

Evaluation of Serum Electrolytes and Uric Acid in Iraqi Epileptic Patients

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ABSTRACT:

BACKGROUND:

Epileptic patients exhibited variably altered status of electrolytes, and antioxidant.

OBJECTIVE:

The aim of this study is to investigate the effect of epilepsy and long-term antiepileptic drug therapy on the level of serum electrolytes (calcium, sodium, and potassium) and antioxidant (uric acid).

PATIENTS AND METHODS:

Thirty epileptic patients and twenty normal healthy individuals as a control were recruited in this study. The mean \pm SD of age of treated and untreated patients was (24.0 \pm 10.0) and (31.0 \pm 11.0) respectively.

Spectrophotometric technique was used to determine all the parameters in this study.

Data were expressed as mean \pm SD. Statistical comparison among different groups was performed by using ANOVA tests. Statistical significance was defined as $P < 0.05$.

RESULTS:

The treated group (particularly with valproate), show increases in the levels of calcium, sodium, with no difference in potassium. however among untreated epileptics, uric acid level was increased.

CONCLUSION:

The above parameters differs in epileptics comparable to controls and hence their correlation to seizures pathophysiology and their degree of control or resistance to antiepileptic drug therapy.

KEYWORDS: electrolyte, antiepileptic drug, antioxidant

INTRODUCTION:

Epilepsy is a chronic dynamic important medical problem with about one in eleven persons experiencing at least one seizure at some point. epilepsy describes a condition in which a person has recurrent seizures due to a chronic, underlying process⁽¹⁾.

A neurons⁽²⁾. The tendency to have recurrent, unprovoked seizures occurs with a prevalence of about 0.5%, and a cumulative lifetime prevalence of 3%. It covers a range of different conditions with varying etiology⁽¹⁾. Certain minerals balance is crucial for a healthy nervous system and neuronal susceptibility to excitability. Several reports suggested that the body electrolytes (sodium (Na⁺), potassium (K⁺) and calcium (Ca²⁺) play a vital role in seizure condition to develop^(3,4). Many antiepileptic drugs (aeds) are metabolized to generate reactive metabolites with the capability of covalent binding to macromolecules as proteins or other vital biomolecules and hence eliciting systemic toxicity⁽⁵⁾.

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Antioxidant defense mechanisms were indicated to involve uric acid^(6,7). It has been suggested that AEDs have occasionally been associated with significant adverse effects on the antioxidant defense system^(8,9).

PATIENTS AND METHODS:

Thirty chronic epileptic patients with idiopathic generalized tonic-clonic seizures (male=20, female= 10) were included in this study. All patients were in the interictal period or at least 12 h seizure free from sampling time. all were randomly recruited from the out-patient neurology clinic, baghdad teaching hospital. Patients with progressive brain disease or other chronic medical or surgical illnesses or chronic medication besides aeds were excluded from this study.

Twenty normal healthy as a control group. For each patient, the following information were obtained: complete medical history and clinical examination with special emphasis on age, sex, type and frequency of seizure, duration of illness, aed(s) used with their doses, and age of starting treatment(duration of treatment) and control of seizures. After the baseline evaluation, the patients were divided into two main groups: untreated epileptic patients (n =5) and treated epileptic patients (n = 25).

SERUM ELECTROLYTES EPILEPTIC PATIENTS

The treated epileptics were subdivided according to the type of the used antiepileptic drug therapy into two groups:

Group i: patients on carbamazepine (cbz) (n = 15) in a dose range of 400 – 1200 mg/day.

Group ii: patients on sodium valproate (vpa) (n = 10) in a dose range of 300 – 1500 mg/day.

From each case, five mls venous blood was collected. the blood sample was allowed to clot at room temperature and centrifuged at 3000 rpm for 10 min and the serum was collected, and aliquots of this serum was kept frozen at 20°C until they were used to assay of serum electrolytes (Ca²⁺, Na⁺, and K⁺), and antioxidant marker (uric acid).

Spectrophotometric technique was used to determine all the parameters in this study.

Data were expressed as mean±sd. statistical comparison among different groups was performed by using anova tests. Statistical significance was defined as p<0.05.

RESULTS:

This study included a total of thirty patients (male = 20, female = 10) (treated group = 25, untreated group = 5). All were chronic epileptics with mean duration of illness of (9.0±6.6) and (3.5 ±0.5) years for the treated and the untreated group of epileptics, respectively. Twenty age- and sex-matched healthy volunteers were chosen as controls for comparison.

The demographic, clinical data of the epileptic patients are shown in table 1.

Table 1: Characteristic of epileptic patients

Characteristic of patients	Treated group Mean±SD(range)	Untreated group Mean±SD. (range)
Age (years)	24.0±10.0 (10-50)	31.0±11.0 (15-45)
Sex (F/M)	9/16	1/4
Duration of illness (years)	9.0±6.6 (2-25)	3.5±0.5 (1-5)
Start of treatment (years)	8.4±6.8 (1-25)	–

Levels of studied electrolytes and uric acid in serum of controls and epileptic patients are summarized in table 2.

