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Morbidity in electroconvulsive therapy

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Summary

Background and objective To assess retrospectively the complications and morbidity of electroconvulsive therapy.

Methods Complications occurring in 75 patients during 612 electroconvulsive therapy procedures under propofol anaesthesia were reviewed by data analysis.

Results At least one complication occurred in 51 patients (68%) during the course of their treatment. Among these complications, 12 were potentially life-threatening: one patient developed angina pectoris, another aspiration pneumopathy, there were two incidences of bronchospasm, three hypoxic episodes ($SpO_2 < 92\%$ with $FiO_2 = 1$) and five severe episodes of laryngospasm which caused hypoxia. Twenty-five patients (33%) were confused for more than 2 h after the electroconvulsive therapy. Confusion recurred in 10 patients (13%) after several sessions of electroconvulsive treatment. Six patients had a traumatic complication, with one requiring surgery.

Conclusion Our results, compared with other studies, suggest that electroconvulsive therapy is not a low-risk procedure, with a particularly high rate of respiratory complications that may have been previously overlooked. Therefore, ambulatory anaesthesia may not be appropriate on a regular basis for most of these patients.

Keywords: ANAESTHESIA, GENERAL, propofol; ASPIRATION; ELECTROCONVULSIVE THERAPY, complications, LARYNX, laryngospasm; MONITORING, physiological, PNEUMONIA, RESPIRATORY MECHANICS, aspiration.

Introduction

Although general anaesthesia has been used since 1963 to provide humane conditions for electroconvulsive therapy (ECT) [1], there are few studies about its complications and their implications for the anaesthesiologist [2–6]. Moreover, some authors have suggested that anaesthesia for ECT is associated with lower standards of care than for other non-surgical anaesthetic procedures [7,8]. Anaesthesia for ECT is associated with specific problems such as repeated exposures and attendant risks. It is performed outside the operating room and pharmacological interactions between anaesthetic drugs, psychiatric medications and convulsions are numerous [1]. Finally, the patients are often elderly and unable to relate their medical problems coherently.

Over the past few years, some authors have suggested that ECT had a lower morbidity rate than antidepressant drugs [4,9] and have suggested that this practice is unsuitable on an outpatient basis [10]. It is estimated that 1% of the general population is suffering from bipolar disorders [11], one of the most common pathologies treated with ECT. It has also been suggested that ECT can be a useful treatment for some forms of neurological disease, e.g. epilepsy and Parkinson's disease [12]. All this implies that potentially a considerable number of patients might receive ECT. Thus, it is useful to re-evaluate its safety. However, surprisingly few studies have tried to quantify its risks. Most studies have focussed on a class of patients with a specific risk factor such as age or cardiopathy. The aim of the present study was to examine the rate and type of complications observed during and after ECT in an unselected group of psychiatric patients, in order to assess the feasibility of ECT on an outpatient basis.

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Methods

The 612 ECT treatments performed in our institution on 75 patients between October 1st 1996 and September 30th 1997 were retrospectively reviewed. The median number of ECT treatments per patient was eight (1–23), with four patients receiving two series of eight treatments and 10 receiving a maintenance ECT each month after an initial course of treatment.

Anaesthesia for ECT was provided according to the French legal standards and the recommendations of the French Society of Anaesthesiology and Critical Care. A preanaesthetic evaluation was performed at least 3 days before the first ECT, and a standard evaluation form completed by the anaesthesiologist. Additionally a full blood count, blood electrolytes, blood urea and activated partial thromboplastin time were determined for all patients. An electrocardiograph, a chest radiograph and a cardiological evaluation were undertaken for patients older than 40 years or those with known cardiovascular pathology. A dental examination was made by a stomatologist and a dental cast was taken to provide a dental protector specific for each patient.

