms of location, generalized and frontotemporal abnormalities predominated and were found in 53.85% and 30.77% of cases respectively.

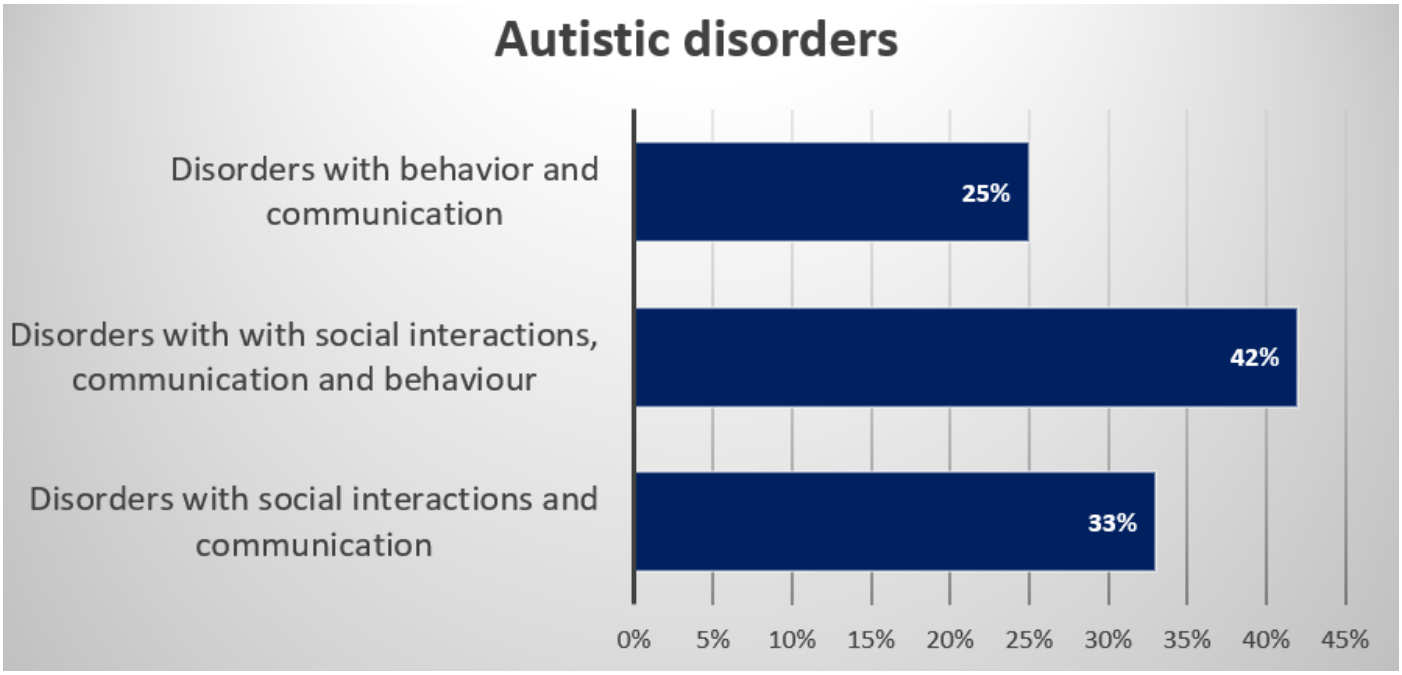

Figure 1: Distribution of children according to identified autism disorders.

