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Effect of carbamazepine on emotional intelligence and mindfulness in patients with partial epilepsy

Amara Gul, Saima Mehreen

Department of Applied Psychology, The Islamia University of Bahawalpur, Bahawalpur, Pakistan

Correspondence: Amara Gul. **Email**: amara_psychology@hotmail.com

Abstract

Objective: To assess the effectiveness of carbamazepine on emotional intelligence and mindfulness in patients with epilepsy.

Method: The repeated-measure case-control study was conducted at the Nishter Hospital, Multan, Bahawal Victoria Hospital, Bahawalpur, and Civil Hospital, Bahawalpur, Pakistan, from April 2017 to March 2018, and comprised patients with partial epilepsy and healthy controls. Baseline data was collected using BarOn Emotional Quotient Inventory and Cognitive and Affective Mindfulness Scale-Revised. Subsequent data was collected twice in titration and maintenance phases during carbamazepine therapy for patients, while the controls were on no medication. . Data was analysed using SPSS 20.

Results: Of the 80 subjects, 40(50%) were cases with a mean age of 37.92±9.09 years, and 40(50%) were controls with a mean age of 37.80±9.00 years. The patients had significantly lower emotional intelligenceand mindfulness compared to the controls ($p<0.001$). Patients showed improved emotional intelligence and mindfulness after the therapy compared to their baseline scores ($p<0.05$).

Conclusion: Carbamazepine was found to be effective in improving emotional intelligence and mindfulness in patients with epilepsy.

Key Words: Epilepsy, Carbamazepine, Mindfulness, Cognition, Emotional intelligence.

Introduction

Epilepsy is one of the most common neurological disorders, affecting 50 million people around the world.Majority of such people lives in low and middle income countries (LMICs). Epilepsy is characterised by partial or generalised recurrent seizures.[1]Carbamazepine ($C_{15}H_{12}N_2O$) is a recommended drug to treat seizures in epilepsy. It acts through two potential mechanisms: reduction of poly-synapse-related responses, and blockage of post-tetanic potentiation. Alongside, it acts as anantidepressant through induction of cytochromes, like P450 3A4, P450 1A2, P450 2B6, and reduction of disorganised electrical activity in the central nervous system (CNS).[2]The effectiveness of carbamazepine in reduction of behavioral and psychological disorders in patients with epilepsy is a unique characteristic of carbamazepine as an antiepileptic drug.[3]In recent years, mindfulness-based interventions have gained popularity for the treatment of behavioural and psychological symptoms in epilepsy patients. Studies have demonstrated that mindfulness-based interventions are associated with functional and structural changes in brain, and improvequality of life (QOL), anxiety and depression in epilepsy patients[4,5].It has been found that people with low mindfulness ability show weak activation in amygdala. In contrast,hyper-activation was observed in prefrontal cortex, anterior cingulate cortex and insular cortex during emotion processing[6]. A recent study suggested that primary emotion processes, such as empathy,are positively correlated with trait-like ability, i.e., mindfulness, in healthy subjects[7]. Further research demonstrated that people with adequate mindfulness ability are better at stress management compared to those with low

mindfulness[8]. Also, behavioural studies have demonstrated that cognitive functioning and emotional intelligence (EI)are correlated,especially when emotional information is required to resolve a cognitive task[9]. It has been suggested that people with higher EI are better at recovery from stress[10].These variables are interlinked in studies with people having psychiatric disorders. For instance, it was found that cognitive performance of people with mental health problems is interfered with in the presence of emotional material[11].

No study has examined the effect of carbamazepine on mindfulness and EI in patients with epilepsy. The current study was planned to fill the gap in literature by examining whether any differences exist on EI and mindfulness ability between healthy individuals and epilepsy patients, and to explore if carbamazepine exerts any effect on EI and mindfulness ability of epilepsy patients.

Patients and Methods

The repeated-measure case-control study was conducted at the Nishter Hospital, Multan, Bahawal Victoria Hospital, Bahawalpur, and Civil Hospital, Bahawalpur, Pakistan, from April 2017 to March 2018. After approval from ethics review board of the Islamia University, Bahawalpur, the sample size was calculated with anticipated effect size 0.5, desired statistical power 0.5 and probability level 0.05. The sample was raised using purposive sampling technique from among the newly-diagnosed patients with partial epilepsyin whom the diagnosis was confirmed with electroencephalogram (EEG). A matching group of healthy individualswere also included as controls. Patients were included if they had at least two partial seizures with or without secondary generalised seizure in the year before the testing session was done, had awareness intact or impaired, and with motor movements,such as automatism, non-motor symptoms like autonomic symptoms, and were not taking any medication.

Patients were excluded if they were using any medication, hadantiepileptic drugs for more than two weeks, had CNS-relatedinfection or disease, had any neurological or medical disease, or had idiopathic generalised epilepsy. Patients who were prescribed carbamazepine as a monotherapy were included in the study with eight weeks of titration and twenty weeks of maintenance period. Healthy individuals were included if they had no previous history or present symptoms of any neurological and psychiatric disorder.

