Safe Treatment of a Patient With an Ommaya Reservoir With Electroconvulsive Therapy

To the Editor,

A 58-year-old Caucasian female with a history of diffuse large B-cell lymphoma presented with a severe depressive episode with psychotic features and intense suicidal ideation. She was diagnosed with diffuse large B-cell lymphoma 3 years before her first depressive episode. At the time of diagnosis, computed tomography of the chest, abdomen, and pelvis and bone marrow biopsy showed diffuse infiltration of bilateral kidneys, retroperitoneal soft tissue, pelvis, and spine. The patient started chemo-immunotherapy with hyper-CVAD (cyclophosphamide, vincristine, doxorubicin, and dexamethasone). After cerebrospinal fluid analysis revealed lymphoma cells, an Ommaya reservoir was placed for intrathecal chemotherapy.

Several months after starting chemotherapy, she experienced her first episode of depression characterized by decreased appetite, low energy, apathy, anhedonia, tearfulness, hopelessness, helplessness, worthlessness, delusions of guilt, and suicidal ideation. Trials of sertraline, fluoxetine, venlafaxine, and mirtazapine were ineffective or poorly tolerated owing to restless leg symptoms. Depressive symptoms improved with olanzapine augmentation; however, this was also discontinued owing to severe akathisia and acute dystonia. Electroconvulsive therapy (ECT) was discussed, and neurosurgical consultation was pursued before treatment to assess risks of treatment with the Ommaya reservoir, which were determined to be minimal.

The patient underwent an acute series of bifrontal ECT using a MECTA Spectrum 5000Q machine with the following settings: pulse width, 0.5 milliseconds; frequency, 40 Hz; duration, 2.25 seconds; current, 800 milliamps; energy, ranging 15 to 29 J. Methohexital was used as the anesthetic agent, and succinylcholine as the neuromuscular blockade. She received a total of 15 treatments on a tapering continuation schedule with full remission of symptoms and major improvements in functionality. The treatments were tolerated well without complication.

DISCUSSION

The Ommaya reservoir is an intraventricular shunt system for direct delivery of intrathecal chemotherapy.[1] It is comprised of a plastic reservoir and silicon catheter. The tip of the drain is stereotactically guided into the frontal horn of the right ventricle, with a plastic reservoir placed under the skin. Ommaya implantation is generally well tolerated, but complications including catheter malposition, cerebrospinal fluid leakage, intraparenchymal or intraventricular hemorrhage, and infections.[2] With many intracranial devices or foreign objects, there is a theoretical concern that electrical stimulation may cause heating of the object, leading to damage of the surrounding brain tissue.[3] In addition, it has been suggested that skull defects may cause a greater amount of energy to be delivered to the brain during ECT owing to increased circuit impedance.[4] Despite these theoretical concerns, ECT-related heat injury in patients with intracranial objects has not been reported.[5] Plastics and silicon are not ferromagnetic and, therefore, have a very low risk of heating with electrical stimulation, and the Ommaya filter is safe with magnetic resonance imaging. Silicon has potential superconductive properties, typically as an alloy with other conductive metals, but is unlikely to contribute to altered stimulus propagation in the form used in the Ommaya filter. Nevertheless, we pursued an adjusted bifrontal lead placement equidistant and furthest from the intracranial object, consistent with recommendations by Mortier et al.[3] Our service has successfully treated other patients with metallic intracranial objects safely with good tolerability and successful outcomes.[6]

Administering ECT with an intracranial device represents a clinical challenge but should not dissuade the psychiatrist from pursuing treatment if indicated. Whereas there are no reports of treating patients with Ommaya filters, rare reports of ECT in patients with other types of plastic intracranial shunts have been associated with minor complications such as prolonged disorientation and urinary/fecal incontinence.[5] Notably, these adverse events can be seen in patients without intracranial devices who receive ECT. The patency of the lumen of any intracranial shunt should be confirmed to avoid increased intracranial pressure, which may increase the risk of brain herniation syndrome.[5]

To our knowledge, this is the first report of a successful and well-tolerated course of ECT in a patient with an Ommaya reservoir. This report affirms a previous body of evidence that ECT is a safe treatment for patients with intracranial medical devices. We recommend formal neurosurgical evaluation before pursuing ECT for any patient with an intracranial object.

Mesut Toprak, MD
Rachel B. Katz, MD
Robert Ostroff, MD
Yale Psychiatric Hospital
Yale Department of Psychiatry
New Haven, CT
Rachel.katz@yale.edu

The authors have no conflicts of interest or financial disclosures to report.

REFERENCES

1. Yoshida S, Morii K. Intrathecal chemotherapy for patients with meningeal carcinomatosis. *Surg Neurol*. 2005;63:52–55; discussion 55 (2005).
2. Lishner M, Perrin RG, Feld R, et al. Complications associated with Ommaya reservoirs in patients with cancer. The Princess Margaret Hospital experience and a review of the literature. *Arch Intern Med*. 1990;150:173–176.
3. Mortier P, Sienaert P, Bouckaert F. Is electroconvulsive therapy safe in the presence of an intracranial metallic object?: case report and review of the literature. *J ECT*. 2013;29:231–238.
4. Gordon D. Electro-convulsive therapy with minimum hazard. *Br J Psychiatry*. 1982;141:12–18.
5. Hanretta AT, Malek-Ahmadi P. Successful ECT in a patient with hydrocephalus, shunt, hypopituitarism, and paraplegia. *J ECT*. 2001;17:71–74.
6. Katz RB, Toprak M, Ostroff R. A successful course of electroconvulsive therapy in a patient with epilepsy and a posterior fossa titanium plate. *J ECT*. 2017;33(2):e17–e18.

Electroconvulsive Therapy and Delirious Catatonic Mania

To the Editor:

Bipolar disorder is one of the most common psychiatric illnesses and affected individuals often present with manic symptoms. Delirious mania is an underrecognized clinical syndrome.[1] It is first described in 1849 as an acute syndrome of excitement, delirium, and psychosis.[2] Between 15% and 20% of patients with acute mania exhibit signs of delirium.[3] Mania with catatonia usually evidences a less good outcome

than mania without catatonia.[4] Benzodiazepines and electroconvulsive therapy (ECT) are effective for treating patients with delirious catatonic mania.[5] A patient with bipolar disorder presented with delirious mania and catatonia. Interventions included benzodiazepines and ECT.

CASE REPORT

A 54-year-old man with a psychiatric history of bipolar disorder was hospitalized on an involuntary commitment order initiated by his wife. Reportedly, he had threatened to beat her and had locked her in a room. The patient was disheveled, agitated, hostile, and uncooperative. He was admitted to the psychiatric unit for safety and stabilization. His history included multiple previous psychiatric admissions beginning in his mid-20s. He has previously been prescribed many different medications, including valproic acid, lithium, risperidone, olanzapine, and trazodone. Twenty milligrams of aripiprazole and trazodone 150 mg were his current daily pharmacotherapy. His wife reported that he was medication compliant.

In the hospital, he was prescribed with 450 mg lithium twice a day and aripiprazole increased to 30 mg/d. The patient refused lithium and was administered haloperidol and lorazepam as needed for agitation/anxiety. Confusion fluctuated during the day. Three days later, he demonstrated abnormal, stereotypical movements, which met criteria for catatonia, that is, mutism, negativism, stereotypy, agitation, and grimacing. Moving his head back and forth, waving his right arm, and grimacing, he would not respond to questions. Neurology and internal medicine consultants ruled out organic brain pathology. Catatonia improved after lorazepam was administered but reappeared the next day. Lorazepam for agitation was administered as needed. After consenting, the patient was scheduled for ECT. He received a series of 6 bilateral ECT over 16 days. After the first one, he no longer exhibited catatonic or manic symptoms. Although he described his mood as "good," his affect remained constricted. The patient was prescribed 100 mg quetiapine after the first ECT; the dose was gradually increased to 400 mg at bedtime. Lamotrigine 25 mg/d was added to the regimen near discharge. He tolerated ECT well and was discharged in stable condition for ongoing outpatient follow-up.

DISCUSSION

Acute agitation and/or delirium have perplexed physicians. This presentation has had a confusing variety of names; "delirious mania with catatonia" or "delirious catatonic mania" might be the most appropriate terminology choices. It is underrecognized; there is controversy about its frequency.[1] Delirious mania may be rare, but some experts believe that it may be present in nearly one-third of all cases of mania. The incidence of co-occurring delirious mania and catatonia is unknown; yet, most patients exhibiting delirious mania also have signs of catatonia, and it might even be a subtype of catatonia.[5] The initial medical evaluation of patients presenting with delirious mania and catatonic features should focus on determining an etiologic diagnosis.

Benzodiazepines are the most recommended pharmacotherapy for treating people with acute catatonia. The ECT is the intervention of choice for case of catatonia and is an effective treatment for persons having a delirious mania.

CONCLUSIONS

Delirious mania is a potentially life-threatening, underrecognized psychiatric syndrome. Patients with delirious mania are at high risk for developing catatonia; this can worsen the clinical condition and prolong hospitalization. Early recognition and appropriate treatment, especially with electroconvulsive therapy, can significantly reduce morbidity and mortality.

Cuneyt Tegin, MD
George Kalayil, MD
Steven Lippmann, MD
University of Louisville
Department of Psychiatry and
Behavioral Sciences
Louisville, KY
cuneyt.tegin@louisville.edu

The authors have no conflicts of interest or financial disclosures to report.

REFERENCES

1. Bond TC. Recognition of acute delirious mania. *Arch Gen Psychiatry*. 1980;37:553–554.
2. Bell L. On a form of disease resembling some advanced stages of mania and fever. *Am J Insanity*. 1849;6:97–127.
3. Taylor MA, Abrams R. The phenomenology of mania. A new look at some old patients. *Arch Gen Psych*. 1973;29:520–522.
4. Krüger S, Bräunig P. Catatonia in affective disorder: new findings and a review of the literature. *CNS Spectr*. 2000;5:48–53.
5. Fink M. Delirious mania. *Bipolar Disord*. 1999;1:54–60.

