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Safe performance of ECT in severely ill patients: A retrospective study

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ABSTRACT – Background and Objectives: Electroconvulsive therapy (ECT) is nowadays known as a first line therapy in many certain illness conditions. Despite the fact that psychotic depression and treatment resistant depression are more common in geriatric psychiatry, the use of ECT is not. The aim of our study was to show that ECT can be safely performed even if patients show high comorbidity and are therefore per se at a higher risk for experiencing severe side effects.

Methods: We examined 25 ECT treated and severely ill patients of advanced age (mean 66 years) by chart review.

Results: Mean age corrected Charlson Comorbidity Index (CCI) was 4.1, mean Cumulative Illness Rating Scale for Geriatrics (CIRS-G) 10.5. Generally, ECT-related complications were rated as mild and short termed, 14 patients showed no complications at all. Complications did not correlate with age or comorbidity. Post hoc, we noted a significant advantage for the use of propofol or etomidate compared with thiopental as narcotic agents.

Conclusions: Under optimized somatic treatment conditions ECT can be performed safely in comorbid patients of advanced age. However, a risk/benefit analysis should always be performed individually.

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Introduction

Electroconvulsive therapy (ECT) is nowadays known as a first line therapy in many certain illness conditions. Among these, and occurring with high incidence in the elderly, are psychotic depression and treatment resistant depression. Despite the fact that psychotic depression and treatment resistant depression are more common in geriatric psychiatry, the use of ECT is not. This is somewhat surprising since medication side effects frequently limit therapeutic approaches in geriatrics and ECT efficacy increases with age. The widespread belief that ECT cannot be performed safely or at least with relative safety in this patient group might partially explain this phenomenon. Higher comorbidity or even multimorbidity underlines the problem since in such cases not only psychopharmacology but also ECT has to be done with great care.

There is a body of evidence that ECT can be performed safely in highly comorbid or old patients, even in the old-old¹⁻¹². Nevertheless, to the best of our knowledge, there are only a few retrospective studies dealing with efficacy and safety of highly comorbid patients or geriatric patients with at least some relevant comorbidity.

Tew *et al.* investigated efficacy and clinical characteristics of ECT in 268 patients¹¹. Adult patients (59 years and younger) showed a lower ECT response rate compared with young-olds and old-olds (older than 75 years). Despite a higher level of comorbidity and cognitive impairment in older patients no differences in safety of ECT was observed.

Philibert *et al.* investigated 192 geriatric patients within the framework of a retrospective study¹³. 108 of them had undergone ECT, and showed greater clinical improvement and were more likely to be alive at follow-up.

Gormley *et al.* examined 93 ECT-courses in patients older than 75 years¹⁴. Ten patients suffered from complications (most common were hypomania and confusion) which all ceased within 2 weeks. The response rate in this cohort was 85 %.

Zisselman *et al.* reported 13 geriatric patients with high comorbidity¹⁵, which was quantified by the Cumulative Illness Rating Scale for Geriatrics (CIRS-G)¹⁶. Of these patients nine were rated as improved and complications were limited to atrial fibrillation in one patient and delirium in another. Despite an average age of 81 years and a mean CIRS-G of almost 20, cognitive impairment was stated in only five patients and was transient in all of them.

The study by Zisselman is limited by the small number of participants. Its strength lies in a well described cohort of psychogeriatric patients with high comorbidity all of which were known personally to the first author.

To assess the problem of quantifying somatic comorbidity we decided to rate the patients' comorbidity using two scales: The Charlson Comorbidity Index (CCI) including age related risk points¹⁷, and the Cumulative Illness Rating Scale for Geriatrics (CIRS-G)¹⁶. Comorbidity rating scales and indices can be used to quantify the burden of current and chronic illnesses in the older adult. CCI and CIRS have shown to be a valid predictor of risk of mortality in longitudinal studies.

With our naturalistic retrospective study we would like to add a cohort of 25 severely ill patients with either old age and/or high comorbidity undergoing ECT. Our retrospective study was conducted to prove the concept of safe ECT performance even under conditions of high comorbidity. To achieve this goal we tried to optimize pre and concurrent ECT treatment at our site

taking into account anesthesiological and internal medicine problems.

