Original Article

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Effect of Electroconvulsive Therapy on Hematological Parameters

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ABSTRACT

Objective: Electroconvulsive therapy (ECT), a method of psychiatric treatment based on the establishment of generalized convulsions, results in a controlled stimulation of the brain tissue by an electrical current. The aim of this study was to examine the impact of the ECT treatment on hemogram parameters. Although the most common areas of use are depressive episodes that do not respond to medication, it is also effective in the treatment of many diseases such as mania, catatonia, schizophrenia with affective disorders, parkinson's disease and neuroleptic malignant syndrome (NMS). Though full blood count before ECT routine, there is no hematologic contraindication for ECT.

Methods: This study included 30 patients who were admitted to the Department of Psychiatry of Harran University Medical Faculty and who underwent ECT. Hemogram parameters were recorded before and after treatment of patients.

Results: Of the 25 patients included in the study, 19 (76%) were female, 6 (24%) were male. The ages of the patients ranged from 16 to 56, and the mean age was 33.12±12.06. The mean number of the ECT seances was 9.04±3.12. Number of red blood cells (RBC) and mean hemoglobin amount in erythrocyte cells (MCH) were found to be significantly changes, according to the results of statistical analysis of hemogram parameters before and after ECT. The RBC average value appeared to decline from 4.90 to 4.68 (p=0.018). But the average value of the MCH increased from 27.37 to 27.85 (p=0.036). The changes in the other hemogram parameters were statistically in significant.

Conclusion: ECT is a safe and an effective and easily applicable treatment method with few adverse effects. This study shows that ECT did not produce any significant statistical changes on many hemogram parameters. Two parameters (RBC and MCH) were found that showed significant changes in our study. More studies are needed to clearly understand how ECT changes the red blood cell count and hemoglobin levels.

Keywords: Electroconvulsive therapy, hemogram parameters, ECT

Introduction

Electroconvulsive therapy (ECT) is a psychiatric treatment method based on the principle of creating generalized convulsions as a result of the stimulation of brain tissue with controlled electrical current (1, 2). It was first applied in Italy in 1938 and it is one of the most effective and safe methods in the treatment of many psychiatric disorders (3). The most common field of use is depression, which does not respond to drug therapy, but it is also effective in the treatment of many diseases such as mania, catatonia, schizophrenia with affective disorders, Parkinson's disease and neuroleptic malignant syndrome (NMS) (4). Life-threatening conditions such as suicidal ideation, urgency of treatment, failure to respond to drug treatment or inadequate response, and conditions such as pregnancy where pharmacotherapy is risky are the main indications for ECT (5).

Although the duration and frequency of ECT, which is the most important somatic treatment modality of psychiatry, varies according to the patient's clinical condition and response to treatment, it is generally performed in 6-12 sessions 2-3 times a week (6). ECT is the least risky one among the interventions performed under general anesthesia (7).

The mechanism of action of electroconvulsive therapy is not clear yet, but it is still under investigation. ECT affects many central nervous system (CNS) structures such as neurotransmitters and their receptors, neuropeptides, hormones and

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neurotrophic factors (8). The healing effect arises from the molecular changes that it makes in the hippocampus, striatum, frontal cortex, entorhinal cortex and temporo-parietal cortex of the brain especially in the short and long term (9). Although complete blood count is routinely evaluated before ECT, there is no hematological contraindication for ECT (10). Systemic studies examining the effect of ECT on hemogram parameters are insufficient.

The aim of this study is to investigate the effect of ECT on hemogram parameters. Therefore, it will be evaluated whether hemogram values differ in post-ECT sessions and according to pre-ECT levels.

Methods

This prospective observational study was conducted between September 2015 and November 2016 in accordance with the Helsinki criteria with the approval of the Ethical Committee of Harran University Medical Faculty dated September 01, 2016, and with the session no 18. Thirty patients who were hospitalized in the Department of Psychiatry of the Medical Faculty of Harran University and underwent ECT were included in this study. Hemogram parameters of the patients that were taken several days before ECT and a few days after ECT was completed were recorded. The patients who received fewer than six sessions of ECT were not included in the study with the consideration that they did not benefit from ECT.