Varied Antidepressant Response and Subjective Experience Across 3 Different Repetitive Transcranial Magnetic Stimulation Devices
A Case Report

To the Editor:

Repetitive transcranial magnetic stimulation (rTMS) is an effective treatment for major depressive disorder (MDD).[1] Since 2008, there have been 4 devices cleared by the Food and Drug Administration to treat MDD: NeuroStar TMS Therapy System (Malvern, PA),[1] Brainsway Deep TMS System (Jerusalem, Israel),[2] Magstim Rapid[2] (Wales, UK),[3] and Magventure (Farum, Denmark).[4] There have been limited comparisons of device efficacy in populations with MDD,[5] and little is known about comparing rTMS device efficacy in a single individual across multiple depressive episodes. We report a patient presenting with treatment-resistant MDD who had 3 separate rTMS treatment courses on 3 different devices (NeuroStar, Magstim, and Brainsway).

Mr A. is a 63-year-old white man presenting with recurrent, episodic MDD since age 40 years. Over the course of 3 years, he was referred to our TMS center on 3 occasions. Prior to each induction, a psychiatrist confirmed that he met the criteria for treatment-resistant MDD, having failed at least 4 prior antidepressant treatment courses across multiple classes in this case. Each induction is composed of 30 sessions (1 session a day, 5 consecutive sessions a week) and is concluded with a brief taper phase. An individual session consists of high-frequency stimulation performed over the left dorsolateral prefrontal cortex as per each device's recommended protocol. The 24-item Hamilton Depression Rating Scale (HAMD-24)[6] was administered before and after each induction to measure response. The Beck Depression Inventory II (BDI-II)[7] was also administered on a weekly basis to assess response throughout the duration of treatment.

Mr A.'s first induction was performed using the NeuroStar device and consisted of 34 sessions (37 minutes, 3000 pulses at 10 Hz, 5.5 cm anterior to motor hotspot, 110% resting motor threshold [RMT]). He remained on stable doses of his medications, which included duloxetine, vilazodone, gabapentin, and methylphenidate. After 34 sessions, Mr A. reported at his final session that he "felt like a new person" and, on numerous occasions throughout this induction, that "the heavy weight on [his]

shoulders [was] not there anymore." He initially described the treatment itself as "very uncomfortable," noting it felt like "a hammer on [his] head." However, he was able to acclimate to the treatment after the first 5 sessions. Clinically, Hamilton scores decreased from 26 to 16 (38.46%) with a similar Beck reduction from 32 to 22 (31.25%).

Mr A. returned to the clinic for a second induction 13 months after his first induction ended, noting that his depression had returned and had again been unresponsive to antidepressant approaches. At that time, he was taking amitriptyline, atorvastatin, clonazepam, duloxetine, gabapentin, L-methylfolate, lisinopril, metformin, methylphenidate, quetiapine, tamsulosin, tolterodine, and vortioxetine. He began this second induction again on the NeuroStar device but was switched to Magstim Rapid^2 device after 1 session because of intolerable discomfort. Neither he nor our clinical staff could identify a clear reason that his comfort level dropped so dramatically between courses. The remainder of this course of treatment consisted of 36 sessions on the Magstim Rapid^2 device. The treatment parameters for Magstim were the same as his first induction, with the exception of the stimulation intensity, which was set at 120% of RMT instead of 110% RMT. Subjectively, he reported on his final session feeling slightly better overall than at the start of his second induction, although he also noted that he did not experience the desired reduction in depressive symptoms from TMS as compared with his first induction. Clinically, both the Hamilton and Beck scores decreased from 24 to 20 (16.67%).

Mr A. had a third induction more than 12 months after his second induction concluded. At this time, his medications were unchanged, and his outpatient psychiatrist was recommending electroconvulsive therapy, which he adamantly refused because of fear of cognitive adverse effects. He agreed to a retrial of TMS using a novel device, in this case the Brainsway Deep TMS device. Treatment consisted of 36 sessions over a longer course of 11 weeks as a result of adherence to the evidence-based Deep TMS protocol (21 minutes, 1980 pulses at 18 Hz, 6 cm anterior to motor hotspot, 120% RMT). Subjectively, Mr A. reported a "huge improvement" in mood by the end of his induction and noted that his friends and family noticed an improvement as well. Clinically, Hamilton scores expressed a small reduction from 19 to 17 (10.53%), followed by a more pronounced Beck reduction from 27 to 20 (25.93%).

Of the 3 courses, his treatment on the NeuroStar device trended the most toward a full response, defined as a 50% reduction in score with both HAMD-24 and BDI-II measures. While the NeuroStar course had the most clinically meaningful HAMD-24 score change, all 3 trials contained individual BDI-II data points that were approaching a full response. Subjectively, however, Mr A. felt that his treatment was most effective on the Brainsway Deep TMS device, followed by NeuroStar, and then Magstim Rapid^2. When asked about this, he could not articulate why he felt his experience did not translate to the rating scales we use, but he was certain that his depression was best treated in that order. He ranked comfort and tolerability as Brainsway Deep TMS, followed by Magstim Rapid^2, and then NeuroStar.

To our knowledge, this is the first report of a patient who has undergone 3 separate inductions on 3 separate devices within the same clinic. Although each induction led to an insufficient response as per our depression scales, both the data and, more importantly, Mr A.'s report not only suggest satisfactory clinical response but also reveal differences in efficacy among the devices that warrant further investigation.

Limitations of this report include the narrow scope of 1 case, as well as the large and uncontrollable number of variables affecting each treatment course. There were also varying severities of depressive episodes, medication changes between episodes, and multiple technicians performing sessions across each device. Comparative studies across devices under controlled settings are indicated.

Carter Paul, BS
Berenson-Allen Center
for Noninvasive Brain Stimulation
Department of Neurology
Harvard Medical School
and Beth Israel Deaconess
Medical Center
Boston, MA

Alvaro Pascual-Leone, MD, PhD
Berenson-Allen Center
for Noninvasive Brain Stimulation
and Division of Cognitive Neurology
Department of Neurology
Harvard Medical School and Beth
Israel Deaconess Medical Center
Boston, MA

Adam P. Stern, MD
Berenson-Allen Center for
Noninvasive Brain Stimulation and
Division of Cognitive Neurology
Department of Neurology
and Department of Psychiatry
Harvard Medical School
and Beth Israel Deaconess
Medical Center
Boston, MA

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A.P.-L. serves on the scientific advisory boards for Neuronix, Starlab Neuroscience, Neuroelectrics, Constant Therapy, Novavision, and Neosync and is listed as an inventor on several issued and pending patents on the real-time integration of transcranial magnetic stimulation with electroencephalography and magnetic resonance imaging. The other authors declare no competing interests.

The content is solely the responsibility of the authors and does not necessarily represent the official views of Harvard Catalyst, Harvard University and its affiliated academic health care centers, the NIH, the Brain and Behavior Research Foundation, or the Sidney R. Baer Jr Foundation.

REFERENCES

1. O'Reardon JP, Solvason HB, Janicak PG, et al. Efficacy and safety of transcranial magnetic stimulation in the acute treatment of major depression: a multisite randomized controlled trial. *Biol Psychiatry.* 2007;62:1208–1216.
2. Levkovitz Y, Isserles M, Padberg F, et al. Efficacy and safety of deep transcranial magnetic stimulation for major depression: a prospective multicenter randomized controlled trial. *World Psychiatry.* 2015;14:64–73.
3. Carpenter LL, Janicak PG, Aaronson ST, et al. Transcranial magnetic stimulation (TMS) for major depression: a multisite, naturalistic, observational study of acute treatment outcomes in clinical practice. *Depress Anxiety.* 2012;29:587–596.
4. Pena CL. Table of Contents [510 k FDA Web site]. July 31, 2015. Available at: http://www.accessdata.fda.gov/cdrh_docs/pdf15/k150641.pdf. Accessed February 23, 2017.
5. Oliveira-Maia AJ, Garcia-Guarniz AL, Sinanis A, et al. Comparative efficacy of repetitive transcranial magnetic stimulation for treatment of depression using 2 different stimulation devices: a retrospective open-label study. *J Clin Psychiatry.* 2016;77:e743–e744.
6. Hamilton M. A rating scale for depression. *J Neurol Neurosurg Psychiatry.* 1960;23:56–62.
7. Beck AT, Steer RA, Brown GK. Beck Depression Inventory-II. *San Antonio*. 1996;78:490–498.

Intravenous Midazolam as a Diagnostic Test for Catatonia

To the Editor,

We present the case of a 46-year-old Caucasian woman with a history of Hashimoto thyroiditis, total thyroidectomy, and hypothyroidism, who developed a thyroid eye disease that required orbital decompression surgery and steroid treatment at the local general hospital. She had no significant psychiatric history or substance misuse. After receiving 3 doses of prednisolone 500 mg per day intravenously (IV), in addition to oral prednisolone 20 mg per day, she suddenly developed restlessness, agitation, insomnia, and paraesthesia. Within the next few days, she developed auditory hallucinations and delusions of being controlled. Psychiatric assessment suggested that she had steroid-induced psychosis, and she was thus initiated on olanzapine 5 mg per day and diazepam 5 mg per day, and her prednisolone was tapered and discontinued 3 weeks later.

Her mental state progressively worsened. She became withdrawn and uncommunicative and began refusing food, fluids, and medications and neglecting her self-care. A nasogastric tube was inserted for feeding and administering medications, and fluids were administered IV. The psychiatric opinion was that she developed severe psychotic depression. Olanzapine was increased gradually to 15 mg per day, and she had sequential trials of the antidepressants sertraline (up to 150 mg per day) and venlafaxine (up to 225 mg per day) with no response. Diazepam was discontinued owing to worsening psychomotor retardation. Her computed tomography and magnetic resonance imaging head scans were unremarkable.

The patient's condition deteriorated over the following weeks, and she became mute and had a blunted affect. She was minimally mobile and doubly incontinent. She repeatedly pulled out her nasogastric tube, and thus, it was replaced with a percutaneous endoscopic gastrostomy tube, 3 months after the onset of her symptoms. In preparation for the percutaneous endoscopic gastrostomy procedure, she received midazolam 2 mg IV, as per the local protocol. Midazolam is a parenteral benzodiazepine with rapid onset and short duration of action compared with other benzodiazepines, which is usually used before surgical operations or invasive procedures.

The administration of IV midazolam was associated with rapid, but transient, resolution of the patient's symptoms. She became more alert and aware of her surroundings. Her mood brightened up, and she spoke spontaneously and interacted with nursing staff. However, her symptoms completely relapsed by the end of the procedure half an hour later. The dramatic response to midazolam pointed to a diagnosis of catatonia, and subsequently, bilateral electroconvulsive therapy (ECT) was recommended.