Subjects and methods

We examined the records of 25 patients with high age and/or high comorbidity who were treated with ECT in the Department of Psychiatry, Central Institute of Mental Health, Mannheim between 1988 and 1999. Within this period a total of 162 patients completed an ECT course. Patients in a severe or life threatening condition (for psychiatric or somatic reasons) before onset of ECT were included in our study. The majority of our cohort (88%) was treated on the psychiatric intensive care unit of the Central Institute of Mental Health, a unit which is specialized in the treatment of psychiatric patients with severe medical comorbidity. The ward is headed by a physician qualified in psychiatry and internal medicine (W.H.). Likewise, the nursing staff has special qualifications and is upsized. The psychiatric intensive care unit includes a specialized emergency room where all ECT sessions are performed. Equipment for diagnostic workup and treatment monitoring with regard to medical comorbidity is available (ECG, Holter monitoring, long term blood pressure recording, ultrasound, including echocardiography, EEG, X-ray equipment, including CT-scanning, clinical chemistry and hematology, on a 24-h basis, if necessary, and monitoring devices for cardiovascular and respiratory function). The head of the unit was responsible for conducting all ECT and internal medicine treatments of all patients. Prior to ECT patients' diagnostic workup and treatment with regard to comorbid general medical disorders were optimized with greatest care. Particular attention

was paid to concurrent medication which was reduced to an essential minimum to avoid interactions and additional side effects. Until 1989 ECT was conducted with a Siemens Convulsator (only the first 2 patients), afterwards with a Thymatron stimulator with short pulse technique (1989-1999 Thymatron DG, Somatics, Inc.). In most of the cases the amount of the released charge of the ECT device was not documented and therefore not implemented into the study.

Comorbidity was rated for all patients with the CCI including age related risk points¹⁷ and additionally with the CIRS-G¹⁶. Relevant comorbidity is visualized in table I. Basically, the CIRS-G assesses a total of 13 items (each coded with '0' = "none", '1' = "mild", '2' = "moderate", '3' = "severe", '4' = "life threatening"). These include items from the cardiovascular-respiratory system (4 items), gastrointestinal system (3 items), genitourinary system (2 items), musculoskeletal-integumentary system (1 item), neuropsychiatric system (2 items), and general system (endocrine/metabolic) (1 item). The CCI accumulates the following items (1 point each): myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease (except hemiplegia), dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, and diabetes (without complications). 2 points are added for diabetes with end organ damage, hemiplegia, moderate or severe renal disease, second solid tumor (non metastatic), leukemia, lymphoma, metastases, 3 points for moderate or severe liver disease and 6 points for a 2nd metastatic solid tumor or AIDS.

Onset of complications during ECT course was assessed as follows (analogue to CIRS-G):

'0' = "none", '1' = "mild", '2' = "moderate", '3' = "severe", '4' = "life threatening". Very

Table I
Diagnoses, age, comorbidity and complication of 25 patients treated with ECT.
ICD: ICD 10 diagnosis; CCI: Charlson Comorbidity Index including age related risk points; CIR: Cumulative Illness Rating Scale for Geriatrics (CIRS-G);
Rem: "remission" = '2' "response" = '1', "non-response" = '0'; ECTs: total number of ECT sessions; gr.: grade of complication.

