



Original article

Clinical experience of electroconvulsive therapy with anaesthetic and muscle relaxant at the Clínica Universidad de La Sabana: 2009–2017



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ABSTRACT

Introduction: Electroconvulsive therapy is an effective and safe procedure, which is indicated mainly in patients with both unipolar and bipolar depressive episodes, mania and schizophrenia, when they do not respond to other treatments.

Objective: To describe the demographic, social and clinical properties of a group of patients treated with electroconvulsive therapy (ECT) with anaesthetic and muscular relaxant at the Universidad de La Sabana Clinic for a period of 8 years.

Methods: The databases and records of the procedures were reviewed from 1 January 2009 to 31 December 2017. An analysis was performed with descriptive statistics.

Results: In this period, 1322 procedures were performed on 143 patients (54.5% women) with an associated diagnosis of major depression in 57%. The number of treatments per person was 9.2 and complications occurred in 3.8%, without any of them requiring invasive management.

Conclusions: Electroconvulsive therapy is performed safely in patients and with different parameters in terms of age, gender and diagnosis, in comparison to other countries in Latin America and the world. It is important to join efforts in research that allow a more complete overview of the characteristics of its application in the country.

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Experiencia clínica de la terapia electroconvulsiva con anestesia y relajación en la Clínica Universidad de La Sabana: 2009-2017

R E S U M E N

Palabras clave:

Terapia electroconvulsiva

Trastornos mentales

Introducción: La terapia electroconvulsiva es un procedimiento efectivo y seguro, el cual se indica principalmente a pacientes con episodios depresivos tanto unipolares como bipolares, manía y esquizofrenia, cuando no responden a otros tratamientos.

Objetivo: Describir las propiedades demográficas, sociales y clínicas de un grupo de pacientes tratados con terapia electroconvulsiva con anestesia y relajación (TECAR) en la Clínica Universidad de La Sabana por un periodo de 8 años.

Métodos: Se revisan las bases de datos y los registros de los procedimientos desde el 1 de enero de 2009 hasta el 31 de diciembre de 2017. Se realiza un análisis con estadística descriptiva.

Resultados: En este periodo se realizaron 1.322 procedimientos a 143 pacientes, el 54,5% de ellos mujeres, y con diagnóstico asociado de depresión mayor en el 57% de los pacientes. El número de tratamientos por persona fue 9,2 y en el 3,8% se presentaron complicaciones, sin que se requiriese tratamiento invasivo en ninguna de ellas.

Conclusiones: La terapia electroconvulsiva se aplica con seguridad a los pacientes y con parámetros diversos en cuanto a edad, sexo y diagnóstico, con más frecuencia en otros países de Latinoamérica y el mundo. Es importante sumar esfuerzos en investigación que permitan tener un panorama más completo de las características de su aplicación en el país.

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Introduction

Electroconvulsive therapy (ECT) has been widely used in psychiatric clinical practice for almost a century.^{1,2} Over the years, and thanks to research and development in the field, it has been established as a safe procedure for the treatment of various mental health conditions.³

ECT originated as a result of the original research of Ladislav Von Meduna, who experimentally used camphor to induce seizures as a treatment for mental disorders.^{1,4} However, the first ECT in history is considered to have been performed in 1938 in Italy, when Ugo Cerletti and Lucio Bini applied it to a patient with psychotic symptoms. Since then, its use has become progressively popularised and it has developed both scientifically and technically. In 1951, in order to improve safety and reduce the associated adverse effects (fractures, arrhythmias and bronchoaspiration), the use of general anaesthesia and muscle relaxation was implemented, and since then it has been called ECT with general anaesthesia and muscle relaxation (ECTAR).¹⁻⁷

The main indications for ECT are major depressive disorder with high suicidal risk, psychotic symptoms or poor response to pharmacological treatment; acute mania with extreme agitation or associated psychosis; and schizophrenia with catatonia and/or a history of good response to ECT.²⁻¹¹

With regard to its mechanism of action, several biological pathways have been described. Following electrical stimulation, neuronal depolarisation is generated by massive synchronous recruitment of neuronal clusters resulting in the induction of a seizure. This phenomenon triggers an

endogenous process with anticonvulsant properties, as well as a modulation in the production, release, reuptake and storage of neurotransmitters such as serotonin, dopamine and GABA.^{12,13} Simultaneously, there are changes in blood flow and brain metabolism, such as increased flow in the hippocampus, amygdala and other limbic structures. In addition, transient loss of continuity of the blood-brain barrier is known to bring tissue into contact with chemicals that promote angiogenesis and neurogenesis by means of transcription and neurotrophic factors, the most studied of which¹² is brain-derived neurotrophic factor (BDNF), involved in the regulation of neurogenesis and dendritic proliferation after repeated sessions.¹³ There are also neuroendocrine effects in which normalisation of the hypothalamic-pituitary-adrenal axis predominates, with an increased release of hypothalamic hormones.¹⁴

