

Research article

Individualized applications of electroconvulsive therapy in modern psychiatry – A case-based approach

Ana-Maria Cojocaru ^{1,2}, Andrei-Gabriel Zanzfir ^{1,2,*}, and Simona-Corina Trifu ^{2,3}

- 1 Doctoral School, “Carol Davila” University of Medicine and Pharmacy Bucharest, 020021 Bucharest, Romania;
- 2 Prof. Dr. Alexandru Obregia Clinical Hospital of Psychiatry Bucharest, 041914, Bucharest, Romania;
- 3 Department of Psychiatry, “Carol Davila” University of Medicine and Pharmacy Bucharest, 020021 Bucharest, Romania;

* Correspondence: Andrei-Gabriel Zanzfir, andrei-gabriel.zanzfir@drd.umfcd.ro

Abstract: Electroconvulsive therapy (ECT) is a well-established intervention for severe psychiatric disorders, particularly in treatment-resistant cases. This study investigates the therapeutic outcomes of severe psychiatric pathologies treated with varying ECT modalities, focusing on the evolution of symptomatology in relation to specific ECT parameters and patient-specific clinical features. A detailed analysis was conducted on ten cases involving severe neuropsychiatric conditions treated with ECT. The methodology incorporated a comprehensive review of psychiatric histories, comorbidities, and previous pharmacological and therapeutic interventions. Particular emphasis was placed on assessing the relationship between variations in ECT parameters—such as electrode placement, seizure threshold, and stimulation intensity—and clinical outcomes, including behavioral and symptomatic changes post-ECT. The findings demonstrate the heterogeneity of responses to ECT across the 10 cases, highlighting the influence of tailored ECT parameters on therapeutic efficacy. Cases illustrate the dynamic interplay between individual patient profiles and treatment modalities, with specific improvements noted in psychotic symptoms, affective dysregulation, and suicidal ideation. Severe psychiatric disorders exhibit diverse responses to ECT, with outcomes closely linked to individual patient profiles and specific treatment parameters. Customizing ECT protocols proved essential for achieving optimal symptom improvement, particularly in cases with significant comorbidities.

Keywords: electroconvulsive therapy, treatment-resistant disorders, neuroplasticity, severe mental illness, psychiatric interventions

1. Introduction

Electroconvulsive therapy (ECT) represents a modality in the treatment of severe psychiatric disorders through electrical brain stimulation, which induces a clinical seizure similar to an epileptic event. This medical procedure strategically initiates seizures in the prefrontal region, which then propagate throughout the cortical and subcortical structures, including the diencephalic regions. The clinical application of ECT spans various neuropsychiatric conditions where traditional treatments may have failed, including major depressive disorder, schizophrenia, bipolar disorder, catatonia, and certain neurological conditions such as Parkinson’s disease and neuroleptic malignant syndrome [1].

The therapeutic efficacy of ECT is notably rapid compared to pharmacological treatments, making it an indispensable tool in urgent psychiatric interventions [2]. The process involves a series of systematic steps starting from a thorough evaluation to determine the suitability for ECT, ensuring informed consent, and performing

Citation: Cojocaru A.M., Zanzfir A.G. and Trifu S.C. - Individualized applications of electroconvulsive therapy in modern psychiatry – A case-based approach
Balneo and PRM Research Journal 2025, 16(1): 769

Academic Editor(s):
Constantin Munteanu

Reviewer Officer:
Viorela Bembea

Production Officer:
Camil Filimon

Received: 07.01.2025
Published: 31.03.2025

Reviewers:
Mihai Hoteteu
Aurelian Angheliescu

Publisher’s Note: Balneo and PRM Research Journal stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2025 by the authors. Submitted for open-access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

extensive somatic and paraclinical assessments. These assessments include neurological, cardiological, and ophthalmological evaluations, supplemented by diagnostic imaging like MRI or CT scans, electroencephalograms (EEG), electrocardiograms (ECG), and comprehensive laboratory tests covering inflammatory markers, electrolytes, thyroid function, and more. This rigorous preparatory phase ensures that the patient's physical health can safely withstand the procedure while optimizing the therapeutic outcomes [3].

Given the clinical procedure, ECT is administered under general anesthesia with muscle relaxants to minimize physical discomfort and risks, using an electrical stimulus precisely calibrated to induce a therapeutic seizure. The electric current, typically oscillating between 0.5-1 ampere, surpasses the convulsive threshold, ensuring effective depolarization of neuronal membranes. This seizure activity is not merely a physical phenomenon but stimulates extensive neurochemical and neurophysiological changes across various brain regions, impacting neurotransmitter systems, enhancing neuroplasticity, and altering regional cerebral blood flow and metabolism [4].

Recent advancements have expanded our understanding of ECT's mechanism, highlighting its ability to significantly upregulate serotonergic transmission and modulate other key neurotransmitter systems including glutamatergic and dopaminergic pathways [5]. These changes are critical in alleviating symptoms of depression, anxiety, and psychosis, contributing to improvements in patient motivation, attention, and overall cognitive functions. Additionally, ECT has been shown to foster neurogenesis and enhance the structural integrity of neural networks, particularly in areas implicated in mood regulation and cognitive processing [6].

ECT has been demonstrated to promote neuroplasticity, encouraging the growth of neural connections and potentially reversing the neural degradation often seen in chronic psychiatric patients. This aspect of ECT is vital for its therapeutic impact, particularly in regions of the brain involved in emotional regulation and cognitive function [7,8]. Additionally, ongoing research has expanded our understanding of ECT's effect on the brain's structural and functional connectivity, revealing that it can induce significant positive changes in white matter integrity, particularly in pathways associated with emotional regulation and mood stabilization [9].

Electroconvulsive therapy's impact extends beyond neurotransmitter modulation and neuroplastic enhancements; it also includes significant neuroendocrine effects. Specifically, ECT has been shown to normalize the hyperactivity of the hypothalamic-pituitary-adrenal (HPA) axis often observed in depressive disorders. This normalization of cortisol levels can lead to substantial improvements in neuroplasticity and overall brain health, which are crucial in combating the pathological mechanisms of depression [10].

Moreover, the hemodynamic changes induced by ECT, such as increases in cerebral blood flow and metabolism, play essential roles in its therapeutic effects. These changes are particularly pronounced in areas of the brain associated with mood and emotion, further illustrating the complex physiological underpinnings of ECT's efficacy in treating severe mental health disorders [11].

Additionally, emerging studies have illuminated the potential of ECT to not only address acute symptoms but also to provide long-term improvements in patients with chronic conditions. For instance, research has shown that ECT can induce lasting changes in the neural architecture, particularly in areas implicated in depression and psychosis, which correlates with sustained improvements in clinical outcomes [12].

Despite its effectiveness, the use of ECT is bounded by stringent ethical considerations and potential side effects, ranging from transient disorientation and memory disturbances to more severe neurological impacts [13]. Moreover, societal perceptions and the historical context of ECT present additional challenges, necessitating

ongoing education and advocacy to align public understanding with current scientific and clinical evidence [14]. ECT has historically been viewed with skepticism due to its portrayal in media and the stigma associated with mental health treatments [15].

The primary aim of this study is to systematically evaluate the efficacy and challenges of electroconvulsive therapy (ECT) in treating severe neuropsychiatric disorders, focusing on individualized patient responses and integration within broader therapeutic frameworks [16].

This exploration is anchored in the analysis of ten cases, each presenting unique diagnostic and treatment complexities. The objectives of this research are multifaceted: first, it seeks to assess the clinical effectiveness of ECT in alleviating severe psychiatric symptoms where traditional treatment modalities have failed. This includes examining both immediate and long-term outcomes in disorders such as schizophrenia, major depressive disorder, and bipolar disorder. Additionally, the study aims to identify patterns of response to ECT, exploring how different psychiatric presentations react to this treatment.

Secondly, this study intends to delve into patient-specific variables that may influence ECT outcomes. By analyzing factors such as genetic predispositions, previous medical history, and psychosocial backgrounds, the research tries to pinpoint how these individual differences affect the efficacy and safety of ECT. This analysis will also consider the impact of comorbid conditions like substance abuse or significant medical illnesses, which often complicate psychiatric management.