Age	Sex	ICD	CCI	CIR	Rem	ECTs	gr.	Complications	Comorbidity
1	47	W	Catatonic schizophrenia.	0	11	2	5	0	Neuroleptic malignant syndrome (NMS) 11 d ahead, hypoxemia, catatonia.
2	80	W	Severe depressive episode with psychotic symptoms.	6	11	1	15	0	Post myocardial infarction (MI), post congestive heart failure (CHF), hyperparathyroidism, hypertension, anemia.
3	38	W	Bipolar affective disorder, current episode severe depression without psychotic symptoms.	1	6	1	20	0	Epilepsia, systemic lupus erythematosus (SLE), high suicidality, relevant weight loss caused by anorexia.
4	66	W	Paranoid schizophrenia.	4	11	1	12	0	Cholesteatoma, hypertension, osteoporosis post fractures, parkinsonism (EPS) iron deficiency anemia, high suicidality.
5	52	W	Recurrent depressive disorder, current episode severe with psychotic symptoms.	1	5	1	12	0	Aspiration pneumonia, ventricular arrhythmia Lown IV, hypertension, cachexia, hypoxemia, dysphagia.
6	69	W	Recurrent depressive disorder, current episode severe with psychotic symptoms.	2	10	2	7	0	Diabetes mellitus type 2, congestive heart failure (CHF), hypertension, post malacia defects, mild cognitive impairment (MCI).
7	83	W	Recurrent depressive disorder, current episode severe with psychotic symptoms.	7	9	1	7	2	Incontinence, high suicidality.
8	48	W	Schizoaffective disorder, mixed type.	0	5	2	17	0	Diabetes mellitus type 2, hypertension, atrial. Premature beats (apb), post atrial fibrillation (afb), post delirium.
9	80	M	Organic mood [affective] disorder.	5	10	2	5	1	Hypertension, congestive heart failure, left bundle-branch block (lbbb), glaucoma, incontinence, urinary tract infection, vascular encephalopathy.
10	72	W	Severe depressive episode without psychotic symptoms.	5	11	2	5	2	Hypertension, congestive heart failure, vascular encephalopathy, iron deficiency anemia, bronchopneumonia, parkinsonism and dyskinesia.
11	78	W	Severe depressive episode with psychotic symptoms.	6	14	2	9	2	Short termed delirium, transient atrial fibrillation (afb) and ventricular ectopy. Reversible cognitive worsening, hypotension (i.v. cafedrine/theodrenaline) after 7th ECT.

Table I (Cont)

Age	Sex	ICD	CCI	CIR	Rem	ECTs	gr.	Complications	Comorbidity	
12	68	W	Recurrent depressive disorder, current episode severe with psychotic symptoms.	3	7	2	12	3	Ventricular tachycardia, reversible cognitive worsening.	Nodular goiter, diabetes mellitus type 2, hypertension, distal radial fracture.
13	69	M	Bipolar affective disorder, current episode severe depression with psychotic symptoms.	2	12	1	18	3	Septic fever after i.v. line infection.	Post urinary tract infection, benign prostatic hypertrophy, possible cervical spine infection.
14	69	W	Organic mood [affective] disorders.	4	13	1	7	0		Vascular dementia, post contusio cerebri, post neuroleptic malignant syndrome, diabetes mellitus type 2, hypertension, incomplete bifascicular heart block, urinary tract infection, percutaneous endoscopic gastrostomy (PEG).
15	44	M	Paranoid schizophrenia.	1	9	1	10	0		Acute neuroleptic malignant syndrome (NMS), tracheobronchitis and tracheostomy, post clozapine induced seizures.
16	74	W	Dementia in Parkinson's disease.	5	12	1	21	1	Transient second degree heart block, atrial premature beats (apb).	Acute akinetic crisis post lumbar spine fracture, toxic goiter, urinary tract infection, percutaneous endoscopic gastrostomy (PEG), suprapubic cystostomy.
17	77	M	Recurrent depressive disorder, current episode severe with psychotic symptoms.	7	15	2	9	0		Post myocardial infarction (MI) with cardiac aneurysm, chronic congestive heart failure (CHF), coronary heart disease (CHD), abdominal aortic aneurysm, post gastrojejunostomy, post transurethral resection of the prostate (TURP), post stroke, post osteomyelitis, chronic renal failure, parotitis, episkleritis. Hypertension.
18	61	W	Recurrent depressive disorder, current episode severe with psychotic symptoms.	2	7	2	11	2	Deep popliteal vein thrombosis.	
19	70	W	Bipolar affective disorder, current episode severe depression without psychotic symptoms.	5	12	2	12	0		Plasmacytoma (multiple myeloma), anemia, paraparesis, axonal polyneuropathy, post irradiation, suprapubic cystostomy and nasogastric tube (NG).
20	59	M	Organic mood [affective] disorder.	3	10	1	12	2	Prolonged confusion.	Post stroke, congestive heart failure (CHF), hypercholesterolemia, implantable cardioverter defibrillator (ICD).
21	65	W	Recurrent depressive disorder, current episode severe with psychotic symptoms.	6	13	2	13	1	Nausea.	Diabetes mellitus type 2, coronary heart disease (CHD), Hypertension, gastric ulcer, cataract, polyneuropathy.
22	71	W	Recurrent depressive disorder, current episode severe with sychotic symptoms.	4	8	2	8	0		Congestive heart failure (CHF), hypertension, post thyroid resection and radioiodine therapy.