The patients were evaluated thrice in the hospital on cognitive tests during the study; at baseline; at the completion of the titration phase; and at the completion of maintenance phase.

The dose during the titration period rangedfrom 100mg/day to 600mg/day, whereas in the maintenance period, it rangedfrom 600mg/day to 1200mg/day.

Cognitive testing was performed by a clinical psychologist blinded to the study objectives. Cognitive and Affective Mindfulness Scale-Revised (CAMS-R)[12] was administered to assess mindfulness. It is a 12-item scale to assess four domains of mindfulness, which arePresent Focus (PF), Acceptability (ACC), Awareness (AW) and Attention (ATT). Each one is scored on a 4-point Likert scale, where 1= not at all and 4= almost always. Higher score shows greater mindfulness (MF)ability, and the maximum score is 48. The scale has good internal consistency, convergent and discriminant validity with other measures of MF, distress, and emotion regulation.BarOn Emotional Quotient Inventory(BarOn EQ-i)[13] was administered to assess EI. The subject had to respond to statements on a 5-point scale. The scores are interpreted as 70= atypical under-developed EI; 70-79=extremely under-developed EI; 80-89=under-developed EI; 90-109=adequate EI; 110-119=well-developed EI; 120-129=extremely well-developed EI; 130and above=atypical well-developed EI.It is a valid and reliable instrument to measure EI with an internal consistency of 0.97. Reliability for the current study was 0.95. In order to

control practice effect, the order of presentation for CAMS-R and BarOn EQ-i was completely randomised across the sample on each assessment.

Data was analysed using SPSS 20. Descriptive statistics were used demographic data. Group differences in terms of EQ-i scores were assessed through multivariate analysis of variance (ANOVA) with dependent variables. Repeated-measure ANOVA was used tosee whether the intervention exerted any difference on scores pertaining to each component of EQ in the patient group.P<0.05 was considered significant.

Results

Of the 80 subjects, 40(50%) were cases with a mean age of 37.92±9.09 years, and 40(50%) were controls with a mean age of 37.80±9.00 years (Table 1).The patients had significantly lower EI and MF scores compared to the controls (p<0.001) in all subscales (Table 2).Within the patient group, there was significant improvement in EI and MF terms after the therapy compared to the baseline scores (p<0.05) (Table 3).

Discussion

Patients with epilepsy and healthy individuals responded differently on EI and MF scales. The patients had extremely under-developed EI and MF compared to the controls. The finding is consistent with earlier studies.[14]Emotion recognition has also been found impaired in epilepsy patients.[15]However, the current study showed an extended picture of EQ in terms of its components. The current study also showed that epilepsy patients had lower MF ability than the controls, and had lower PF, ACC, AW and ATT than the healthy individuals.This finding is consistent with previous research.[14,16]Disturbance in emotional behaviour is related with reduced synchronisation between signals from the neural network involved in emotion centres of the brain affected by epilepsy.[17]Studies have suggested that maladaptive behaviours are associated with low EI in epilepsy

patients[18].The current study revealed that carbamazepine therapy improved all components of EI and MF abilityin the patients. The result is consistent with previous research.[3]Along with excellent properties as an anti-convulsant, carbamazepine improves performance on mental tasks requiring attention and problem-solving skills. These results have implications in rehabilitation of epilepsy patients.

The current study has limitations, like a small sample size, and the sample being without very young and very old patients with epilepsy. As such, the generalisability of the findings are limited to a specific age group. Further research is recommended to examine various age groups in order to assess the efficacy of carbamazepine.

Conclusion

Carbamazepine was found to be effective in reducing EI and MF deficits in patients with partial epilepsy.

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Conflicts of Interests: None.

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229 **Table 1: Demographic Characteristics.**

	Patients (n=40)	Controls(n =40)	
	M ±SD	M±SD	
Age (20-55 years)	37.92±9.09	37.80±9.00	$t(39)= 0.12^a$
Education (years)	9.27±1.24	9.52±1.39	$t\ (39) = 0.67^b$
Age at seizure onset (years)	33.92±0.09		
Duration of epilepsy (years)	2.62±0.97		
Titration dosemg/day	332.50±173.03		
Maintenance dose mg/day	415.00±131.16		
Seizure frequency in last 6 months (n)	1.92±0.76		
Seizure freedom in maintenance phase (n)	30 (75%)		
Type of partial epilepsy			
Symptomatic	20		
Cryptogenic	20		
History of antiepileptic treatment	03		
Family history of epilepsy	02		
Gender			
Male	20 (50%)	20 (50%)	
Female	20 (50%)	20 (50%)	

230 [a]p=0.90; [b] p=0.50. SD: Standard deviation.