Another objective is to evaluate the therapeutic challenges associated with the administration of ECT. This includes managing potential side effects, navigating ethical considerations around patient consent, and handling the logistical aspects of treatment setup and follow-through. The study will also assess how ECT protocols can be optimized based on observed interactions between ECT and specific clinical features of patients.

Through a methodological framework employing both qualitative and quantitative research methods, this study will provide a detailed examination of ECT's role in psychiatric care. Expected outcomes include a deeper understanding of ECT's clinical utility, insights into optimizing treatment protocols, and enhanced guidelines for its use in complex psychiatric cases.

2. Materials and Methods

This case series was conducted at Prof. Dr. Alexandru Obregia Clinical Psychiatry Hospital in Bucharest. It involved a detailed analysis of ten patients who underwent electroconvulsive therapy (ECT) for severe neuropsychiatric disorders. Each case was selected based on its complexity and the use of ECT as a critical intervention after other treatments had failed.

The study included a cohort of ten patients who underwent ECT at the hospital between 2018 and 2023. Patients included in this series were those who had not responded adequately to at least two conventional treatment modalities, including pharmacological and psychotherapeutic interventions. Diagnoses among the patients varied and included major depressive disorder, schizophrenia, bipolar disorder, and other severe psychiatric conditions necessitating ECT. All diagnoses were established by the medical team at Prof. Dr. Alexandru Obregia Hospital in accordance with national clinical guidelines and internationally recognized diagnostic criteria, ensuring a standardized and comprehensive approach to patient assessment and treatment planning.

The case series adhered strictly to ethical guidelines consistent with the Declaration of Helsinki. Ethical approval for reviewing and publishing patient data was obtained from the Ethics Committee of Prof. Dr. Alexandru Obregia Hospital. Prior to participation, all patients or their legal guardians (where applicable) provided in-

formed consent. The consent process was comprehensive, ensuring that all participants were fully informed about the nature of ECT, the expected outcomes, potential risks, and their right to withdraw from the study at any time without affecting their ongoing care.

Informed consent was obtained using a detailed form that outlined the procedures involved in ECT, including the risks and benefits, alternative treatments available, and confidentiality aspects. This form also included information on the patient's rights in accordance with the Helsinki Declaration, emphasizing voluntary participation and the assurance of anonymity in any published data.

ECT was administered in a controlled clinical setting. The procedure was carried out under general anesthesia with the use of muscle relaxants to prevent physical injury during induced seizures. A brief-pulse, bilateral electrode placement technique was employed to maximize efficacy while minimizing cognitive side effects. The parameters for the electric current were set to individual seizure thresholds, which were determined during initial treatment sessions.

Each session was closely monitored by a team of psychiatrists, anesthesiologists, and nursing staff. Parameters monitored included seizure duration, heart rate, blood pressure, and oxygen saturation. Comprehensive documentation during each session ensured that any deviations from the expected clinical course were noted and addressed. Post-treatment follow-up involved regular psychiatric assessments to monitor the effectiveness of ECT and any adverse effects.

The primary outcomes measured were changes in symptom severity, assessed through validated psychiatric scales, and overall patient functionality post-treatment. Secondary outcomes included patient and family satisfaction with the treatment, rehospitalization rates, and long-term side effects.

Detailed records were kept for each patient, documenting the entire course of treatment from initial assessment through to follow-up evaluations. Follow-up was conducted at three months, six months, and one year post-treatment to assess the durability of treatment effects and any long-term complications.

3. Results

The results of this study encompass ten documented cases in which ECT was applied to treat severe neuropsychiatric conditions. In the following section, the main quantitative results and patient characteristics will be synthesized in Table 1 and Table 2. An interpretation of the results will then be provided in the latter subsections.

Table 1. Patient characteristics (sex, age, diagnosis and diagnosis-related particularities)

Case	Sex	Age	Diagnosis	Particularities
1	Male	29	Schizophrenia, substance abuse	Substance use, familial disengagement
2	Female	25	Hebephrenic schizophrenia	Severe behavioral dysregulation, cerebral thrombosis
3	Female	68	Recurrent depressive disorder	Cerebral organicity, alcohol use history
4	Male	43	Bipolar disorder	Chronic alcohol use, severe mania and depressive episodes
5	Male	38	Paranoid schizophrenia	Suicidal ideation
6	Male	32	Bipolar disorder with neurological complications	Suspected autoimmune component, demyelination
7	Male	45	Paranoid schizophrenia	Aggressive and antisocial features

8	Female	30	Bipolar affective disorder	Resistant to pharmacotherapy
9	Male	35	Bipolar affective disorder, substance abuse	Persistent auditory hallucinations, methadone maintenance
10	Male	42	Recurrent severe depressive disorder	Psychotic features, significant stressors

Table 2. Psychometric data, treatment variables and quantitative outcomes after the ECT treatment

Case	Psychometric Tool	ECT Sessions	Reduction in Quantitative Scales	Outcome
1	PANSS, MADRS	12 sessions	PANSS: 14.5%, MADRS: 21%	Temporary improvement, tragic outcome
2	PANSS, CGI-S	12 sessions	PANSS: 20.8%, CGI-S: 33%	Moderate improvement, sustained over time
3	HDRS, BDI	14 sessions	HDRS: 50%, BDI: 43.75%	Moderate improvement, combined with rTMS
4	YMRS, HDRS	4 sessions	YMRS: 56.25%, HDRS: 38.46%	Partial improvement, significant cognitive disturbances
5	PANSS, C-SSRS	12 sessions	PANSS: 31.58%, C-SSRS: 50%	Partial remission of suicidal ideation and psychotic symptoms
6	YMRS, HAM-D	6 sessions	YMRS: 43.75%, HAM-D: 40%	Marginal improvement, short-lived
7	PANSS, BPRS	14 sessions	PANSS: 29.3%, BPRS: 32%	Partial improvement, temporary gains
8	YMRS, HAM-D	12 sessions	YMRS: 21.4%, HAM-D: 27.6%	Marginal improvement, not sustained
9	PANSS, AHRs	6 sessions	PANSS: 19%, AHRs: 45.45%	Moderate improvement, temporary reduction in hallucinations
10	PANSS, HAM-D	11 sessions	PANSS: 33.8%, HAM-D: 40%	Moderate improvement, temporary remission

3.1. Case 1: Complex interplay of schizophrenia and substance abuse in ECT treatment outcomes.

A 29-year-old male patient, diagnosed with schizophrenia comorbid with chronic substance use disorder, exhibited a complex and multifaceted clinical presentation. His psychiatric symptoms began after a suicide attempt (jumping into a well), which led to his first hospitalization under voluntary conditions. He had a significant family history of affective disorders and suicide. His substance abuse was extensive, focusing primarily on synthetic cannabinoids and various inhalants, including glue, which exacerbated his psychotic symptoms and contributed to treatment resistance.

His familial relationships were dysfunctional, particularly with his father, who dismissed psychiatric concerns and attributed the patient's behavior to intentional drug use, responding with punitive measures rather than seeking appropriate psychiatric intervention. This delayed effective treatment, leading to recurrent hospitalizations and a worsening condition.

3.1.1. Symptomatology and Disease Progression

Over six years, the patient showed increasing addiction to inhalants, particularly after hospital discharge, leading to destructive behaviors, including vandalism. His schizophrenia symptoms worsened, with pronounced negative symptoms such as social withdrawal, anhedonia, and the development of repetitive behaviors (notably, stereotypic movements like juggling), earning him the nickname "juggler" within the hospital.

Neuroimaging revealed an arachnoid cyst, adding to the complexity of his treatment. His response to standard pharmacological treatments was minimal, with some improvement noted with sedative antipsychotics. Given the ineffectiveness of these treatments, combined with severe tolerance to medication, electroconvulsive therapy (ECT) was initiated to address his profound depressive and psychotic symptoms.

3.1.2. ECT Treatment Protocol

ECT was initiated after a failure of conventional pharmacotherapy, particularly due to the patient's severe and refractory symptoms. The treatment consisted of 12 ECT sessions administered over four weeks.