Table I (Cont)

Age	Sex	ICD	CCI	CIR	Rem	ECTs	gr.	Complications	Comorbidity
23	70	W	Catatonic schizophrenia.	5	11	2	13	0	Vascular encephalopathy, parkinson's-syndrome, diabetes mellitus type 2, obesity (WHO II°).
24	75	M	Severe depressive episode with psychotic symptoms.	11	17	1	2	0	Chronic obstructive pulmonary disease (COPD), peripheral artery occlusive disease (PAOD) II, renal failure, post atrial fibrillation (afib), gastritis, allergic angitis, anemia, urinary tract infection.
25	76	W	Severe depressive episode with psychotic symptoms.	7	13	2	18	2	Congestive heart failure (CHF), pacemaker; hyperthyroidism, diabetes mellitus type 2, gonarthrosis, varicosis III, urinary tract infection.

short termed cardiac arrhythmias such as postictal bigeminy or compensatory sinus bradycardias were not stated as complications (and had occasionally been probably ignored or not documented). Urgency of ECT indication was stated as “acute” = ‘1’ and “subacute” = ‘0’. ECT treatment itself was classified into right unilateral (RUL) and bilateral (BIL) treatment. For ECT narcosis we used thiopental, etomidate or propofol. Number of individual ECT sessions and duration of the complete ECT course were noted. ECT treatment success was clinically defined as “remission” = ‘2’, “response” = ‘1’, or “non-response” = ‘0’. Patients’ primary psychiatric illness was additionally described (as far as possible from chart review) with years since first diagnosis, duration of the current episode, and number of former episodes. Number of concurrent psychiatric and non-psychiatric drugs were noted as well as number of psychiatric and non-psychiatric drugs taken 7 days before the initiation of the ECT course. All statistical analyses were calculated with STATA (version 9.0).

Results

Mean age of our cohort was 66.4 (+/-12) years, the youngest patient was 38 years, the oldest 88 years of age. 6 patients were male. Our sample of 25 patients showed a mean age corrected Charlson Comorbidity Index of 4.1 and a Cumulative Illness Rating Scale for Geriatrics of 10.5. Both indices correlated well $F(1,23) = 28.9$, $r^2 = 0.56$, corr. coeff. = 0.65, $p < 0.001$). 14 patients experienced no complications at all, and mean complications were rated as mild (= 0.8), with no significant difference for older subgroups (e.g. age >70 years, $n = 10$, mean = 1.0 ± 0.9 , range 0-2) or for the old-old patients (age >75 years, $n = 6$, mean = 1.1 ± 1.0 , range 0-2).

There was no correlation between complications and age corrected Charlson Comorbidity Index or the Cumulative Illness Rating Scale for Geriatrics ($F(1,23) = 0.14$, $r^2 = 0.006$, $p = 0.71$, and $F(1,23) = 0.001$, $r^2 = 0.00$, $p = 0.99$, respectively).

In 14 cases indication for ECT was acute. In all, 14 patients remitted, with eleven showing a response to ECT treatment. Five patients were initially treated bilaterally, another five were switched during the course to bilateral treatment. Six patients received etomidate as narcotic agent, 3 propofol and 10 thiopental, another 4 switched during the course (for two cases the narcotic agent was not documented).

There was also no correlation between age and remission rates, as well as no correlation between age and complications ($F(1,23) = 0.52$, $r^2 = 0.02$, $p = 0.48$, and $F(1,23) = 2.25$, $r^2 = 0.09$, $p = 0.15$, respectively).

