



Original Research Article

The Effect of Electroconvulsive Therapy (ECT) on The Blood Levels of Glucose, Sodium, Potassium, and Calcium Selectionly in Mentally Ill Patients

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Abstract

Electroconvulsive therapy (ECT) is a tool in the treatment for a few numbers of severe mental illnesses. It was used widely from 1930 s afterward to treat different types of psychiatric illnesses. And nowadays is very much limited for very sever conditions. Amnesia is reported as one of the post-ECT side effects associated with changes in certain electrolytes level especially serum calcium ($s.Ca^{+2}$) immediately after ECT and changes in blood brain permeability. Likewise changes in serum potassium ($S.K^{+2}$), sodium ($S.Na^{+}$) & blood glucose ($b.Glu.$) levels in patients after ECT session were also reported. ECT is also associated with CVS changes which again could reflect electrolytes change.

The aim of the study is to establish if there would be any alteration in the level of ($s.ca^{+2}$), ($S.K^{+2}$) and ($b.Glu.$) in psychiatric patients admitted to Basra General Hospital. This finding could highlight the possible harm effects of ECT especially in patients with cardiovascular system (CVS) & renal disorders and aware physicians about this possible harm effects of ECT.

The study was performed on 64 patients (31 male & 33 female) with averaged age of 45.5 years. The standard bilateral method of ECT was used to treat those patients with all precautions to eliminate any associated side – effects of the procedure.

Blood samples were taken from all patients immediately pre- & post – ECT application, & were sent to the lab in Basra Hospital for ($b.Glu.$) & electrolytes analysis.

Statistical analysis of the results was performed using SPSS application.

There was a significant decrease in the values of ($S.Na^{+}$), ($S.K^{+2}$), & ($b.Glu.$) levels ($P = 0.000$) immediately after ECT exposure in the total number of patients with insignificant, decrease in the ($s.Ca^{+2}$) level ($P = 0.067$).

In addition, a gender wised analysis showed that in male patients, there were significant decline in ($b.Glu.$), ($S.Na^{+}$), ($S.K^{+2}$), but, a significant increase in ($s.Ca^{+2}$) level. While in female patients, the same results were recorded for the ($b.Glu.$), ($S.Na^{+}$), & ($S.K^{+2}$) with an insignificant increase in ($s.Ca^{+2}$) level ($P = 0.36$).

Key words: Electroconvulsive therapy (ECT), potassium, sodium, calcium, glucose.

الخلاصة

يستعمل العلاج بالصدمات الكهربائية لمعالجة بعض الأمراض النفسية. نشأ هذا العلاج عام ١٩٣٠م وانتشر أستعماله في عام ١٩٥٠ وعام ١٩٦٠ ولكن الآن يستعمل لعلاج حالات محددة فقط. وأحد الأعراض الجانبية التي تظهر بعد أستعمال الصدمات الكهربائية هي فقدان الذاكرة بسبب تغيير بعض الألكتروليات في الدم خاصة الكالسيوم بعد استخدام الصدمة الكهربائية. كما لوحظ تغيير في مستوى البوتاسيوم والصوديوم والسكر بعد جلسة الصدمة الكهربائية. والذي قد يفسر التغييرات التي تحدثها الصدمة في القلب والأوعية الدموية.

الهدف من الدراسة: هي لدراسة اي تغيير يحدث في مستوى الكالسيوم والبوتاسيوم والصوديوم في بلازما الدم وكذلك مستوى السكر لمرضى الحالات النفسية الراقدين في مستشفى البصرة العام بعد استعمال علاج الصدمات الكهربائية خاصة على المرضى المصابين بأمراض في جهاز الدوران والجهاز البولي وتوعية الأخصائيين بمخاطر العلاج بالصدمات الكهربائية.