The physiological changes that occur during each session must be monitored for an appropriate approach for each patient. For example, blood flow velocity is increased by up to 130% and an initial bradycardia is produced by a parasympathetic response, with subsequent sympathetic discharge, inducing tachycardia and transient arterial hypertension lasting up to 5 min. In addition, there is an increase in corticotrophin followed by cortisol release, together with an increase in noradrenaline and adrenaline during the first minute of therapy, followed by a progressive decrease.¹⁵

As with any procedure, there are adverse effects, the least frequent and most risky of which are cardiovascular, such as congestive heart failure, acute myocardial infarction and arrhythmias. Additionally, prolonged seizures (defined by a duration >180s), headache, confusion and cognitive distur-

bances affecting retrograde and anterograde memory may occur. Special attention should also be given to the duration of unconsciousness and the occurrence of apnoeas that increase the seizure threshold, with shorter seizure duration and an increase in the aforementioned cardiovascular complications.¹⁶

This procedure is now routinely performed in a number of health institutions around the world, and its application rate is highly variable between countries, with an average of 2.34 patients/810,000 inhabitants per year. In Europe, application rates vary substantially; for example, they are high in countries such as Belgium, the United Kingdom and the Nordic countries (>3 patients/10,000 inhabitants/year), but decrease significantly in Germany and Eastern European countries (<0.2 in Ukraine); furthermore, the practice is banned in Slovenia and practically never used in Italy.^{16,17} Moreover, availability and use in North America also vary. In Canada it is estimated to be available to more than 90% of the population¹⁸ and about 10% of patients hospitalised for depression receive it,¹⁹ while in the United States there has been a significant decline in its use, from an annual rate of 12.6 in 1993 to 7.2 in 2009²⁰; it is only available in one out of 10 hospitals and 1.5% of patients hospitalised for depression receive it.²¹

In Latin America there are few studies assessing the rate of ECTAR application, but there are some descriptive studies. For example, a hospital in Lima, Peru, described the use of ECT in 372 patients between 2001 and 2011, mostly males with a diagnosis of paranoid schizophrenia, reporting a clinical response in 70.1% and mild and transient side effects, with a decrease in its use over the years.²² Similarly, in the Hospital Psiquiátrico Villahermosa [Villahermosa Psychiatric Hospital] in Tabasco (Mexico), ECT was reported in 104 patients, mostly women, over a 12-month period; the main indication was poor response to neuroleptics. Overall, 28% of the sessions were performed without anaesthesia.²³ At the Clínica Universitaria Bolivariana [Bolivariana University Clinic] in Medellín, Colombia, 276 patients treated with ECT (67.4% women) were reported. The main indication was a major depressive episode without psychotic symptoms and mild and transient complications were reported, the most frequent being bradycardia.²⁴ Similarly, the Clínica Universitaria Teletón [Teletón University Clinic] – now Clínica Universidad de La Sabana [La Sabana University Clinic] (CUS) – conducted a descriptive observational study of patients undergoing ECT in 2007 and 2008. In that paper, most of the diagnoses were depressive disorders, including severe and refractory disorders or psychotic symptoms. The main adverse effect following ECTAR was mobilisation of secretions in the airway.²⁵

In view of the above, it is clear that information on the application of this technique is scarce in Colombia. For this reason, the aim of this paper is to present the experience of CUS located in Chía, Cundinamarca, which has been applying ECTAR regularly since 2007 and is a referral centre for this procedure for mental health units in Bogotá and other cities in the country. In a previous paper,²⁵ the experience from 2007 to 2008 was reported; in this paper we aim to describe the procedure between 2009 and 2017, so the question guiding this research was: what were the characteristics of patients

undergoing ECTAR and the procedure at CUS between 2009 and 2017?

