STUDY OF THE MENTAL REPRESENTATION OF THE ENVIRONMENT IN EPILEPTIC PATIENTS

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ABSTRACT:

Background: The search for possible topographical disorientation in epileptic patients was carried out with the aim of better understanding the behavior of these patients and optimizing their neuropsychological accompaniment.

Method: forty-five (45) patients suffering from generalized epilepsy after having traveled a loop, had to draw on a square sheet of blank standard A4 white paper, a free plan of the previously traveled route. We counted and compared the number of benchmarks, of change of orientations, to those of the healthy control subjects.

Results: Epileptic patients significantly (F (1.46) = 22.21, p = 0.00002) have fewer decision markers than control subjects. They were significantly (F (1.46) = 11.74, p = 0.00130) more errors than the healthy control subjects in the number of changes of orientation.

Conclusion: Thus, we can conclude that epileptic patients are deficient in allocentrated representations of their environment. They can therefore have topographical disorientations. Patients and parents should be informed of these disorders for better management.

Key words: allocentred, generalized epilepsy, navigation.

Introduction

To know how to navigate is primordial and even vital for every living being. This ability occurs daily to ensure the survival of the species, in animals (find food, escape predators) as in humans to make travel in complex urban environments or natural environments, familiar or not, visit of a city, professional meetings, mountain hike [1]. This ability to navigate in a familiar or unfamiliar environment depends both on an intact mental representation of allocentric spatial information and the integrity of systems that support complementary egocentric representations [2]. And to move from one place to another, we regularly generate internal representations of surrounding spaces, which may include egocentric (centered on the body) and allocentric (centered on the world) coordinates [3,4]. The allocentric coordinates (centered on the world) refer to the salient landmarks and their relative positions, while the egocentric coordinates (centered on the body) rest on sensorimotor indices of the movements of the head, trunk and body, updating the information that arrives according to the movements. We can navigate and find our way as well through a direct perception of the environment as through symbolic representations such as language or maps. These symbolic representations allow humans to construct a mental representation of the environment. Once an individual has constructed and memorized a mental representation, he can use it in different ways to navigate the environment. However, this ability to navigate is particularly difficult in the case of CNS dysfunction, particularly in the context of epilepsy. Indeed, in addition to the annoyance caused by seizures, epileptic patients often complain of memory disorders that constitute the dominant element of this pathology and which, rightly, are often considered as behavioral markers of the period interictal epilepsy [5]. They manifest themselves, to varying degrees, by frequent forgetfulness, learning difficulties or problems in memorizing a route, which considerably affect their daily lives. In the Ivory Coast, where this pathology represents a real public health problem, few studies have documented the disorders of topographical orientation associated with cases of generalized epilepsy. The objective of this study is to search for topographical disorientation in epileptic patients in order to better understand the behavior of these patients and optimize their neuropsychological support.

Material and methods

Study population

The study described here totaled 70 participants of both sexes. The age of the subjects varies between 18 years and 30 years. They are distributed as follows:

- 25 control subjects with no history of neurological, psychiatric, stroke disorders and épilepsy. They were chosen from the general population;

- 45 patients were recruited from the Department of Neurology of C.H.U CocodyAbidjan (Ivory Coast). they suffering from generalized epilepsy.

methods

The subjects had to travel a loop, not too long, of an average duration of 10 minutes inside the university hospital of cocody. The trip was done twice, successively and all the participants were accompanied, both times, by the experimenter. Before starting the experiment, the following instruction was given to the participants; "We will travel together a route in the hospital compound We will do this ride together twice in a row. Be careful during the course because you will have then answer questions about the route. " After having traveled the route, the subjects had to realize a free plan of the previously traveled route. The following instruction was given to the participants: "Imagine now that you have to provide someone who has never been to the Cocody University Hospital an annotated and intelligible plan of the route you have just traveled. Thank you for drawing this plan in the most accurate and faithful way possible, knowing that your supposed interlocutor will not be in possession of any other description". Their plan was drawn on a square sheet of standard A4 white paper, thus showing no orientation. This sheet did not contain any information. The participants, to carry out this test, in addition to the standard white paper sheet, only had a pencil and an eraser. After a full description of the subject study, written consent was obtained. For the statistical analysis of the data, we used statistica version 6 software. The ANOVA was used to compare the performances of the participants; it was significant for $P < 0.05$.

