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Geriatric Disorders (K Zdanys, Section Editor)

The Use of Electroconvulsive Therapy in Late-Life Psychiatric Disorders

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Abstract

Purpose To review the current literature regarding the use and safety of electroconvulsive therapy (ECT) in the elderly population.
Recent findings Electroconvulsive therapy (ECT) is both a safe and effective treatment for geriatric patients with severe psychiatric illness. In an era of often inadequate or poorly tolerated pharmacologic treatments, ECT can provide life-saving treatment for depression, catatonia, movement disorders, and even mood and behavioral dysregulation in dementia syndromes. The Prolonging Remission in Depressed Elderly (PRIDE) study directed by Charles Kellner has provided clear and convincing empirical data for the use of ECT in this age group for the treatment of depression.
Summary The data for the use of ECT for the treatment of depression in the elderly and in prolonging remission is convincing. The convergence of data for the treatment of late-life catatonia is also favorable. Data regarding the use as a treatment for the core movement disorder of Parkinson's disease is intriguing and warrants further investigation. The data for its use in other areas, particularly dementia, is less clear and a possible clinical algorithm is presented.

Introduction

The use of electroconvulsive therapy (ECT) in geriatric populations is increasing, in part due to an increasing appreciation of its safety and effectiveness, along with inadequacy of our existing pharmacotherapy for ECT-responsive conditions [1••]. Elderly patients respond less often and less robustly to antidepressant

medications. This decreased effectiveness is related to increased sensitivity to psychotropic agents related to pharmacokinetic changes including decreased first-pass metabolism, increased polypharmacy, increased body fat (leading to increased volume of distribution of lipophilic drugs), and decreased metabolic capacity of CYP-related phase I reactions [2]. For example, agents with significant anticholinergic effects are more likely to cause cognitive impairment in this population than in a younger, more cognitively intact age group. In addition, many psychotropic medications can cause orthostatic hypotension increasing a risk of falls [3, 4].

ECT is not without risk, and decision to pursue ECT must be made with consideration of severity of illness and potential efficacy. This article reviews age-specific risks of ECT in the elderly population and the ECT-responsive conditions for which ECT has demonstrable efficacy (major depressive disorder), strong evidence for its use (catatonia), or a growing body of evidence for a salutary effect (Parkinson's disease). Last, this article will review the use of ECT in the heterogeneous population of individuals with dementia who show behavioral changes which may be indicative of a mood disturbance or may be simply psychiatric symptoms of dementia.

Pre-ECT evaluation

The use of ECT in elderly patients demands consideration of health factors that are specific to this patient population. Geriatric patients often suffer from comorbid cardiovascular disease, pulmonary disorders, musculoskeletal disorders, and cerebral vascular disease, which all contribute to the risk of potential medical complications from ECT. In order to understand these risks, it is important to understand the physiologic changes that take place during the actual treatment. The patient is induced with a short-acting barbiturate and once unconscious is paralyzed with a short-acting depolarizing agent, suxamethonium chloride also known as succinylcholine which can raise serum potassium level 0.5 mmol/l [5]. A seizure is then induced by electrical stimulation to scalp electrodes. Because of proximity to the masseter muscles, there is an immediate clenching of the teeth. There is also a centrally mediated vagal response that can cause asystole of as much as 10 s. This asystole can be prevented by pre-treatment use of atropine or glycopyrronium bromide, both anticholinergic agents [6]. The seizure often results [7] in a transient rise in blood pressure and a tachycardia. At the end of the seizure, there is a peripherally medicated vagal response that results in a bradycardia. It is not uncommon to see two- to threefold swings in heart rate pre-treatment to during treatment to post-treatment. It has been thought that intracranial pressure increases during the seizure although this has been challenged by recent data [7]. As a consequence of the physiologic changes that occur, it is important that a pre-treatment evaluation addresses cardiac risks, hemodynamic risks, dental risks, and neurologic and neuromuscular risks. A strategy for managing any of these risks should be developed pre-treatment.

