

CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Electroconvulsive therapy in a young adult patient with treatment-resistant depression and electroencephalogram epileptiform activity

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Introduction Electroconvulsive therapy (ECT) causes a seizure which is different from a convulsion in epilepsy. Despite this, ECT remains a challenge in patients with comorbid epileptiform activity. Our aim was to indicate the importance and safety of the ECT in a young adult with treatment-resistant depression (TRD) and electroencephalogram (EEG) epileptiform activity.

Case report A 21-year-old female patient was scheduled for ECT due to TRD and suicidal behavior. During the preparation for ECT, EEG epileptiform activity was noticed, and upon the anticonvulsant medication administration, the patient received the acute ECT, combined with quetiapine XR 600 mg/d, duloxetine 60 mg/d and pregabalin 450 mg/d, since the disease was life threatening. We noted a significant increase in the stimulus dose, i.e., elevation in the convulsive threshold during ECT. The clinical outcome was without adverse events and with a reduction of the depression severity. The continuation of the maintenance ECT, psychopharmacotherapy and psychotherapy was planned.

Conclusion ECT is the most effective therapy for TRD, while the presence of EEG epileptiform activity is not a contraindication for ECT, with the advantage of the ECT Thymatron IV device (Somatrics Inc., Venice, FL, USA), as a four-channel digital EEG machine, allowing us to record and analyze EEG.

Keywords: depression; ECT; EEG; young adults; suicidal behavior

INTRODUCTION

In the era of technological advancement, depression is one of the leading mental health problems among young adults. The prevalence of treatment-resistant depression (TRD) in young adults is as high as 40% and is associated with a higher risk of suicide [1, 2]. Young adults with depression often use deliberate self-harm which is an important risk factor for suicide attempts [3].

ECT (electroconvulsive therapy) reduces the severity of depression faster and more significantly compared to antidepressants [4, 5]. In adolescents younger than 18 years with depression and suicidal behavior (SB), the effectiveness of ECT is increasing with age, and with more than eight ECT sessions in a series (acute ECT) [6, 7].

It is important to keep in mind that ECT causes a seizure which is different from a convulsion in epilepsy, namely there is no abnormal connection and therefore does not lead to the appearance of spontaneous epileptic activity. Despite this, ECT remains a challenge in patients with epilepsy and comorbid epileptiform activity [8, 9].

Our aim was to indicate the importance and safety of ECT in a young adult patient with TRD and electroencephalogram (EEG) abnormal waveforms.

CASE REPORT

A 21-year-old female patient has been treated for depression since the age of 18, and the diagnosis of recurrent depressive disorder was established based on the International Classification of Diseases, tenth revision criteria at the age of 19. The course of treatment is characterized by frequent hospitalizations (six in total) due to maintenance of depression and SB (deliberate self-harm using razor blades – approximately 50 new and 100 old scars in the area of breasts, abdomen, upper legs, forearms; and deliberate self-poisoning using medications and alcohol) (Figure 1).

She has mostly been prescribed two or more psychiatric medications: antidepressants (duloxetine 30–60 mg/d, fluoxetine 20–40 mg/d, sertraline 50 mg/d, escitalopram 10–20 mg/d), antipsychotics (olanzapine 5–20 mg/d, cariprazine 3 mg/d, aripiprazole 15 mg/d, chlorpromazine 150 mg/d, clozapine – missing data, quetiapine 50–600 mg/d), mood stabilizers (lithium carbonate 600–1200 mg/d, valproate 500 mg/d), benzodiazepines and non-benzodiazepines (clonazepam 1 mg/d, pregabalin – missing data), psychostimulants (methylphenidate 18–36 mg/d).

Due to TRD and high suicide risk, the patient was referred to the Clinic of Psychiatry Military Medical Academy for acute ECT. She

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Figure 1. Deliberate self-harm in our patient with treatment-resistant depression

was admitted with the following therapy: duloxetine 60 mg/d, pregabalin 450 mg/d, and quetiapine XR 600 mg/d, and this therapy was continuously maintained during acute ECT. Among other medications, she had desmopressin 120 mg/d, prescribed by a urologist for nocturnal enuresis. Due to recent deliberate self-harm, she was surgically examined and antibiotic therapy (trimethoprim sulfamethoxazole) was prescribed for seven days. With a body mass index (BMI) of 33.1 kg/m², a hygienic-dietary regimen was implemented in accordance with the dietitian instructions.