3.1.3. Psychometric Evaluation

Positive and Negative Syndrome Scale (PANSS): Pre-treatment score was 110, reflecting severe psychotic symptoms. Post-treatment, the score decreased to 94, a reduction of 14.5%, indicating a moderate improvement in psychotic symptomatology.

Montgomery-Åsberg Depression Rating Scale (MADRS): Pre-treatment score was 38, indicating severe depressive symptoms. Post-treatment, the score was 30, showing a 21% reduction in depressive symptoms, signifying a partial improvement in mood regulation.

3.1.4. Outcome and Prognosis

Despite the partial reduction in both psychotic and depressive symptoms, the patient tragically completed suicide by defenestration approximately one year after his last ECT session. This outcome highlights the difficulty of treating severe and complex cases involving schizophrenia, substance abuse, and inadequate family support. The effectiveness of ECT in this case is categorized as temporary, as the improvements were not sustained over time, and the patient's underlying condition, compounded by ongoing substance abuse, remained largely resistant to treatment.

Given the complex interplay of psychotic and depressive symptoms, substance use, and familial disengagement, the final outcome remains tragically aligned with the patient's trajectory of deteriorating mental health.

3.2. Case 2: Complex management of hebephrenic schizophrenia with severe behavioral dysregulation.

A 25-year-old woman with a history of hebephrenic schizophrenia, diagnosed at the age of 16, presented with a severely deteriorated clinical state. By the time of evaluation, her cognitive abilities had markedly declined, and she exhibited significant psychomotor agitation. The patient's interactions with her primary caregiver (mother) were minimal and violent, characterized by emotional inversion, with frequent biting, scratching, and physical aggression. Her emotional responses appeared disconnected from the external environment, dominated by internal stimuli leading to violent outbursts.

The patient had no clear psychological triggers for the onset of her illness, and there was no known family history of psychiatric disorders. Imaging revealed the presence of deep venous cerebral thrombosis, which was considered a relative contraindication for certain treatments. However, the severity of her aggression and risk of self-harm justified the initiation of electroconvulsive therapy (ECT).

3.2.1. Symptomatology and Disease Progression

The patient exhibited severe cognitive decline and psychomotor agitation, with a significant loss of reality comprehension. Her behavior was marked by extreme violence, largely due to internal emotional stimuli, and an absence of emotional reactions to external stimuli. In addition to violent outbursts, she displayed compulsive eating behaviors, leading to obesity. This combination of symptoms contributed to a challenging clinical presentation, requiring intensive intervention.

3.2.2. Treatment Protocol and ECT Implementation

Upon admission, the patient was being treated with 400 mg Clozapine and 400 mg Amisulpride, as well as a 20 mg Flupentixol depot injection administered bi-weekly. Despite these pharmacological interventions, the patient's symptoms remained largely unresponsive, with aggressive behaviors still requiring the presence of security staff and sedation with Propofol during episodes. Due to the treatment's ineffectiveness and the severity of her symptoms, 12 sessions of ECT were administered over a 4-week period.

3.2.3. Psychometric Evaluation

Positive and Negative Syndrome Scale (PANSS): Pre-ECT, the patient's PANSS score was 120, indicating severe psychotic symptoms. Post-ECT, the score improved to 95, a 20.8% reduction, reflecting a moderate improvement in psychotic symptomatology.

Clinical Global Impression – Severity (CGI-S): Pre-ECT score of 6 (severe illness); post-ECT score was 4, reflecting a 33% reduction, suggesting a moderate improvement in overall functioning.

3.2.4. Outcome and Prognosis

Following the 12 ECT sessions, the patient experienced a marked reduction in violent outbursts and a significant decrease in compulsive eating behaviors, contributing to weight loss and a lowered risk of diabetes. These improvements made her care more manageable and allowed her to remain with her family, which provided essential support. Over the following three years, her behavioral symptoms remained substantially reduced, and her overall quality of life improved, as evidenced by her ability to stay at home and engage in more stable interactions with her caregivers. There was no recurrence of violent behaviors or significant weight gain, underscoring the sustained impact of the ECT treatment.

The outcome of ECT in this case can be classified as moderate, given the significant improvement in violent behaviors and compulsive eating. However, continued monitoring was essential due to the patient's complex medical and psychiatric background, including the cerebral thrombosis.

3.3. Case 3: Integrating electroconvulsive therapy and r-TMS in the treatment of recurrent depressive disorder with cerebral organicity.

A 68-year-old female with a high intellectual level and effective social functioning experienced a severe decline in mental health following her retirement. The onset of her chronic depressive symptoms coincided with her decision to abstain from alcohol, which she had intermittently used throughout her adult life. These depressive symptoms, primarily noradrenergic in nature, were characterized by prolonged bed rest, loss of interest in previously pleasurable activities, and a general lack of vitality, significantly impairing her daily life and overall well-being.

The patient's history revealed that she had intermittently struggled with depressive episodes throughout her life, but this episode was notably more severe. The depressive symptoms appeared to be motivational and volitional, leading to a profound flattening of emotional and physical energy.

3.3.1. Pharmacotherapy and Complications

Initially, the patient was prescribed SSRIs (Cipralex and Sertraline), but these medications exacerbated her depressive symptoms and led to lamentative behaviors. Subsequently, a switch to Fluoxetine 200 mg led to an inappropriate shift toward hypomanic episodes, which suggested the presence of an underlying frontal lobe pathology. Although no direct imaging findings were noted, her response to medications suggested a deeper, organic component to her depressive disorder, likely related to cerebral organicity due to her long-term alcohol use. The patient's response to pharmacological treatments was inadequate, prompting consideration of electroconvulsive therapy (ECT) as a potential treatment. The patient herself requested ECT, hoping for a more immediate and impactful resolution to her depressive symptoms.

3.3.2. ECT Treatment Protocol

The patient received 14 sessions of ECT, which were aimed at resetting the neurochemical imbalances thought to be at the core of her condition.

3.3.3. Psychometric Evaluation

Hamilton Depression Rating Scale (HDRS): Pre-ECT, the patient's score was 28, indicating severe depression. Post-ECT, her score decreased to 14, reflecting a 50% reduction in depressive symptoms, which is consistent with a moderate improvement in mood regulation and functioning.

Beck Depression Inventory (BDI): Pre-ECT score of 32, signifying severe depression. Post-ECT, the score was 18, showing a 43.75% reduction, which aligns with a moderate improvement in overall depressive symptomatology.

3.3.4. ECT Outcome and Prognosis

Post-ECT, the patient underwent repetitive Transcranial Magnetic Stimulation (rTMS) for three consecutive weeks, approximately 8-9 months later, during another hospitalization. This combined approach significantly improved her symptoms, restoring a substantial degree of her independence. She was able to resume daily activities such as shopping, attending church, caring for a pet, and forming new friendships within her community. The outcome of the ECT treatment in this case is classified as moderate, with significant improvements in depressive symptoms and functional outcomes.

3.4. Case 4: Neurological complications and behavioral manifestations post-electroconvulsive therapy in bipolar disorder.

A 43-year-old male with a history of bipolar disorder for approximately 11 years presented with recurrent manic and depressive episodes. The onset of his illness was characterized by mania, which was initially triggered while working abroad. His symptoms were accompanied by delusional beliefs, particularly the interpretation that his career and social interactions had been sabotaged by "the system," and that he had "upset the wrong people." These delusions were prominent during his manic phases and significantly influenced his perception of reality. The patient's clinical history was further complicated by chronic alcohol use, which aggravated the frequency and intensity of his manic and depressive episodes. Over the years, he experienced repeated fluctuations between manic and depressive states, leading to the development of persistent delusional beliefs that were exacerbated during both phases of his illness.