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234 **Table2:Multivariate analysis of variance (ANOVA)comparison of scores on**

235 **BarOn EQ-iand CAMS-R at baseline.**

	Controls (n=40)		Patients (n=40)	
	M ± SD	Lower Bound-Upper Bound	M ± SD	Lower Bound-Upper Bound
IEQ	115.77± 2.41	115.04-116.50	76.17± 2.24	75.44-76.90
INEQ	116.42± 1.67	115.95-116.89	77.12± 1.28	76.65-77.59
AD	115.97±1.92	115.43-116.51	76.85± 1.47	76.30-77.39
SM	116.32± 1.78	115.79-116.85	76.77± 1.54	76.24-77.30
GM	115.65±1.84	115.15-116.14	77.30±1.26	76.80-77.79
BEQ-i	116.03±0.99	115.76-116.29	76.84±0.63	76.58-77.10
PF	11.27±0.71	11.04-11.50	3.25±0.74	3.02-3.48
ACC	11.45±0.74	11.20-11.69	1.97±0.83	1.72-2.22
AW	11.45±0.67	11.18-11.71	2.35± 1.00	2.08-2.61
ATT	11.37±0.77	11.08-11.66	2.25± 1.03	1.96-2.53
MF	45.50±1.66	44.97-46.12	9.82±1.99	9.24-10.40

SD: Standard deviation;BEQ-i: BarOn Emotional Quotient Inventory; CAMS-R: Cognitive and Affective Mindfulness Scale-Revised; IEQ: Intrapersonal Emotional Quotient; INEQ: Interpersonal Emotional Quotient; AD: Adaptability; SM: Stress Management; GM: General Mood; PF: Present Focus; ACC: Acceptability; AW: Awareness; ATT: Attention; MF: Mindfulness.

Table3:Comparison of scores of epilepsy patients at baseline and in titration and maintenance phases.

	M ± SD	LB-UB	F(df),p
IEQ			F(2,39)= 546.44, *p*< 0.001
Baseline	76.17± 2.24	75.45-76.89	
Titration	86.25 ± 2.19	85.54-86.95	
Maintenance	97.85 ± 4.31	96.46-99.23	
INEQ			F(2,39)= 1132.86, *p*< 0.001
Baseline	77.12± 1.28	76.71-77.53	
Titration	86.92 ± 1.75	86.36-87.48	
Maintenance	99.90 ± 3.15	98.89-100.90	
AD			F(2,39)= 821.42, *p*< 0.001
Baseline	76.85± 1.47	76.37-77.32	
Titration	86.65± 1.77	86.08-87.21	
Maintenance	99.70± 3.38	98.61-100.78	
SM			F(2,39)= 1165.79, *p*< 0.001
Baseline	76.77±1.54	76.28-77.26	
Titration	87.02±1.34	86.59-87.45	
Maintenance	98.77±2.79	97.88-99.66	
GM			F(2,39)= 1534.03, *p*< 0.001
Baseline	77.30±1.26	76.89-77.70	
Titration	87.30±1.28	86.88-87.71	
Maintenance	98.52±2.48	97.73-99.31	
BEQ-i			F(2,39)= 3195.79, *p*< 0.001
Baseline	76.84±0.63	76.64-77.04	
Titration	86.83±0.87	86.55-87.18	
Maintenance	98.95±1.95	98.32-99.57	
PF			
Baseline	3.25±0.74	3.01-3.48	F(2,39)= 715.75, *p*< 0.001
Titration	7.30±0.64	7.09-7.50	
Maintenance	9.10±0.77	8.85-9.34	
ACC			F(2,39)= 844.55, *p*< 0.001
Baseline	1.97±0.83	1.70-2.24	
Titration	7.17±0.71	6.94-7.40	
Maintenance	9.12±0.85	8.85-9.39	
AW			F(2,39)= 550.22, *p*< 0.001
Baseline	2.35±1.00	2.03-2.67	
Titration	7.25±0.70	7.02-7.47	

Maintenance	8.97±0.76	8.73-9.22	
ATT			F(2,39)= 809.53, p< 0.001
Baseline	2.25±1.03	1.92-2.58	
Titration	7.15±0.73	6.91-7.38	
Maintenance	9.50±0.75	9.26-9.74	
MF			F(2,39)= 2554.64, p< 0.001
Baseline	9.82±1.99	9.18-10.46	
Titration	28.87±1.30	28.45-29.29	
Maintenance	36.70±1.62	36.18-37.21	

SD: Standard deviation; LB-UB: Lower bound-upper bound; BEQ-iL BarOn Emotional Quotient Inventory; CAMS-R: Cognitive and Affective Mindfulness Scale-Revised; IEQ: Intrapersonal Emotional Quotient; INEQ: Interpersonal Emotional Quotient; AD: Adaptability; SM: Stress Management; GM: General Mood; PF: Present Focus; ACC: Acceptability; AW: Awareness; ATT: Attention; MF: Mindfulness.