أجريت الدراسة على ٦٤ مريضاً (٣١ منهم ذكور و٣٣ إناث) والذي كان معدل أعمارهم هو ٤٥ سنة. حيث تم علاجهم باستخدام الصدمات الكهربائية ثم سحب نماذج من الدم من هؤلاء المرضى قبل وبعد الصدمة الكهربائية وأرسلت النتائج إلى المختبر في مستشفى البصرة العام لمعرفة مستوى السكر والألكتروليتات في الدم. أظهرت النتائج هبوط في مستوى الصوديوم والبوتاسيوم والسكر بعد استخدام الصدمات الكهربائية لجميع المرضى وكانت النتائج معنده أحصائياً ($p=0.000$). وكذلك هبوط بمستوى الكالسيوم ولكن النتائج كانت غير معنده أحصائياً ($p=0.67$). ولكن بالنسبة للنتائج في الذكور لوحظ أن هناك هبوط معنده أحصائياً بالنسبة للصوديوم والبوتاسيوم والسكر وأرتفاع معنده أحصائياً بالنسبة للكالسيوم. ونفس النتائج كانت للأنثى بالنسبة لمستوى الصوديوم والبوتاسيوم والسكر مع أرتفاع غير معنده أحصائياً بالنسبة للكالسيوم ($p=0.36$).

الكلمات المفتاحية: العلاج بالصدمات الكهربائية، الكالسيوم، البوتاسيوم، الصوديوم، الكالسيوم، البوتاسيوم.

Introduction

Electroconvulsive therapy (ECT) is used as an effective tool in the treatment for a few numbers of severe mental illnesses like catatonia, severe depressive illness, and in prolonged of severe manic episode [1]. It was developed in the 1930s and was used widely afterward to treat different types of psychological illnesses. Previously the death rate attributed to the ECT is a very rare so it is safe procedure [2], While its uses nowadays is very much limited only to a very severe conditions and when the other treatment have not worked [3] despite the anesthetic procedure is the risk particularly in cardiovascular patients [4].

One of the post-ECT side effects is temporary loss of memory which could be caused by high blood pressure that lead to increase the blood brain barrier permeability [5] or could be explained on the basis of electrolytes changes in the blood especially calcium [6]. McClean & Howe reported a significant rise of serum potassium level in patients after ECT session [7]. Likewise Bali [8], & Haw [9] have found a significant alteration in the blood glucose, serum Na^+ , & serum K^+ level. The amount of electrical energy delivered to the patient's brain considered another causes for temporary loss of memory post ECT [10].

In addition, ECT was reported to be associated with CVS changes which again could reflect electrolytes changes [11].

Based on the above finding, & the fact that ECT is usually done using general anesthesia, the present work was done to see the possible effect of ECT on certain

blood parameters like blood glucose, serum Na^+ , K^+ , & Ca^{++} .

The ECT works is not certainly known, it could be change the patterns of blood flow through the brain and change the metabolism of areas of the brain which may be affected by depression [12, 13]. It was found that the severe depression it caused by problems with certain brain chemicals, In addition to the abnormality in a monoamine neurotransmitter system in the brain [4].

It is thought that ECT enhance the release of these chemicals and elevated their levels in the blood [13].

The aim of the study is to establish any alteration of these parameters in psychiatric patients admitted to Basra General Hospital, so as, doctors could be aware for the possible harm effects of ECT especially in patients with CVS & renal disorders.

Materials and Methods

The study was performed on 64 patients (31 male & 33 female) with averaged age of 45.5 years. The cases were chosen randomly: 31 male (16 Schizophrenia, 3 Mania, & 12 Depression); 33 female (14 Schizophrenia, 4 Mania, & 15 Depression). The standard bipolar method of ECT was used to treat those patients with all precautions to eliminate any associated side – effects of the procedure. All relevant information regarding each patient was listed in the patient's sheet. This information includes especially the patient's family history of diseases, drugs consumed, & nature & duration of illness. Blood samples were taken from all patients immediately pre- & post – first

ECT application, & were sent to the lab in Basra General Hospital for blood glucose & electrolytes analysis.

Statistical analysis of the results was performed using SPSS application.

Results

There was a significant decrease in the value of both serum sodium & potassium & blood glucose levels ($P = 0.000$, $P = 0.000$, & $P = 0.000$ respectively) immediately after ECT exposure in the total number of patients. Likewise, there were increase in the serum calcium level after ECT, but, the increases were statistically insignificant ($P = 0.067$). See Table (1).

In addition, a gender wised analysis showed that in male patients, there were significant decline in blood glucose, & serum sodium & potassium, but, a significant increase in serum calcium level. While in female patients, the same results were recorded for the blood glucose, & serum sodium & potassium. Never the less, Female patients showed an insignificant increase in serum calcium level ($P = 0.36$). Tale (2) shows there was no significant differences of ECT effects on the measured physiological parameters between patients of schizophrenia and patient with depression.

