Can Mini Mental State Examination (MMSE) Scores Predict Short-Term Impairments in Memory During Electroconvulsive Therapy (ECT)?

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Abstract

Objective: To determine whether the Mini-Mental State Examination (MMSE) could be used to predict short-term impairments in memory functions during a course of Electroconvulsive Therapy (ECT).
Method: Patients with severe depression (n=32) were followed up while they were receiving ECTs, and up to a month after that. They were rated independently and blindly on the MMSE for global cognitive dysfunction, the PGI Memory Scale (PGIMS) for memory loss, and the Montgomery-Asberg Depression Rating Scale (MADRS) for severity of depression.
Results: MMSE scores dipped during the course of ECT, but picked up in the week and month following cessation of treatment. The PGIMS scores mimicked this pattern, whereas the MADRS scores continued to decline slowly as the patients improved. MMSE scores were highly correlated with memory impairment (PGIMS scores) prior to, during, and up to one month after treatment with ECT. MMSE scores were the strongest predictor of the PGIMS scores at virtually all these points of assessment.
Conclusions: The MMSE can be used to reliably detect and monitor the progress of memory impairment during treatment with ECT and in the few weeks following cessation of treatment. Pre-ECT MMSE scores may be useful in predicting the severity of memory impairment during and shortly after a course of ECT(German J Psychiatry 2007; 10: 8-12).

Keywords: ECT, MMSE, memory impairment

Introduction

Electroconvulsive therapy (ECT) is normally associated with minimal side effects. However, cognitive impairment is a common and troublesome problem, and arguably the main factor that has limited the use of this treatment.

Characteristic cognitive effects in the immediate post-ECT period (acute effects) include disorientation and difficulties in attention/concentration; which generally resolve within days. Short-term or subacute effects in the form of memory disturbances become evident at this point. These disturbances include anterograde amnesia which persists up to a few weeks after ECT, and retrograde amnesia which may be more enduring, particularly for autobiographical information. The magnitude of immediate and short-term effects is largely dependent on treatment parameters such as dose, electrode placement, frequency of treatment etc. (Benbow, 2005)

Monitoring for global cognitive changes and memory disturbances is routinely recommended during a course of ECT. The Mini Mental State Examination (MMSE; Folstein et al, 1975) a simple, yet valid bedside measure of cognitive function has been widely used to assess global cognitive status during ECT. However, its sensitivity in detecting memory

impairments during ECT has been questioned. Moreover, it has been contented that, changes in global cognitive status measured by the MMSE do not correlate well with the degree of anterograde or retrograde amnesia evident during and subsequent to a course of ECT. Thus, patients can show unchanged or improved MMSE scores despite having considerable amnesia (Robertson & Pryor, 2006).

Then again, a study by Sobin et al (1995) demonstrated that global cognitive function or MMSE scores before treatment predicted the extent of short-term and persistent retrograde amnesia for autobiographical memories.

The current study sought to determine whether the MMSE could be used to predict short-term impairments in memory functions during a course of ECT.

Materials and Method

Patients

Consecutive inpatients/outpatients with an ICD-10 DCR (WHO, 1992) diagnosis of depressive episode, recurrent depressive disorder, or bipolar disorder-currently depressed, of 18-60 years of age and receiving ECT were inducted. Those with comorbid psychiatric disorders, organic brain syndromes, substance dependence (except nicotine dependence), and those who had received ECT in the 6-month period prior to the study, were excluded.

ECT administration

All patients were administered brief pulse, bilateral, modified ECT 2-3 times a week. Stimulus parameters included electrical energy ranging from 36-135 Joules and stimulus duration ranging from 0.5-3.8 seconds. Atropine (0.2-0.3 mg) was used for premedication, thiopentane sodium (150-450 mg) for induction and succinyl choline (30-60 mg) for muscle relaxation. The cuff method was used to estimate seizure duration

Assessments

The ECT register and case notes were used to record demographic, clinical and treatment details. The MMSE was used to assess post-ECT (global) cognitive impairment. Depression was rated on the Montgomery-Asberg Depression Rating Scale (MADRS; Montgomery and Asberg, 1979). The MMSE and the MADRS were administered by a research assistant or psychiatric trainee on the day following the ECT at the same time each morning. Memory functions were examined using the PGI Memory Scale (PGIMS; Pershad, 1979), which is an Indian adaptation of the Wechsler Memory Scale (Wechsler, 1987), with adequate psychometric characteristics and local population norms. It was administered by an experienced consultant clinical psychologist who was blind to the MMSE/MADRS scores and other treatment details. All assessments were done prior to administration of ECT and repeated after the second, fourth, sixth and eighth ECTs, as well as 1 week and 1 month after the course of ECT was completed.

The plan of the study was approved by the Institute Research and Ethics Committees. Written informed was taken from patients (wherever possible) and their relatives agreeing to participate in the study.

Results

Demographic, clinical and treatment details

Consecutive sampling over a 1-year period yielded 36 patients who met selection criteria. Two patients refused consent and 2 dropped out of treatment leaving 32 patients who eventually completed the study.

Demographic, clinical and treatment details are included in Table 1.

