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Research paper

Cognitive outcome in epileptic patients in a tertiary care centre in Kolkata, India

Gautam Das [a,*], Piya Saha [b], Pritha Mukhopadhyay [b], Shankar P. Saha [c]

[a] Department of Medicine, North-24 Parganas District Hospital, Barasat, India
[b] Department of Psychology, University of Calcutta, 92, A.P.C. Road, Kolkata, India
[c] Department of Neurology, N.R.S. Medical College, 138, AJC Bose Road, Kolkata, India

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ABSTRACT

Objective: The objective of the study is to assess the diverse cognitive dysfunctions in epileptic patients.
Methods: Generalized tonic–clonic seizure (GTCS) and complex partial seizure (CPS) patients and those control matched and assessed for their IQ were undertaken for the present study. ANOVA test was used to assess the differences between GTCS and CPS with the control.
Results: GTCS and CPS exhibit lower scores than the control. In number cancellation task, they are at par. GTCS performed poorer than CPS.
Conclusion: Epileptic group showed impairment in working memory function, visuo-spatial skill, processing speed, visuo-perceptual attainment and reasoning ability. The deficit is more pervasive in GTCS group.

1. Introduction

Cognitive behavioural problems were recognized in patients with epilepsy in ancient times and documented in the 19th century neurological literature. The most reported cognitive complaints in adults are mental slowness, memory impairment and attention deficits. Epileptic seizures can cause cognitive and neuropsychological alteration. Assessment of diverse cognitive functions is mandatory in epileptic patients to device holistic cognitive intervention programme, which is the ultimate aim of any clinical assessment. Cognitive impairment in epileptic patients has been attributed to interactions of genetic factors, different epilepsy syndromes, subclinical epileptiform discharges, psychosocial issues and treatment with antiepileptic drugs.[1] Generalized tonic–clonic seizure (GTCS) and complex partial seizure (CPS) are two subgroups of idiopathic epilepsy (IGE). GTCS involves both cerebral hemispheres. The cognitive function of patients with GTCS tends to be somewhat lower than in the general population.[2] Neuroimaging studies demonstrated that cortical and subcortical networks, including regions of the fronto-parietal association cortex, thalamus, brainstem and cerebellum, are adversely affected in GTCS.[3] Because no underlying lesion can be discerned in idiopathic epilepsies, IGE has been thought to be the best model for studying the relationship of epilepsy and cognition (Christopher Helmstaedter). A uniform pattern of cognitive impairment may not be predicted in epilepsy as it depends on the unique pathophysiology of underlying seizure disorder.

With this perspective, in the present study attempt has been taken to explore diverse cognitive functions in epileptic patients to identify the nature of cognitive dysfunctions in the specific diagnostic category of IGE.

2. Materials and methods

The study consists of two groups and was cross-sectional with case control design. Purposive sampling has been used in this study. After controlling IQ (i.e., those who fall in 25th to 50th percentile according to Standard Progressive Matrices), clinical sample ($n = 28$) of right-handed patients, with mean age of 22.7 ± 4.35 years, mediocre socio-economic status, generalized tonic–clonic seizure (GTCS) ($n = 14$), complex partial seizure of temporal lobe origin ($n = 14$), was taken from neurology outdoor of N.R.S. medical college and hospital, Kolkata, India. The diagnosis of epilepsy was made

Abbreviations: GTCS, generalized tonic–clonic seizure; CPS, complex partial seizure; HC, healthy control; DF, digit forward; DB, digit backward; AED, antiepileptic drugs.

* Corresponding author. Tel.: +91 9433145795.
E-mail address: drgautamdasmd@gmail.com (G. Das).

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through detailed clinical examination and corroborated with EEG finding at times.

Patient with any traumatic brain injury, mentally challenged patients, any structural brain lesion as revealed by imaging and all secondary cases of epilepsy were excluded. Handedness, which is extremely relevant in terms of neuropsychological assessment, was determined with 10-item Edinburg Handedness Inventory. The circumstances of seizure's occurrences, their semiology, duration and evolution were noted. The medical context was systemically explored to list familial and personal antecedents, any psychiatric disorders and central nervous system drugs. Patient's activity of daily living was sought (ADL; Katz 1983). The neurological examination was done to assess motor function, saccades, Parkinsonian symptoms, any movement disorder, gait and sensory function. Brief interview was done to explore main biographical steps and milestones in personal and familial life. Various blood tests like sugar, electrolytes, liver function test (LFT) and thyroid profile were done to rule out any infective and metabolic causes. EEG was observed for interictal activities. Imaging was done to rule out any structural or vascular changes.

To minimize variations in AEDs' (anti-epileptic drugs) related factors on cognitive functions, we restricted the drug to sodium valproate, divalproex sodium, oxcarbazepine, lamotrigine and levetiracetam mainly for patients with epilepsy on regular treatment for at least the past 6 months, and we performed the serum levels of AEDs to choose patients with their serum levels within standard therapeutic range to exclude the effect of drug toxicity. This serum level measurement was restricted to valproate only, because that was the predominant drug used and also because that of the other drugs was not available. Other AEDs were added or substituted by valproate as permitted by the patient's clinical condition.