Table 1: The effect of ECT on blood glucose, serum Na^+ , serum K^+ and serum Ca^+

Parameter (31)	MALE (33)			FEMALE					
	Pre	Post	P	Pre	Post	P	Pre	Post	P
Blood Glucose	104.06 ± 15.99	101.51 ± 12.65	0.000	104.13 ± 14.7	101.13 ± 12.73	0.000	104 ± 17.4	101.63 ± 12.76	0.000
Serum sodium	144.18 ± 12.65	140.45 ± 9.11	0.000	144.42 ± 12.4	140.48 ± 0.48	0.000	143.97 ± 12.45	140.48 ± 8.9	0.06
Serum Potassium	4.23 ± 0.64	4.09 ± 0.62	0.000	4.27 ± 0.66	4.09 ± 0.57	0.000	4.19 ± 0.63	4.08 ± 0.68	0.000
Serum Calcium	9.12 ± 0.81	8.9 ± 1.07	0.067	4.29 ± 0.81	8.76 ± 0.68	0.006	8.96 ± 0.78	9.03 ± 1.33	0.380

Table 2: Comparison of the effect of the ECT on blood glucose, serum Na⁺, serum K⁺ and serum Ca⁺ between patients of schizophrenia and patient with depression

<i>Disease</i>		Schizophrenia	Depression	Mean	p
<i>parameter</i>		N=30	N=27	difference	
Blood glucose	Pre	94.0 ±16.85	100.93 ±12.0	6.93 ±19.46	0.206
	Post	99.71 ±8.32	89.93 ±27.66	9.79 ±30.23	0.247
Serum sodium	Pre	140.20 ±13.02	141.33 ±6.18	1.13 ±15.26	0.778
	Post	138.20 ±11.25	141.33 ±7.48	3.133 ±10.64	0.273
Serum Potassium	Pre	4.03 ±0.66	4.07 ±0.61	0.02 ±0.88	0.931
	Post	3.77 ±0.62	3.88 ±0.63	0.093 ±0.62	0.569
Serum Calcium	Pre	8.47 ±2.58	8.91 ±0.72	0.45 ±2.7	0.525
	post	8.93 ±0.87	9.33 ±1.65	0.4 ±1.22	0.224

Discussion

The results of the present study showed that ECT did cause a significant alteration in certain blood biochemical parameters, viz; glucose, sodium, potassium, & calcium. These results are in consistent with what have been reported by many other workers across the world[6-9].

The finding of a significant decrease in blood glucose of these patients (both in male & female) immediately after ECT is interesting, since, there is an outgoing proposal that ECT could be useful in treatment or alleviating diabetes mellitus (DM) in certain patients[14]. Such dilemma could need further exploration in order to establish its benefits in the clinical practice for the management of DM.

Likewise, the significant lowering of serum Na⁺ & K⁺ levels needs further consideration. Physiologically speaking, these cations play a very vital role in the normal functions of many organs particularly the heart, the neurons, the muscles, & the kidneys[1]. Therefore, doctors must be very much aware of the possible hazardous effects of ECT especially in patients with CVS, neural, & renal diseases. This finding of serum electrolytes alteration may justify the CVS changes seen after ECT[10]. Rumi et al

reported a significant increase in the value of arterial blood pressure & heart rate. In addition, they showed that ECT application was associated with myocardial ischemia in the absence of coronary obstructive disease[11]. Thus, the findings of the present study, & the reports of other workers ring a bell for the possible harmful effects of ECT as well as it needs a careful & cautious selection of patients to be managed by ECT.

The present study showed that the effect of ECT on serum calcium level was inconsistent in male & female. While there was a significant increase of calcium in male, there was an insignificant rise in female patients immediately after ECT. Although such result needs further follow up for more exploration, never the less, other researchers who reported that there were no significant changes in serum calcium level with ECT [6]. Thus, the issue of the effect of ECT on serum calcium level seems to be dealt in a careful way regarding size of the sample, method of collection, & biochemical technique used in the assay. If these conditions are met with, one could possible highlight more about this interesting finding. This is because calcium ion is reported to have

some role in the pathogenesis of post-ECT amnesia[2] beside the alteration in blood brain barrier permeability[5].

In conclusion, the present work described that ECT is associated with significant alteration in very important cations of the blood, & this denotes a careful look by doctors when considering ECT as method for the management of mental patients. Likewise, the reported lowering effect of ECT upon blood glucose level merits further consideration to highlight more the possible, if any, role of ECT in the management of the debilitating DM disease.

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