Cardiovascular evaluation

All patients should have a complete physical exam including a cardiogram. When the patient is in chronic atrial fibrillation, there should be an echocardiogram done in the prior 30 days. The ejection fraction is important because it will inform the anesthesiologist how closely to control blood pressure. If the patient has a cardiac pacemaker, it does not need to be

turned off. If an implantable cardioverter-defibrillator (ICD) is present, it should be turned off during the treatment and turned back on when the seizure ends to prevent firing during transient changes in rate [8, 9]. Patients who are anticoagulated because of atrial fibrillation should have an International Normalized Ratio (INR) done within 24 h of treatment to ensure it is within therapeutic range [10–12].

Neurological evaluation

The rise in CSF pressure that may occur with ECT necessitates a careful evaluation of patients with space occupying cranial lesions, and more common arterio-venous malformation. Although there are reports that ECT is safe in these conditions, a neurosurgeon should consult prior to the first treatment [13, 14]. ECT has been used successfully in patients with pre-existing seizure disorders. It is a standard practice in these patients to obtain an EEG prior to the first treatment. Often, the antiepileptic drugs need to be reduced prior to treatment and can be maintained at a lower dose than usual for the patient because the treatment itself raises seizure threshold [15–17]. Perhaps, the most vexing issue in the elderly population is the use of ECT in the presence of dementia. Alzheimer's type dementia and Lewy body dementia increase the risk for comorbid depression [18, 19]. When depression occurs in a patient with a dementia, it is imperative that the target symptoms be clearly identified before commencing any type of antidepressant therapy. ECT can be appropriately used in this population to produce rapid symptomatic relief [20–24]. These patients require formal cognitive assessment pre-treatment, during the treatment course and post-treatment. Cognitive decline increases with age and requires consideration and careful pre-treatment assessment of baseline cognitive abilities to distinguish potential cognitive side effects of the treatment from pre-existing cognitive impairments [25, 26]. Patients with spinal cord injuries also need care consideration because the use of suxamethonium may cause a grossly exaggerated release of potassium from muscle [27]. The anesthesiologist may decide to use an alternative agent in these cases.

Dental evaluation

A thorough dental assessment should be done prior to the first treatment. This exam should include an assessment of any oral devices, caps, and loose teeth. This exam should also include an assessment of jewelry such as tongue and lip clips. If there are loose teeth, the decision needs to be made whether to have an extraction prior to initiating ECT. Dentures, retainers, tongue, and lip jewelry are usually removed prior to treatment because of the risk of aspiration [28–31].

Spinal cord disease

The elderly population is more likely to have spinal complications related to diseases of aging such as osteoarthritis and rheumatoid arthritis. Some patients

with a history of reconstructive spinal surgery with implanted spinal surgical rods require consultation with an orthopedic surgeon or neurosurgeon to assess the risk of dislodging an implanted rod during the seizure. Typically, the use of an adequate dose of a neuromuscular blocking agent mitigates the risk of such problems during treatment [32, 33].

Hemodialysis

The administration of ECT to patients maintained on chronic hemodialysis requires careful management. The dialysis patient is subject to fluctuating changes in volume load, metabolic acidosis, and potentially cardiotoxic elevation in serum potassium. Often, there are high levels of parathyroid hormone that increase the risk of osteopenia and consequently increase the risk of fractures during the treatment if significant muscle contractions occur. Because of the increase in potassium following the use of suxamethonium, serum potassium levels need to be followed closely. An alternative is the use of a non-depolarizing agent which would avoid the use of suxamethonium, but it is difficult to obtain adequate muscle paralysis with these agents and they could increase the risk of fractures [34–36].

Prostate disease

Prostate disease is common in elderly men, particularly benign prostatic hypertrophy (BPH) [37]. This condition is prone to urinary retention. It is common for anesthesiologists to use atropine or glycopyrronium bromide to mitigate the asystole induced by the initial stimulation [38]. Both of these agents are strongly anticholinergic. Atropine induces rebound tachycardia and has a short half-life. Glycopyrronium has a 6-h half-life and does not cause significant tachycardia, so it is used more often in the elderly in order to avoid cardiac stress. Unfortunately, its peripheral anticholinergic effects can persist for hours after the treatment and can induce urinary retention. For that reason, it is prudent to not discharge elderly men to home before they can demonstrate that they can urinate.