After the patient had her first ECT, her speech and movement minimally improved. She had her second ECT 3 days later, after which her symptoms dramatically subsided. She was assessed as having made full recovery on the same day, with no evidence of any active psychopathology. Symptomatic and functional recovery was maintained when the patient was interviewed 7 months after the ECT treatment.

A PubMed and Google Scholar search (last run in June 2017), using the key terms *midazolam* and *catatonia*, revealed 5 case reports where the diagnosis of catatonia was confirmed after response to midazolam, which was in the majority of cases administered incidentally.[1–5]

The delayed diagnosis of catatonia in this case, and in the cases revealed by the literature search, supports the view that catatonia is under-recognized in clinical practice. Although catatonia is known to respond to treatment with benzodiazepines, this case adds to the limited evidence particularly supporting the use of midazolam. However, the patient's response to ECT is in line with the existing evidence.

The dramatic resolution of catatonia with IV midazolam potentially justifies its use as a diagnostic test, albeit the parenteral administration, the short duration of action, and the necessary monitoring for respiratory depression could limit its use as a standard treatment.

Feras Ali Mustafa, MD
Northamptonshire Healthcare NHS Foundation Trust
Campbell House
Campbell Square
Northampton, United Kingdom
feras.mustafa@nhft.nhs.uk

The author has no conflicts of interest or financial disclosures to report.

REFERENCES

1. DeLisle JD. Catatonia unexpectedly reversed by midazolam. *Am J Psychiatry.* 1991;148:809.
2. Morena G, Sunderland B, Billig N. Midazolam and the treatment of catatonia in major depression in an older adult. *Psychosomatics.* 1994;35:392–395.
3. Aloysi AS, Popeo DM, Kellner CH. Cases of catatonia on an academic electroconvulsive therapy service: lessons to learn. *J ECT.* 2011;27:259–261.
4. McDonald LV, Liskow BI. Reversal of catatonia with midazolam. *Jefferson J Psychiatry.* 2011;10:10.
5. Peng TJ, Patchett ND, Bernard SA. Takotsubo cardiomyopathy and catatonia in the setting of benzodiazepine withdrawal. *Case Rep Cardiol.* 2016;2016:8153487.

Successful Electroconvulsive Therapy for a Patient With McArdle Disease

To the Editor:

Electroconvulsive therapy (ECT) is a recommended option for patients with treatment-resistant depression and a high risk of suicide and for other severe mental illnesses. The efficacy of ECT is dependent on the duration of the electrically induced seizure delivered in anesthetized patients. Increased muscular activity during a seizure may produce rhabdomyolysis, especially in patients with hereditary metabolic disorders such as McArdle disease.

McArdle disease, also known as glycogen storage disease type V (GSD-V), is the most common metabolic myopathy of muscle carbohydrate metabolism, caused by mutations in the *PYGM* gene on chromosome 11q13, which encodes the muscle glycogen phosphorylase.[1] Patients with GSD-V typically present exercise intolerance, episodic rhabdomyolysis, and the second wind phenomenon. The lack of the glycolytic enzyme is responsible for an inability to use glycogen reserves and is suspected for increasing the risk of hyperkalemia, myoglobinuria, and acute renal failure. Psychiatrists may hesitate to perform ECT on patients with such somatic risks.

Here, we first demonstrate the safety and the efficacy of ECT in a patient with GSD-V, using anesthesia with rocuronium-sugammadex.

CASE REPORT

A French 67-year-old man with a history of GSD-V was admitted in our department with a first episode of severe and refractory major depression. The patient underwent a short-term series of bitemporal ECT after the failure of 5 trials of antidepressant drug and a course of 20 high-frequency repetitive transcranial magnetic stimulation sessions. An anesthetist and nephrologist evaluated the patient before ECT. Because

succinylcholine is contraindicated in this case, relaxation would be achieved with rocuronium, a rapid-acting neuromuscular blocking agent, followed by sugammadex as its reversal agent. As recommended, the adductor pollicis train of four (TOF) ratio using kinemyography (TOF-Watch; Avalon-Medical AS, Oslo, Norway) and a CPK dosage were performed before and after ECT.[2]

All sessions of ECT were performed in our ECT unit. For the first treatment, anesthesia was induced with propofol (2 mg/kg). Rocuronium was given with an incremental dose to obtain the TOF ratio of 0% (rocuronium, 16 mg/kg). Thereafter, we administered ECT with a custom-modified MECTA spECTrum 5000Q device (MECTA Corp, Tualatin, Oregon). The patient did not show any clinical signs of convulsion, but we recorded satisfactory EEG seizure in terms of duration, ictal EEG amplitude, intensity, and symmetry. Immediately after the seizure stopped, sugammadex was gradually administered. After 2 minutes, TOF ratio was 100%. Anesthesia was prolonged with additional propofol in the post-ictal period while waiting for full reversal of neuromuscular blockade. CPK was recorded before (577 UI/L) and after (931 UI/L) ECT, showing a short elevation. However, kidney function remained stable with preventive intravenous hydration. On awakening, the patient had no complaints. Twelve sessions of ECT were performed twice weekly under these conditions, and the patient's depressive state dramatically improved, allowing him to leave the hospital, without complications.

DISCUSSION

To the best of our knowledge, this is the first report about the use of ECT for a patient who is experiencing severe depression and a comorbid McArdle disease.

McArdle disease represents certainly the paradigm of exercise intolerance and a debilitating illness. This inherited disorder worsens quality of life for patients, in all domains when compared with the general population,[3] and may be related to an increased risk of depression. Moreover, the antidepressant management has proven difficult in some cases where using venlafaxine has been suggested to be related to acute renal failure.[4] Our report shows that ECT was safe with careful pre-ECT evaluation and prophylaxis.

Ideally, general anesthesia for ECT should provide rapid induction and recovery, with few adverse effects and seizure durations of at least 20 seconds. Usually, succinylcholine is commonly administered as the muscle relaxant, but rocuronium as a safe alternative for ECT, when succinylcholine is contraindicated.[5] However, sugammadex is not systematically used to reverse the neuromuscular blockade because it is either not available,[5] or deemed to be too expensive for routine use. Therefore, it may be necessary to prepare for maintenance of anesthesia while waiting for the patient to be reversible. In our case, other neuromuscular blockade agents could not be considered because of their pharmacokinetics, particularly the duration of onset. Moreover, higher doses of rocuronium were administered to ensure perfect neuromuscular blockade, allowing a perfect hemodynamic and respiratory stability with lower time of recovery.

We conclude that rocuronium associated with sugammadex for ECT is safe and should be a treatment option in cases where use of succinylcholine is contraindicated. In addition, this case report highlights the importance of careful evaluation of patients with GSD-V in liaison with other specialties and precautions during ECT.

Francois-Xavier Robert, MD
Pauline Modica, MD
Department of Anesthesiology
Sainte Marguerite University Hospital
Marseille, France

Guillaume Lagrange, MD
Department of Psychiatry
Sainte Marguerite University Hospital
Marseille, France

David Delahaye, MD
François Prima, MD
Philippe Vilcoq, MD
Jacques Albanese, MD
Department of Anesthesiology
Sainte Marguerite University Hospital
Marseille, France

Christophe Lançon, MD, PhD
Raphaëlle Richieri, MD, PhD
Department of Psychiatry
Sainte Marguerite University Hospital
Marseille, France
Aix-Marseille University
EA 3279 Self-Perceived Health Assessment
Research Unit
Marseille, France
raphaellemarie.richieri@ap-hm.fr

The authors have no conflicts of interest or financial disclosures to report.

REFERENCES

1. McArdle B. Myopathy due to a defect in muscle glycogen breakdown. *Clin Sci*. 1951;10:13–35.
2. Hamaguchi S, Tezuka N, Nagao M. Rocuronium and sugammadex under TOF monitoring on mECT. *J Anesth*. 2015;29:815.
3. Munguía-Izquierdo D, Santalla A, Lucia A. Cardiorespiratory fitness, physical activity, and quality of life in patients with McArdle disease. *Med Sci Sports Exerc*. 2015;47:799–808.
4. Torner S, Tinel C, Soltani Z, et al. Rhabdomyolysis with acute renal failure requiring dialysis in mcardle disease: a role for the antidepressant venlafaxine? *J Clin Psychopharmacol*. 2016;36:406–408.
5. Bryson EO, Aloysi AS, Katz M, et al. Rocuronium as muscle relaxant for electroconvulsive therapy in a patient with adult-onset muscular dystrophy. *J ECT*. 2011;27:e63–e64.

The Use of Ultrabrief Left Unilateral Electroconvulsive Therapy in a Patient With Cerebral Aneurysms and Right-Sided Encephalomalacia and Stroke
A Case Report

To the Editor:

We are presenting a case of a 50-year-old right-handed woman with a long-standing history of major depressive disorder. In 2002, she underwent 2 brain surgeries with trial of clipping of 2 aneurysms in basilar and anterior communicating arteries. However, she developed brain edema during the procedure. She had a third successful endovascular surgery in 2003, where she had coiling of her aneurysms; however, it was complicated by ischemic stroke on the right side, resulting in encephalomalacia. Patient's ischemic stroke affects mainly her cognitive functions. Patient's quality of life has been declining, and she became disabled because of severe depressive symptoms in the context of borderline cognitive impairment per clinical and neuropsychological assessments. Patient presented to our interventional clinic for further treatment of medication-resistant depression. Her baseline PHQ-9 (9-item Patient Health Questionnaire) was 21, the CGI (Clinical Global Impression) of severity of illness was 6/7, and the MOCA (Montreal Cognitive Assessment) was 23.

DESIGN AND METHODS

After we carefully assessed and evaluated the benefits and risks of electroconvulsive therapy (ECT), we offered the patient ECT to treat her refractory depression. She underwent left unilateral (LUL) ECT rather than right unilateral (RUL) procedure because of her underlying brain pathology. We hypothesized that using ultrabrief (UB) pulse width will decrease the risk of significant impairment in cognitive functions associated with LUL ECT.