It should be noted that she is unemployed, childless, and that she lives with her sister. At the age of two, she was observed at the Institute for Maternal and Child Health Care in Belgrade, due to a head injury as the result of the fall. An EEG was performed, and the findings were normal. A computed tomography (CT) of the head showed discrete brain edema. During growing up, nocturnal enuresis, nail biting and thumb sucking were present. The patient's mother informed us that, during the school period,

patient had episodes of staring at one spot or at another student, for couple of seconds during which she seemed "absent". Since she was 12 years old, due to nocturnal enuresis classified as primary enuresis, the urologist prescribed her desmopressin at a dose of 120 mg/d. She was subjected to verbal abuse and social isolation by her peers because of her physical appearance.

Her mother punished her physically, with frequent verbal insults, while her father was absent and uninterested. She does not abuse

psychoactive substances and alcohol. Heredity factor is present: father with alcohol use disorder, brother being treated for bipolar disorder, sister for anxiety-depressive disorder, two uncles committed suicide.

Preparation for ECT, description of ECT and ECT treatment

In accordance with the guidelines for ECT preparation [9] the following diagnostic procedures were performed: blood tests (complete blood count, metabolic panel, thyroid hormones) – test results were within the reference ranges; chest X-ray, electrocardiography, fundoscopy – unremarkable; magnetic resonance imaging of the brain – normal finding; EEG. She was examined by a cardiologist and an anesthesiologist prior to induction into general anesthesia.

The EEG showed a generalized spike-wave complex-like activity with an anterior maximum for about one second during hyperventilation and spontaneously at the end of

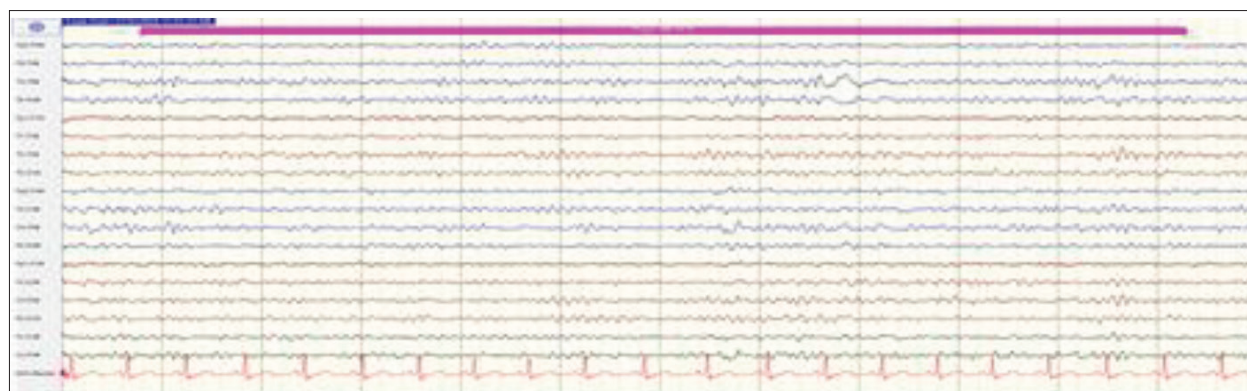


Figure 2. Abnormal electroencephalogram with epileptiform activity in our patient with treatment-resistant depression

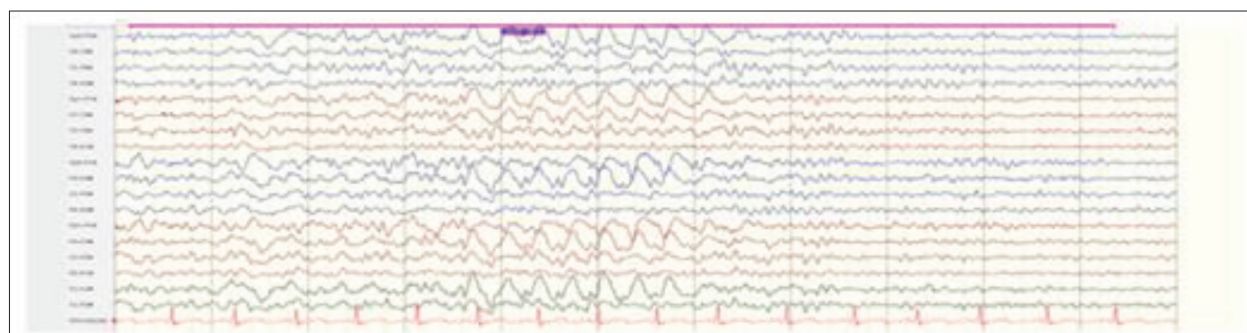


Figure 3. Abnormal electroencephalogram with epileptiform activity after sleep deprivation in our patient with treatment-resistant depression