None of the ECT courses was conducted on an outpatient basis or those for maintenance ECT, except in five patients and for 25 ECT treatments. The patients fasted from midnight. Although no premedication was given regular cardiac medications were given. ECT sessions were conducted from 08:00 to 12:00 hours, twice a week. Patient monitoring was performed with an electrocardioscope, an electroencephalogram, a pulse oximeter and a non-invasive blood pressure device, and dental protectors were inserted into the patients' mouths. After preoxygenation, anaesthesia was induced with propofol (1–1.5 mg kg^{-1}) and a Guedel oral airway was inserted if required. In five patients, with severe osteoporosis or prosthetic joints, succinylcholine (1 mg kg^{-1}) i.v. was also administered. Then, the patient was firmly held by the nursing staff to prevent any trauma and the bilateral ECT stimulation (Thymathron DG, Somatics) was applied by the psychiatrist. After the end of the period of convulsions, manual ventilation of the lungs with oxygen 6–8 L min^{-1} was performed until spontaneous respiration was resumed. After the patient had opened his/her eyes, he/she was taken to the recovery room, given oxygen 3 L min^{-1} and monitored using pulse oximetry and an automatic blood pressure device until the anaesthesiologist authorized discharge. A standardized record was then completed by the anaesthesiologist. Blood pressure, pulse rate and mood were monitored every 1 to 3 h for the next 8 h by the nursing staff in the psychiatric department. The anaesthesia and clinical records of ECT were retrospectively analysed by an independent observer. Complications were considered as severe when they were life threatening (such as laryngospasm, bronchospasm, inhalation pneumonitis, severe angina pectoris or hypoxaemia despite an enriched oxygen supply) or they potentially impede discharge on the same day. No files were missing.

Results

There were 17 men and 58 women. The median age for men was 47 years (36–88 years), and their median weight was 87 kg (60–100 kg). The median age for women was 62 years (25–76 years), and the median weight was 58 kg (43–90 kg). Amongst the patients, 22 (29%) were class ASA I, 43 (57%) ASA II, seven were (9%) ASA III and three were (4%) ASA IV; 34 patients (45%) were older than 60 years, and 25 (33%) had previously received one or more courses of ECT. The psychiatric diagnosis was depression resistant to medication in 56 patients, unipolar and bipolar disorders for five and eight patients, respectively, schizophrenia for three patients and undetermined for three patients. Patients also received various psychiatric medications (lithium, tricyclic antidepressants, neuroleptics, paroxetine and benzodiazepines) which changed several times during the course of the study period. The past medical history of the patients is summarized in Table 1.

One hundred and twenty-six complications (20.6% of the ECT procedures) occurred in 51 patients (68% of the patients) (Table 2). Some patients experienced the same type of complication after several different ECT sessions: 11 patients had the same complication twice, seven patients, three times, one patient, four times and five patients, five times (Table 3). Fourteen patients suffered from two different complications, and six from three (Table 4). Twelve potentially life-threatening complications (2% of all the ECT procedures) occurred in seven patients (9% of the patients) (Table 4).

Table 1. Types of pathology found among the ECT patients

Pathology	*n*
Hypertension	5
Hypertension and angina pectoris	1
Hypertension and previous myocardial infarction	1
Hypertension and atrial fibrillation	1
Hypertension and COPD	1
Hypertension and Parkinson's disease	1
Hypertension and epilepsy	1
Obstructive cardiomyopathy	1
Non-obstructive cardiomyopathy	1
Recent phlebitis treated with low-weight heparin	1
Parkinson's disease: recent phlebitis treated with low-weight heparin	1
Atrial fibrillation: recent phlebitis treated with low-weight heparin	1
Diabetes mellitus: recent phlebitis treated with low-weight heparin	1
Pulmonary embolism treated with low-weight heparin	1
Asthma	1
COPD	3
Epilepsy secondary to cerebral infarction	1
Epilepsy	1
Diabetes mellitus	2
Hiatus hernia	3
Repeated occlusions	1
Severe denutrition	3
Rheumatoid arthritis	1
Smoker	10
Alcoholism	2

COPD, chronic obstructive pulmonary disease.

Table 2. Complications after ECT

Complications allowing same day discharge	Number of ECTs	Number of patients
Dental fracture	3	3
Traumatic wound	2	2
Cutaneous rash	1	1
Headache	15	8
Nausea	8	3
Delayed awakening	1	1
Laryngospasm*	5	4
Bronchospasm*	2	2
Sinus dysrhythmia	1	1
Hypertension	14	11
Hypotension	2	1
Bradycardia	4	4
Complications preventing from same day discharge	**Number of ECTs**	**Number of patients**
Confusion	46	25
Agitation	16	9
Bone fracture	1	1
SpO_2 < 93% with oxygen*	3	2
Aspiration pneumonia*	1	1
Angina pectoris*	1	1

*Potentially life threatening.