ECT Prescription

Thymatron System IV (Somatics, LLC, Lake Bluff, IL) was used to deliver ECT treatments. After initial determination of seizure threshold, a course of LUL UB was started with energy setting of 6 times more than her seizure threshold of 10%. Average charge delivered 49.8 mC, current range 0.75 to 0.89 A, stimulus duration was 5.2 to 7.1 seconds, dynamic impedance was 250 to 380 Ω, frequency was 20 Hz, and the pulse width was 0.25 millisecond. Patient had an average response of 30.1 seconds of electromyographic seizure and 43.5 seconds of electroencephalographic seizure. She received a total of 10 ECT treatments 3 days per week, distributed over 3 weeks. During ECT treatments, her immediate post-ECT blood pressure was acceptable with maximum systolic pressures generally ranging from 130 to 140 mm Hg, with average mean blood pressure of 90 mm Hg. We used esmolol, an ultrashort-acting β-blocker to minimize potential cardiovascular adverse events in the first 5 minutes postictally.

RESULTS

Following the series of 10 ECT treatments, the patient had a full remission from her depression. The CGI score of improvement was 1/7, the PHQ-9 score went down to 3, and the MOCA score was 22 (indicating essentially no change in cognitive functions).

DISCUSSION

This patient underwent LUL ECT instead of the standard RUL ECT because of her previous history of 2 craniotomies on the right side and right-sided stroke, consequently leading to encephalomalacia, which would jeopardize the response to RUL ECT (Fig. 1).

The major concern of utilizing ECT is the potential impact on cognitive functions especially retrograde amnesia. Thus, clinicians are performing RUL ECT over the standard bilateral ECT to reduce the potential cognitive adverse effect. Moreover, LUL ECT is associated with substantial impairment in cognitive (especially verbal and visual memory) and language functions compared with RUL lead placement. Therefore, clinicians refrained from performing LUL ECT.

Autobiographical memory impairment is reduced when using brief pulse ECT rather than sine wave (unilateral vs bilateral ECT, respectively) and also by titrating the dose of the treatment according to each patient seizure threshold. Ultrabrief pulse width modification (<0.5 millisecond) for RUL has been associated with a lower cognitive adverse effect. However, there are some debates with regard to the therapeutic benefits of UB ECT. For example, the efficacy of bilateral ECT with UB pulse did not differ from placebo. Thus, UB modification is limited to RUL lead placement. To this date, we have not found any research evaluating the safety or the efficacy of LUL ECT, with UB modification.

Prudence dictates caution when delivering ECT to patients diagnosed as having cerebral aneurysms because ECT can trigger a transient surge in blood pressure, which may increase the wall tension of the aneurysm, thus hypothetically raising the chances for the aneurysm to rupture. Yet, there are no case reports of ruptured cerebral aneurysms following ECT. In general, ECT has been shown to have favorable outcome when used in patients with poststroke depression with emphasis on its safety even in acute poststroke period. There is a case report of acute thromboembolic stroke immediately following ECT in a 44-year-old woman who had no significant medical history other than major depression. There are 9 cases reported of absence of rupture of cerebral aneurysm in association with ECT. Four cases received ECT with no complications. There are 5 cases who either had rupture of aneurysm reportedly unrelated to ECT, then followed by repair or underwent repair of their aneurysm before ECT. Those 5 cases did not experience any complications related to ECT or their repaired cerebral aneurysms. In addition, there is a case report of a 34-year-old woman who underwent a course of 8 ECT sessions, which was initiated 6 days after a balloon-assisted embolization of a 7-mm aneurysm. After our literature reviews, we have not found reports on the safety of LUL ECT for patients with cerebral aneurysm.

In summary, this is a report of a depressed woman with history of 2 brain aneurysms and a right-sided stroke with secondary encephalomalacia. The patient safely and successfully responded to a series of uncommon LUL ECTs, with UB pulse width modification that did not impact her MOCA scores; as such, this suggests minimal effect on her preexisted borderline cognitive impairment.

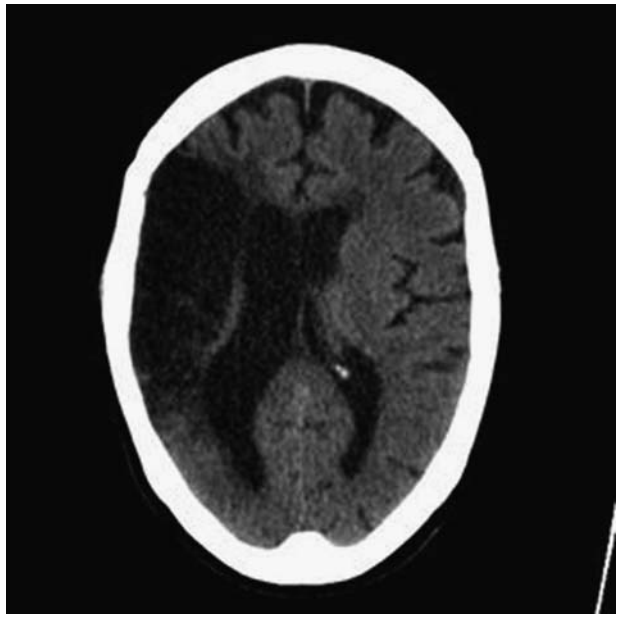

FIGURE 1. Follow-up MRI showing right-sided encephalomalacia.

Ahmed Z. Elmaadawi, MD
Interventional Psychiatry Division
Beacon Health System–Behavior Health
Indiana University School of
Medicine–South Bend Campus
South Bend, IN
aelmaada@iupui.edu

Shady I. Mashaly, MD
Interventional Psychiatry Division
Beacon Health System–Behavior Health
South Bend, IN
Department of Psychiatry
Mansoura University College of Medicine
Mansoura City, Egypt

Suhayl Nasr, MD
Interventional Psychiatry Division
Beacon Health System–Behavior Health
Indiana University School of
Medicine–South Bend Campus
South Bend, IN

The authors have no conflicts of interest or financial disclosures to report.

Bifrontal Electroconvulsive Therapy in a Patient With Subcallosal Cingulate Deep Brain Stimulation for Depression

To the Editor:

In recent years, various forms of psychosurgery have been explored as potential treatments for refractory major depressive disorder.[1] Rather than ablating brain tissue, deep brain stimulation (DBS) has been shown to create a functional lesion and is therefore optimally suited as a surgical intervention for certain neurological and psychiatric conditions. Based on clinical, postmortem, and neuroimaging results, the subcallosal cingulate (SCC, also referred to as Brodmann area 25 or Cg25) is the region most thoroughly studied in treatment-refractory depression.[2]

Although there are reports of the safe use of electroconvulsive therapy (ECT) in patients with DBS in movement disorders, this is the first report we are aware of in a case of SCC DBS for treatment-refractory depression.

Ms B. is a 56-year-old woman with a diagnosis of severe treatment-refractory depression since 1994. Over the years, although there would be brief episodes of improvement, she had chronic neurovegetative features and suicidal ideations. She received numerous medication trials, individual cognitive-behavioral therapy, group therapy, and 5 courses of ECT until 2005 (3 of the courses continued with outpatient maintenance ECT treatments up to 1 year in duration).

In 2006, she enrolled in an open-label trial for SCC DBS for treatment-refractory depression.[3] Response to high-frequency stimulation (130-Hz) DBS treatment varied through the years, but complete remission of the depression symptoms remained elusive. Because of the partial response to treatment and repeated implantable pulse generator (IPG) replacements related to battery drain, in 2014, the IPG was replaced with a Brio™ Rechargeable IPG (St Jude Medical, St. Paul, MN).

Unfortunately, despite pharmacotherapeutic adjustments, her mood state declined very significantly in 2016 after the death of a parent, supportive psychotherapy, and maintenance of optimal DBS parameters. In February 2016, she was admitted to a nonhospital residential facility and had 3 bifrontal ECT treatments. Her course had to be interrupted when she developed a right-arm axillary vein thrombosis. She was started on long-term anticoagulation therapy with rivaroxaban because of a prior pulmonary embolus in 2008.

Her mood improved temporarily but then progressively deteriorated with suicidal ideations, ultimately requiring readmission to our hospital for a full course of ECT in early 2017.

ECT was initiated following the British Columbia provincial guidelines.[4] Pre-ECT workup included baseline electrocardiogram, complete blood count, differential, electrolyte panel, liver functions, and creatinine. Computed tomography of the brain scan was done prior to the ECT, which confirmed DBS placement. Beck Depression Inventory demonstrated a score in the "severe depression" range. Pre-ECT cognition screen was normal. Anesthesia consultation was obtained.

She was maintained on aripiprazole 4 mg 3 times a day, paroxetine 60 mg daily, trazodone 300 mg at bedtime, dextroamphetamine 25 mg in the morning, and 5 mg at noon through the ECT course because these medications were felt to be symptomatically helpful. Other medications included rivaroxaban (dose halved the day before and morning of ECT as suggested by hematology), hydrochlorothiazide, levothyroxine, pantoprazole, and tramadol for chronic pain.

The patient was hyperventilated with Po_2 94% at 4 L/min. Methohexital 120 mg was the induction agent used with succinylcholine 50 mg as muscle relaxant for all treatments. A mouth guard was used, and the IPG was interrogated immediately pre-ECT to ensure it was turned off before treatments.

The ECT device used was a Somatics Thymatron System IV (Somatics, LLC, Venice, FL). Bitemporal electrode placement was considered, but given the patient's subjective complaints of short-term memory deficits prior to treatment, we decided to proceed with bifrontal placement as in the 3 treatments prior to the axillary vein thrombosis with the hope of less cognitive impairment. We also wondered if bifrontal placement might reduce the charge density in the region of the DBS electrodes and lower potential effects on the DBS electrical system.

Seizure threshold was obtained in the first treatment at 100 mC (20% power on Thymatron, brief 0.5-millisecond pulse width, 0.9-A current), and subsequent treatments were initiated at twice the threshold of 200 mC with gradual upward titration based on duration and seizure electroencephalogram (EEG) quality (bilateral frontopolar EEG was monitored through ECT-induced seizure).

The patient received a total of 13 treatments, with the last 2 treatments at 500-mC charge (100% power on North American Thymatron, 0.5-millisecond pulse width, 70 Hz, 8 seconds, 0.9 A). Except for 2 treatments resulting in brief seizures of 15 and 18 seconds, all others demonstrated EEG seizure durations from 20 to 46 seconds with good postictal suppression. Overall, tolerance of ECT was good, although by the 10th treatment, she expressed some subjective concerns of worsened short-term recall but was willing to continue. By the 13th treatment, with ongoing cognitive concerns and no evidence of persistent mood improvement, ECT was stopped.

