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Social cognition dysfunctions in patients with epilepsy: Evidence from patients with temporal lobe and idiopathic generalized epilepsies

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ABSTRACT

Background and aim: Despite an extensive literature on cognitive impairments in focal and generalized epilepsy, only a few number of studies specifically explored social cognition disorders in epilepsy syndromes. The aim of our study was to investigate social cognition abilities in patients with temporal lobe epilepsy (TLE) and in patients with idiopathic generalized epilepsy (IGE).
Materials and methods: Thirty-nine patients (21 patients with TLE and 18 patients with IGE) and 21 matched healthy controls (HCs) were recruited. All subjects underwent a basic neuropsychological battery plus two experimental tasks evaluating emotion recognition from facial expression (Ekman-60-Faces test, Ek-60F) and mental state attribution (Story-based Empathy Task, SET). In particular, the latter is a newly developed task that assesses the ability to infer others' intentions (i.e., intention attribution — IA) and emotions (i.e., emotion attribution — EA) compared with a control condition of physical causality (i.e., causal inferences — CI).
Results: Compared with HCs, patients with TLE showed significantly lower performances on both social cognition tasks. In particular, all SET subconditions as well as the recognition of negative emotions were significantly impaired in patients with TLE vs. HCs. On the contrary, patients with IGE showed impairments on anger recognition only without any deficit at the SET task.
Discussion: Emotion recognition deficits occur in patients with epilepsy, possibly because of a global disruption of a pathway involving frontal, temporal, and limbic regions. Impairments of mental state attribution specifically characterize the neuropsychological profile of patients with TLE in the context of the in-depth temporal dysfunction typical of such patients.
Conclusion: Impairments of socioemotional processing have to be considered as part of the neuropsychological assessment in both TLE and IGE in view of a correct management and for future therapeutic interventions.

1. Introduction

During the last century, the interest on cognitive deficit in the course of epilepsy considerably increased. A large body of research has been indeed collected, defining the cognitive profile of patients with epilepsy [1] and the importance of the assessment of cognitive functions on the comprehensive care program for persons with epilepsy [2]. While the first behavioral studies of patients with epilepsy mostly tested global intelligence level, only recently, researchers tried to disclose specific neuropsychological profiles according to the different subtypes of epilepsy [1]. Overall literature findings suggest that the neuropsychological evaluation must take into account the subtype of the epileptic syndrome, in particular its localization, the possible etiology, and the pharmacological therapy. All these elements undoubtedly influence the presentation of the cognitive deficits [1]. Although an intensive research led in the last few decades in this field, it is still unclear whether such cognitive impairments are generally related to the chronic and stigmatizing condition the epilepsy patients live or are mainly due to a specific neuropathological process [3].

Temporal lobe epilepsy (TLE) is the most common focal epilepsy syndrome. Cognitive functions may be variably impaired in people with TLE. Even if memory deficits are usually the core of the cognitive phenotype of TLE, impairments largely vary also including low global intelligence level and deficits on verbal learning, visuospatial skills, and

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executive functions (e.g., problem solving) [1,4,5]. On the contrary, idiopathic generalized epilepsy (IGE) is defined as an epilepsy syndrome that has no apparent cause and is assumed to have an underlying genetic etiology. Compared with cognitive impairments in TLE, those in IGE are less prominent and, thus, have been less investigated by researchers. At the cognitive evaluation, most of patients with IGE show just a low global intelligence level [6]. Nevertheless, some of these patients can, however, present mild deficits on attention, visuospatial skills, and nonverbal memory tasks [6–10].

Social cognition is a high-level cognitive function that broadly includes all the processes used to understand and store information about the interactions with other people in a social context [11]. Perception of social signals pertaining to others' mental states is a fundamental prerequisite in order to obtain a correct formulation of the appropriate responses. In addition, a correct processing of such signals, attributing independent mental (knowledge, beliefs, and motives) or emotional (feelings) states to other individuals, is also fundamental to understand and predict others' behavior.

Epilepsy condition can variably impair social cognition abilities according to the localization of the epileptic focus and to the associated pathology. However, the clinical significance of such deficit is largely unexplored. Some studies provided evidence of the presence of deficits of negative emotion recognition in patients with TLE as well as in patients with IGE [12,13]. These authors showed that fear and disgust recognition is impaired in both epilepsy syndromes, with TLE deficit also extending to facial identity recognition [12]. Other studies have previously proved selective impairment of fear recognition in the TLE syndrome [13,14]. Reynders et al. also showed a fear recognition deficit in a small sample of patients with IGE [13].