3.4.1. Symptomatology and Disease Progression

The patient's most recent severe depressive episode led to psychomotor retardation, and he became bedridden, exhibiting fervent prayer for salvation. This episode was marked by major depressive symptoms and an inability to perform daily functions, severely impacting his overall well-being. The patient's condition did not improve with pharmacological treatment, including Clomipramine 100 mg, Venlafaxine

150 mg, Aripiprazole 15 mg, and Flupentixol, and was further complicated by diabetes. The comorbid diabetes restricted certain medication options, notably Mirtazapine and Olanzapine, due to their metabolic side effects. In response to the severity of his symptoms and poor pharmacological response, electroconvulsive therapy (ECT) was considered.

3.4.2. ECT Treatment Protocol

The decision was made to administer ECT, and four sessions were completed. However, the patient's response to ECT was marked by severe complications. He developed an obsession with the anesthesiologist, which escalated into psychotic anxiety and further delusional interpretations. Post-ECT, the patient exhibited severe confusion, disorganized speech, and non-discriminatory violence, along with altered states of consciousness. These disturbances led to the decision to discontinue ECT after the fourth session.

3.4.3. Psychometric Evaluation

Young Mania Rating Scale (YMRS): Pre-ECT, the patient's score was 32, indicating a severe manic episode with marked delusions. Post-ECT, the score decreased to 14, showing a 56.25% reduction, which corresponds to a moderate improvement in mania but with lingering symptoms.

Hamilton Depression Rating Scale (HDRS): Pre-ECT score of 26, indicating severe depressive symptoms. Post-ECT, the score was 16, reflecting a 38.46% reduction in depressive symptoms, suggesting a moderate improvement in mood.

3.4.3. ECT Treatment and Outcomes

Unfortunately, the outcome of the ECT treatment was overshadowed by severe post-ECT cognitive and behavioral disturbances. While the patient's manic and depressive symptoms showed partial improvement, the post-ECT confusion, delusional thinking, and violence were significant. These complications indicated moderate improvements in mood symptoms but also underscored the risk of transient neurocognitive effects following ECT, especially in patients with complex psychiatric profiles.

Several months after his last hospitalization, the patient tragically passed away due to mechanical asphyxiation from a food bolus, in a bizarre accident. This death underscores the challenges in managing complex cases of bipolar disorder, especially in patients with comorbid conditions and complicated pharmacological histories.

The ECT outcome is classified as partial, given the improvement in depressive and manic symptoms but also accompanied by significant cognitive and behavioral disturbances post-treatment. The patient's response was complicated by neurological disturbances, possibly linked to transient disruptions in cortical and subcortical connectivity.

3.5. Case 5: Complex management of treatment-resistant schizophrenia with suicidal ideations.

A male 38-year-old male patient with a protracted history of paranoid schizophrenia was previously maintained on Clozapine 300 mg daily for 13 years, which provided sufficient stability for minimal participation in societal activities. However, the patient experienced a profound destabilization following an acute psychotic episode, which significantly altered his emotional relationship with his primary caregiver, his father. This episode coincided with a transition attempt from Clozapine to Aripiprazole, which led to a resurgence of severe psychotic symptoms and persistent suicidal ideation.

3.5.1. Symptomatology and Disease Progression

The acute exacerbation of symptoms upon medication change suggests a complex interaction between neurobiological mechanisms and psychosocial stressors. The transition from Clozapine to Aripiprazole likely triggered a neuroadaptive response due to long-term Clozapine therapy, potentially involving dopaminergic, serotonergic, and glutamatergic pathways. These neurotransmitter systems are essential

in the pharmacodynamics of schizophrenia treatments, and the reinstatement of acute symptoms following this switch points to the delicate balance of neurotransmitter systems necessary for psychiatric stability.

3.5.2. ECT Treatment Protocol

The patient's suicidal ideation and psychotic symptoms became increasingly severe, and given his resistance to conventional pharmacotherapy, electroconvulsive therapy (ECT) was initiated. ECT was considered as a means to modulate neurotransmission and neuroplasticity, potentially resetting maladaptive neural circuits involved in schizophrenia. The treatment plan consisted of 12 ECT sessions aimed at addressing the intractable suicidal ideation and augmenting the efficacy of his ongoing pharmacological treatment.

3.5.3. Psychometric Evaluation

Positive and Negative Syndrome Scale (PANSS): Pre-ECT score was 95, indicating severe psychotic symptoms with a dominance of positive symptoms (e.g., delusions, hallucinations). Post-ECT, the score decreased to 65, reflecting a 31.58% reduction, indicating moderate improvement in psychotic symptoms.

Columbia-Suicide Severity Rating Scale (C-SSRS): Pre-ECT, the patient's score was 4 (severe suicidal ideation), while post-ECT, the score was 2, reflecting a 50% reduction in suicidal ideation. This reduction corresponds to a partial remission of suicidal thoughts.

3.5.4. ECT Treatment and Outcomes

The ECT treatment resulted in partial remission of the patient's suicidal ideation and psychotic symptoms. However, despite some improvement, the patient's response to Clozapine gradually diminished, suggesting possible receptor desensitization or pharmacoresistance. This highlights the limited efficacy of ongoing pharmacological treatment in the face of complex neurobiological processes. Consequently, the patient required prolonged hospitalization in a specialized chronic care facility to manage the persistent delusions and cognitive distortions associated with his schizophrenia.

The ECT outcome is classified as partial, with moderate improvements in suicidal ideation and psychotic symptoms, but with persistent resistance to pharmacological treatment.

3.6. Case 6: ECT in bipolar disorder with neurological complications and treatment-resistant features.

A young 32-year-old male patient experienced his first episode of acute mania, marked by hetero-aggressive behavior and violent outbursts towards his family and medical staff. Prior to this episode, the patient had been a successful automation electronics technician, known for his leadership, high competency, and fluency in German. Despite his professional achievements, the patient's mania necessitated hospitalization due to several days of uncontrolled fury and violent behavior.

Imaging studies during his hospitalization showed no abnormalities on CT scan; however, MRI scans revealed multiple areas of demyelination, raising suspicions of lupus vasculitis. This finding suggested a potential autoimmune or inflammatory component contributing to his psychiatric symptoms, complicating both his diagnosis and treatment approach.

3.6.1. Symptomatology and Disease Progression

The patient's psychiatric condition was characterized by alternating manic and depressive episodes, with possible hypomanic states reported by his wife. Over time, his depressive episodes worsened, marked by significant noradrenergic apathy that gradually evolved into profound disinterest and negativism toward personal and familial responsibilities. This progression indicated a deepening affective disorder, possibly exacerbated by underlying neurological changes. Over a period of 7 years, the patient displayed a recurrent pattern of manic and depressive episodes. He had

two distinct manic episodes, with additional hypomanic episodes suggested by his wife's reports. His depressive episodes became progressively severe, marked by a shift from apathy to profound disengagement from personal and familial matters. The patient's resistance to conventional treatments was marked by minimal improvement from various mood stabilizers and antidepressants. Duloxetine (120 mg) provided only marginal improvement. Given the patient's complex psychiatric and neurological picture, a combination of antimentia drugs (Memantine, Rivastigmine, and Galantamine) and antipsychotics was introduced. This regimen aimed to address aggressive behaviors, improve engagement with reality, and enhance functionality in societal norms.

3.6.2. ECT Treatment Protocol

Despite these interventions, the patient's behavioral disturbances remained severe, and a course of six ECT sessions was initiated to manage the symptoms. The patient demonstrated limited cooperation and understanding of the treatment, reflecting his impaired cognitive state.

3.6.3. Psychometric Evaluation

Young Mania Rating Scale (YMRS): Pre-ECT score was 32, indicating severe manic symptoms with significant affective dysregulation, aggression, and impulsivity. Post-ECT, the score reduced to 18, indicating a 43.75% reduction in manic symptoms and a moderate improvement in mood stabilization.

Hamilton Depression Rating Scale (HAM-D): Pre-ECT score was 25, reflecting severe depression with prominent apathy, anhedonia, and negativism. Post-ECT, the score decreased to 15, reflecting a 40% reduction in depressive symptoms and some improvement in emotional engagement.

3.6.4. ECT Treatment Outcome

The six-session ECT course resulted in marginal improvements in the patient's mood and engagement, as evidenced by transient periods of joy and increased family interaction. However, these improvements were short-lived, as the patient relapsed into another depressive episode within six months. The outcome of the ECT treatment is categorized as marginal, with temporary improvements in mood and social interactions that were not sustained long-term.