The DBS device was turned back on to high-frequency stimulation with no evidence of damage to the machine from the ECT delivery. Montreal Cognitive Assessment screen at 1 month after ECT was 28/30, unchanged from the pre-ECT screen. Ms B. remained in hospital for the next month for medication adjustments and supportive psychotherapy during which the suicidal ideations subsided, and she was discharged home to the care of her outpatient psychiatrist.

The ECT team at UBC Hospital has previously reported on using ECT in a case with bilateral pallidal DBS for treatment of dystonia.[5] We believe that this case is the first documented safe use of ECT in a patient with SCC DBS. This patient received a total of 16 treatments utilizing a bifrontal placement (3 prior to hospitalization and 13 during inpatient course) with no adverse effects linked to the DBS location. The electrical charge from ECT did not result in any damage to the DBS device, including 2 treatments at 500-mC charge (100% on Thymatron).

Given that the target for DBS for treatment-refractory depression remains unclear, and many individuals report partial response, it may be increasingly important that clinicians understand the compatibility of these 2 potentially lifesaving therapies.

Joseph Chun Wearn Tham, MD, FRCP(C)
Andrew Howard, MD, FRCP(C)
Magdalena Ilcewicz-Klimek, MD, FRCP(C)
Trevor A. Hurwitz, MBChB, FRCP(C)
BC Neuropsychiatry Program
UBC Hospital, and Neurostimulation Program
Vancouver General Hospital
Vancouver, British Columbia
Canada
drjoe@shaw.ca

The authors have no conflicts of interest or financial disclosures to report.

REFERENCES

1. Temel Y, Lim LW. Neurosurgical treatments of depression. *Curr Top Behav Neurosci*. 2013;14:327–339.
2. Mayberg HS, Lozano AM, Voon V, et al. Deep brain stimulation for treatment-resistant depression. *Neuron*. 2005;45:651–660.
3. Lozano AM, Giacobbe P, Hamani C, et al. A multicenter pilot study of subcallosal cingulate

area deep brain stimulation for treatment-resistant depression. *J Neurosurg*. 2012;116:315–322.

4. Mental Health Evaluation and Community Consultation Unit for the Ministry of Health Services of British Columbia. Available at: http://www.health.gov.bc.ca/library/publications/year/2002/MHA_ect_guidelines.pdf. Accessed May 1, 2017.
5. Vila-Rodriguez F, McGirr A, Tham J, et al. Electroconvulsive therapy in patients with deep brain stimulators. *J ECT*. 2014;30:e16–e18.

Catatonia Misdiagnosed as Dementia

To the Editor:

Catatonia is an abnormality of movement with that medical diagnosis clinically determined by examination of an affected individual.[1] Three of 12 criteria in the *Diagnostic and Statistical Manual of Mental Disorders*, *Fifth Edition*, define the diagnosis.[2] Recognition of catatonia and differentiation from dementia are important because although there usually are effective treatments for catatonia,[3] there is no cure for most people with dementias. Perseverations of speech, rigidity, mannerism, behavioral stereotypy, and abnormal posture are features suggestive of a catatonic diagnosis. Dementia is characterized by a wide range of signs and symptoms associated with a decline in cognitive and executive functions, language, and complex motor skills.[4] Many different neuropathologies can cause a person to become demented. Cognitive deterioration eventually can affect a person's ability to perform daily activities, simulating catatonia.

CLINICAL VIGNETTE

A 53-year-old man with a history of schizoaffective disorder, bipolar type; alcohol use disorder; and dementia was hospitalized in transfer from another facility where he was currently diagnosed as having a dementia. After the initial assessment, the patient was admitted to the psychiatric service. He was confused on admission, disorganized, intrusive, and yelling. The patient was oriented only to himself. Without his clothes, he stood naked in child-like behavior with a wide base gait. He was unkempt, disheveled, inattentive, with poor concentration, and a flat affect. Reportedly, he had previously failed to respond to clozapine and other antipsychotic drugs and was now refusing medication.

Perseveration, rigidity, mannerism, behavioral stereotypy, and abnormal postures were signs suggestive of catatonia. Lorazepam pharmacotherapy was initiated but was not helpful. The patient then agreed to undergo electroconvulsive therapy (ECT) as a treatment for the catatonia.

Seven inpatient ECT sessions were administered without complications. After the ECT, his cognition improved. No longer yelling, he became calm and cooperative. Speech became clear and gait improved. He denied hallucinations. Oral aripiprazole was prescribed and switched to a maintenance injection format once the oral form was well tolerated. Thought processes were well organized. At discharge, the patient was appropriately dressed, calm, cooperative, fluent in speech, cheerful, and with a congruent, full affect. Referred to a rehabilitation facility, future treatment recommendations included ECT, if needed.

DISCUSSION

Although patients with catatonia often present with catalepsy and waxy flexibility and these 2 common symptoms can prompt diagnostic consideration for catatonia, only 3 of the following 12 criteria are enough for catatonia diagnosis: stupor, catalepsy, waxy flexibility, mutism, negativism, posturing, mannerism, stereotypy, agitation, grimacing, echolalia, and echopraxia.[2]

Benzodiazepine pharmacotherapy is often effective and usually the first selected treatment option. When this medicine is not efficacious, ECT is frequently indicated and a dramatically powerful intervention for patients with catatonia. Beyond benzodiazepine and ECT catatonia treatment options, other alternative therapies are individualized and management of coexistent conditions is provided as indicated. Always attend to hydration, nutrition, mobility, thrombosis prevention, and related aspects of patient care.

Cuneyt Tegin, MD
George Kalayil, MD
Steven Lippmann, MD
Department of Psychiatry and Behavioral Sciences
University of Louisville
Louisville, KY
cuneyt.tegin@louisville.edu

The authors have no conflicts of interest or financial disclosures to report.

REFERENCES

1. Bhati MT, Datto CJ, O'Reardon JP. Clinical manifestations, diagnosis, and empirical treatments for catatonia. *Psychiatry (Edgmont)*. 2007;4:46–52.
2. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Arlington, VA: American Psychiatric Publishing; 2013:119. ISBN 978-0-89042-555-558.
3. Taylor MA, Fink M. Catatonia in psychiatric classification: a home of its own. *Am J Psychiatry*. 2003;160:1233–1241.
4. American Speech-Language-Hearing Association. Dementia. Available at: http://www.asha.org/PRPSpecificTopic.aspx?folderid=8589935289&section=Signs_and_Symptoms. Accessed June 9, 2017.

Electroconvulsive Therapy in a Patient With Ultrarapid Cycling Bipolar Disorder: A Case Report

To the Editor:

Rapid cycling (RC) within bipolar disorder (BD) is usually defined as having 4 or more mood disturbance episodes within a 1-year span. When RC occurs, the treatment of BD is considered as even more difficult. There is no clear consensus with respect to the optimal pharmacological management of RC in the established guidelines. Mostly lithium and/or valproate, often in combination with an atypical antipsychotic and lamotrigine as an alternative, is recommended. Furthermore, based on case reports, the use of electroconvulsive therapy (ECT) is suggested in cases of treatment-resistant RC.

Ultrarapid cycling (URC) in BD is a subcategory of RC, which is defined as a spectrum of cycling frequencies with distinct, clinically robust mood shifts, that occur at frequencies within the course of weeks to several days.[1,2] Treatment recommendations for URC are based on case reports only.

Here we report the case of a young female patient with treatment-resistant URC, who was successfully treated with ECT: a 21-year-old female patient was admitted to our clinic as an in-patient for the first time and presented with a severe depressive syndrome featuring depressed mood, loss of interest in everyday activities, loss of energy, psychomotor retardation, insomnia, and difficulties to concentrate. These symptoms had already persisted for 3 months and were accompanied by severe daytime fatigue, feeling hopeless and worthless, and thoughts of committing suicide. The patient reported that the depressive state has been discontinued by about 5 phases, lasting approximately 3 days of experiencing euphoric mood, reduced need of sleep, expanded self-esteem, and many ideas flitting in her mind. In these periods, she had been more talkative and her interest in sexual contacts had

increased. Psychotic symptoms were not present throughout the whole course of illness. Psychiatric history revealed no manifest previous episodes, but subclinical depressed mood swings because she was 14 years old. No family history of psychiatric disorders was reported. A substance use disorder also could be excluded. In addition, Structured Clinical Interview for DSM-IV-I and -II interviews were performed, to rule out any other psychiatric disorders and any personality disorder. To rule out any organic disorders, we performed laboratory analyses, electrocardiogram, electroencephalogram, and cranial magnetic resonance imaging as well as analyses of the cerebrospinal fluid. These examinations did not reveal any evidence of an organic cause of the described psychiatric symptoms. The patient was diagnosed with URC bipolar II disorder. Therefore, we initially treated the patient with lithium, which had to be replaced after some days owing to severe and intolerable gastrointestinal adverse effects with extended release quetiapine, which was subsequently increased up to 600 mg per day without relevant adverse effects, but also did not show any significant alleviation of the patient's symptoms. For that reason, we augmented quetiapine after 4 weeks with aripiprazole (up to 5 mg/d; stopped because of severe akathisia and agitation) and after that with levothyroxine (up to 300 μg/d). After approximately 2 months of unsatisfactory results, we restarted lithium again. This time, the patient tolerated the medication and it was given for 4 weeks with adequate serum levels (around 0.8 mmol/L). Unfortunately, also the combination of lithium with quetiapine neither improved the depressive symptoms nor the rapidly changing mood. After altogether 15 weeks of unsuccessful and frustrating psychopharmacological treatment, we offered a course of ECT to the patient, which she agreed. Electroconvulsive therapy was performed right unilaterally starting at 5% (25.2 mC), and then, stimulation dose at subsequent treatments was given at 2.5 times the seizure threshold using a stimulus duration of 7.5 seconds, pulse width of 1 millisecond, and a frequency of 60 Hz (Thymatron IV device, Somatics, LLC, Lake Bluff, Ill). We administered 200 mg of thiopental as anesthetic agent. Concurrent psychotropic medication was paused for the duration of the ECT. In total, the patient received 6 ECT sessions within 2 weeks, and full remission of the symptoms could be achieved, while no clinically significant adverse effects occurred. Already after the first ECT, the symptoms improved markedly and the mood stabilized. After the final ECT session, mood-stabilizing medication was restarted, consisting of quetiapine (300 mg/d) and lamotrigine (75 mg/d). After 3 further weeks on our ward, the patient could be discharged successfully.