Table 3. Iterative complications after ECT

Complication	Number of occurrences in the same patient	Number of patients
Confusion	2	1
	3	1
	4	1
	5	3
Agitation	2	3
	5	1
Headache	2	1
	3	3
Nausea	2	1
	5	1
Hypertension	2	1
	3	1
Hypotension	2	1
Laryngospasm	2	1
Isolated hypoxia	2	2

Table 4. Patients who had several different complications during the course of ECT

Complications	Number of patients
Confusion and headache	2
Confusion and agitation	3
Confusion and nausea	1
Headache and nausea	1
Headache and dental fracture	1
Agitation and lip wound	1
Agitation and hypertension	1
Delayed awakening and hypertension	1
Confusion and hypertension	1
Laryngospasm and bronchospasm	1
Hypertension and tongue wound	1
Confusion, laryngospasm and bronchospasm	1
Agitation, hypoxia and laryngospasm	1
Hypoxia, hypertension and bradycardia	1
Hypertension, bradycardia and broken tooth	1
Hypertension, agitation and nausea	1
Hypertension, agitation and dental fracture	1

Neuropsychiatric complications

Eight patients (10%) complained of headaches and in three patients, headaches reappeared after several (three or more) ECT episodes. Three patients had nausea, one patient suffering from this after several ECTs. Twenty-five patients (33%) suffered from confusion for more than 2 h after ECT. In 10 of them (13%) the confusion recurred after subsequent ECT. Nine patients (12%) were agitated for more than an hour after ECT and in three the agitation reappeared after the next ECT. One patient was agitated after a maintenance ECT session and was confused after another. One patient recovered consciousness only 15 min after ECT.

Traumatic complications

In six patients (8%) traumatic complications occurred; all of them had previously had ECT. Three patients had dental damage despite the use of dental protection in all and succinylcholine in one of them. Poor dental condition had previously been noted on the anaesthesia evaluation form for all these patients. One patient had a split lip and another a lacerated tongue. One patient with rheumatoid arthritis suffered a fractured humerus which required surgical repair.

Respiratory complications

Respiratory problems occurred in six patients (8%) but none during the three first ECTs. They were considered as life threatening in five patients (Table 5). Patient no. 1 was carefully watched on the nights before ECT to prevent him from smoking and eating and no adverse respiratory event occurred. The course of ECT was initially interrupted in patients nos. 2 and 5, but because medical treatment of depression was inefficient it was decided to attempt ECT again. In addition to their usual antisialogue medication, they were given metoclopramide, cimetidine and sodium citrate as premedication. ECT was performed in the seated position and cricoid pressure was maintained during the procedure. These patients did not suffer from any other respiratory incident. Patient nos. 3, 4 and 6, did not receive any other ECT.

Cardiovascular complications

Eleven patients (15%) had hypertension after ECT and required treatment (three of these patients more than 2 h after the ECT) and two patients after two or

Table 5. Respiratory complications after ECT

Patients	Previous medical pathology	Pathological events	Immediate consequences
Patient 1, male 36 years, 96 kg, ASA I	Smoker, poor compliance to treatment	1. Laryngospasm during the emergence of ECT while keeping unnoticed chewing gum	1. Resolved spontaneously
		2. SpO_2 < 92% despite oxygen after an ECT procedure	2. Oxygen therapy
		3. SpO_2 < 92% despite oxygen after an ECT procedure	3. Oxygen therapy
Patient 2, female, 51 years, 72 kg, ASA II	Hiatus hernia	1. Laryngospasm during the emergence of ECT	1. Resolved spontaneously
		2. Laryngospasm during the emergence (maintenance ECT)	2. Resolved with succinylcholine
Patient 3, female, 43 years, 61 kg, ASA II	Epilepsy	1. Laryngospasm during the emergence of ECT	1. Resolved spontaneously
		2. Bronchospasm during the emergence of ECT	2. Resolved spontaneously
Patient 4, female, 52 years, 70 kg, ASA 1.	None	1. Laryngospasm during the emergence of ECT.	1. Resolved with propofol
		2. Bronchospasm during the emergence of ECT	2. Oxygen therapy
Patient 5, female, 58 years, 90 kg, ASA I	Hiatus hernia	1. Cough and bradycardia during emergence (maintenance ECT).	1. Pharyngeal aspiration and atropine
		2. SpO_2 < 92% despite oxygen given (maintenance ECT).	2. Oxygen therapy
Patient 6, female, 73 years, 49 kg, ASA 3	Non-obstructive cardiomyopathy	Aspiration pneumonitis	Interruption of ECT procedure and antibiotic therapy for 3 weeks