In addition, in the last years, researchers also investigated the mentalizing abilities of patients with TLE and patients with IGE. Low performances on different Theory of Mind (ToM) tasks [15–20] have been reported in TLE. Both cognitive and affective facets of ToM have been proved to be impaired [19]. Identification and comprehension of sincere, deceitful, and sarcastic social exchanges are also impaired in individuals with TLE [20]. This deficit seems to be partly related to the presence of mesial temporal lobe sclerosis and the early age at seizure onset [20], as also supported by Giovagnoli et al. [16]. Cohn and coworkers also proved in a voxel-based morphometry MRI study a significant relationship between left hippocampal atrophy and overall social inference abilities, as well as between left anterior temporal neocortex atrophy and sarcasm comprehension [20]. These results support a critical role of the anterior temporal cortex as converging zone of higher-order perceptual and emotional processes and of stored representations. Studies assessing different facets of ToM ability in patients with TLE proved, however, contradictory results, ranging from wide ToM impairments [15,19,21] to normal performances [22] or selective deficits [23]. Such variability is probably due to the intrinsic heterogeneity of the TLE syndrome which may include lesional and nonlesional patients, as well as cases with unilateral (left or right) or prevalent medial or lateral TLE. The same authors suggested a role of executive functioning in performances of patients with TLE on ToM tasks, although in disagreement with a previous study supporting a dissociation between these cognitive functions [15].

At the opposite, only a few studies investigated other aspects of social cognition (e.g., social judgment, and empathy) in patients with IGE [13,24], consistently proving impaired social cognition abilities compared with healthy controls. Cognitive and affective empathy has been indirectly investigated by Jiang et al. by means of the Interpersonal Reactivity Index (IRI) questionnaire. Study findings provided evidence of the presence of a selective perspective-taking deficit in patients with IGE with preserved ability of the affective component supporting the more limited damage of social cognition networks in this epilepsy syndrome [24].

The aim of this study was to investigate in patients with TLE and in those with IGE the type and the severity of ToM deficits, assessing for the first time the ability to attribute mental states (either intentions or emotions) to others with a single newly ad hoc developed task. We also assessed the ability to recognize emotions from facial expression in both epilepsy syndromes and explored possible correlation of social cognition performances with executive measures. In particular, we used the Italian version of the Ekman-60-Faces (Ek-60F) test [25] and the Story-based Empathy Task (SET) [26]. According to the neural correlates of socioemotional processing, which involves specific frontotemporal and limbic networks [27,28], we expected low social cognition performances in both IGE and TLE but with a wider impairment in patients with TLE. We also hypothesized that deficits of basic cognitive functioning may result in patients with TLE and in those with IGE in poor performances on specific social cognition tasks.

2. Methods

2.1. Subjects

We recruited 39 consecutive patients with epilepsy (21 patients with TLE (8 males; mean age = 37 ± 12.5 years) and 18 patients with IGE (6 males; mean age = 26.3 ± 7.2 years)) referred to the Centre for the Diagnosis and the Treatment of Epilepsy of University of Palermo (Palermo, Italy). All participants underwent electroclinical phenotyping using a validated seizure questionnaire and review of medical records to investigate age at seizure onset, ictal semiology (described by both the patient and an external observer), seizure frequency, and response to treatment. Selected cases underwent a prolonged video-EEG monitoring for seizure recording. Seizure semiology in patients with TLE was based above all on the clinical history in all cases. Unfortunately, since we observed only unspecified interictal discharges and no seizures during the EEG monitoring, we were not able to identify specific lateralization.

Patients with TLE in our study did not show mesial temporal sclerosis or other structural brain lesions at the brain MRI; indeed, recognition of subtle cortical abnormalities is limited by actual neuroimaging resolution. So, we can define our patients as having “probably symptomatic” TLE, taking into account that some of them should have unrecognized subtle malformations of cortical development that correlate with the localization of the focus of epilepsy [29,30].

Exclusion criteria for patients' enrollment were an age younger than 18 years, a positive anamnesis for psychiatric disorders, and the presence of comprehension deficits or learning disorders that may influence the results of the neuropsychological evaluation. In addition, we recruited on a voluntary basis (i.e., partners or relatives of patients with epilepsy) a control group of 21 age-, gender-, and education-matched healthy subjects (HCs; 12 males; mean age = 31.95 ± 11.54 years) with no history of neurological or psychiatric illnesses. See Table 1 for demographic and clinic details of the enrolled sample.

All subjects or their caregivers gave informed consent to the experimental procedure, which was approved by the local ethics committee.

2.2. Standard neuropsychological battery

Both patients and HCs underwent a battery of neuropsychological tests in order to provide background information about their cognitive functioning. In particular, memory and executive functions (Rey Auditory Verbal Learning Test; Rey's Figure Recall Test; Verbal and Visual Digit Span Task; and Attentive Matrices) (see Lezak, 2000 for details) [31]; language abilities (Phonological and Semantic Fluency; Token test [32]; Aachener Aphasie Test (AAT) naming [33]); and visuoperceptual and visuospatial abilities (Rey's Figure Copy Test) (see Lezak, 2000) [31] were assessed in each patient. Depression and anxiety were investigated with the Beck Depression Scale (BDI, total score = 0–39) [34].

2.3. Experimental social cognition battery

A brief experimental battery including the Italian version of the Ekman-60-Faces (Ek-60F) test [25] and the Story-based Empathy Task

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