Informed consent is obtained from each patient with ECT indication and / or from the first degree relatives before the ECT application in our clinic. In addition, electrocardiogram (ECG), whole blood measurement, posterior-anterior chest radiography (PAAC) and routine biochemical tests are asked for all patients before ECT. Patients with severe cardiac pathology or another systemic disease are not treated with ECT unless they are very obligatory in our clinic.

All patients are evaluated with the tests results taken before the procedure by the Anesthesiology and Reanimation Outpatient Clinic. Patients are kept hungry for 12 hours before the application and the use of psychotropic medication continues. Medication was discontinued before the administration only in those receiving drugs in benzodiazapine group. After anesthesia approval, ECT is applied 3 sessions per week, on Mondays, Wednesdays and Fridays. An average of 6-8 sessions of ECT is preferred for each patient in our clinic, but this number can be decreased or increased according to the patient's clinical response. The procedure is performed under the supervision of anesthesiologists and psychiatrists, together with a team consisting of anesthesia assistant, anesthesia technician, nurse and psychiatry assistant in operating room conditions. Propofol 1 mg / kg IV. bolus is used as anesthetic agent. Sufammadex IV. with 20-30 mg rocuronium bromide and antidote is applied as a muscle relaxant. The doses of these drugs are adjusted by the anesthesia assistant. In addition, during the ECT, the patient is continuously ventilated with high doses of oxygen; the patient's ECG, pulse and blood pressure are monitored routinely, and whether complications develop or not is recorded.

Thymatron System II ECT device is used in electroconvulsive therapy applications in our clinic. The application is performed bilaterally and bitemporally. The maximum charge of the device is 504 milicoulumb (mC) at a 100% dose and the charge applied to each patient in this study is recorded as the percentage of the electrical dose applied to the patient. The "half age method" was used as the initial application dose of ECT. In half-age method, half of the age of the patient is taken as the basic value in terms of percentage. This number is determined by adding and removing the parameters affecting the seizure threshold (drugs that affect seizure threshold, anesthetic agents, history of epilepsy, antiepiletic drug use). The specified number is taken as the first dose of the application in terms of percentage. Whether patients have seizures during ECT is monitored via electroencephalography (EEG) outputs of the device, and patients are provided to have seizures for 20-60 seconds. The number of ECT, its results, complications and anesthesia notes are recorded in each patient's own file.

Statistical analyses

Statistical evaluations were made using IBM SPSS version 23.0 for Windows (Armonk, NY, USA). Descriptive statistics such as frequency distribution, mean, and standard deviation were used to describe the sample. The assumption of conformity to normal distribution was examined with the Kolmogorov Smirnov test. Paired Sample T Test was used to compare the variables before and after ECT. The level of statistical significance was accepted as $p < 0.05$.

Results

Thirty patients who were hospitalized in the Psychiatry Department of Harran University Hospital were included in this study. However, a total of 5 patients were not included in the study because 4 of them were pregnant and 1 had infection. Of the 25 patients included in the study, 19 (76%) were female and 6 (24%) were male. The ages of the patients ranged from 16 to 56, and the mean age was 33.12 ± 12.09. Of these patients, 14 (56%) were followed up with the diagnosis of unipolar depression, 4 (16%) with schizophrenia, 4 (16%) with bipolar disorder depressive episode and 3 (12%) with bipolar disorder manic episode. The mean number of ECT sessions was 9,04 ± 3,12. In addition, all patients were receiving medication while receiving ECT. The patients used antipsychotics, antidepressants, benzodiazepines and mood stabilizers alone and / or in combination. The most common symptoms were headache and memory problems as mild and transient side effects after ECT.

In Table 1, the values of hemogram parameters before and after ECT are compared. According to the results of statistical analysis, a significant change was found in RBC (Red Blood Cell) and MCH (mean number of hemoglobin in erythrocyte cells) values. The mean value of RBC decreased from 4.90

to 4.68 (p=0.018). The mean value of MCH increased from 27.37 to 27.85 M (p=0.036). The changes in other hemogram parameters are not statistically significant.