more ECTs. Among them, eight had not suffered previously from hypertension. Four patients developed severe bradycardia – 20 beats min^{-1} – immediately after the convulsions: this resolved after atropine i.v. administration. One patient had a sinus dysrhythmia, which terminated spontaneously. One patient, a 42-year-old, with previously untreated hypertension, developed ST segment changes and chest pain after his fourth ECT. He was transferred to the cardiology department and the ECT course was discontinued. He reported later having previously had chest pain during exercise, although he had not mentioned it during the preanaesthesia assessment.

Allergic reactions

One patient suffered from a skin rash after her sixth ECT. Propofol was then changed to etomidate for future sessions.

Miscellaneous complications

One patient aged 42 years, died at home from pneumonia 4 days after ECT. She had previously had several bowel obstructions due to the large amount of antipsychotic medication she was taking. Unfortunately, we have no information to judge whether the pneumonia was related to ECT or not. In five patients central venous access was required for parenteral feeding (cachexia) as peripheral venous access was impracticable. One of these patients suffered from a pneumothorax and another one from catheter-induced septicaemia.

Discussion

In this series of ECT under general anaesthesia, 51 patients (68%) were affected by a complication and among them, seven (9%) had one or more potentially life-threatening events. The general morbidity of ECT had been previously estimated between

0.3% and 0.4% [1], but confusion, and headaches were not considered as significant complications by some authors [2,4,13]. On the contrary, studies rating confusion and agitation as complications reported morbidity rates up to 54%, which is similar to our morbidity rate [14]. Other authors consider psychiatric complications and memory impairment as part of a normal ECT course [15]. Their occurrence is increased by the use of bilateral stimulation and simultaneous psychiatric medication [15,16] such as in the present study explaining the high confusion rate. Older patients are also prone to develop confusion after ECT. Out of 136 patients, Burke and his colleagues [2] observed 18% and 35% complication rates in patients, respectively, under and above 60 years of age with higher confusion rates in older patients (13% vs. 18%). Casey and his colleagues [6] found 22.7% complications when patients were over 75 years of age. In patients over 65 years, Cattan and his colleagues [3] noted that repeated confusion was the most frequent complication.

In cases of outpatient ECT, confusion and agitation are serious problems, as confused patients have a risk of falls (14% of iterative falls in patients between 65 and 80 years and 36% above 80 years) [3], wounds and fractures, escape from their family, as well as violence [2]. Confusion can also mask somatic problems such as bladder distension as well as more serious events such as cardiac ischaemia [17]. Thus, confusion precludes any ambulatory ECT. Moreover, all the serious complications including confusion, occurred after three or more uneventful ECT procedures. Burke and his colleagues [2] have reported the absence of correlation between the number of ECTs and the occurrence of complications. They suggest that if a patient had previously received an ECT without any complications, this does not imply that subsequent ECT remains at low risk. In the present study, the organization of ECT courses on an outpatient basis would have thus been possible only in a very limited number of patients.

Cardiovascular complications

Other studies suggest that cardiovascular complications are the main components of the morbidity rate and are favoured by pre-ECT cardiovascular status [18]. In the study by Rice and his colleagues [5], 19.2% of major complications occurred in patients with a cardiovascular risk factor whereas in only 14.8% without. In another study, out of 40 patients with previous cardiovascular disease, 22 had a cardiovascular complication, eight of which were potentially life threatening (chest pain, ECG modification, asystole) [4]. A threefold increase in cardiovascular complications was also found in patients over 80 years of age (36%) [3].

However, in this study cardiovascular complications were not the main factor contributing to morbidity and only one patient suffered from a serious cardiovascular complication, mainly because he failed to report his previous cardiac symptoms. This case outlines the specific difficulties of the assessment of psychiatric patients who might forget important parts of their past medical history.