Methods

This study is part of a larger research project on ECTAR currently underway at the Universidad de La Sabana [La Sabana University] (US), which was approved by the University's Faculty of Medicine and the CUS Independent Ethics Committees. This was a descriptive observational study of all patients treated with ECTAR at CUS between January 2009 and December 2017. The parameters of the procedures performed in this period were also analysed. ECTAR is applied at CUS by a multidisciplinary team consisting of anaesthesiology, nursing and psychiatry. The equipment used is a Thymatron IV, second series with a constant current of 0.9 A, a maximum stimulus duration of 8 s, at a frequency of 10 Hz and a pulse width of 0.25–1.5 ms; the commonly used pulse width is 0.5 ms (bipolar wave, short pulse and square wave).²⁶

The majority of treatments are performed three times a week. Anaesthesiology is in charge of complete monitoring (ECG, blood pressure monitoring, pulse oximetry, capnography), while psychiatry takes three readings (bifrontal electroencephalogram [EEG], ECG and electromyogram [EMG]). By protocol, anaesthesia is induced with thiopental 3–5 mg/kg and succinylcholine as a muscle relaxant, at a dose of 1 mg/kg. Bilateral frontotemporal shock electrodes are placed in all therapies. It starts with a charge equivalent to the patient's age, and is adjusted according to response and the medicinal products associated with the treatment. A course of treatment consists of at least six sessions of ECT for a patient with major depressive disorder (MDD), while for patients with schizophrenia and bipolar affective disorder (BPAD), a course can have between six and 12 treatments.

For this study, the information for this time period was obtained from three different databases: a) the recording of each session in the CUS medical record management computer system since January 2009; b) the construction of a database from the computer records saved by the Genie IV software, and c) the database built by the Surgical Departments. Each of these sources of information has different data, complementary in most cases, which were cross-checked to ensure the best possible information.

The first source has socio-demographic data, the diagnosis and the surgical note; the second has only the records of the session itself: charge released, stimulus duration, frequency, pulse amplitude, impedance, coherence, EEG and EMG endpoint, and the last one has socio-demographic data, payer and diagnosis.

After cross-checking the three databases, the most complete one was chosen and fed into the others in case of inconsistencies or missing data. The final database was reviewed four times by four different reviewers, and then checked again during the analysis process to look for outliers and confirm that they were correct. Where data were missing and were not obtained after cross-checking the three databases, these data were not taken into account in the analyses. Analyses were performed with descriptive statistics using Microsoft Excel v. 10.

Table 1 – Distribution of patients and treatments by year.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Patients	21	43	11	10	8	5	12	15	18
Treatments	103	320	92	86	57	17	89	264	294

Table 2 – Treatments per person.

	Total	Male	Female
Age (years)	43	42 ± 16*	44 ± 17*
Total treatments	1322	642	680
Treatments per person	9.2	9.87	8.71

* Mean ± standard deviation.

Results

In the period from January 2009 to December 2017, a total of 1322 procedures were performed at CUS on 143 patients of an average age of 43 years. The youngest patient was 16 years old at the time of the procedure and the oldest was 77. Of these, 78 (54.5%) were women (Tables 1 and 2). For 40% of patients, the procedure was covered by their health insurance company and the rest by their medical policies, prepaid plans or their own means.

MDD was the most common diagnosis (Table 3), followed by BPAD and psychotic disorders, which together accounted for 98% of the diagnoses associated with treatment. The remaining 2% is accounted for by two patients with obsessive-compulsive disorder. With the exception of 38 treatments (2.9%) with etomidate and 18 (1.4%) with propofol, the procedure was performed with thiopental as the anaesthetic.

Regarding the parameters used for the treatment (Table 4), the average charge used was 62.8%, which is equivalent to 314.2 mC. The average initial charge (first procedure) for the first cycle was 49% (247.1 mC) and the final treatment charge was 314.8 mC, while in the second treatment cycle the final charge was 403.8 mC, implying a 27.4% increase in charge during the first cycle and 63.4% between the first treatment of the first cycle and the last treatment of the second cycle. The duration of the EEG response was 39.4 s and the EMG response was 26.4 s, while the average interhemispheric coherence was 88.2%. A second stimulation was required in 93 treatments (7%) because efficacy parameters were not achieved with the first stimulation.

Complications occurred in 3.8% of treatment sessions (Table 5). The most common were prolonged seizures, arrhythmias and hypertensive crises. None of the complications required invasive treatment or hospitalisation. Most of them reversed on their own or with first-line medicinal products (atropine for bradycardia and midazolam for prolonged seizures).