Special considerations for the procedure

The elderly population requires special pre-procedure planning as to lead placement, the type of anesthesia used, and the monitoring required. Lead placement is unclear in terms of efficacy and duration. The Prolonging Remission in Depressed Elderly (PRIDE) data clearly favored the use of right unilateral lead place where the Consortium for Research in ECT (CORE) data contradicted this recommendation with better outcomes with bilateral lead placement [39, 40]. While also unclear, because of contradictory data, elderly patients may take longer to respond and persisting in the treatments up to at least 20 sessions may be necessary [41]. When minimizing exposure to anesthesia is crucial, bitemporal placement is still the standard treatment. When the individual does not have significant comorbid disease, then right unilateral is the preferred treatment. Like all patients

who receive ECT, elderly patients are continuously cardiac monitored during and post-recovery through discharge. They are also hyper-oxygenated pre-treatment. Because the elderly are more susceptible to dehydration, it is helpful to hydrate the patient with intravenous fluids pre-treatment because relative dehydration can lead to difficulty inducing a seizure. Each patient's blood pressure should be controlled before presenting for ECT treatment. Typically, patients receiving antihypertensive agents are instructed to take their morning medications as they normally would with a sip of water before coming to treatment. If the hypertensive patient did not take his or her prescribed medications before treatment or the pre-treatment blood pressure is elevated, severe increases in blood pressure can be avoided by pre-treating the patient with labetalol [42–44].

A history of a recent myocardial infarction (MI) in a patient who is a candidate for ECT carries an increased risk of reinfarction, arrhythmias, or cardiac rupture. However, depression immediately post-MI dramatically increases the post-MI mortality rate making it imperative to effectively treat the depressive condition [45–48]. Clinical judgment and active patient and family decision-making must play a role in the decision to treat with ECT versus the potential consequences of not treating [45]. Patients who are on beta blockers should be advised to continue their medication in the morning of the procedure. Pre-oxygenation is also especially important for this class of patients to limit anoxic time and increase myocardial oxygen supply as decreases in oxygen saturation below 90% have been demonstrated when pre-oxygenation was omitted. Avoiding or at least attenuating the titration of the stimulus for the index treatment may need to be considered in this population because of the high risk of bradycardia with sub-convulsive stimuli [46, 49].

Implantable cardioverter-defibrillators (ICDs) are used typically for secondary prevention in patients who have had a previous episode of resuscitated ventricular tachycardia, ventricular fibrillation, or sustained unstable ventricular tachycardia in the absence of treatable underlying causes. In addition to the obvious increased risk to a patient with identified ventricular disease, the presence of an ICD presents an additional concern. Supraventricular tachycardia (SVT) is common and can occur briefly during the ECT procedure. Although strategies are programmed into the ICD to help discriminate between SVTs and VT\VF, incorrect firing is not uncommon. To avoid incorrect firing of the device, it is a standard practice to turn it off during the procedure itself and to restart it when the procedure is over. Some have argued that it is safer to leave the device on in case a shockable rhythm occurs [50].

The presence of intracranial lesions or arterio-venous malformations also requires special modifications. In general, the anesthesiologist tries to keep the systolic pressure from rising over 140 mm. This goal is usually achieved with a nitroglycerin drip and pre-treatment with appropriate blood pressure agents [13, 51, 52].

Monitoring seizure efficacy is important. There are sufficient data suggesting that seizure duration does not directly correlate with treatment efficacy and there is no convincing evidence that there exists a minimal seizure duration in order to have an efficacious treatment [53–56]. From a practical standpoint, the qualities of the ictal EEG that are easy to observe that indicate a likely therapeutic treatment are the presence of a synchronous, symmetrical structure with

high amplitude relative to baseline, spike, and slow wave phases and significant post-ictal suppression [51, 55].