This is to our knowledge the first report of a patient suffering from de novo URC, who was successfully treated with ECT. Another case was published, in which the patient developed URC due to the cessation of lithium before ECT, where ECT resolved the URC symptoms.[3] Although URC is for sure not a very common phenomenon in BD, which is reflected by the disregard of this state by the common classification and diagnostic tools, such as *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition* and *Fifth Edition* and *International Statistical Classification of Diseases*, *10th Revision*, and data about epidemiology, aetiology, and treatment recommendations are sparse, it seems worthwhile to add clinical experience concerning the treatment of URC. This is even more valid nowadays, when valproate, which had at least some evidence to be moderately effective in RC and URC, is rightly prescribed more restrictive to women of childbearing age owing to the increased risk of negative outcomes for children after exposure in utero. Other authors also reported successful treatment of URC with lamotrigine and quetiapine. Electroconvulsive therapy is supposed to possess not only antidepressive, antimanic, anticatatonic, and antipsychotic properties but also mood-stabilizing properties,[4] which makes ECT an alternative to the establishes substances not only for acute phases, but also for maintenance treatment and for conditions within BD, where mood lability is the major problem, such as RC and at least in our case also URC. It should be noted that, in contrast to its mood-stabilizing effects, ECT itself has also been reported to induce URC in a patient,[5] which could be basically an effect of the strong antidepressive effects of ECT, similar to some antidepressants in BD.

In summary, ECT led to the rapid remission of a state of treatment-resistant URC in a young female patient suffering from BD.

Laura Kranaster, MD
Suna Su Aksay, MD
Department of Psychiatry and Psychotherapy
Central Institute of Mental Health
Medical Faculty Mannheim/Heidelberg University
Mannheim, Germany
laura.kranaster@zi-mannheim.de

Jan Malte Bumb, MD
Christian Wisch, MD
Department of Addictive Behavior
and Addiction Medicine
Central Institute of Mental Health
Medical Faculty Mannheim/Heidelberg University
Mannheim, Germany

Michael Deuschle, MD
Alexander Sartorius, MD
Department of Psychiatry and Psychotherapy
Central Institute of Mental Health
Medical Faculty Mannheim/Heidelberg University
Mannheim, Germany

The authors have no conflicts of interest or financial disclosures to report.

REFERENCES

1. Tillman R, Geller B. Definitions of rapid, ultrarapid, and ultradian cycling and of episode duration in pediatric and adult bipolar disorders: a proposal to distinguish episodes from cycles. *J Child Adolesc Psychopharmacol.* 2003;13: 267–271.
2. Kramlinger KG, Post RM. Ultra-rapid and ultradian cycling in bipolar affective illness. *Br J Psychiatry.* 1996;168:314–323.
3. Huber JP, Burke D. ECT and lithium in old age depression — cause or treatment of rapid cycling? *Australas Psychiatry.* 2015;23:500–502.
4. Medda P, Toni C, Perugi G. The mood-stabilizing effects of electroconvulsive therapy. *J ECT.* 2014; 30:275–282.
5. Zavorotnyy M, Diemer J, Patzelt J, et al. Occurrence of ultra-rapid cycling during electroconvulsive therapy in bipolar depression. *World J Biol Psychiatry.* 2009;10:987–990.

General Anesthesia for Electroconvulsive Therapy in a Patient With Systemic Mastocytosis

To the Editor:

Previously, we reported the safe anesthetic management of a patient with urticaria pigmentosa receiving electroconvulsive therapy (ECT).[1] In this letter, we report the safe anesthetic management of a patient with systemic mastocytosis, a more severe form of the disease, referred for ECT.

Patients with systemic mastocytosis typically report a history of symptoms related to mast cell degranulation ranging from episodes of flushing, pruritus, urticaria, nausea, vomiting, and diarrhea, to dyspnea and even episodes of anaphylactoid shock. Although the cause of shock in patients with systemic mastocytosis is a non–immunoglobulin E–mediated immediate hypersensitivity reaction and not a true allergic disorder, it is responsive to epinephrine,[2] and most patients with systemic mastocytosis are encouraged to carry an EpiPen (Mylan

Pharmaceuticals, Basking Ridge, NJ) in case of inadvertent exposure to triggering agents. The more severe attacks may be life threatening, involving palpitations, tachycardia, hypotension and syncope, or shock, leading to cardiac arrest. Triggers include all histamine-releasing medications, as well as some medications that are not known to result in histamine release, many of which are commonly used during the course of anesthetic administration. The risk of perioperative anaphylaxis is estimated to be 1 in 10,000 to 1 in 20,000 anesthetic procedures in the general population[3] and thus likely significantly higher in patients with mastocytosis.

Patients with systemic mastocytosis are commonly prescribed prophylactic H1 and H2 receptor antagonists, with diphenhydramine as needed, for breakthrough degranulation; these medications are typically continued during the course of ECT. Even in the properly prepared patient, avoidance of potential triggering agents is essential. If potential triggering agents cannot be avoided, judicious use and increased vigilance are mandatory. Historically, the nondepolarizing neuromuscular agents have been recommended as the relaxants of choice in patients with systemic mastocytosis, because of minimal histamine release. In ECT, however, because of the short duration of the procedure, succinylcholine is the agent of choice for the clear majority of patients.[4] The use of succinylcholine in patients with systemic mastocytosis is a concern because of the potential for histamine release, but rocuronium, either at full dose followed by reversal with sugammadex or at a reduced dose followed by reversal with neostigmine, is an acceptable alternative. The choice of hypnotic agent allows flexibility because all the induction agents commonly used for ECT are considered acceptable.

In this case, a 41-year-old, 83-kg man with a history of systemic mastocytosis characterized by frequent "fainting spells" responsive only to epinephrine was referred for ECT. By self-report, a single injection from his EpiPen (300 μg epinephrine) has not been an effective treatment, so he carries 2 injectors at all times. This is despite being maintained on multiple prophylactic medications including cetirizine (10 mg daily), ranitidine (150 mg twice daily), fexofenadine (180 mg twice daily), cromolyn sodium (200 mg thrice daily), and diphenhydramine (50 mg as needed). His most recent anaphylactoid episode was reportedly within the past year; he also described frequent flushing episodes responsive to diphenhydramine in the week prior to beginning ECT. His psychiatric history included episodic major depressive episodes since adolescence. His current complaint was a severe, unremitting major depressive episode associated with active suicidal ideation, unresponsive to several trials of antidepressant medications. Medical history also included peptic ulcer disease and migraine headaches. He had received 1 prior anesthetic during a repair of a traumatic injury to his finger. Although the patient reported "being asleep" during the surgery, it was unclear what type of anesthesia had been used. Because of his persistent active suicidal ideation despite antidepressant medication trials, ECT was recommended.

After thorough evaluation and discussion of the risks and benefits of treatment under anesthesia, he consented to a course of ECT with several modifications designed to reduce the risk of triggering an episode. Pretreatment laboratory studies obtained prior to the first ECT were unremarkable, as was an electrocardiogram (normal sinus rhythm).

At the time of treatment, a 20-gauge intravenous needle was inserted into the left antecubital fossa, and a balanced salt solution was infused with the intravenous line running wide open. Immediately before treatment, he received additional prophylaxis with diphenhydramine (100 mg, intravenously). Anesthesia was induced with 120 mg of propofol, and following loss of consciousness, 25 mg of rocuronium (0.3 mg/kg) was administered. Respirations were maintained manually via bag-valve-mask device. After approximately 3 minutes, adequate neuromuscular relaxation had been achieved, as verified by qualitative reduction in response to posterior tibial nerve stimulation. The ECT stimulus was administered at 20% device maximum (100 mC) via bilateral electrode placement, resulting in a generalized grand-mal tonic-clonic seizure of 31 seconds' duration and an electroencephalographic seizure of 51 seconds. Upon spontaneous cessation of seizure activity, 2 mg midazolam was administered along with 5 mg neostigmine, accompanied by 1 mg glycopyrrolate. Train-of-4 neuromuscular monitoring was performed to closely monitor the response to this agent and assess the degree of recovery of motor function. Respirations were maintained manually via bag-valve-mask, and propofol was administered (50-mg bolus every 5 minutes) until spontaneous respirations resumed, 12 minutes later. He tolerated the treatment well, without complications, and reported no periprocedural awareness or residual weakness upon waking. Because his score on the Quick Inventory of Depressive Symptomatology (Self-report) decreased from 18 before treatment to 4 after the first treatment, and clinically he reported complete remission from depression, he received only 1 additional ECT, during which the same protocol was followed.

We continued our patient's longstanding regimen of histamine-blocking medications throughout the course of treatment and added intravenous diphenhydramine immediately prior to each ECT session. During the treatment, intravenous fluid remained running as a precaution, and epinephrine, as well as other resuscitative equipment, was immediately available. We chose propofol as the anesthetic induction agent and opted for a nondepolarizing muscle relaxant, rocuronium, instead of succinylcholine, with reversal of neuromuscular blockade with neostigmine, because sugammadex is not available at our institution. Bilateral electrode placement was chosen over right unilateral placement because of the clinical severity of our patient's psychiatric illness and the desire to minimize the number of exposures to potential triggering agents.[5]

Ethan O. Bryson, MD
Departments of Anesthesiology and Psychiatry
The Icahn School of Medicine at Mount Sinai
New York, NY
ethan.bryson@mssm.edu
ethan.bryson@mountsinai.org

Amy S. Aloysi, MD, MPH
Departments of Psychiatry and Neurology
The Icahn School of Medicine at Mount Sinai
New York, NY

Kate G. Farber, BA
Charles H. Kellner, MD
Department of Psychiatry
The Icahn School of Medicine at Mount Sinai
New York, NY

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REFERENCES

1. Aloysi AS, Ahle GM, Geduldig E, et al. General anesthesia in a patient with urticaria pigmentosa referred for electroconvulsive therapy. *J ECT.* 2016;32:204–206.

2. Dewachter P, Castells MC, Hepner DL, et al. Perioperative management of patients with mastocytosis. *Anesthesiology*. 2014;120: 753–759.