ECT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Treatment No.																				
Days since ECT initiation	0	2	5	7	9	12	14	16	19	21	23	26	28	30	36	39	41	43	46	48
CD (mC)	50.4	50.6	75.0	75.1	74.8	100.2	99.1	150.4	151.0	175.7	200.9	200.2	199.5	199.5	199.6	199.3	200.1	201.2	200.8	201.1
SD (s)	5.6	5.6	4.2	4.2	4.2	5.6	5.6	5.6	5.6	6.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Frequency (Hz)	10	10	20	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30	30	30
EMG	14	14	13	19	15	13	9	12	15	17	13	13	12	10	12	12	10	12	13	13
EEG	/	12	31	22	/	22	9	19	45	24	23	15	17	18	17	14	12	15	14	14
PSI (%)	/	19.4	92.8	64.9	/	<10	27.1	82.2	41.6	90.7	93.2	87.4	40.1	96.4	81	95.4	96.6	78.9	96.2	95.8

Figure 4. Acute electroconvulsive (ECT) therapy in our patient with treatment-resistant depression and abnormal electroencephalogram with epileptiform activity; CD – charge delivered; SD – stimulus duration; EMG – electromyography; EEG – electroencephalography; PSI – postictal suppression index

the recording, i.e., there are interictal borderline to specifically generalized epileptiform discharges (Figure 2).

The EEG after sleep deprivation indicated, that, during wakefulness and sleep, spike-wave complex series of 3 Hz lasting up to 5–6 seconds became more frequent with a maximum over the frontal regions and, more dominantly on the right side (Figure 3). Due to recorded EEG abnormalities, nocturnal bedwetting, and data about episodes of staring, the neurologist introduced anticonvulsant medication lamotrigine, with a gradual increase in the dose to 150 mg/d, desmopressin was removed from the therapy.

The following clinical scales were performed: Hamilton Depression Rating Scale 21 (HAM-D 21) score 32; childhood trauma questionnaire total score 62, emotional abuse score 21, physical abuse was 18; Mini-Mental State Examination score 30.

The patient signed an informed consent for ECT and general anesthesia. For ECT we utilized Thymatron System IV device (Somatics Inc., Venice, FL, USA), and brief pulses (0.5 ms), the electrodes were placed bi-temporal. Setting the stimulus dose was based on the “half-age” method [10]. Acute ECT was applied three times a week in general anesthesia. The patient received a total of 20 ECT sessions in acute ECT, with a recorded increase from the initial to final dose of the stimulus, 50.4 mC vs. 200.1 mC, respectively (Figure 4).

A more significant reduction in depressive symptomatology was recorded after fifth ECT session (HAM-D 21 score was 21), however therapy continued until 20th ECT session, i.e., until HAM-D 21 score was 11. There were no changes in cognitive functioning.

The combined administration of ECT and psychopharmacotherapy (quetiapine XR 600 mg/d, duloxetine 60 mg/d and pregabalin 450 mg/d), along with an anticonvulsant medicine, resulted in the termination of nocturnal enuresis and reduction in the severity of depression and SB. BMI at the end of hospital treatment was 29.4 kg/m², i.e., she lost 10 kg.

Ethics: The patient gave her informed consent and the study was approved by the Ethics Committee of the Military Medical Academy (Decision No. 19/2025).

DISCUSSION

The use of ECT in psychiatric patients with comorbid epilepsy may be considered a serious clinical challenge [9, 11, 12]. Accordingly, a study from 2006 reported that ECT is safe to use in patients with epilepsy and that no dose adjustments of anticonvulsant medications are necessary [13], and ECT can also be used for the treatment of refractory epilepsy and status epilepticus [14, 15]. There are studies stating the contradictory results, that after ECT there was a tendency to epilepsy [16, 17]. However, our experience so far, as in other researches, did not establish this [14, 15, 18]. The main disadvantage of the “half-age” method which we used is that it is not possible to know the individual seizure threshold, i.e., whether the stimulus dose is sufficiently above the convulsive threshold to ensure the effectiveness of ECT. In our patient, a significant increase in the stimulus dose, i.e., a raise in the convulsive threshold is evident.