Results

Healthy control subjects (n = 25, mean age 25.5 years) and patients (n = 45, mean age 27.5 years) were matched for age (Table 1). No significant difference (t (46) = 0.55, p = 0.62) existed between the two populations. We also matched our subjects with their level of study (Table 1), using the bachelor's degree (Bac = 12 years of study) as a reference. There was no significant difference (t (39) = 0.44, p = 0.52) between our two populations.

Table1: Age machtings, level of study of participants

Participants	Ages (years)	Level of study (years)
control subjects	25,5	12,62
Patients	27.5	11,3

We counted the total number of benchmarks included in their plan by the different participants (Figure 1).

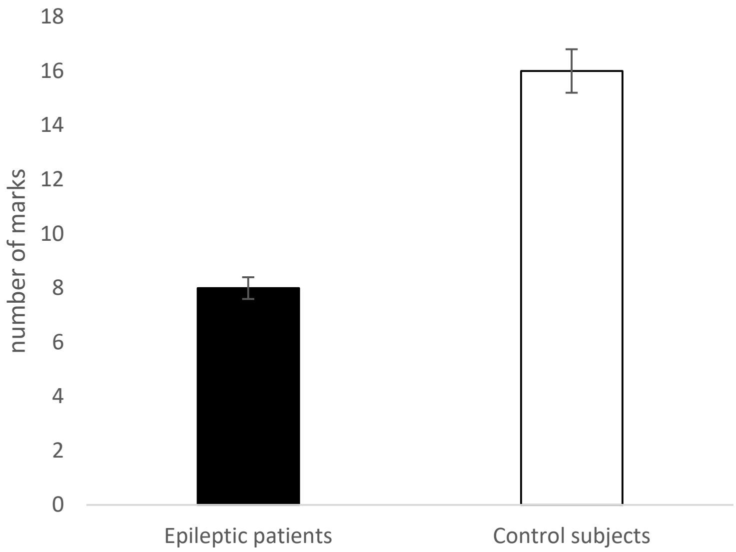

Figure 1: Total number of landmarks

The results indicated that a significant difference (F (1.46) = 24.60, p = 0.00001) exists in the choice of global benchmarks between the two populations tested. Indeed, epileptic patients represent significantly fewer benchmarks than controlled subjects. Plans of epileptic patients are poorer in information than those of healthy controls. Regarding the decision markers, they are the most important of the cartography of the subject. They are located at the changes of orientation and allow the subjects to orient themselves. Epileptic patients significantly (F (1.46) = 22.21, p = 0.00002) had fewer decision markers than healthy control subjects. This result is almost identical for confirmatory markers. The epileptic patients show significantly (F (1.46) = 18.06, p = 0.00010) less confirmatory markers in their plane (Figure 2).

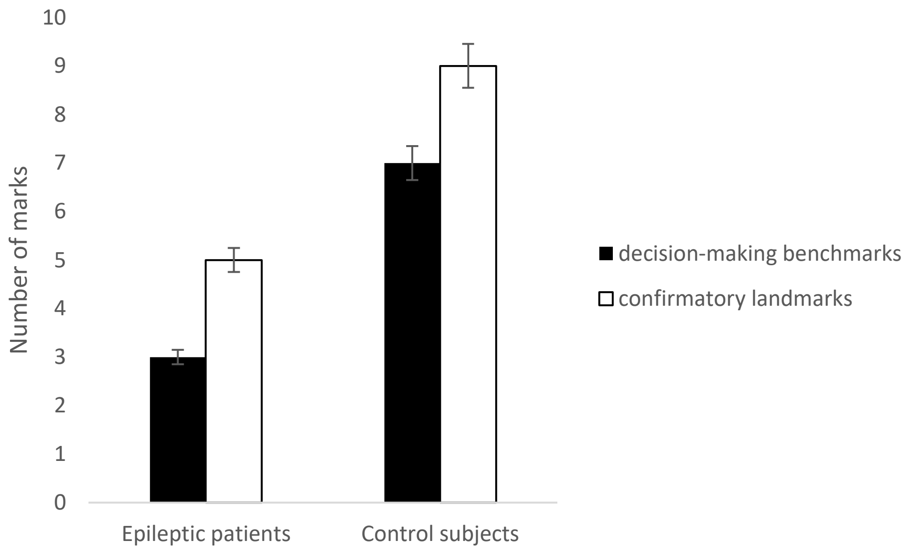

Figure 2: Total number of benchmarks and confirmatory benchmarks.

