

## **Multiple-Monitored Electroconvulsive Therapy (MMECT) – does it really just belong in psychiatry’s past? A case report**

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### **Summary**

Electroconvulsive therapy has been a method used in psychiatry since 1938 and despite its rather turbulent history, it is still the most effective method of treating severe mental disorders. Despite its high efficiency and good safety profile, patients with catatonia usually require a large number of treatments. It entails a long hospitalization time and the necessity to repeatedly induce general anesthesia. In 1966, Blachly proposed to induce more than one seizure during a single anesthesia. According to this method, the patient was to be constantly monitored (ECG, EEG) during a series of electroconvulsions, which consisted of two to even eight treatments. For simplicity, the method is called multiple-monitored ECT (MMECT). The work is based on the medical history of a patient diagnosed with catatonic schizophrenia. Due to the insufficient effect of single treatments, we decided to use the MMECT method, which was performed in series of three treatments, twice a week. Thanks to the therapy, catatonic symptoms remitted. Studies in various patient populations have shown that MMECT reduces hospitalization time, the duration of acute symptoms, and the patient’s total exposure to anesthetics and muscle relaxants. As the above case shows, MMECT can potentially be considered as a safe treatment alternative in patients that require a large number of treatments, resistant to standard forms of therapy.

**Key words:** MMECT, catatonia, ECT

### **Introduction**

Electroconvulsive therapy (ECT) has been a method used in psychiatry since 1938, and despite its rather turbulent history, it still remains the most effective method of treating severe mental illnesses [1]. The concept of catatonia as a syndrome of neuropsychiatric symptoms was already proposed by Kahlbaum in 1874 and although its nosological position was uncertain for decades, in the new DSM-5 classification it is

clearly separated from schizophrenia [2]. The effectiveness of ECT in patients with catatonia ranges from 59 to 100%, which makes it, next to benzodiazepines, the first choice treatment [3, 4]. Even despite such a high efficiency and good safety profile of the method, catatonic patients usually require a large number of treatments, which are performed on average 3 times a week. This entails a long hospitalization time, the necessity to repeatedly introduce the patient to general anesthesia, which is an additional burden for the patient and may be a significant technical and financial limitation for the facility. For many decades, a search has been made for ways to optimize electroconvulsive therapy.

In 1966, Blachly proposed to induce more than one seizure during a single anesthesia. According to this method, the patient was to be constantly monitored (ECG, EEG) during a series of electroconvulsions, which consisted of two to even eight treatments (usually three to five). The interval between the end of one seizure activity and the administration of another electrical impulse was to last at least three minutes. In order to perform the procedure, the cooperation of the anesthesiologist and psychiatrist was necessary, which at that time was not a standard procedure. For the sake of simplicity, the method was named multiple-monitored ECT (MMECT) [5]. In further studies on various populations of patients, it was shown that this method shortened the hospitalization time, the duration of acute symptoms, which was particularly important in the case of a significant suicidal potential, and reduced the patient's total exposure to anesthetics and muscle relaxants. It turned out to be as safe as single electroconvulsive treatments also in the population of elderly patients [6–8].

Due to the remarkable drug resistance and the lack of any therapeutic effect using standard single ECT, the authors returned to the long-forgotten MMECT technique in a schizophrenic patient with catatonic symptoms, achieving a spectacular effect.

### A case report

A 49-year-old patient, treated since 1991 due to schizophrenia in the form of alternating paranoid and catatonic syndromes. She lived all her life in a single-family home with her father, mother and grandmother. From the beginning of the illness, despite many psychiatric hospitalizations, she never achieved full remission in terms of both psychotic symptoms and everyday functioning. Most of the time the patient spent without leaving the bed, where she was experiencing the contents of active psychosis, it seemed to her that there was a war going on and she herself would be sent to a concentration camp, which made her feel a great deal of fear and danger. Complex activity was limited to basic activities. For most of her life, she was constantly looked after by her mother, who took care of meeting her basic needs, filling her prescriptions and administering medications. She has been taking olanzapine at a dose of 20 mg/day for many years. Moreover, she suffered from type 2 diabetes – successfully treated with gliclazide 30 mg/day and metformin 500 mg/day. She did not consume alcohol or used any psychoactive substances. In 2020, the patient's mother died, which resulted in a rapid deterioration of the patient's mental state – paranoid symptoms, oneiric delusions, auditory, visual and olfactory pseudohallucinations intensified, and an extreme

psychotic anxiety appeared, which made her try to run away from home. Due to the exacerbation of the illness, she was taken to the hospital, where pharmacotherapy was applied – initially zuclopenthixol acetate in the form of injections every other day for six days, then risperidone in a dose of up to 6 mg/day for six weeks, which, due to the lack of effect, was changed to olanzapine 20 mg/day for the next six weeks. Additionally, she was given diazepam on an ad hoc basis in doses up to 20 mg/day.