Despite the fact that ECT shows a response rate of 50% to 90% in young adults with TRD with suicidal ideation or psychotic symptoms, its use in practice remains low [2, 19]. Our patient was diagnosed with recurrent depression at the age of 19, and was referred for ECT at the age of 21. Explanations for this discrepancy can be partly explained by the small number of ECT centers in Serbia. Namely, ECT was only applied at the Military Medical Academy Clinic of Psychiatry in Belgrade, until 2016, when ECT center at the Clinic of Psychiatry, Clinical Center Kragujevac was open [18]. Another possible explanation is a common belief about the association of ECT with cognitive impairments. By using reliable methods of cognitive testing (computerized neuropsychological tests), it has been shown that the deficit of cognitive functions

improves during the treatment of depression with ECT [20, 21, 22], therefore, the effect of ECT is the same as in the adult population [2].

Due to the severity of the clinical presentation, it was not possible to discontinue the use of psychopharmacotherapy in our patient, which is in accordance with the results of the positive effects of ECT in combination with antidepressants and antipsychotics, while lamotrigine of all mood stabilizers raises the seizure threshold the least [23].

This presentation also aims to emphasize the importance of EEG in psychiatry, namely, our patient had an EEG performed immediately after a traumatic brain injury and as part of preparation for ECT. After traumatic brain injury, EEG epileptiform activities were determined in 16 % of patients [24], however EEG changes are not uniform, that is, they depend on the severity and location of traumatic brain injury and can gradually develop over time (if serial recording is performed), which was not done in our patient [25]. In patients with bipolar disorder, it has been shown that abnormal EEG with epileptiform activity is possible predictor of lithium resistance [26]. Also, EEG is important for treating TRD, considering that

treatment-resistance can occur in patients with epilepsy, that is, EEG can contribute to more effective treatment strategies for TRD, which was the case in our patient [27, 28]. The development of artificial intelligence indicates that deep learning methods based on EEG help in the early detection of patients with depression vs. healthy subject, with accuracy from 90% to even 99.24% [29].

In conclusion, the increase in mental health problems in young adults in recent decades, especially depression, requires comprehensible guidelines for the TRD therapy in this population. When choosing a treatment, one should always consider the risk and benefit of the proposed treatment, and the fact is that ECT is still the most effective therapy for TRD. ECT, in addition to being effective, is also a safe therapy for TRD, and the presence of EEG abnormalities is not a contraindication for ECT, with the advantage of the ECT Thymatron System IV device (Somatics Inc.), as a four-channel digital EEG machine, allowing us to record and analyze EEG.

Conflict of interest: None declared.

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Електроконвулзивна терапија код младог одраслог болесника са терапорезистентном депресијом и електроенцефалографском епилептиформном активношћу

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САЖЕТАК

Увод Електроконвулзивна терапија (ЕКТ) изазива напад који се разликује од конвулзија код епилепсије. Упркос томе, ЕКТ остаје изазов код болесника са коморбидном епилептиформном активношћу. Циљ рада је био да се укаже на значај и безбедност ЕКТ у лечењу терапорезистентне депресије код младе одрасле особе код које су утврђене електроенцефалографске (ЕЕГ) абнормалности са епилептиформном активношћу.

Приказ болесника Приказујемо болесницу стару 21 годину код које је због терапорезистентне депресије и суицидалног понашања била планирана ЕКТ. Током припреме за ЕКТ установљене су ЕЕГ абнормалности са епилептиформном активношћу, а болесница је након укључивања антиконвулзива подвргнута акутној ЕКТ, у комбинацији са кветиапином XR 600 mg/d, дулоксетином 60 mg/d и прегаблином 450 mg/d,

јер је болест била опасна по живот. Примећено је значајно повећање дозе стимулуса, односно пораст конвулзивног прага током ЕКТ. Клинички исход је био без нежељених догађаја, уз редукцију тежине депресије. Планиран је наставак лечења одржавајућом ЕКТ, психофармакотерапијом и психотерапијом.

Закључак ЕКТ је најефикаснија терапија за терапорезистентну депресију, а присуство ЕЕГ абнормалности није контраиндикација за ЕКТ, уз додатну предност апарата за ЕКТ *Thymatron IV* (Somatics Inc., Венеција, ФЛ, САД), који као четвороканални дигитални ЕЕГ уређај омогућава снимање и анализу ЕЕГ.

Кључне речи: депресија; електроконвулзивна терапија; електроенцефалографија; млади одрасли; суицидално понашање