The use of ECT in major depressive disorder in the elderly

The most common use of ECT in the geriatric population is for the treatment of major depressive disorder (MDD). Our empirical data have increased significantly since Van der Wurff et al. concluded in a Cochrane review in 2003 that "it is not possible to draw firm conclusions on whether ECT is more effective than antidepressants, or on the safety or side effects of ECT in elderly people with depression" [52]. Since that time, evidence has emerged that supports its use [57, 58]. Two major multicenter studies in the last decade have provided convincing evidence of the effectiveness of ECT for depression in the elderly: Consortium for Research in ECT (CORE) conducted between 1997 and 2011 and Prolonging Remission in Depressed Elderly (PRIDE), a two-phased trial starting in 2009; data is still being published [39, 40, 59••].

ECT has documented efficacy in depression with psychotic features [40], atypical depression [60], and melancholic depression [61]. Data from CORE found that remission rates demonstrated 62.1% with melancholic MDD and 78% with non-melancholic MDD. The remission rate for MDD with psychotic features was 95% [62]. ECT has also been shown to be effective in bipolar depression with similar response rates to unipolar depression and some evidence of a faster response [63]. One randomized controlled trial for bipolar depression from Norway compared response to ECT versus a pharmacotherapy algorithm and found no difference in remission rates. However, the response rate with ECT was 73.9 versus 35% [64]. Remission rate was defined as a Hamilton-D score less than 10 and a response rate of a decrease of 50% or more.

The PRIDE study directed by Charles Kellner has provided clear and convincing empirical data for the use of ECT in this age group [39]. This study was a two-phase multisite protocol that started with an acute course of right unilateral ultra-brief pulse ECT combined with venlafaxine. One hundred seventy-two out of 242 patients completed the study with a 70% rate of response and 61.7% of remission. Strikingly, the mean number of treatments to remission was 7.3, much lower than empirically expected in this population. The mean number of treatments to induce remission in the geriatric population has had contradictory data with some series indicating a higher than average number required for remission compared to the general adult population [65]. For elderly patients with treatment-resistant depression, we find it prudent to extend the treatment series up to 20 treatments because of the possibility of a slow response. The CORE study also showed superiority in response to bitemporal ECT which is clearly contradicted by the PRIDE data [40].

Phase 2 of PRIDE was a randomized continuation of the phase 1 trial [59••]. Two randomized arms were compared: a medication only arm (venlafaxine + lithium) and a continuation ECT + medication arm over a 24-week period. Patients in the ECT + medication arm received ECT four times in 1 month, then during weeks 5–24 only by determination by an algorithm based on Hamilton Depression Scale (Ham-D) scores. The odds of relapsing were 1.7 times higher for the medication-only group [59••].

A follow-up analysis of these data looked at health-related quality of life (HRQOL) [66•] showed a significant improvement in patients who received ECT plus venlafaxine. The study added meaningful empirical data for the use of ECT in the elderly population for its efficacy and effect on quality of life. Several questions of clinical importance remain to be addressed, e.g., is there any utility to switching to bilateral ECT when there is no response to ultra-brief pulse right unilateral? and would a more traditional continuation phase method with the flexibility of clinical judgment produce better remission rates?

As Fochtmann has already pointed out, the PRIDE study is invaluable for providing evidence for the efficacy of acute ECT for the treatment of geriatric depression, but also importantly for the use of continuation and "rescue" ECT for the maintenance of the robust clinical benefits [67].

The treatment course in the elderly population is partially evidence based and partially driven by individual response. It is more difficult to induce therapeutic seizures in the elderly since impedance to the electrical charge administered to induce a seizure is increased by dehydration, cortical atrophy, and oxygenation. These conditions are more likely to be present in the elderly leading to less robust seizures which can result in longer treatment courses. Despite the PRIDE data, there are many patients who require 20 or more treatments to reach remission [41].