This result is almost identical for confirmatory markers. The epileptic patients show significantly (F (1.46) = 18.06, p = 0.00010) less confirmatory markers in their plane (Figure

2). These landmarks are less important than the previous ones. They allow the subjects to check that they are on the right road. The epileptic patients were significantly (F (1.46) = 11.74, p = 0.00130) more errors than the healthy control subjects in the number of changes of orientation. (Figure 3)

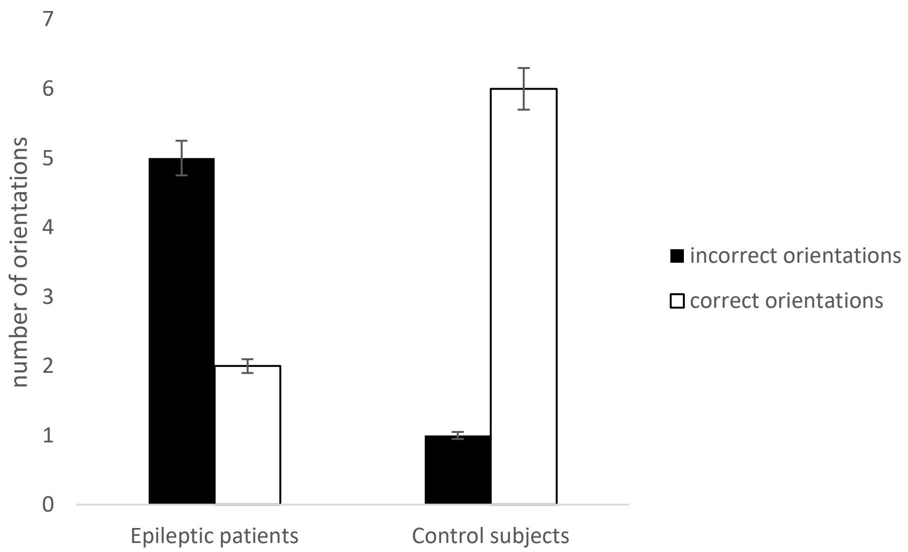

Figure 3: Correct and incorrect orientation changes.

Discussion

As our results show, epileptic patients are deficient in navigation tests, mainly in the return of a path, cartography type. Indeed, in their free maps of the environment previously visited, epileptic patients compared to healthy controls, represent significantly fewer benchmarks. However, the knowledge of the landmarks is essential to the knowledge of the journey, as well as the possibility of redoing it [6,7,8]. This result is comparable to those of [9], which in a similar study showed that schizophrenic patients were deficient in the free map-based restoration of the previously visited environment compared to healthy control subjects. During the restitution of the route by cartography, the subjects must mentally revisit the path by remembering, the markings encountered (decision-making, confirmatory), the actions and their place of realization (to turn, to continue), the sequential and temporal order of these actions and benchmarks. This mental navigation, according to the literature [10,11], activates the cerebral areas such as the hippocampus, the parahippocampus and the parietal cortex. And even the motor cortex [12,13,14] would be activated by the subject during this mental journey, which is reminiscent of the results of [14,15,16]. The deficits observed during the epileptic free route mapping restoration could be explained by hyperexcitation of the posterior cerebral parietal cortex. Indeed, epileptic seizures are linked to an abnormal, excessive and sudden electrical discharge of a more or less extensive population of neurons in the cerebral cortex. Their presence in the ictal or interictal phase of epilepsy is at the origin of certain cognitive disorders, notably working memory [17]. Regarding the type of representation, free maps are generally an allocentred representation of the environment. They correspond to a graphical representation of the environment or to the knowledge of the topographical spatial relationships between the various landmarks, mainly the decision-making landmarks that allow good navigation. They also correspond to a sequential sequence of actions, but graphical and nonverbal. Thus, we can conclude that epileptic patients are deficient in allocentrated representations of their environment. This result contrasts with that of [18] which obtained an intact allocentrated representation in patients with temporal lobe epilepsy in virtual. They had lesions of the parietal cortex. However, in this same study, [18] noted a deficit in egocentric representations.

Conclusion

Epileptic patients compared to healthy controls perform a much less accurate, less annotated, and more error-prone route mapping. These errors are mainly in the correct number of orientation changes drawn on the map. Thus, the plans of epileptic patients are generally irrelevant, poorly detailed and poor in information. Patients with generalized epilepsies are deficient in the allocentred representation of their environment. They can therefore have topographical disorientations. Patients and parents should be informed of these disorders for better management.

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