3. Dewachter P, Mouton-Faivre C, Emala CW. Anaphylaxis and anesthesia: controversies and new insights. *Anesthesiology*. 2009;111: 1141–1150.

4. Bryson EO, Aloysi AS, Farber KG, et al. Individualized anesthetic management for patients undergoing electroconvulsive therapy: a review of current practice. *Anesth Analg*. 2017;124: 1943–1956.

5. Kellner CH, Tobias KG, Wiegand J. Electrode placement in electroconvulsive therapy (ECT): a review of the literature. *J ECT*. 2010;26: 175–180.

A 6-Month Follow-up Case Study of Low-Frequency Right Prefrontal Repetitive Transcranial Magnetic Stimulation in Treatment-Resistant Bipolar Depression

To the Editor:

Bipolar disorder is characterized by a high recurrence and inveteracy with neurocognitive dysfunction.[1,2] Longitudinal studies show that a depressive episode lasts much longer than manic or hypomanic episodes. However, there are few proven medications for bipolar depression.

Repetitive transcranial magnetic stimulation (rTMS) has been shown to be effective in major depressive disorder.[3] However, it is unclear whether rTMS is effective in bipolar depressed patients, and the stimulation parameter for those patients has not been clarified.[3] A recent systematic review of rTMS in the treatment of bipolar depression demonstrates that low-frequency right-sided (LFRS) rTMS may be superior to high-frequency left-sided rTMS in the number needed to treat (NNT).[4]

Therefore, in this case study, we delivered LFRS rTMS to patients with bipolar depression who did not respond to any one of the medications recommended by the guidelines of Japanese Society of Mood Disorders. The aims of this case study were to examine changes in severity of depression and cognitive function in treatment-resistant bipolar depression during the 4-week rTMS treatment and 6-month observation periods.

METHODS

Eligible subjects were patients aged 20 to 75 years with a *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, diagnosis of bipolar disorder including types I and II, with a current depressive episode duration of 3 years or less. Patients who had a total score of greater than 18 on the 17-item Hamilton Depression Rating Scale (HDRS) in the current episode and did not respond to any one of lithium (>0.8 mmol/L), quetiapine 300 mg, olanzapine 5 to 20 mg, or lamotrigine 200 mg for at least 8 weeks were enrolled in this study. Medications given to the patients were not allowed to be changed during the entire study. All patients provided written informed consent before undergoing any study procedures. The study was approved by the ethics committee of the National Center of Neurology and Psychiatry.

Repetitive TMS was delivered using a MagPro R30 magnetic stimulator and a Cool-B65 coil (MagVenture A/S, Denmark). Repetitive TMS treatment was applied at 120% motor threshold with 1 Hz over the right prefrontal cortex. Patients received a total of 1800 magnetic pulses for 30 minutes, 5 days a week, for 4 weeks.

Severity of depression was rated with HDRS, Montgomery-Åsberg Depression Rating Scale, Clinical Global Impressions, and Beck Depression Inventory Second Edition. Remission was defined as a total score of 7 or less on the HDRS. Response was defined as a 50% or greater reduction in the HDRS score. To evaluate a manic symptom, various social and cognitive functions in bipolar patients, we used the Young Mania Rating Scale; Social Adaptation Self-evaluation Scale, Japanese version; Sheehan Disability Scale; Brief Assessment of Cognition in Schizophrenia, Japanese version (BACS); and Wisconsin Card Sorting Test (WCST). These measures, except for BACS and WCST, were rated every 2 weeks in the treatment period and then once a month in the observation period, respectively. The BACS and WCST were conducted at baseline, 4 weeks, and 3 and 6 months. All assessments were administered by a trained psychologist.

RESULTS

Three of 4 patients with treatment-resistant bipolar depression completed the entire study. One patient (71 years old, female) discontinued study participation after the 4-week rTMS treatment because she had experienced no change in severity of depression. All the patients had no severe adverse events such as a seizure or treatment-emergent mania/hypomania switches during the trial. Medications given to the patients were as follows: a 70-year-old woman was taking lithium, sodium valproate, quetiapine, and escitalopram; a 50-year-old man was taking lithium, lamotrigine, and quetiapine; a 32-year-old man was taking olanzapine and lithium; and a 71-year-old woman was taking olanzapine and sodium valproate. Those medications were not allowed to be changed during the entire trial.

Three patients (a 70-year-old woman, a 50-year-old man, and a 32-year-old man) achieved remission at week 4, and 2 of them had no clinical deterioration during the observation period. One patient (a 32-year-old man) showed remission at week 4, but his symptoms were exacerbated at month 3. The BACS scores of the 2 patients (a 50-year-old man and a 32-year-old man) were improved after the rTMS treatment. Those changes were especially pronounced in executive function. Three patients (a 70-year-old woman, a 50-year-old man, and a 32-year-old man) improved their performance on the WCST. The demographic and clinical characteristics of patients and all the clinical assessments were shown in Supplementary Tables 1 (http://links.lww.com/JECT/A64) and 2 (http://links.lww.com/JECT/A65).

DISCUSSION

This is the first follow-up case study, to our knowledge, of LFRS rTMS in patients with bipolar depression who do not respond to the medications recommended by the guidelines of Japanese Society of Mood Disorders. We found that LFRS rTMS was well tolerated in combination with lithium, quetiapine, olanzapine, or lamotrigine.

Although there are a limited number of studies to test whether rTMS is effective in patients with bipolar depression, a recent systematic review suggests that rTMS may be a safe and efficacious treatment option for bipolar depression, showing an overall NNT of 6 for clinical response, a high-frequency left-sided rTMS NNT of 7, and an LFRS rTMS NNT of 3.[4] Therefore, we applied LFRS rTMS to bipolar depressed patients in this case study.

Cognitive dysfunction is common in patients with mood disorders including major depressive disorder and bipolar disorder.[2] To date, there are few proven treatments of cognitive dysfunction. A systematic review of the effects on cognition indicates that LFRS rTMS might have a cognitive enhancing potential.[5] In the current study, some patients improved their performance on cognitive functions, and these positive impacts were observed for 6 months after the acute rTMS treatment. These findings suggest that LFRS rTMS might provide a therapeutic benefit to cognitive dysfunction in bipolar patients, although the mechanisms

underlying the effect of rTMS on cognition remain uncertain.

The results of the current study raise the possibility that LFRS rTMS might be a new therapeutic option for cognitive dysfunction and depressed mood in patients with treatment-resistant bipolar depression. However, this study's aim was to use an open-label design without a sham control. Therefore, to confirm the efficacy of rTMS in bipolar depression, further well-designed studies are needed.

Shinsuke Kito, MD, PhD
Department of Psychiatry and
Advanced Medical Technology
National Center Hospital
National Center of Neurology
and Psychiatry
Tokyo, Japan
kito@ncnp.go.jp
shin.kito@gmail.com

Yuki Matsuda, MD, PhD
Yurie Sewaki, MA
Junpei Sekiya, MD
Takeshi Fujii, MD, PhD
Takamasa Noda, MD
Satoru Ikezawa, MD, PhD
Harumasa Takano, MD, PhD
Kanako Nakazawa, PhD
Mami Nomura, MA
Shiori Setoyama, PhD
Department of Psychiatry
National Center Hospital
National Center of Neurology and Psychiatry
Tokyo, Japan

Kazuyuki Nakagome, MD, PhD
National Institute of Mental Health
National Center of Neurology and Psychiatry
Tokyo, Japan

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REFERENCES

1. Perlis RH, Ostacher MJ, Patel JK, et al. Predictors of recurrence in bipolar disorder: primary outcomes from the Systematic Treatment Enhancement Program for Bipolar Disorder (STEP-BD). *Am J Psychiatry*. 2006; 163:217–224.
2. MacQueen GM, Memedovich KA. Cognitive dysfunction in major depression and bipolar disorder: assessment and treatment options. *Psychiatry Clin Neurosci*. 2017;71:18–27.
3. Lefaucheur JP, André-Obadia N, Antal A, et al. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS). *Clin Neurophysiol*. 2014;125: 2150–2206.
4. McGirr A, Karmani S, Arsappa R, et al. Clinical efficacy and safety of repetitive transcranial magnetic stimulation in acute bipolar depression. *World Psychiatry*. 2016;15:85–86.
5. Lage C, Wiles K, Shergill SS, et al. A systematic review of the effects of low-frequency repetitive transcranial magnetic stimulation on cognition. *J Neural Transm (Vienna)*. 2016;123: 1479–1490.

Electroconvulsive Therapy as an Intervention for Autoimmune Neuropsychiatric Disease

To the Editor:

Autoimmune neuropsychiatric disease is a poorly understood phenomenon with a sparse body of literature, and much of the research has focused on neuropsychiatric systemic lupus erythematosus (NPSLE). Electroconvulsive therapy (ECT) may be effective in treatment of refractory cases of NPSLE by stimulating the immune and neurotrophic systems.[1] Electroconvulsive therapy increases levels of brain-derived neurotrophic factor (BDNF),[2] and animal models show that BDNF induces neurogenesis and has antidepressant effects.[1] The following case demonstrates the successful use of ECT to treat refractory autoimmune neuropsychiatric disease.

CASE

A 50-year-old professor of mathematics with no psychiatric or medical history was admitted for treatment of depression, psychotic symptoms, and active suicidal and homicidal ideations. Two months before admission, he endorsed concentration difficulties and a decline in work performance. Shortly after, his depression and suicidal and homicidal ideations developed. According to the patient's wife, he began to ruminate and pace. He would sit in a parked car for up to 12 hours at a time, and he became suspicious of friends. He presented to his local emergency department 3 times complaining of depression.

The patient had a 10-day admission at a local psychiatric hospital and was diagnosed with severe major depressive disorder (MDD) with psychotic features. He was discharged to a partial hospitalization program on olanzapine 15 mg daily and escitalopram 10 mg daily. The patient discontinued his medication, and within 48 hours, his symptoms returned and worsened. Before admission to our service, he had paced throughout his neighborhood all night, and when he returned home, he said to his wife, "You and the children have to get away. The monster is here." Frightened, his wife called a friend, and together, they brought the patient to the emergency department where he was involuntarily admitted to our inpatient facility.

The patient was diagnosed with severe, recurrent major depressive disorder with psychotic features and suicidal and homicidal ideations. The patient was a risk to himself and others and had demonstrated an inability to adhere to an outpatient prescription regimen. Electroconvulsive therapy was indicated, and he began treatment 1 week after admission.