Table 2: Levels of calcium, sodium, potassium and uric acid in serum of controls, untreated and treated epileptic patients

Studied parameters	Controls Mean ±SD	Untreated patients Mean ±SD	Treated patients Mean ±SD
Ca ²⁺ (mg/dl)	9.8±0.7	9.7±0.6	12.0±1.6**
Na ¹⁺ (mmol/l)	137.0±4.0	155.0±12.0*	147.0±14.0
K ¹⁺ (mmol/l)	4.5±0.75	3.8±0.39	4.7±0.56*
Uric acid(mg/dl)	6.0±0.7	6.8±0.9**	4.8±2.0

** P<0.01

* P<0.05

Treated epileptic patients show a significant increase in calcium level when compared with controls and no change with untreated patients (p <0.01).

Sodium level was significantly higher among the untreated epileptic patients in comparison to the other two groups (p<0.05).

Treated patients show a significant increase in potassium level when compared with controls and decrease with untreated patients (p<0.05).

The level of uric acid was significantly higher among the untreated epileptic patients in comparison to the other two groups (p<0.01).

Levels of studied electrolytes and uric acid in serum of controls and epileptic patients treated with carbamazepine (cbz) and valproate (vpa) are summarized in table 3.

SERUM ELECTROLYTES EPILEPTIC PATIENTS

Table 3: Levels of serum calcium, sodium, potassium and uric acid in controls and epileptic patients treated with carbamazepine (CBZ) and valproate (VPA).

Studied groups	Ca ²⁺ Mean ±SD	Na ¹⁺ Mean±SD	K ¹⁺ Mean±SD	Uric acid Mean ±SD
Controls	9.8±0.7	137.0±4.0	4.5±0.75	6.0±0.7
CBZ-treated group(n=15)	11.0±2.0	148.0±12.1**	4.2±0.9*	5.0±1.0
VPA-treated group(n=10)	11.5±2.5**	144.11±10.11	4.3±0.5	6.9±1.2*

** P<0.01

* P<0.05

Epileptic patients treated with valproate(vpa) and carbamazepine(cbz) show a significant increase in ca²⁺ level when compared with controls (p<0.01).

Epileptic patients treated with cbz show a significant increase in na¹⁺ level when compared with controls and patients treated with vpa (p<0.01).

Epileptic patients treated with cbz show a significant decrease in k¹⁺ level when compared with controls and (vpa) (p<0.05).

Epileptic patients treated with valproate(vpa) show a significant increase in uric acid level when compared with the both two groups(p<0.05).

DISCUSSION:

The mechanisms of epileptogenesis are not well established. several studies in the last years suggested that the body electrolytes and the activities of antioxidant defense mechanisms may be causally involved in some forms of epilepsies and also to increase the recurrence of seizures^(8,10,11).

Several studies suggested that the body electrolytes play a vital role for enabling seizure conditions to develop; and routine laboratory estimation of serum na⁺, k⁺, and ca²⁺ are essential for the rational understanding and management of epileptic patients⁽¹²⁾.

This study reported unaltered ca²⁺ levels among untreated epileptics, which is consistent with other studies⁽¹³⁾. In contrast, many documented that low level of ca²⁺ is responsible for initiation of convulsions^(12,14). The significantly higher levels of ca²⁺ among our vpa and cbz-treated group of epileptics (tables 2 and 3) could be a marker for better seizure control with aeds therapy.

The present study reported high na⁺ levels in untreated and cbz-treated epileptics (tables 2 and 3). biochonski et al⁽¹⁵⁾. Reported hypernatremia and hypokalemia in epileptic children. white et al⁽¹⁶⁾. Reported elevation of na⁺ levels during periods of intense seizure activity. In contrast, natelson et al.⁽¹⁷⁾ and shah et al⁽¹³⁾. Reported unaffected serum na⁺ during and after seizure activity in their untreated patients. Other studies reported

hyponatraemia in some cbz-treated patients and attributed this to the associated water intoxication , as the capacity of some of the patients to excrete the water load was found to be grossly impaired⁽¹⁸⁾.

This study reported hypokalemia with unaltered ca²⁺ levels in untreated epileptics (tables 2 and 3) which agrees with many studies^(19,20). White et al⁽¹⁶⁾. Reported elevation of k⁺ levels during periods of intense seizure activity. generally, the deficiency in k⁺ is correlated to hypomagnesaemia and hypocalcaemia⁽¹³⁾. We think that the k⁺ deficiency in our untreated epileptics may be expressed as an increase in the ratio of intracellular to extracellular k⁺ concentrations, which may in the future, result into serious neurological symptoms⁽¹³⁾.

Uric acid is an effective antioxidant⁽²¹⁾. The observed hyperuricaemia (tables 2 and 3) among untreated epileptics in this study could be a compensatory mechanism trying to counteract oxidative stress encountered in epilepsy⁽⁶⁾. Also, we suggest that hyperuricaemia observed in our vpa- treated epileptics may be related to alteration of the renal excretion of the drug⁽²²⁾ or a cellular protective mechanism against peroxidative damage⁽⁶⁾.

CONCLUSION:

We suggested that the homeostasis of electrolytes and antioxidant is altered in epileptic patients. levels of the studied indices found in this study were different from the results of some other studies.

We suggested that the age of the patients; the type, and duration of epilepsy; and the type, duration, and doses of drug treatment are important variables added to the difference in methodologies used. differential effects were detected among different aeds treatments in which cbz was found to be better anticonvulsant for the control of free radical related seizures. We also concluded that adequate antioxidant supply is important for brain functions and prevention of neurological diseases and further elucidation of the pathological actions of such

SERUM ELECTROLYTES EPILEPTIC PATIENTS

substances in the brain should result in new therapeutic approaches.

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