Despite the repeatedly modified pharmacotherapy, the patient's condition did not improve. Symptoms of catatonia have developed. She stopped eating, required 24-hour staff care and intravenous hydration, she was withdrawn, with blunted affect, there was cognitive inhibition, mutism, active and passive negativism. Olanzapine was discontinued, lorazepam was used in injections of 12 mg/day for a week, then clozapine was administered, gradually increasing the dose to 300 mg/day, still not improving. During the initiation of clozapine treatment, the patient experienced an epileptic seizure, and therefore treatment with olanzapine was restarted at a dose of 20 mg/day. After 5 months of hospitalization, it was decided to transfer the patient to our Clinic for electroconvulsive treatment.

The patient was admitted pursuant to Article 22 of the Mental Health Act as unable to give consent. Upon admission to the ward, the patient was conscious, without any forms of verbal contact. The affect was flat, fixed. We observed stupor, mutism, passive negativity. She did not seem hallucinating. Due to negativity, the physical examination was difficult, the patient was lying on her right side, she did not allow to change her position, she did not cooperate. There were visible ecchymoses in the area of the right wrist. HR 100/min, SpO2 97%, RR 130/80 mmHg. Heart tones were clear. No peripheral edema. Perceptible peripheral heart rate. Abdomen soft, painless, no peritoneal symptoms, peristalsis present. Chelmonski's sign/Goldfalm's sign was negative. On a neurological examination, meningeal symptoms were negative; no nystagmus, no symptoms of focal CNS damage; Romberg's test – negative; MRI of the head was without visible structural changes. Laboratory tests did not reveal any significant abnormalities. Abdominal ultrasound and chest X-ray revealed no significant changes. A gastric tube and a catheter were placed.

After an internal medicine, neurological and anesthesiological consultation, the patient was qualified for ECT procedures for life indications pursuant to Article 34 of the Act on the Medical Profession. Due to the documented treatment resistance and no abnormalities in resting EEG, despite the previously described single seizure, it was decided to reintroduce clozapine, the dose of which was systematically increased, reaching 650 mg/day in the 8<sup>th</sup> week of hospitalization [9]. Treatment with clozapine was also continued during ECT procedures. Due to the difficult general condition, all procedures were performed in the bilateral technique with the use of a pulse width of 1.0 ms using the Thymatron® System IV device. The treatments were performed twice a week. Initially, propofol was used for induction of anesthesia, but due to the lack of an adequate seizure response, the decision was made to replace the anesthetic with etomidate due to the significantly increased seizure threshold. Full muscle relaxation was achieved using suxamethonium. The charge was determined by titration and was 250 mC.

The patient was hyperventilated each time before delivering the electric charge in order to induce intentional hypocapnia. After eight treatments with the maximum charge of 357.3 mC, some improvement in the patient's condition was noticed. She still did not establish verbal contact, but communicated by means of gestures, including nodding when asked about the presence of pseudohallucinations in the form of imperative voices forbidding her to speak. Due to independent eating, it was decided to remove the gastric tube. She followed simple commands – raising her hand, blinking, smiling. After another two treatments, there was a significant improvement. The patient provided a coherent verbal response, she was comprehensively oriented. However, the psychomotor drive was lowered, the train of thought slightly slowed down, and the affect remained weakly modulated. She reported periodically occurring pseudohallucinations in the form of commenting and discussing voices, the source of which she localized in her head. She gave stereotypical answers to questions.

Despite initial optimism, in the following week the patient's condition deteriorated and the symptoms of catatonia exacerbated. She stopped talking again, actively opposed attempts to feed her or administer medications, and therefore a gastric tube was placed again. Due to the recurrence of catatonic symptoms, despite regular electroconvulsive procedures, increasing resistance to subsequent treatments and no additional cause of mental state decompensation, it was decided to implement MMECT in series of three treatments, twice a week. Such decision was dictated by the extreme risk to the health and life of the patient due to long-term immobilization, muscle stiffness, the risk of pressure ulcers and complications related to repeated induction of general anesthesia. Etomidate was still used for induction of anesthesia, while mivacurium at a dose of 20 mg was chosen as the relaxant, which allowed for the extension of the duration of anesthesia above 10 minutes. The airways were secured with a laryngeal mask. Epileptic seizures were induced at 3-minute intervals in order to bypass the repolarization period of neurons.