Given the complex interplay of bipolar disorder, suspected early-onset dementia, and potential autoimmune contributions, the diagnosis was reconsidered to include early-onset dementia.

3.7. Case 7: Chronic schizophrenia with aggressive and antisocial features undergoing electroconvulsive therapy

This case involves a 45-year-old male with a longstanding diagnosis of schizophrenia, primarily marked by negative symptoms and social withdrawal.

3.7.1. Symptomatology and Disease Progression

Over the course of approximately two decades, his condition progressively led to emotional inversion, particularly towards his mother, and a marked retreat from social interactions. He chose to live in relative isolation, residing in a rudimentary shack and subsisting on self-cultivated, non-irradiated food, reflecting a profound connection with nature and a complete disconnection from societal norms.

Mandated for treatment by the local Legal Medical Service under Article 109 of the Penal Code, the patient was initially managed with Clopixol depot (200 mg bi-monthly) at a provincial psychiatric facility. Despite this treatment, his aggressive behavior towards his mother persisted, prompting his transfer to our institution for intensive management.

3.7.2. ECT Treatment Protocol

At our institution, the patient was involuntarily admitted for a series of 14 ECT sessions, following the failure of conventional treatments, including Xeplion and

other newer antipsychotic agents. His hostility and aggressive tendencies remained largely unaddressed, necessitating the introduction of ECT as an alternative treatment modality. Due to his history of violence and a profound lack of insight into his psychiatric condition, the sessions were conducted under strict security measures to ensure the safety of both staff and other patients.

3.7.3. Psychometric Evaluation

Positive and Negative Syndrome Scale (PANSS): Pre-ECT score was 99, indicating severe positive symptoms (delusions, paranoia, hostility) and negative symptoms (social withdrawal, emotional flattening). Post-ECT, the score reduced to 70, reflecting a 29.3% reduction in overall symptoms. Improvements were observed in both positive symptoms (from 32 to 23) and negative symptoms (from 32 to 24).

Brief Psychiatric Rating Scale (BPRS): Pre-ECT score was 50, with elevated hostility (5), delusions (5), and emotional withdrawal (6). Post-ECT, the score decreased to 34, with improvements in hostility (3), delusions (3), and emotional withdrawal (4). This represents a 32% reduction in the BPRS score, indicating substantial improvement in aggression and emotional engagement.

3.7.4. ECT Treatment and Outcomes

The combination of ECT and a pharmacological regimen consisting of Quetiapine (800 mg daily) and Amisulpride (400 mg daily) resulted in partial emotional restoration, particularly in his interactions with his mother, who engaged in regular visits. During these interactions, however, the patient's communication remained heavily influenced by delusional themes such as surveillance, persecution, and a cosmogonic delirium, suggesting a distorted view of reality and a belief in being in harmony with the universe. Despite the therapeutic progress, the patient continued to exhibit behaviors that indicated a high-risk profile, including fascination with knives and extensive engagement with pornography.

The outcome of the ECT treatment can be classified as partial, with moderate improvement in emotional responsiveness and behavior, but temporary gains with a tendency towards relapse.

3.8. Case 8: Navigating complex bipolar disorder with familial and psychosocial intersections in a high-functioning individual

The patient is a 30-year-old female with a robust creative and professional portfolio, known for her success as a novelist and organizer of painting exhibitions and workshops. She had a high level of functionality within her socio-professional environment despite a family history of affective disorders. Her sister experienced postpartum depression, and her father had chronic depression after retirement. The patient managed to maintain a successful career, earning respect and support from peers.

Her psychiatric illness emerged at the age of 27, following her marriage and deep-seated personal reservations about motherhood, exacerbated by her sister's psychiatric history. The discovery that she did not desire children, combined with her husband's traditional views on family, triggered a profound psychosocial conflict. This led to her first manic episode, characterized by grandiosity and an increased creative output, eventually spiraling into psychosis that required hospitalization.

3.8.1. Symptomatology and Disease Progression

The patient's bipolar affective disorder, characterized by endogenous manic and severe depressive episodes, was poorly responsive to various mood stabilizers and a combination of antidepressants, including Citalopram, Venlafaxine, Mirtazapine, and Olanzapine. Antipsychotics such as Aripiprazole, Risperidone, Paliperidone, and Quetiapine were also ineffective, particularly in managing her suicidal ideations.

The patient's condition led to recurrent episodes of both mania and severe depression, with one critical suicidal attempt by submersion in a lake. In response to

her deteriorating condition, the patient underwent 12 sessions of ECT, but the response was minimal, with no significant improvement towards euthymia. The introduction of Bupropion, along with neurofeedback sessions and the eventual dissolution of her marriage, resulted in a distinct therapeutic response, stabilizing her mood where other treatments had failed.

3.8.2. ECT Treatment Protocol

The patient's bipolar affective disorder proved resistant to standard pharmacologic treatments, leading to the consideration of ECT after the failure of various antidepressants and antipsychotics. Despite undergoing 12 ECT sessions, her response was limited, and no significant stabilization of mood occurred. Following a suicide attempt, further interventions including Bupropion and neurofeedback sessions were introduced, leading to notable improvement in her symptoms.

3.8.3. Psychometric Evaluation

Young Mania Rating Scale (YMRS): Pre-ECT score was 28, indicating severe manic symptoms with significant mood dysregulation, impulsivity, and aggression. Post-ECT, the score was 22, reflecting a 21.4% reduction in manic symptoms and a slight improvement in mood stabilization.

Hamilton Depression Rating Scale (HAM-D): Pre-ECT score was 29, reflecting severe depressive symptoms with prominent suicidal ideation, emotional withdrawal, and anhedonia. Post-ECT, the score decreased to 21, indicating a 27.6% reduction in depressive symptoms and a mild improvement in emotional engagement.

3.8.4. ECT Treatment and Outcomes

Despite undergoing 12 sessions of ECT, the patient's response was marginal. There was some improvement in mood and engagement, but the effect was not sustained, and she continued to experience significant depressive episodes, leading to her critical suicidal attempt. The outcome of ECT in this case can be classified as marginal, as there were transient improvements that did not result in long-term stabilization or remission.

3.9. Case 9: Bipolar affective disorder in a patient with substance abuse and medication with Methadone

The patient is a 35-year-old male with a complex psychiatric and medical history. His early life was marked by premature birth, developmental delays, and a long history of heroin addiction treated with methadone maintenance therapy, with a maximum dose of 120 mg daily. He has also experienced significant medical challenges, including his mother's thyroid cancer treatment, which involved a total thyroidectomy and radioactive iodine therapy, indirectly influencing his developmental environment. The patient's cognitive history includes signs of Attention-Deficit/Hyperactivity Disorder (ADHD), for which he was treated with Strattera. Additionally, he was diagnosed with a left ventricular ejection pathology, a condition indicative of early cardiovascular concerns that may have contributed to his neurological development.

Throughout his life, the patient exhibited fluctuating cognitive abilities, ranging from mild mental disability to lower average intellect, which contributed to academic and social challenges. Encouraged by his mother, the patient pursued higher education, despite academic difficulties that necessitated additional study. Currently, he holds a modestly demanding job, secured with his mother's influence, which provides structure but also contributes to psychiatric vulnerability.

3.9.1. Symptomatology and Disease Progression

Post-heroin addiction, the patient was diagnosed with Bipolar Affective Disorder, though there is ongoing concern about a potential shift towards Affective or Paranoid Schizophrenia. Despite this, the patient's family—particularly his mother—minimizes the severity of his symptoms, influencing his perception and treatment. His psychiatric course is marked by persistent auditory hallucinations, which have

proven resistant to conventional antipsychotic treatments, including a high dose of Clozapine (400 mg).

3.9.2. ECT Treatment Protocol

The patient's auditory hallucinations were persistent and refractory to various treatments, necessitating the use of Electroconvulsive Therapy (ECT) to provide relief and assess the nature of his symptoms. 6 ECT sessions were initiated to temporarily suppress the auditory hallucinations and improve the patient's quality of life. The patient was maintained on Risperidone and a depot neuroleptic following the ECT sessions.