Discussion

This study describes the ECT sessions carried out at CUS between 2009 and 2017. The findings show that the majority of patients had access through prepaid health insurance companies or privately, which is largely due to agreements

with the clinic; however, this is in line with reports from the United States,²¹ where people with private schemes have greater access. Since there are no national statistics on the use of ECTAR, it is not possible to establish a rate of use, but the procedure's usage trends are noteworthy, with a higher number of sessions in 2009 and 2010, a significant drop from 2011 to 2014 and an increase again at the end of the observation period. This contrasts with reports from other countries with a clear trend of decreasing procedures.^{19,21,22,27} The data show that the average patient is an adult female with a diagnosis of depression who receives a treatment cycle of eight sessions and has no complications during her procedures. An analysis of the literature reveals that women are also beneficiaries of the majority of treatments in studies from Colombia, Mexico and Australia,^{23–25,28} while studies from Peru and India show a majority of men, which is also related to the most associated diagnosis (schizophrenia).^{22,29} The diagnosis associated with the procedure is similar to previous national^{24,25} and international^{27,28,30} studies, consistent with the indications for the procedure, although in some the proportion of patients with bipolarity is higher, such as in studies from Canada and Peru.^{19,22} In our study there is a higher proportion of patients with psychotic disorders than in the study by Ocampo et al., but much lower than those reported in Mexico, Peru and India.^{22,23,29} It is also striking that higher-income countries refer older adult patients more frequently.^{19,31} Regarding complications during the procedure, very low figures and similar causalities are also reported in Colombia and in other countries.^{16,21–25}

As far as prescribed medicinal products are concerned, the session parameters show that in other countries propofol is used more often^{27,30} and atropine is common.³⁰ The procedure is also applied bilaterally in Spain,³⁰ with similar average charges in Spain,³¹ but higher than in India and Mexico (194.4 and 201 mC, respectively), although the average age in these studies was at least 10 years younger, which correlates with the charge used.^{23,29,31}

This study had a triangulation of sources, which ensures the validity of the data; however, in several of the procedures (5%) there was interference from the equipment signals, resulting in some data not being recorded (EEG endpoint or interhemispheric coherence). Moreover, being a referral centre for the procedure and not being directly involved with the treatment meant that some data, such as symptom scales, were not available and effects on the cognitive sphere, for example, were not followed up.

Taking into account what has been discussed, we consider it important to carry out specific research and academic meetings in the area of ECTAR and, in general, neuromodulation, in which the experience of the institutions that carry out the procedure and the responses in Colombia can be learned, so that some basic points or guidelines can be established to guarantee that the procedure follows quality standards and

Table 3 – Diagnoses associated with the procedure.

Diagnoses	Male, no.	Female, no.	Total patients, no.	Distribution of the diagnoses, %
Major depressive d.	34	48	82	57
Bipolar affective d.	7	22	29	20
Schizophrenia	20	2	22	15.3
Schizoaffective d.	2	3	5	3.4
Obsessive compulsive d.	2	0	2	1.4
Other psychotic d.	1	2	3	2.1

d: disorder.

Table 4 – Technical characteristics of the sessions.

Average charge (%)	Energy (mC)	Initial charge (mC)	Final charge (mC)	Final charge cycle 2 (mC)	EEG endpoint (s)	EMG endpoint (s)	Coherence (%)
62.8	314.2	247.1	314.8	403.8	39.4	26.4	88.2

EEG: electroencephalogram; EMG: electromyogram.

Table 5 – Adverse effects during treatment sessions.

Adverse effect	n	%	Observations
Prolonged seizure	14	1	Bradycardia: 5 bigeminy: 3 ventricular extrasystole: 3
Arrhythmia	13	1	Tachycardia: 1 Asystole: 1
Hypertensive crisis	12	0.9	
Headache	4	0.3	
Agitation	3	0.2	
Confusion	2	0.2	
Anxiety	2	0.2	
Allergic reaction	2	0.2	Skin rash
Laryngeal spasm	1	0.1	

comparable parameters, both nationally and internationally. For example, there is a call to use techniques that limit adverse cognitive effects, such as applied dose, unilateral application with ultra-brief pulses, hyperventilation and oxygenation, and even the administration of medicinal products.^{9,11} However, access in Colombia is limited, and the patients who attend often come in as a last treatment option, so having a more complete picture of the procedure in the country and the region would contribute both to making the best decisions for patients and to the body of clinical evidence in this regard.

Conclusions

ECTAR is a safe treatment which, in the observation period, was mostly applied to private patients, with the most frequent entry diagnosis being affective disorders. There are similar and differentiated characteristics with respect to high-income countries and similar-income countries. It is important to continue research in the area to consolidate local evidence.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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