Discussion

The mechanism of action of electroconvulsive therapy is still a subject of research. Many neurotransmitters, neurohormones and neurotrophic factors are thought to be effective in the emergence of the effect of electroconvulsive therapy (11, 12). In many studies, ECT has been shown to alter the release of hormones such as prolactin, adrenocorticotropic hormone (ACTH), arginine-vasopressin, neuropeptide Y and growth hormone in the hypothalamic-pituitary-adrenal (HPA) axis (13, 14). In ECT stimulation, depolarization occurs in neurons and depolarization causes intense release of neurotransmitters (such as noradrenaline, serotonin, glutamate) (15). Changes in the blood count seen after ECT are associated with the release of catecholamines from the adrenal medulla (16). It was reported in several studies that neutrophilia and lymphopenia were seen in mood disorders, and this is thought to be caused by the drug use or hypolatamus-pituitary axis stimulation (17, 18).

Table 1 . Comparison of hemogram parameters before and after ECT

Parameters	After ECT Mean ± SD	Before ECT Mean ± SD	p
Leukocyte (10e3 / ositL)	8.26±2.96	8.53±2.35	0.641
Neutrophil (10e3 / ofilL)	4.96±2.66	5.14±1.80	0.738
Lymphocyte (10e3 / ositL)	2.51±0.74	2.60±0.85	0.446
Monocyte (10e3 / (L)	0.55±0.14	0.58±0.21	0.458
Eosinophil (10e3 / inL)	0.16±0.16	0.10±0.08	0.073
Bazofil (10e3/uL)	0.07±0.02	0.08±0.03	0.214
RBC (10e6 / (L)	4.68±0.44	4.90±0.49	0.018*
HGB (g / dL)	12.95±1.46	13.35±1.83	0.058
MCV (fL)	85.86±8.27	85.04±8.47	0.279
MCH (g/dL)	27.85±3.50	27.37±3.60	0.036*
MCHC (g/dL)	32.37±2.04	32.09±1.75	0.409
PLATELET (10e3/uL)	316.77±86.40	298.67±75.47	0.129
MPV (fL)	7.36±1.36	7.64±1.55	0.161
PDW (fL)	19.72±0.95	19.72±0.96	0.968
RDW (%)	12.67±1.88	12.64±2.41	0.895

*P<0.05. SPSS Paired Sample T Test was used. SD: standard deviation; ECT: electroconvulsive therapy; RBC: Red Blood Cell; HGB: Hemoglobin; MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Hemoglobin; MCHC: Mean Cell Hemoglobin Concentration; MPV: Mean Platelet Volume; PDW: Platelet Distribution Width; RDW: Red Cell Distribution Width

There are many studies examining the effect of electroconvulsive therapy on the immune system (19-21). In a study conducted by Kronfol et al. (22) on this issue, the effects of ECT on hematological parameters were investigated and as a result, a statistically significant difference was found in total leukocyte count (TLC), number of red blood cells (RBC), and in the amount of hemoglobin (Hb). An increase in TLC, and a simultaneous decrease in the levels of RBC and Hb were observed. In our study, the changes in RBC (number of red blood cells) and MCH (mean hemoglobin mass in erythrocyte cells) were found to be significant. There was a decrease in the number of RBC and an increase in the number of MCH after ECT compared to before ECT. There is no clear data on how ECT makes changes in red blood cells and hemoglobin levels.

In our study, it may be thought whether the changes seen on the hemogram parameters are caused by ECT or the drug treatment administered, or both. However, considering that almost all patients in the study were under medication treatment both before and after ECT, these changes in hematological parameters are likely to be caused by ECT. Inadequate data on the effect of ECT on hemogram parameters increases the importance of our study. In order to obtain more robust evidence on the effect of ECT on hemogram parameters, it is necessary to conduct studies in larger samples and with patients who do not receive additional drug treatment.

Conclusion

ECT is a very effective, safe and easily applicable treatment with a low risk of side effects. There are not enough studies examining the effect of ECT on hemogram values in the literature. This study shows that ECT does not make a significant statistical change on many hemogram parameters. In our study, 2 parameters (RBC and MCH) were found to be significantly different. More studies are needed to obtain clear data on how ECT acts on the amount of red blood cells and hemoglobin.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Harran University School of Medicine (Date: 01.09.2016, No: 07).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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