The sample of health participants recruited from community (HC) (n = 23, mean age = 25.9 ± 5.48 years) matched with age, sex, education, handedness, socio-economic status and IQ was selected through snowball technique and screened through General Health Questionnaire. Participants scoring above the cut-off value of 4 were excluded. Exclusion criteria also included any psychiatric, neurological or sensory impairment.

Ethical committee permission was obtained for conducting the research. All the participants who gave their consent to participate in the study were corroborated in the study.

2.1. Measures

- Standard progressive matrices[4]
- Digit span[5]
- Digit symbol[5]
- Object assembly[5]
- Block design[5]
- Number cancellation[6]

2.2. Statistical analysis

The data were tested for normative distribution using the Levene's test. Since most of the neuropsychological variables were normatively distributed, parametric analysis was carried out. One-way analysis of variance (ANOVA) test was used followed by post hoc test to compare GTCS and CPS with their control counterparts. The critical value required for significance was set at 0.05 level. Statistical Package for Social Sciences (SPSS) version 15.0 was used for analyses and all reported p values are two-tailed.

3. Results

The two groups were comparable in terms of age (mean age = 22.7 ± 4.35 years and 25.9 ± 5.48 years), sex and years of education. In epilepsy group, duration of illness ranged from 8.6 ± 6.67 years, age of onset is between 14.7 ± 6.8 years and frequency ranged between 2.6 ± 1.06 years. The socio-demographic details of the two groups are provided in Table 1.

Table 1
Socio-demographic description of the sample.

Category	Clinical sample (n = 28)	Healthy control (HC) (n = 23)
Age	22.7 ± 4.35 years	25.9 ± 5.48 years
Education	11.1 ± 2	11.1 ± 1.93
Age of onset	14.7 ± 6.8 years	
Frequency	2.6 ± 1.06	
Duration	8.6 ± 6.67 years	

3.1. Group differences among GTCS, CPS and HC

Epileptic subgroups GTCS, CPS and HC were compared. Epileptic subgroups, GTCS and CPS, exhibit lower scores than HC in digit span task (F value-16.110*), in both digit forward (F value-24.791*) and backward tasks (F value-12.676*), digit symbol task (F value-11.720*), object assembly (F value-27.899*) and similarities task (F value-16.237*). In number cancellation, epilepsy subgroups are as per with HC (F value-0.680). In digit symbol and object assembly task, GTCS group (2 ± 1.1 and 3.4 ± 1.4) performed poorer as compared to CPS group (5 ± 1.4 and 5.4 ± 2.3). The findings are elaborated in Table 2.

4. Discussion

Neurocognitive impairment deserves investigation in epileptic patients, owing to the complex relationship between seizures and cognitive dysfunctions. The cognitive functions of attention, working memory, visuo-spatial and visuo-constructional abilities and psychomotor speed have been considered in this study, as these are the major domains to adversely affect brain–behaviour relationship.

A widespread neural network in the brain subserves the attention function. Digit forward (DF) taps the selectivity aspect of attention and is closely related to freedom from distractibility. In our study, the GTCS and CPS fared worse than the normal control in DF task, with equal vulnerability to distractibility indicating their deficit in attentional efficiency. It appears that impairment in attention network in IGE group is severe enough to adversely affect the DF task, which involves very minimal rehearsal process in phonological storage system of the working memory. Affection of the normal storage system of the working memory, involving prefronto-parietal and prefronto-temporal regions, is inferred in both the epileptic groups. Compromised selective attention in GTCS and CPS may not spare involvement of inferior parietal lobule in the left hemisphere, a crucial region for the functioning of the phonological short-term storage.[7]

Table 2
Comparison of scores of GTCS, CPS and HC.

Test	GTCS (n = 14)	CPS (n = 14)	Healthy (n = 23)	F value
Digit span	4.7 ± 1.6	5.8 ± 1.9	8.2 ± 2	16.110*
Digit forward	6.3 ± 1.6	6.8 ± 1.4	9.1 ± 1.02	24.791*
Digit backward	4.4 ± 3.1	4.4 ± 1.5	7.3 ± 1.3	12.676*
Digit symbol	2 ± 1.1	5 ± 1.4	6 ± 2.5	11.720*
Block design	4 ± 1.3	4.8 ± 1.4	7.4 ± 1.6	27.899*
Object assembly	3.4 ± 1.4	5.4 ± 2.3	6.8 ± 1.6	15.458*
Similarities	3.1 ± 1.3	4.1 ± 2.2	6.7 ± 2.1	16.237*
Number cancellation	151.4 ± 10.9	154 ± 6.7	154.5 ± 6.9	0.680

* Significant at 0.05 level.

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