A multiple regression analysis including degree of complications and remission as dependent variables revealed only one significant result: Remission rates were positively correlated with an increasing number of concurrent psychiatric medications. A post hoc regression for remission and the number of concurrent psychiatric drugs confirmed the significant correlation ($F(1,20) = 6.23$, $r^2 = 0.24$, correlation coefficient = 0.28, $p = 0.02$). Other independent variables (duration of acute episode, number of concurrent non-psychiatric drugs, number of concurrent psychiatric and non-psychiatric drugs taken 7 days before) showed no significances. Including diagnosis or subsyndromes (e.g. psychotic symptoms) in the regression analysis did not influence any of the above results.

Post hoc, a regression analysis for narcotic agents showed a significant impact on complications: All 9 patients receiving propofol or

etomidate showed no complications at all, whereas 10 patients treated with thiopental had an average degree of complications of 1.4 ± 1.1 (range 0-3). Comparing complications of thiopental treated patients with patients treated with etomidate or propofol reveals $p = 0.002$ (two-sided unpaired *t*-test). All 4 patients switching during the course were changed from thiopental to propofol or etomidate.

Remission rates were slightly higher in patients treated with bilateral ECT ($p = 0.1$, one-sided *t*-test). Complication rates did not differ between RUL and BIL treatment.

Illustrative example

Patient #19 (see Table I) may serve as an illustrative example: This 70 year old female patient had been suffering from a bipolar affective disorder for the last 51 years. She also had been diagnosed with plasmacytoma (or multiple myeloma) two years earlier. Three weeks before admission she became abasic. At admission she showed symptoms of a severe depressive episode with psychot-

ic features, but without suicidality. She presented with a transverse spinal cord syndrome (T10) with severe paraparesis (initially atonic and later spastic), as well as hypaesthesia and hypalgesia of both legs. Total spine NMR revealed a spinal cord compression (spinal canal diameter of 7 mm). By biopsy the tumor was diagnosed as a plasmacytomic tumor. Hemoglobin concentration was below 10g/dl. Electrophysiology revealed a severe axonal motor polyneuropathy, probably caused by a critical illness syndrome. Because our patient refused food and medication we decided to start an ECT course taking the vertebral fracture risk into account. In parallel radiation of the vertebral tumor was initiated. All of the 12 ECT sessions were well tolerated, no side effects occurred with carefully adapted muscle relaxation. Psychopathology initially improved, but a psychotic decompensation occurred while dexamethasone and morphine were introduced. Reducing the doses of dexamethasone and morphine finally resulted in a remission of the depressive episode and our patient was discharged with a medication of valproate, haloperidol and nortriptyline.

Table II
Means of comorbidity indices, complications, episode history and concurrent medication of 25 patients.

	Mean	s.d.	Range
Age corrected CCI	4.1	2.6	0-11
CIRS-G	10.5	3.0	5-17
Complications (graded 0-4)	0.8	1.1	0-3
Duration of episode (month)	13.5	34.5	1-168
# of episodes	5.9	7.4	0-35
Time since first diagnosis (years)	13	14	0-51
# of psychiatric drugs (7d ahead)	2.9	0.8	1-4
# of non-psychiatric drugs (7d ahead)	3.9	2.0	1-8
# of psychiatric drugs (concurrent)	1.7	0.9	0-4
# of non-psychiatric drugs (concurrent)	4.0	2.2	1-8
# of ECT sessions	11.2	5.0	2-21

Discussion

Both, age corrected CCI and CIRS-G are well validated scales for comorbidity¹⁸. In our cohort a highly significant correlation between both measures was shown.

ECT was performed safely independent of age, age corrected CCI and CIRS-G. In a patient group with high comorbidity and/or advanced age only short termed side effects occurred.

Compared with a study by von Ammon Cavanaugh¹⁹ the mean CCI in our cohort was high. In her study of 241 patients hospitalized with MDE 20 died while in hospital. This subgroup had a mean CCI of 5.4 ± 2.6 , while discharged patients had a CCI of 3.1 ± 2.0 . Our patients (60% diagnosed with MDE) suffered from illnesses amounting to a mean CCI of 4.1, indicating the severity of comorbidity.