The patient reported a family history of autoimmune illness, and his blood work was positive for antinuclear antibodies with elevated anti-ssDNA and anti-dsDNA. A brain magnetic resonance imaging revealed atrophy and scattered white matter hyperintensities. Neurological consult interpreted possible nonspecific vasculitis and recommended outpatient lumbar puncture after psychiatric stabilization to rule out a central nervous system autoimmune process. Neuropsychological examination was suggestive of frontal subcortical dysfunction without gross decline in cognitive abilities. The rapid onset of the depression and psychotic symptoms, in combination with the imaging and laboratory work, was suspicious for a neurodegenerative autoimmune process, such as NPSLE.

The patient was hospitalized for a total of 25 days and received 9 right unilateral ECT treatments. He also participated in multimodal treatment engaging in individual supportive psychotherapy, milieu therapy with peers, and cognitive behavioral skills training. On discharge, the patient exhibited appropriate insight and judgment and demonstrated resolution of his suicidal and homicidal ideations. He was discharged on lithium 300 mg twice per day, venlafaxine 225 mg daily, and olanzapine 15 mg daily.

DISCUSSION

An acute psychiatric presentation of an autoimmune illness can pose diagnostic and treatment dilemmas. Because this patient was unable to follow an outpatient regimen and his symptoms had worsened, ECT was indicated. When workup of his psychiatric symptoms revealed an underlying autoimmune process, we continued ECT

guided by literature suggesting its efficacy in treating autoimmune disease.

The paucity of literature on the effects of ECT in autoimmune neuropsychiatric disease makes implementing evidence-based treatment difficult. However, case reports of ECT to treat NPSLE promote its use. In one example, a 15-year-old girl developed catatonia, secondary to her NPSLE, so severe that she was transferred to an inpatient rehabilitation institute for 3 months.[3] Her symptoms were refractory to antibiotics, steroids, hydroxycholorquine, antipsychotics, plasmapheresis, and lorazepam. However, after the second ECT treatment, she was able to speak and obey commands. She was discharged home after 6 ECT treatments. She continued with 14 outpatient treatments and had no recurrence of symptoms at a 6-month follow-up.

One mechanism of action for ECT in neuropsychiatric illness may involve modulation of BDNF, a neurotrophic factor implicated in both depression and immune illness. Patients with high NPSLE disease activity have low serum BDNF levels.[4] However, ECT increases BDNF.[2]

Measured doses of inflammation seem to be an essential element to the efficacy of ECT as it influences both the peripheral immune system and microglial cells. Electroconvulsive therapy increases interleukin 6 and tumor necrosis factor-alpha (TNF-alpha) in peripheral blood, demonstrating an inflammatory response. Other evidence shows this response is present after each ECT treatment.[5] However, after an ECT course is completed, TNF-alpha plasma levels are below baseline, suggesting that the chronicity of ECT leads to an overall reduction in cytokine activity.[5]

Reinforcing effects between neurotrophin and the immune system may further promote the therapeutic value of ECT in autoimmune disease. The interleukin 6 and TNF-alpha stimulate BDNF from monocytes, and BDNF is protective against multiple sclerosis, central nervous system damage, and psychiatric symptoms.[1] When microglial cells produce BDNF, gliogenesis and neurogenesis increase.[1]

When our patient was admitted involuntarily, his depression and suicidal ideation provided the greatest threats to his safety, and ECT was indicated. As we uncovered an autoimmune process underlying his psychiatric presentation, we continued ECT, although with a different understanding: ECT can been successful in treating autoimmune psychiatric conditions. Suggested mechanisms include the increase in serum BDNF, an overall decrease in cytokine activity, and an increase in neurogenesis and gliogenesis.

Peter Chamberlin, BFA
Nabil Kotbi, MD
Pablo Sanchez-Barranco, MD
Laura Kragt, PA
Dora Kanellopoulos, PhD
Weill Cornell Medicine
New York, NY
pdc2002@med.cornell.edu

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REFERENCES

1. van Buel EM, Patas K, Peters M, et al. Immune and neurotrophin stimulation by electroconvulsive therapy: is some inflammation needed after all? *Transl Psychiatry*. 2015; 5:e609.
2. Bocchio-Chiavetto L, Zanardini R, Bortolomasi M, et al. Electroconvulsive therapy (ECT) increases serum brain-derived neurotrophic factor (BDNF) in drug resistant depressed patients. *Eur Neuropsychopharmacol*. 2006; 16:620–624.
3. Mon T, L'Ecuyer S, Farber NB, et al. The use of electroconvulsive therapy in a patient with juvenile systemic lupus erythematosus and catatonia. *Lupus*. 2012;21: 1575–1581.
4. Tamashiro LF, Oliveira RD, Oliveira R, et al. Participation of the neutrophin brain-derived neurotrophic factor in neuropsychiatric systemic lupus erythematosus. *Rheumatology (Oxford)*. 2014;53:2182–2190.
5. Hestad KA, Tønseth S, Støen CD, et al. Raised plasma levels of tumor necrosis factor alpha in patients with depression: normalization during electroconvulsive therapy. *J ECT*. 2003; 19:183–188.

Safe Electroconvulsive Therapy Use After Hip Fracture Fixation Without an Increase in Muscle Relaxant

To the Editor,

Acetabular fractures and joint dislocations have been reported after electroconvulsive therapy (ECT),[1,2] although fortunately, medical advancements have significantly reduced their occurrences in later years. In modified ECT, standard anesthetic techniques involve the use of a muscle relaxant to reduce serious musculoskeletal complications and a rapid, short-acting induction agent.[3] Succinylcholine is a commonly used muscle relaxant, with its typical dose ranging between 0.5 and 1 mg/kg. Although it has been demonstrated that complete muscle relaxation with higher doses of succinylcholine (1.5–1.8 mg/kg) after surgical fixation of a hip fracture[4] and a vertebroplasty[2] have led to no further orthopedic complications after ECT, it remains unclear whether an increased dose of muscle relaxant is necessary to mitigate this risk.

I write to describe a case of a woman who safely resumed ECT after surgical fixation of her hip fracture, with the use of regular muscle relaxant doses. A 59-year-old Chinese woman with bipolar disorder was admitted under the psychiatry department at a general hospital in Singapore for treatment of a depressive relapse. She had medical history of Gilbert syndrome. Her medications at admission included quetiapine, lorazepam, and diazepam. Her mood had not improved despite increased quetiapine doses to 250 mg at night during the admission. Before the admission, she was ECT naive. Her height was 160 cm, and her weight was 40 kg. She had consented to ECT and received 3 treatments of ECT with bitemporal electrode placement, spaced 2 to 3 days apart, using the Thymatron System IV (Somatics, LLC, Lake Bluff, IL). General anesthesia had been induced with 50 mg of propofol, and adequate muscle relaxation had been achieved with 50 mg (1.25 mg/kg) of succinylcholine for those 3 initial ECT treatments. Energy levels were increased from 60% to 65% to 75%, respectively. Seizure durations ranged from 20 to 36 seconds. Her mood had improved considerably.

Unfortunately, 2 days after her third ECT treatment, while she was attempting to use her foot to retrieve her slippers from under her bed, she had lost her balance and fell to the floor on her left side, sustaining a left neck of femur fracture. The fracture was repaired surgically within 48 hours with the insertion of cancellous screws. She was allowed partial weight bearing on her affected hip after the operation. However, she reported that she was starting to feel more depressed again.

The orthopedic surgeons and anesthetists consulted agreed that there was no contraindication to resume ECT. Twelve days after surgical repair of her hip fracture, our patient continued to receive ECT, with general anesthesia induced with 50 mg of propofol and adequate muscle relaxation achieved with 40 mg (0.95 mg/kg) of succinylcholine. Although her weight had increased to 42 kg, there was a change in anesthetist, who was comfortable with the smaller succinylcholine dose, which was otherwise still within the lower limit of the hospital protocol. After a total of 4 further ECT treatments with the same succinylcholine dose and with seizure durations of 41 to 47 seconds, there was a significant

improvement in her mood. She had no other complaints and was discharged safely back home. On a follow-up radiograph, there were also no orthopedic complications like that of dislodgement of cancellous screws or periprosthetic fractures at 4 weeks after her hip fracture.

Previous case reports have demonstrated the safe administration of ECT in individuals after various surgeries.[2,4] These included the use of higher doses of muscle relaxants in patients after surgical fixation of their fractures, which was described as between 1.5 and 1.8 mg/kg of succinylcholine, to ensure that maximal neuromuscular blockade had been achieved. However, because there are currently no standards of practice regarding the use and risks of ECT in patients after surgical fixation for hip fractures, it is unknown whether it is more appropriate to induce complete muscle relaxation with higher doses of muscle relaxants. Increasing the dose of muscle relaxants like succinylcholine may increase the risk of adverse effects including apnea, longer time to ventilation recovery, and cardiac dysrhythmias.[5] To date, there is no evidence suggesting that higher doses of muscle relaxants reduce the incidence of subluxation of prostheses or periprosthetic fractures in patients undergoing ECT after surgical fixation of a fracture. This case highlights the safe use of ECT without increments in the doses of muscle relaxants, in a patient who had just undergone surgical fixation of a hip fracture.

Yi Hang Tay, MBBS
Department of Psychological Medicine
Khoo Teck Puat Hospital
Singapore
yihang.tay@mohh.com.sg

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REFERENCES

1. Sarpel Y, Toğrul E, Herdem M, et al. Central acetabular fracture-dislocation following electroconvulsive therapy: report of two similar cases. *J Trauma*. 1996;41:342–344.
2. Briggs MC, Popeo DM, Pasculli RM, et al. Safe resumption of electroconvulsive therapy (ECT) after vertebroplasty. *Int J Geriatr Psychiatry*. 2012;27:984–985.
3. Scott AIF. *The Third Report of the Royal College of Psychiatrists' Special Committee on ECT. The ECT Handbook*. 2nd ed. London: Royal College of Psychiatrists; 2005.
4. Bryson EO, Liebman L, Nazarian R, et al. Safe resumption of maintenance electroconvulsive therapy 12 days after surgical repair of hip fracture. *J ECT*. 2015;31:81–82.
5. Horowitz BZ. Paralytic agents. In: Dart RC, et al. eds. *Medical Toxicology*. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2004: 579–593.