After two MMECT series the patient's condition improved. She again communicated verbally with the environment, cooperated, ate meals, and used the toilet on her own. In addition, affect became more lively, though still somewhat inadequate. The patient confirmed fleeting auditory pseudohallucinations. Due to the improvement of the mental state – remission of catatonic symptoms – we returned to single ECT procedures, however, during the next three procedures, an increase in electrical resistance, an increase in the seizure threshold and a shortening of the seizure response were observed, despite the increase in the charge to 410 mC. Clinically, the patient's motility slowed down again, reduced affect was observed, contact and thinking were impaired. It was necessary to return to MMECT, which was performed until the end of hospitalization. In total, during the stay at the clinic, 15 single ECT procedures and 7 series of 3 MMECT procedures were performed. A total of 42 ECT procedures were performed. Ultimately, the patient received clozapine at a dose of 650 mg/day. During hospitalization, all procedures were uncomplicated, and no side effects were observed. After 64 days, the patient was discharged home in a good general condition, without catatonic symptoms, she was properly oriented, she was in logical verbal contact, presented indifferent mood with a slightly shallow affect. She reported fleeting productive

symptoms in the form of auditory pseudohallucinations of moderate intensity, towards which she remained indifferent.

Table. Parameters in subsequent MMECT series

MMECT series of 3 ECT treatments	Anesthesia	Muscle relaxant	Charge	Pulse width	Frequency	Current	Length of EEG seizure activity in subsequent seizures
1	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.92 A	60 s, 51 s, 26 s
2	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.91 A	77 s, 43 s, 33 s
3	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.92 A	65 s, 55 s, 67 s
4	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.91 A	56 s, 41 s, 97 s
5	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.91 A	34 s, 53 s, 42 s
6	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.91 A	61 s, 43 s, 33 s
7	Etomidate 20 mg	Mivacurium 20 mg	410 mC	1 ms	70 Hz	0.92 A	50 s, 51 s, 45 s

## Discussion

To the knowledge of the authors of this study, no description of the MMECT use has been published in the Polish literature so far. There are only a few publications on the use of this method, mainly in the treatment of depression, where it has been proven that it allows to shorten the total hospitalization time, shorten the duration of suicidal thoughts, and is associated with lower exposure to anesthetics and muscle relaxants, with a good safety profile [7, 8]. In 1972, Bridenbaugh et al. [10] conducted a study on a group of 17 patients diagnosed with schizophrenia (including 4 diagnosed with catatonic schizophrenia) in whom he used MMECT. They pointed to a significant reduction in the length of hospital stay in patients with schizophrenia – in the case of MMECT hospital stay lasted 21.3 days on average compared to 40–50 days in patients undergoing single ECT procedures [10]. Our patient was hospitalized for 64 days, during which a total of 42 ECT procedures were performed, if a similar number of single procedures were performed, the length of stay would have to be almost doubled, which would translate into treatment costs and could expose the patient to additional complications. It is worth emphasizing that despite the concerns initially described in the literature regarding the safety of clozapine during electroconvulsive therapy, increasing number of reports now indicate a high safety profile of such a combination, as well as its augmentative nature [11].

Despite the proven effectiveness and practically a similar risk of complications, the MMECT study was abandoned for unknown reasons and was forgotten for many years. Also, in the case of our patient, we did not observe any differences in the intensity

of postoperative arousal or in the time to reorientation. There was no prolongation of seizures or development of status epilepticus. Reconsidering the above case, the following conclusions can be drawn – due to the lack of a satisfactory response to single ECT and the observed efficacy, with the simultaneous lack of side effects in multiple ECT, MMECT should be implemented at an earlier stage of treatment and consistently, uninterruptedly continued until a certain remission in relation to catatonic symptoms. Such a procedure could allow for an additional shortening of the length of hospitalization, and perhaps for a reduction in the total number of ECT procedures. The suboptimal application of the described method resulted from the lack of available standards or protocols for this treatment approach. So far, the questions asked by Blachly in 1966 have not been answered: is it possible to perform in certain cases all ECT procedures necessary to achieve remission during one MMECT series? Currently, ECT procedures are usually performed in cooperation with a psychiatrist and an anesthesiologist, and basic parameters such as saturation, arterial pressure or ECG are constantly monitored [12]. There are also available safer anesthetics and relaxants than in 1966 [13]. Further studies in the field of MMECT seem to be necessary to answer the question of what the current safety and efficacy profile of multiple repeated procedures would look like using the latest technical possibilities and which group of patients could benefit most from this form of treatment. As the above case shows, MMECT has the potential to be an effective and safe treatment alternative in the most resistant to treatment cases and those requiring a large number of treatments.

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