Respiratory complications

Contradicting previous epidemiological studies, a high rate of respiratory events was observed in this study. Respiratory complications are amongst the most common complications of general anaesthesia and seizures [19]. Burke and his colleagues [2] found two instances of aspiration pneumonia among 136 ECT patients. Cattan and his colleagues [3] reviewed the medical records of 81 older patients (65 years of age and over), who underwent ECT at a university-affiliated private geriatric hospital, to evaluate the safety and efficacy of this treatment for depression in the 'young-old' (65–80 years) compared with the 'old-old' age group (over 80 years). They found that patients over 80 years had significantly more cardiovascular complications and falls (95% confidence interval) and tended to have a worse ASA-scale rating and a somewhat less successful outcome. Because all patients with pulmonary aspiration do not show clinical symptoms [20], the incidence may be underestimated, especially in confused patients. Thus, Wayne and his colleagues [21] compared chest radiographs before and after ECT in 12 patients. They found abnormalities in three patients: two had atelectasis of the lower left lobe and one had pulmonary oedema. None of the patients had dyspnoea. Thus, it seems that respiratory complications occur quite often after ECT and perhaps were unnoticed in some previous studies because of the lack of appropriate

monitoring. The use of pulse oximetry is not mentioned in some studies although patients received oxygen before and during the ECT procedures [2,4]. McCormick and Saunders [8] found a decrease in $SpO_2 < 90\%$ after ECT in 17% of the patients breathing air during the recovery period, which is similar to the present study. However, the incidence of laryngospasm is far higher than the 5.6% and 8.9% rate already observed during general anaesthesia [22]. Out of the six patients with a respiratory complication, five were recorded probably because of specific risk factors such as a broken preoperative fast (patient 1), hiatus hernia (patients 2 and 5) and gastro-oesophageal reflux. Berrios and Sage [23] noted that among 76 patients, 21 broke the preanaesthetic fast and most often during the 3 h before ECT. However, the relationship between hiatus hernia and gastro-oesophageal reflux is still debated. In our series of patients, one of the patients with hiatus hernia did not develop any adverse respiratory event. The incidence of gastro-oesophageal reflux has been estimated between 14.8% and 15.9% during general anaesthesia with a facemask, and between 18.8% and 11.1% during the recovery period [24,25]. Studies of anaesthesia using a facemask for other procedures do not report such a high incidence of laryngospasm or coughing [25]. However, the depth of anaesthesia for ECT is only light which is a known factor contributing to increased reactivity of the larynx. Combined psychiatric medications may also enhance the risk of gastric fluid regurgitation. The upper and lower oesophageal sphincter pressures are decreased by benzodiazepines [25,26]. Tricyclic antidepressants reduce gastric secretion [27], but can induce hiatus hernia [28]. Although neuroleptic drugs increase the lower oesophageal pressure [29], they may induce laryngopharyngeal dyskinesia and death after food inhalation in conscious patients has been reported [30]. Thus, the laryngospasm, coughing or pneumopathy observed in patients 3, 4 and 6 could have also been linked to inhalation of saliva [31].

The management of ECT in patients with hiatus hernia, or at risk of inhalation, is controversial. The sole use of succinylcholine may not prevent pulmonary aspiration, as it increases the intragastric pressure and decreases the upper oesophageal pressure [31,32]. The most effective way to prevent pulmonary aspiration is endotracheal intubation with cricoid pressure, but, to our knowledge, there have been no studies on elective tracheal intubation for ECT except an anecdotal case report of ECT for a pregnant patient [33]. Elective tracheal intubation is unlikely to be considered in patients with difficult intubation, for example patient no. 5 in our series. Antacid and antiemetic premedication, the application of cricoid pressure and administration of ECT in the sitting position were simple methods with few side-effects that could be applied to any patient but deserves evaluation.

Traumatic complications

Traumatic complications during ECT can be prevented with short-acting muscle relaxants although one of our patients had a tooth broken despite the use of succinylcholine. Since the publication of the French National Guidelines for Electroconvulsive Therapy, succinylcholine 1 mg kg^{-1} is now given to all patients unless contraindicated.

In conclusion, the morbidity associated with ECT may have been underestimated. This study addresses the specific problem of pulmonary aspiration and respiratory complications during ECT, although the effects of most psychiatric drugs on gastric emptying and oesophageal tone are well known. Because of the high incidence of post-ECT confusion (and potential associated complication), or the risk of broken preoperative fasting, anaesthesia should not be performed regularly on an outpatient basis. The occurrence of complications despite previous uneventful ECT must be kept in mind to inform patients of the risk of unanticipated admission after an ECT scheduled on an outpatient basis.

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