Once the individual reaches remission, the decision is made whether to continue a tapering schedule of ECT or change to maintenance pharmacotherapy. The best data for maintenance pharmacotherapy come from the PRIDE continuation trial in which subjects treated with venlafaxine, lithium, and a short tapering dose of ECT were followed closely. If signs of relapse occurred, the patient would receive a short course of ECT. Relapse occurred in 20.3% of the medication-only group versus 13.1% in the medication plus ECT group [59••, 65, 68, 69]. From a clinical standpoint patient who tolerated ECT well, remitted, and had minor side effects should receive a maintenance dose of ECT and medication for 6 to 12 months following remission.

Catatonia

Catatonia is a syndrome traditionally thought to be associated with schizophrenia but now recognized to also occur with primary mood disorders, neurological diseases, and other general medical conditions. This recognition has led to catatonia to be defined by a single set of criteria across DSM-5 as a specifier for schizophrenia, major mood disorders, psychotic disorders, substance-induced disorders, and medical conditions. Catatonia NOS has been added to allow for the rapid diagnosis and treatment in individuals for whom the underlying etiology is not readily available and to allow for quick effective treatment [70].

Catatonia is defined as the presence of three or more of the following symptoms: catalepsy, waxy flexibility, stupor, agitation independent of external stimuli, mutism, negativism, posturing, mannerisms, stereotypes, grimacing, echolalia, and echopraxia. In clinical practice, it can be difficult to distinguish catatonia from delirium [71]. Unfortunately, to give high doses of lorazepam that are necessary to induce remission of catatonia can be problematic in the elderly because of increased risk of falls [72, 73].

Malignant catatonia, a rare but potentially fatal form of catatonia, presents with autonomic instability, rigidity, and hyperthermia. These patients require continuous cardiac monitoring, intravenous fluids, and urgent aggressive treatment. While lorazepam is often given at high doses, prompt treatment with ECT should be initiated to prevent mortality. This condition is associated with a 30% mortality rate often from stroke or heart failure [74–77]. Early recognition of catatonia and intervention is essential, particularly in cases in which intensive hospital care is needed because of potential multiorgan failure. Delirious patients should be assessed for possible catatonia because of the importance of early intervention, and elderly patients are more at risk for delirium necessitating an even higher level of scrutiny for possible catatonia [71, 77, 78].

One of the poorly understood aspects of catatonia is relapse. As many as 50% of individuals successfully treated for catatonia, regardless of intervention, have a recurrence of catatonic symptoms after the treatment is tapered or discontinued [79–81]. There is a paucity of evidence regarding use of maintenance lorazepam and/or ECT [81, 82].

Parkinson's disease

Parkinson's disease (PD) is a progressive neurodegenerative illness for which prevalence increases with age. PD commonly produces debilitating symptoms including rigidity, postural instability, tremor, and bradykinesia. Comorbid depression is common; prevalence rates range from 20 to 90%. Symptomatic treatment of PD may consist of various combinations of levodopa, dopamine agonists, anticholinergics, and other medications, many of which are fraught with side effects that may worsen the clinical picture and decrease the patient's quality of life [83, 84].

There is a large body of data for the use of ECT to treat the depression associated with PD including depression with psychotic features and without psychotic features and psychosis without depression [1••, 40, 85–89]. The CORE data support the use of ECT early in the course of psychotic depression given the robust response rates in patients with psychotic features [62]. In this study, patients with psychotic depression had a remission rate of 95% compared to individuals with non-psychotic depression whose remission rate was 83%.

There is evidence that ECT actually improves the core pathophysiology of PD and yet has been widely ignored as a treatment for PD in the absence of depression. There has been no systematic study of the use of ECT in PD since 2008 [90]. Most of the publications regarding the use of ECT in PD are case reports and series that document the positive effects of ECT on motor symptoms. Unfortunately, these reports largely describe individuals with comorbid depression [89–97, 98•]. One exception is a study by Andersen in 1987 [99]. This double-blind study was of patients with PD who experienced severe "on-off" phenomena with their current medication. Six patients received sham ECT and five active ECT. The active ECT group showed significantly prolonged duration of the "on" periods after treatment compared to the controls. The patients who received sham ECT were given active ECT when the controlled part of the study was completed.