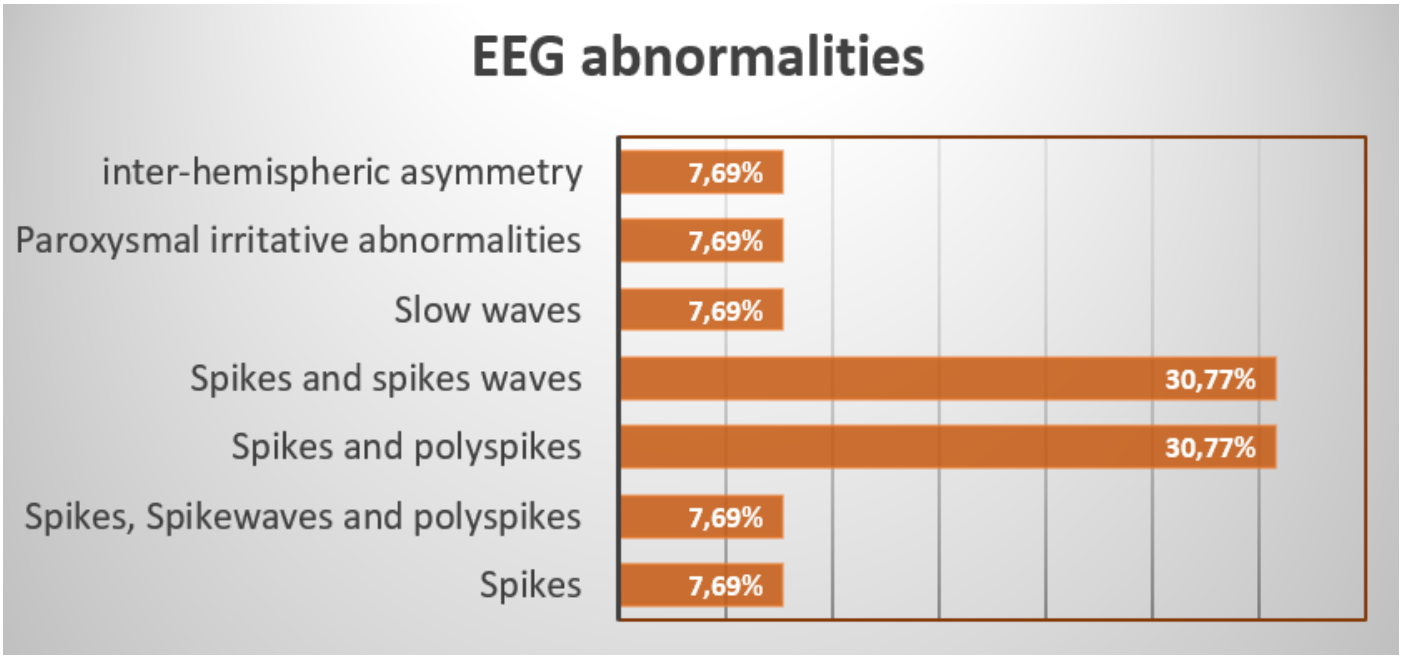

Figure 2: Distribution of children according to EEG abnormalities.