3.9.3. Psychometric Evaluation

Positive and Negative Syndrome Scale (PANSS): Pre-ECT score was 68, indicating moderate positive symptoms (including auditory hallucinations) and mild negative symptoms (affective flattening, emotional withdrawal). Post-ECT, the PANSS score was 55, reflecting a 19% reduction in positive symptoms and a moderate improvement in emotional engagement.

Auditory Hallucinations Rating Scale (AHRs): Pre-ECT score was 22, indicating persistent and distressing auditory hallucinations. Post-ECT, the score decreased to 12, reflecting a 45.45% reduction in the severity of auditory hallucinations and a moderate improvement in symptom management.

3.9.4. ECT Treatment and Outcomes

The ECT sessions yielded a temporary but significant reduction in auditory hallucinations, confirming the efficacy of ECT in managing severe, refractory symptoms of psychosis in the context of bipolar disorder. Despite these improvements, the patient's psychiatric stability remained vulnerable, exacerbated by unemployment and ongoing familial stress. The outcome of ECT treatment is classified as moderate, with a temporary improvement in psychotic symptoms, particularly auditory hallucinations, although challenges in maintaining long-term stability persisted.

3.10. Case 10: Chronic management of recurrent severe depressive disorder with psychotic features

The patient is a 42-year-old male engineer with a seven-year career in engineering and postgraduate education. He is a father of three children and has experienced significant psychosocial stressors, including a recent separation from his wife, which led to his voluntary admission to psychiatric care. His psychiatric history is characterized by recurrent severe depressive episodes with psychotic features, including profound depressive mood, anhedonia, apathy, fatigue, and persistent thoughts of incapacity and suicidality without a clear plan. These symptoms emerged despite adherence to therapeutic guidelines, suggesting a persistent and resistant nature of his affective disorder.

The patient's familial history includes psychiatric conditions, with his mother experiencing a delusional disorder and postpartum depression, and his elder sister showing early signs of a psychotic disorder. The patient's personal history includes moderate alcohol and episodic cannabis use, which have coincided with the peaks in his depressive symptoms. A pivotal traumatic event at age four, linked to his mother's abortion, is perceived by the patient as a foundational trauma that contributed to his emotional fragility.

3.10.1. Symptomatology and Disease Progression

The patient's psychiatric course began with a suicide attempt in 2004, followed by his first psychiatric intervention in 2018 for a severe depressive episode with psychotic features. His condition continued to deteriorate despite initial treatments with antipsychotics and mood stabilizers. As his psychiatric symptoms worsened, necessitating hospitalization, a more intensive approach was adopted. Conventional pharmacotherapy provided limited relief, prompting the initiation of Electroconvulsive Therapy (ECT).

3.10.2. ECT Treatment Protocol

After an initial series of five ECT sessions, followed by an additional six sessions during a subsequent hospitalization, the patient achieved temporary remission of his symptoms.

3.10.3. Psychometric Evaluation

Hamilton Depression Rating Scale (HAM-D): Pre-ECT score was 30, indicating severe depression with significant anhedonia, apathy, and suicidal ideation. Post-ECT, the score decreased to 18, reflecting a 40% reduction in depressive symptoms and improvement in emotional engagement.

Positive and Negative Syndrome Scale (PANSS): Pre-ECT score was 68, indicating moderate positive symptoms, including delusions and hallucinations, and moderate negative symptoms. Post-ECT, the PANSS score decreased to 45, reflecting a 33.8% reduction in positive symptoms and significant improvement in emotional expression and cognitive engagement.

3.10.4. ECT Treatment Outcome

A total of 11 ECT sessions resulted in a temporary remission of depressive symptoms and psychotic features, improving the patient's mood and overall functionality for approximately two years. However, the patient experienced a relapse of depressive symptoms triggered by psychosocial stressors, underscoring the chronic and cyclical nature of his disorder. The outcome of ECT treatment is classified as moderate, with substantial improvement in mood and psychotic symptoms during the remission period, though the patient remains vulnerable to recurrence following significant stressors.

3.11. Interpretation of the results

To synthesize the effectiveness of electroconvulsive therapy (ECT) across various psychiatric conditions, we computed a pooled Hedges' g effect size. This involved aggregating the individual Hedges' g values from each case, which were calculated using the pre- and post-treatment scores for different psychometric instruments. The pooled effect size was estimated to be approximately -1.046, indicating a large overall effect of ECT in reducing symptoms across the studied cases.

Hedges' g was chosen as the effect size metric because it is a more robust measure compared to Cohen's d , particularly when dealing with small sample sizes or when the assumption of equal variances between groups is violated. Hedges' g adjusts for bias in the sample size, providing a more accurate estimate of the population effect size. This is especially important in meta-analyses involving single-case studies or small samples, where precision is important. The large negative effect size suggests that ECT significantly improves symptomatology in patients with complex psychiatric conditions, including schizophrenia, bipolar disorder, and depressive disorders. However, it is essential to interpret this result cautiously due to the heterogeneity of the cases and the variability in treatment responses.

The cases underscore significant heterogeneity in patient responses to standard pharmacological treatments, highlighting the complex interplay between genetic predispositions, environmental factors, and individual psychopathology. This necessitates personalized treatment plans tailored to individual needs. ECT emerged as a crucial intervention for cases where traditional medication regimens failed, proving effective in rapidly reducing severe symptoms such as refractory hallucinations and suicidal ideation and reinforcing its utility as a valuable tool in managing acute psychiatric crises.

Early and aggressive intervention, particularly employing multi-modal approaches, tended to yield better outcomes, emphasizing the importance of early treatment initiation, especially in the context of psychosis and severe mood disorders, in preventing long-term disability. The influence of familial relationships and social support systems was markedly evident, where dysfunctional family dynamics often

exacerbated patient conditions, while supportive environments tended to enhance treatment outcomes.

Challenges of managing dual diagnoses involving substance abuse disorders alongside psychiatric illnesses required more integrated and often more intensive treatment strategies to address both the psychiatric and substance-related aspects. Psychotherapeutic interventions, used alongside pharmacotherapy and ECT, provided significant benefits in terms of patient insight, coping strategies, and long-term management of psychiatric disorders, underscoring the importance of a holistic approach to psychiatric care.

The development of tolerance to certain medications and the variable efficacy of newer pharmacological agents pointed to the ongoing need for innovation in psychiatric medication. Particularly, the cases illustrated the limitations of current antipsychotics and mood stabilizers in some patients, necessitating ongoing adjustments and sometimes a trial-and-error approach.

These several cases illustrated the chronic nature of psychiatric disorders, with patients experiencing multiple relapses over time, highlighting the need for long-term treatment strategies and monitoring, emphasizing the chronic nature of these diseases. The intersection of neurological abnormalities with psychiatric symptoms in some cases provided insights into the potential organic bases for some psychiatric symptoms, suggesting that integrative treatment approaches that consider both neurological and psychiatric care are important.

These case studies collectively demonstrate the complexities involved in diagnosing and treating severe psychiatric disorders. They highlight the necessity for personalized, comprehensive treatment plans that are adaptable and responsive to the evolving dynamics of each patient's condition. The findings advocate for an integrative approach that combines pharmacological, psychotherapeutic, and social interventions, tailored to the unique needs of each patient to optimize outcomes and improve quality of life.

4. Discussion

The findings of this study align with existing research on the efficacy of Electroconvulsive Therapy (ECT) in treating severe psychiatric disorders. Studies have demonstrated ECT's rapid symptom relief in cases of treatment-resistant depression and other psychiatric conditions, corroborating its role as a critical intervention where pharmacological and psychotherapeutic options fail [4,16]. For instance, the results mirror meta-analyses demonstrating ECT's utility in reducing suicidal ideation but highlight specific challenges, such as the interplay between substance abuse and psychiatric symptoms [2,17].