Surprisingly, the difference in complication rates of thiopental and etomidate/propofol anesthesia was striking. It is known that sinus bradycardia and premature ventricular contractions appear more often with thiopental even when compared with methohexital. Additionally, middle cerebral artery flow velocities and arterial pressure increase with thiopental compared with propofol^{20,21}. However, it is difficult to explain the generally higher complication rate by these properties. Nevertheless, any clinical significant cognitive deterioration and all cardiac arrhythmias were observed in thiopental treated patients. There is a great lack of clinical data comparing side effects or complications with thiopental /methohexital versus propofol/etomidate in older patients²². From our patient group it can be suggested that if induction of seizure is not problematic propofol should be preferred. If induction of

seizures is a problem, however, etomidate may be the anaesthetic of first choice.

Data on concurrent use of psychotropic medication are heterogeneous and at times contradictory (e.g. for lithium²³). In general, additional medication leads to more interaction and side effects. It is widely accepted that patients suffering from a schizophrenic disorder can benefit from concurrent psychotropic drugs compared with ECT alone²⁴. Evidence showing an advantage for concurrent medication in patients with affective disorders is less extensive^{25,26}. In our study concurrent psychiatric medication (in most cases 1 benzodiazepine and 1 antidepressant or 1 antipsychotic) was associated with significantly higher remission rates. Additionally, we would like to emphasize that our patients did not suffer from more complications when taking a greater number of psychotropic or non-psychotropic drugs (with a mean of 1.7 and 4.0 drugs per patient, respectively). This may be interpreted as a probably u-shaped complication rate over number of medication curve. A low but well chosen number of drugs is necessary to lower risks in multimorbid old patients while a further increase of prescribed medication again rises the probability of interactions and side effects. This probably holds true for both, psychiatric medication as well as non-psychiatric medication. In our opinion great care must be taken to optimize individual medication. At least in our patients this proved very beneficial, since our data suggest that they were neither over- nor undermedicated.

Cardiac arrhythmias were rare and characterized as short termed and not serious. In three cases arrhythmia was stated as mild, moderate and severe (ventricular tachycardia in one case), respectively. This is in good agreement with recent ECT investigations that included patients with cardiac risk fac-

tors^{4,8,27}. Mild cardiac arrhythmias were seen in 10-50% of all patients, but severe side effects in just 1.5-20%. It is noteworthy that in the study of Zielinski *et al.* severe complications were found in 20% of all patients, but ECT was still much better tolerated than drugs. In his study tricyclic antidepressants had been discontinued (due to intolerable side effects) in patients who then completed an ECT course. In the naturalistic study of Agelink *et al.* only 3 patients showed minor complications, which was attributed to an optimized somatic pretreatment of patients at cardiac risk.

Distinguishing between RUL and BIL treatment did not reveal significant findings in our cohort. On the one hand BIL was more efficient (not reaching the significance level, however), which is not surprising²⁸. On the other hand our sample size is too small for comparison owing to the fact that stimulation energy was not standardized (e.g. by seizure threshold titration). RUL and BIL treatment did not differ regarding clinically significant cognitive side effects. Most studies dealing with MDE prefer high dose RUL to BIL because of comparable efficacy and better cognitive outcome^{29, 31}. Thus our results do not contradict findings of other studies dealing with RUL/BIL efficacy and side effects, but are most likely due to non standardization of stimulation energy and other confounds in our relatively small sample size.

Conclusions

Optimized somatic diagnostics and pretreatment made it possible to safely perform ECT in 25 severely ill patients with high age and/or high comorbidity. Only short termed complications occurred. Neither age nor

comorbidity correlated with number and severity of complications. Compared to thiopental propofol and etomidate may be preferable as narcotic agents.

Interpretation is also limited by the naturalistic design of our study and by the small sample size. Within this context registration of very short termed and minor events was probably not always sufficient. Furthermore specific interpretations are limited by the heterogeneity of psychiatric and differentiated comorbid diagnoses in our cohort.

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