In 1991, Rasmussen and Abrams summarized the recommendations for the appropriate use of ECT in patients with PD, noting that the primary indication

for the use of this treatment was refractory motor symptoms or intolerance to medication side effects [100]. They recommended the use of right unilateral ECT to start (to limit cognitive side effects) and to consider maintenance treatments to prevent the return of motor symptoms. Twenty-eight years later, the use of ECT in PD is still being discussed, but is not routinely utilized. Popeo and Kellner postulate that the persistent stigma of ECT may be a primary factor in its lack of utilization in the management of PD [101]. Strikingly, given its underutilization, there is evidence that ECT may treat the pathophysiology of PD directly by improving the responsiveness of the dopaminergic system by inducing dopamine release and the modulation of dopamine receptors [102, 103].

Dementia with behavioral disturbances

As many as 50% of demented patients are agitated at some point during their illness and up to a third may become physically aggressive [22]. First-line treatment approaches for behavioral disturbances in dementia are non-pharmacological interventions [104, 105]. Pharmacological interventions are second line, but the use of the vast majority of medications is off label and complicated by side effects [106]. There is an absence of evidence-based data as to the use of ECT to treat refractory behavioral disturbances in dementia, although a large body of case reports and case series points to its possible safety and efficacy [24, 107]. In the absence of clear evidence for its efficacy and indications for use, we have developed a clinical guide to inform the use of ECT in this population as follows:

1. Does the patient have a history of a pre-existing psychiatric disorder that responded to ECT?

   Case example: An 80-year-old woman with Alzheimer's type dementia gradually stopped eating, lost 10 lb over a month and became increasingly withdrawn, and had been treated 10 years earlier for an episode of depression with ECT. This individual had a clear prior history of major depression that had responded to ECT making it likely that the symptoms represented a relapse of the depressive illness.

2. Does the patient have a symptom cluster that might respond to ECT?

   Case example: An 81-year-old man with Alzheimer's type dementia stopped eating and drinking due to a belief he was "dead" and therefore had no need for food. This patient was diagnosed with Cotard's syndrome, a phenomenon that has been reported to respond to ECT [108, 109]. This individual had clear symptoms of a syndrome that has responded well to ECT and had failed to respond to pharmacotherapy. This represents a potentially fatal delusional disorder that has some existing data for response to ECT.

3. Does the potential benefit outweigh the risks?

   Case example: A 79-year-old man with frontal-temporal dementia began suddenly talking rapidly, declaring he could "sting like a bee" and began punching staff at his facility without provocation. He had failed behavioral and pharmacologic interventions. We thought that his symptoms could be representative of a manic episode even in the absence of a history of bipolar illness. ECT was considered a low-risk intervention. Fortunately, he responded to a short ECT series.

Given the heterogeneous nature of dementia and its psychiatric manifestations in the elderly, this simple algorithm serves as a guide for clinical judgment when considering ECT in this population.

Other indications

There is a significant body of literature for the use of ECT to augment the response to medication in schizophrenia [110–112]. There are little data for the use in schizophrenia in the elderly except for encouraging care reports [113]. ECT has also been used to treat mania in the elderly and shown to be effective but rarely used since the response to medication is typically robust [114].

Conclusion

There is significant evidence for use of ECT to treat depression in older adults and the ability to prolong remission with concomitant use of medication. ECT is also very effective in the treatment of catatonia and may present fewer risks in an elderly population than the standard first-line treatment with high doses of lorazepam. There is evidence that ECT may be beneficial for the treatment of both motor symptoms and depression in PD, although further investigation is needed. The use of ECT to treat behavioral disturbances of dementia is complicated by the lack of clear criteria for its use. We describe a practical clinical algorithm to inform decision-making in this population.

Compliance with Ethical Standards

Conflict of Interest
Robert B. Ostroff declares that he has no conflict of interest.
Rachel B. Katz declares that he has no conflict of interest.

Human and Animal Rights and Informed Consent
This article does not contain any studies with human or animal subjects performed by any of the authors.

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