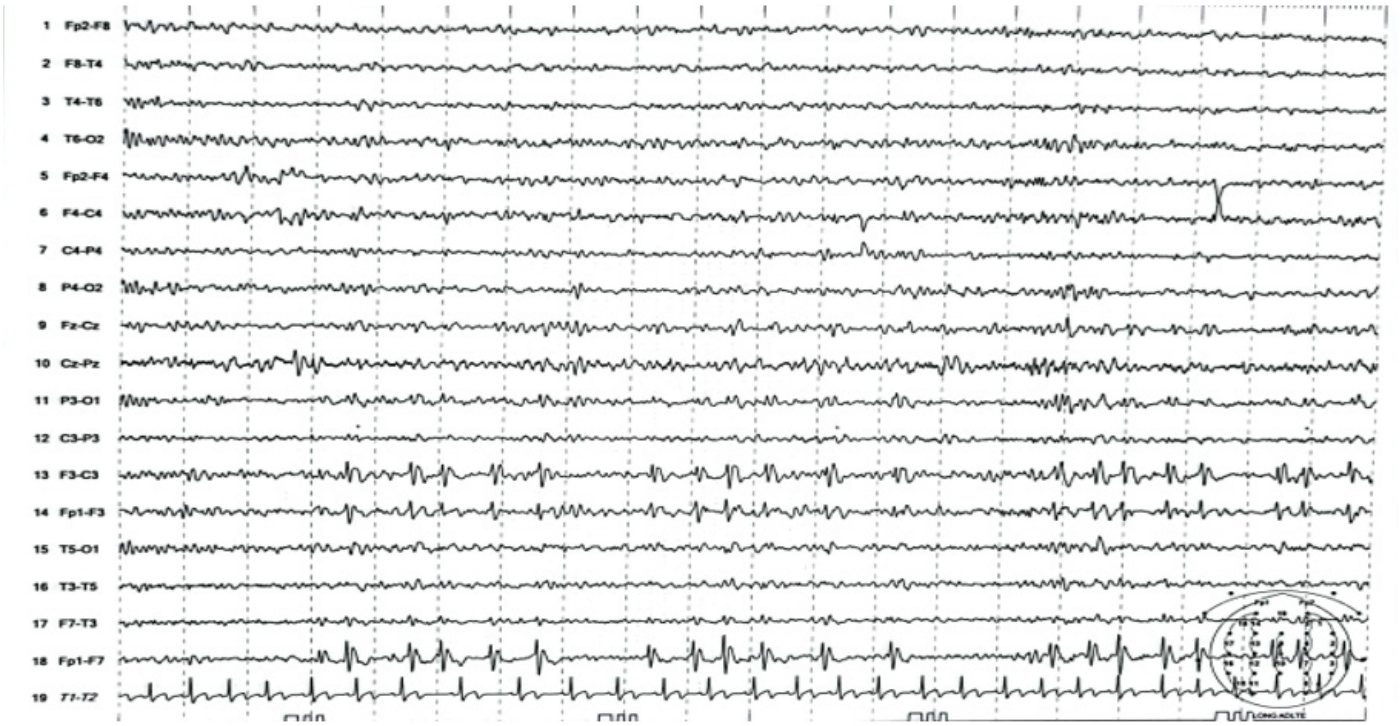

Figure 3: EEG showing left frontal spike waves in one of our patients

Discussion

- Sociodemographic characteristics

Although it has long been recognized that the signs of autism develop before the age of 3, it was traditionally considered that a formal diagnosis should only be made from the age of 3, which explains the low prevalence before the age of 05. However, knowledge of the early signs of autism makes it possible to make a diagnosis using validated instruments: the Checklist for Autism in Toddlers (CHAT) and the Modified ChAT (M-CHAT) for children aged 18 months; the Autism Diagnostic Interview-Revised (ADI-R) and the Autism Diagnostic Observation Schedule (ADOS), which can be used from the age of 2 [9]. Our majority age group was like the figures for Quebec in the Canadian multicentre study, with a higher prevalence of ASD in children aged from 5 to 9 [10]. As for gender, our results were like those of Kaba and al. in 2020, who also reported a predominance of males and a sex ratio of 2 [11]. A meta-analysis by Loomes and al. in 2017 also found a sex ratio of 4:1 in favor of males [12]. In fact, several studies confirm that girls with autism are more at risk than boys of having their disorder neglected, misdiagnosed or identified late [13-16]. In fact, compared with boys, girls with autism are less likely to show restricted interests, which would reduce the chances of their disorder being identified [17]. In addition, just under half of our respondents did not attend school. These results are in line with those of Sow in Dakar, who reported a proportion of 40% of autistic children not attending school [18]. This proportion was higher in the study by Traoré in Mali (84.6%) [19]. These high prevalence of out-of-school autistic children could be explained by the lack of suitable school structures and learning facilities in our developing countries. Despite the existence of common characteristics, the difficulties encountered manifest themselves differently from one individual to another, demonstrating great heterogeneity in the clinical forms of autism, the associated impairments, the age of onset of the first signs and their development [20]. This can complicate schooling in ordinary classes [21].

- Clinical and radiological data

Language delay was the most common reason for consultation, followed by behavioural problems.

These results are like those of Mahajnah in Israel, who found language delay to be the reason for consultation, followed by behavioural problems in her Israeli series in 2015 [22]. Regarding the average age at diagnosis of autism, Mahajnah in Israel found that diagnosis was earlier, with an average age of 3.1 ± 1.4 years and extremes ranging from 2.6 to 4.5 years [22]. This difference could be explained by the fact that health workers are not sufficiently trained in the early signs of autistic disorders. A meta-analysis published in 2021 on the overall age at diagnosis of ASD showed a mean age of 60.48 months (05 years) with extremes ranging from 30.90 to 234.57 months, i.e., from 2.5 to 19.5 years. [23]. Brain MRI was performed in 40% of the children and was normal in 98% of cases. These results are similar to those of Sow, where brain MRI was performed in 36.4% of patients and was without abnormality in 93.9% of cases [18]. In fact, a meta-analysis by Stan Field and al. (2008), which included 43 structural neuroimaging studies on more than 800 subjects with ASD and a similar number of matched controls, revealed that, apart from increased brain volume, there was no typical abnormalities of ASD on brain imaging [24].