Dierckx et al. (2012) highlighted the differential efficacy of ECT in bipolar versus unipolar major depression, attributing variability in outcomes to the interplay between mood stabilization mechanisms and individual neurochemical profiles. Similarly, our findings emphasize the importance of tailoring ECT protocols to patient-specific variables, such as underlying neurological conditions and concurrent pharmacological regimens. This underscores the growing consensus that a "one-size-fits-all" approach is suboptimal for ECT [18].

The results of this study resonate with Abbott et al. who reviewed neuroimaging studies and identified significant changes in brain structure and connectivity post-ECT [15]. Our findings extend this understanding by highlighting cases where neurological anomalies, such as deep venous cerebral thrombosis or cerebral organicity, influenced treatment outcomes. These observations suggest that while ECT induces neuroplastic changes, the presence of pre-existing neurological conditions may moderate its therapeutic effects, necessitating more integrative treatment strategies that consider both psychiatric and neurological dimensions [4].

The current results aligns with Rose et al., who emphasized the critical role of patient perceptions and societal attitudes in determining ECT's acceptance and utilization. Several cases in our study illustrate how stigma surrounding ECT affected patient and family engagement in treatment. By documenting long-term improvements in quality of life and symptom remission, this research adds to the growing body of evidence advocating for enhanced public education to mitigate stigma and promote ECT as a scientifically validated and ethically sound intervention [19].

The study's case-based design highlights the diversity of patient profiles, particularly the impact of comorbidities, neurological anomalies, and psychosocial dynamics on ECT outcomes. Unlike large-scale meta-analyses, which often generalize findings, this research provides detailed insights into how patient-specific variables—such as the presence of deep venous cerebral thrombosis or arachnoid cysts—affect treatment efficacy. This individualized perspective complements recent calls for personalized medicine in psychiatry, such as those proposed by Hori et al., who advocate for tailored approaches to psychiatric interventions [20].

This study is among the few to document the combined use of ECT and repetitive Transcranial Magnetic Stimulation (rTMS) in the management of treatment-resistant depressive disorders. By integrating these neuromodulatory techniques, the research addresses a critical gap in the literature, as highlighted by Ijaz et al. (2022), who emphasize the need for exploring synergistic interventions to enhance long-term outcomes [21].

The inclusion of longitudinal follow-up data, spanning up to three years in some cases, provides a rare glimpse into the durability of ECT's therapeutic effects. Recent studies, such as those by Andrade et al. (2020), have highlighted the paucity of long-term efficacy data in ECT research [22]. This study addresses that gap, offering evidence of sustained symptom remission in conditions like hebephrenic schizophrenia and bipolar affective disorder, albeit with variability.

The research also focuses on the intersection of psychiatric disorders and substance abuse, an area that remains underexplored in the context of ECT. Cases involving synthetic cannabinoids and methadone maintenance therapy reveal the complexity of addressing dual diagnoses. This aligns with findings by Brakemeier et al. (2021), who stress the importance of developing integrated treatment models for patients with co-occurring psychiatric and substance use disorders [23].

One of the primary limitations of this study is its small sample size, which restricts the generalizability of findings and hinders the ability to draw robust statistical conclusions. Although the ten cases provide detailed insights into individual responses to electroconvulsive therapy (ECT), larger cohorts are necessary to validate these observations and assess the consistency of results across diverse populations. This issue is well-documented in the literature, as larger datasets are often required to identify subtle patterns and trends in treatment outcomes [24].

The heterogeneity of the patient cohort poses another challenge, as the variability in diagnoses, comorbid conditions, and psychosocial contexts complicates the interpretation of results. While this diversity underscores the importance of personalized approaches, it limits the ability to generalize findings across broader clinical populations. Prior research has emphasized the need to control for such variability to ensure comparability in outcomes [25].

Additionally, the study's observational design precludes causal inferences, making it difficult to ascertain whether the observed outcomes are directly attributable to ECT or influenced by extraneous factors such as concurrent treatments or psychosocial interventions. The absence of a control group further compounds this limitation, as it precludes direct comparisons with alternative treatments, such as pharmacotherapy or repetitive transcranial magnetic stimulation (rTMS). These methodological gaps are consistent with criticisms raised in systematic reviews of ECT research, which often highlight the lack of rigor in trial designs [23].

Another limitation is the relatively short follow-up period in some cases, which restricts the ability to evaluate the long-term durability of ECT's therapeutic effects. Although a few cases were monitored for up to three years, the absence of consistent, extended follow-ups makes it challenging to assess the risk of relapse and the sustainability of improvements over time. Longitudinal data are critical, as studies have shown that relapse rates can vary significantly depending on post-ECT maintenance strategies [25].

Future studies should include longitudinal designs to evaluate the durability of ECT's effects over time. Monitoring inflammatory markers and neuroplasticity indicators pre- and post-ECT can provide critical data on the sustained impact of the treatment. This approach aligns with broader trends in precision psychiatry, which aim to integrate biological, psychological, and social factors into treatment plans. Additionally, the series showcases the potential benefits of integrating advanced monitoring techniques, such as neuroimaging and biomarker analysis, into routine ECT protocols. For instance, the role of extracellular vesicles in neuropsychiatric conditions, as discussed by Bravo-Miana et al., could offer new insights into how ECT influences neural repair and plasticity [26].

Moreover, combining ECT with complementary therapies, such as repetitive transcranial magnetic stimulation (rTMS) or cognitive-behavioral therapy (CBT), could enhance treatment efficacy and reduce relapse rates [27].

This case series also underscores the need for public education and advocacy to reduce the stigma surrounding ECT. Highlighting its scientific basis and technological advancements can improve acceptance and accessibility. Furthermore, exploring ECT's application in specific populations, such as geriatric, or neurologically impaired patients, could expand its utility and provide new insights into its versatility as a psychiatric intervention.

5. Conclusion

Electroconvulsive therapy (ECT) exemplifies the advancement of precision psychiatry, offering tailored interventions for severe mental health conditions unresponsive to standard treatments. This case-based investigation reinforces ECT as an effective and versatile treatment for severe psychiatric disorders, particularly when conventional pharmacological and psychotherapeutic methods fail. The observed cases illustrate ECT's efficacy in achieving rapid symptom remission, even in complex presentations involving comorbid conditions such as substance abuse and neurological abnormalities.

The study's longitudinal insights reveal the potential for sustained improvements in quality of life and functional recovery, particularly when ECT is integrated with complementary modalities like repetitive transcranial magnetic stimulation (rTMS). Nevertheless, limitations, including transient cognitive disturbances and the risk of relapse, highlight the importance of ongoing monitoring and individualized post-ECT care strategies. The multiple case study also identifies challenges, such as stigma, cognitive side effects, and variability in long-term outcomes, emphasizing the need for integrated treatment approaches that combine ECT with pharmacotherapy, psychotherapy, and social support. The heterogeneity of responses of these ten patients reaffirms the necessity of personalized psychiatric care, underlining ECT's role as an indispensable yet nuanced tool in modern mental health practice.

Author Contributions: Conceptualization, A.G.Z., S.C.T., A.M.C.; methodology, A.G.Z., S.C.T., A.M.C.; software, A.G.Z., S.C.T.; validation, A.G.Z., S.C.T.; formal analysis, A.G.Z.; investigation, A.G.Z., S.C.T.; resources, A.G.Z., S.C.T., A.M.C.; data curation, A.G.Z., S.C.T.; writing—original draft preparation, A.G.Z.; writing—review and editing, A.G.Z., S.C.T., A.M.C.; visualization, A.G.Z.; supervision, S.C.T.; project administration, A.G.Z., A.M.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of “Carol Davila” University of Medicine and Pharmacy Bucharest, Romania.

Informed Consent Statement: Written informed consent for participation in this study was provided by the patients for publication of any potentially identifiable images, personal history, personal details, or data included in this article. Written informed consent has been obtained from the patient to publish this paper.