- Electroencephalographic data

The sleep EEG was performed in all children. It was normal in about ¾ of our subjects, which is comparable to the series of Sow in Dakar, in which the EEG was normal in 62.2% of cases [18]. Seck in Dakar, in 2019, also reported that the EEG was normal in half of the cases [25].

In a critical review, Spence and Schneider summarized EEG findings in ASD from 12 small to medium studies and found highly variable rates (4-61%) of abnormalities [26]. This is probably secondary to a variety of methodological factors, some of which are similar to those in samples involving patients with ASD and epilepsy. EEG data are further complicated by more than one finding bias. Patients with seizures tend to obtain more EEG. Consequently, in studies that do not separate patients with and without epilepsy, the rates of EEG abnormalities are higher [27,28]. In addition, the EEG technique itself can have a major impact. Most studies show that prolonged EEGs and those including the sleep state are more sensitive to the detection of abnormalities [27,29,30]. The most prevalent abnormalities in our study were spikes, spike-waves and polyspikes. Kaba and Seck also found in most of the cases, spikes, and spike-waves in their series [11,25]. It should be noted that the abnormalities found on the awake EEG are superimposable on those of the sleep EEG, as demonstrated in the series of Sow (Dakar) [18], Masmoudi (Tunis) [31], and Matsuo (Tokyo) [32]. Some abnormalities tend to signify epileptogenicity such as spikes and sharp waves, while others are related to underlying encephalopathy or structural abnormalities such as generalized or focal slowing, respectively. The epileptiform abnormalities in our series were generalized spikes and polyspikes. Many studies do not clearly distinguish between these abnormalities, which were generally referred to as 'paroxysmal EEG abnormalities' [4].

Generalized and frontotemporal localizations were the most represented in 53.85% and 30.77% of cases respectively in our study. This differs from the results of Seck, where abnormalities were focal in 88.9% of cases, mainly involving the frontal and parietal lobes [25]. For Kaba, the abnormalities involved the fronto-temporal regions in 77.77% of subjects [11]. In Sow's series, the locations varied: frontal in 60%, centro-parietal in 26.6%, temporal and centro-temporal in 6.7% [18]. In a review from 2020, Francesco and al. showed that it is very unlikely that ASD has a distinct EEG pattern as heterogeneity is a feature of ASD in its aetiologies, phenotypes, and outcomes [33]. However, epileptiform discharges appear to be more frequent than non-epileptiform abnormalities in the EEG of patients with ASD. Epileptiform abnormalities include generalized, focal, multifocal, unilateral or bilateral discharges and are located in different areas of the brain but are probably more frequent in temporal areas [34]. In our study, 8.33% of EEGs showed abnormalities consistent with epilepsy. Epilepsy in patients with ASD accounted for a higher proportion (37.8%) in the series of Sow (Dakar) [18].

The use of EEG to study brain function in developmental disorders such as ASD also has several practical advantages. Compared with MRI, EEG can be used across a wider range of age groups and developmental abilities to study brain physiology, has a higher relative tolerance for motion, has higher temporal resolution, is more clinically available and can be used to collect repeated measurements [34]. This is particularly promising for the study of more severely affected and/or younger patients who may not be able to perform tasks accurately due to cognitive, physical or developmental problems.

Conclusion

The epidemiological profiles of autism appear to be similar, whatever the populations studied. Diagnosis is often made late, around the age of 5, and is based on language and/or behavioural disorders. There is no specific EEG pattern for ASD. It is difficult to establish the exact prevalence of epilepsy in autistic children. It is therefore advisable to carry out an early EEG and even repeat the EEG in autistic patients, given the recognized comorbidity of epilepsy, the management of which improves behavioural problems. Larger-scale studies will be considered in order to better describe the relationship between EEG abnormalities and autism.

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Conflict of interest : None

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