Data Availability Statement: Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Rudorfer, M. V., Henry, M. E., & Sackeim, H. A. (2003). Electroconvulsive therapy. In A. Tasman, J. Kay, & J. A. Lieberman (Eds.), *Psychiatry* (2nd ed., pp. 1865–1901). John Wiley & Sons Ltd. <https://doi.org/10.1002/0470867967.ch123>
2. Pagnin, D., de Queiroz, V., Pini, S., & Cassano, G. B. (2004). Efficacy of ECT in depression: A meta-analytic review. *The Journal of ECT*, 20(1), 13–20. <https://doi.org/10.1097/00124509-200403000-00004>
3. Jørgensen A, Gronemann FH, Rozing MP, Jørgensen MB, Osler M. Clinical Outcomes of Continuation and Maintenance Electroconvulsive Therapy. *JAMA Psychiatry*. 2024;81(12):1207–1214. doi:10.1001/jamapsychiatry.2024.2360
4. Abbott, C. C., Gallegos, P., Rediske, N., Lemke, N. T., & Quinn, D. K. (2014). A review of longitudinal electroconvulsive therapy: Neuroimaging investigations. *Journal of Geriatric Psychiatry and Neurology*, 27(1), 33–46. <https://doi.org/10.1177/0891988713516542>
5. Bahji A, Hawken ER, Sepehry AA, Cabrera CA, Vazquez G. ECT beyond unipolar major depression: systematic review and meta-analysis of electroconvulsive therapy in bipolar depression. *Acta Psychiatr Scand*. 2019;139(3):214–226. doi:10.1111/acps.12994
6. Bouckaert, F., De Raedt, R., & Sienaert, P. (2014). Neuroplastic effects of electroconvulsive therapy: A review of electroconvulsive therapy-induced structural brain plasticity. *Journal of ECT*, 30(2), 143–151. <https://doi.org/10.1097/YCT.0000000000000133>
7. Wilkinson, S. T., Sanacora, G., & Bloch, M. H. (2017). Hippocampal volume changes following electroconvulsive therapy: a systematic review and meta-analysis. *Biological psychiatry. Cognitive neuroscience and neuroimaging*, 2(4), 327–335. <https://doi.org/10.1016/j.bpsc.2017.01.011>
8. Trifu, S. C., Vlăduți, A., & Trifu, A. I. (2020). Genetic aspects in schizophrenia. Receptor theories. Metabolic theories. *Romanian journal of morphology and embryology = Revue roumaine de morphologie et embryologie*, 61(1), 25–32. <https://doi.org/10.47162/RJME.61.1.03>
9. Gbyl, K., & Videbech, P. (2018). Electroconvulsive therapy increases brain volume in major depression: a systematic review and meta-analysis. *Acta psychiatrica Scandinavica*, 138(3), 180–195. <https://doi.org/10.1111/acps.128841>
10. Belvederi Murri, M., Pariante, C. M., Mondelli, V., Masotti, M., Atti, A. R., Mellacqua, Z., ... & Amore, M. (2014). HPA axis and aging in depression: Systematic review and meta-analysis. *Psychoneuroendocrinology*, 41, 46–62. <https://doi.org/10.1016/j.psyneuen.2013.12.004>
11. Takano, H., Motohashi, N., Uema, T., Ogawa, K., Ohnishi, T., Nishikawa, M., Kashima, H., & Matsuda, H. (2007). Changes in regional cerebral blood flow during acute electroconvulsive therapy in patients with depression: positron emission tomographic study. *The British journal of psychiatry: the journal of mental science*, 190, 63–68. <https://doi.org/10.1192/bjp.bp.106.023036>
12. Ousdal, O. T., Brancati, G. E., Kessler, U., Ersland, L., & Eide, G. E. (2019). The neurobiological effects of electroconvulsive therapy studied with magnetic resonance imaging: Systematic review and meta-analysis. *Biological Psychiatry*, 85(6), 489–500. <https://doi.org/10.1016/j.biopsych.2018.10.015>
13. Griffiths C, O'Neill-Kerr A. Patients', Carers', and the Public's Perspectives on Electroconvulsive Therapy. *Frontiers in Psychiatry*. 2019;10. doi:10.3389/fpsy.2019.00304
14. Fink, M., & Taylor, M. A. (2007). Electroconvulsive therapy: Evidence and challenges. *JAMA*, 298(3), 330–332. <https://doi.org/10.1001/jama.298.3.330>
15. Chen X, Yang H, Cui LB, Li X. Neuroimaging study of electroconvulsive therapy for depression. *Front Psychiatry*. 2023;14:1170625. Published 2023 Jun 9. doi:10.3389/fpsy.2023.1170625
16. Li, X. K., & Qiu, H. T. (2022). Current progress in neuroimaging research for the treatment of major depression with electroconvulsive therapy. *World journal of psychiatry*, 12(1), 128–139. <https://doi.org/10.5498/wjpv.12.i1.128>
17. Rönqvist I, Nilsson FK, Nordenskjöld A. Electroconvulsive Therapy and the Risk of Suicide in Hospitalized Patients With Major Depressive Disorder. *JAMA Netw Open*. 2021;4(7):e2116589. doi:10.1001/jamanetworkopen.2021.16589

18. Dierckx, B., Heijnen, W. T., van den Broek, W. W., & Birkenhäger, T. K. (2012). Efficacy of electroconvulsive therapy in bipolar versus unipolar major depression: A meta-analysis. *Bipolar Disorders*, 14(2), 146–150. <https://doi.org/10.1111/j.1399-5618.2012.00997.x>
19. Rose, D., Fleischmann, P., Wykes, T., Leese, M., & Bindman, J. (2003). Patients' perspectives on electroconvulsive therapy: Systematic review. *BMJ*, 326(7403), 1363. <https://doi.org/10.1136/bmj.326.7403.1363>
20. Hori, H., & Kunugi, H. (2021). Personalized psychiatry for depression: An update. *Current Opinion in Psychiatry*, 34(1), 7–13. <https://doi.org/10.1097/YCO.0000000000000645>
21. Ijaz, S., Davies, P., Williams, C. J., Kessler, D., Lewis, G., & Wiles, N. (2022). The clinical effectiveness of repetitive transcranial magnetic stimulation (rTMS) for depression: A meta-analysis. *The British Journal of Psychiatry*, 220(1), 1–8. <https://doi.org/10.1192/bjp.2021.51>
22. Andrade, C., Arumugham, S. S., & Thirthalli, J. (2016). Adverse Effects of Electroconvulsive Therapy. *The Psychiatric clinics of North America*, 39(3), 513–530. <https://doi.org/10.1016/j.psc.2016.04.004>
23. Brakemeier, E.-L., Merkl, A., Quante, A., Wilbertz, G., Regen, F., & Bajbouj, M. (2014). Cognitive-behavioral therapy as continuation treatment to sustain response after electroconvulsive therapy in depression: A randomized controlled trial. *Biological Psychiatry*, 76(3), 194–202. <https://doi.org/10.1016/j.biopsych.2013.08.023>
24. van Diermen, L., van den Amele, S., Kamperman, A. M., Sabbe, B. C. G., Vermeulen, T., Schrijvers, D., & Birkenhäger, T. K. (2018). Prediction of electroconvulsive therapy response and remission in major depression: meta-analysis. *The British journal of psychiatry : the journal of mental science*, 212(2), 71–80. <https://doi.org/10.1192/bjp.2017.28>
25. Perna, G., Alciati, A., Daccò, S., Grassi, M., & Caldirola, D. (2020). Personalized Psychiatry and Depression: The Role of Sociodemographic and Clinical Variables. *Psychiatry investigation*, 17(3), 193–206. <https://doi.org/10.30773/pi.2019.0289>
26. Bravo-Miana, R.d.C., Arizaga-Echebarria, J.K. & Otaegui, D. Central nervous system-derived extracellular vesicles: the next generation of neural circulating biomarkers?. *Transl Neurodegener* 13, 32 (2024). <https://doi.org/10.1186/s40035-024-00418-9>
27. Trifu, S., Sevcenco, A., Stănescu, M., Drăgoi, A. M., & Cristea, M. B. (2021). Efficacy of electroconvulsive therapy as a potential first-choice treatment in treatment-resistant depression (Review). *Experimental and therapeutic medicine*, 22(5), 1281. <https://doi.org/10.3892/etm.2021.10716>