Table 1. Demographic, Clinical and Treatment Details of Patients Receiving ECT (n=32)

Age, mean (SD), years	37.65 (11.65)
Men (n)	16
Women (n)	16
Married (n)	24
Not married (n)	8
Years of schooling	
<10 years (n)	10
> 10 years (n)	22
Employed (n)	16
Unemployed (n)	6
Duration of illness, mean (SD)/years	3.78 (6.11)
Diagnoses (n):	
Bipolar depression	3
Unipolar depression, single episode	11
Unipolar depression, recurrent	18
Current epidode (n):	
Severe, without psychotic symptoms	17
Severe, with psychotic symptoms	15
Drugs (n):	
Antidepressants	30
Antipsychotics	15
Mood stabilizers	3
Sedatives/anxiolytics	12
Number of ECTs:	
Range	3-14
Mean (SD)	5.88 (5.10)
Seizure duration, mean (SD), secs	32.99 (9.55)

MMSE, PGIMS and MADRS scores during ECT

The scores on the MMSE, PGIMS and MADRS prior to, during and after ECT are depicted by the figure. As expected MMSE scores show a decline during the ECT but started to pick up one week and one month following end of treatment. The PGIMS scores show a similar trend, whereas the MADRS scores continue to decline throughout the course of ECT, as well as 1 week and 1 month after stopping treatment.

Correlation of MMSE and PGIMS scores during ECT

The association between MMSE and PGIMS scores was examined by calculating Spearman's correlation coefficients. The results at various time points are depicted in Table 2. They clearly show that there were significant positive corre-

lations between MMSE scores and PGIMS scores prior to administration, and following the second, fourth, sixth and eighth ECTs. Moreover, the significant positive association between MMSE and PGIMS scores was also evident at one week and one month following cessation of treatment.

Logistic regression analysis

Results of the regression analysis showed that before, during and after the course of ECTs, change in MMSE scores significantly ($p<0.05$) predicted change in PGIMS scores, except after the first week of completion of treatment. Overall, changes in MMSE scores predicted 97.1% of the change in PGIMS scores, based on the linear regression model.
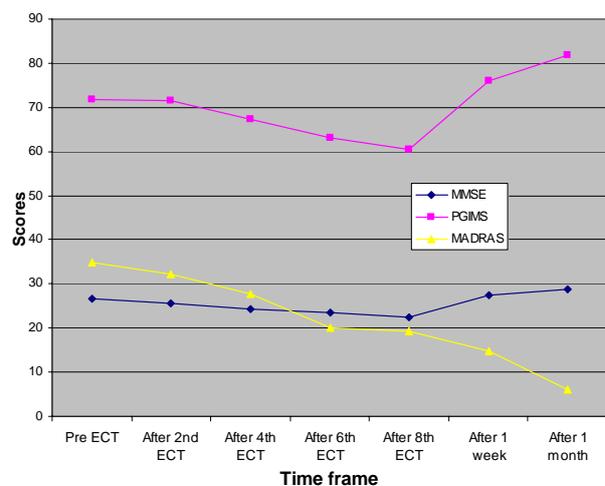
Figure 1. MMSE, PGIMS and MADRS Scores During ECT

Discussion

Routine monitoring of cognitive functions is recommended during ECT, but hampered by the lack of appropriate tests. The MMSE is used quite commonly for this purpose, but is said to lack the sensitivity needed to detect memory dysfunction (Robertson and Pryor, 2006)

This study followed up 32 patients with severe depression while they were receiving ECTs. They were rated independently and blindly on the MMSE (global cognitive dysfunction), the PGIMS (memory loss), and the MADRS (depression severity).

Changes in severity of cognitive dysfunction, memory impairment and depression were along expected lines. Thus the MMSE scores dipped during the course of ECT, but had started to pick up in the week and month following end of treatment. The PGIMS scores mimicked this pattern, whereas the MADRS scores continued to decline slowly as the patients improved. This profile is typical of ECT and has been reported in a number of previous studies (Sackheim,

Table 2. Correlation Between MMSE and PGIMS Scores (Spearman's Correlation Coefficients)

	PGIMS[1] Pre ECT	PGIMS 2nd ECT	PGIMS 4th ECT	PGIMS 6th ECT	PGIMS 8th ECT	PGIMS 1 week post-ECT	PGIMS 1 month post-ECT
MMSE[2] Pre-ECT	0.43 **	0.36 *	0.62 **	0.47 *	0.66 **	0.53 **	0.39 *
MMSE 2nd ECT	0.64 **	0.57 **	0.44 **	0.52 **	0.52 **	0.67 **	0.67 **
MMSE 4th ECT	0.70 **	0.71 **	0.62 **	0.69 **	0.84 **	0.62 **	0.77 **
MMSE 6th ECT	0.67**	0.60 **	0.51 **	0.71 **	0.78 **	0.65 **	0.73 **
MMSE 8th ECT	0.85 **	0.76 **	0.56 **	0.42 *	0.56 **	0.70 **	0.76 **
MMSE 1 week post-ECT	0.56 **	0.64 **	0.55 **	0.57 **	0.69 **	0.62 **	0.70 **
MMSE 1 month post-ECT	0.60 **	0.56 **	0.58 **	0.59 **	0.75 **	0.65 **	0.63 **

1. PGIMS - PGI Memory Scale
2. MMSE - Mini-Mental State Examination
* $p < 0.05$; **$p < 0.01$

1986). The presence of such a typical pattern of cognitive and memory deficits lends further validity to the main finding of this study, which is a consistent and significant positive association between the MMSE and memory scores at different points during treatment with ECT. Thus MMSE scores were highly correlated with memory impairment as measured by the PGIMS prior to, during, and up to one month after treatment with ECT. MMSE scores were the strongest predictor of the PGIMS scores at virtually all these points of assessment.

These results thus suggest that the MMSE can be used to reliably detect memory impairment during treatment with ECT and in the few weeks following cessation of treatment. Since pre-ECT MMSE scores also showed significant associations with memory deficits at 1 week and 1 month following ECT, the MMSE can be also used to predict the severity of memory impairment during and shortly after a course of ECT. A similar association between MMSE scores and retrograde amnesia following ECT administration has been reported previously by Sobin et al (1995) Taken together, these results indicate that the MMSE can thus be used to screen for patients who are liable to develop more severe memory impairment during treatment with ECT. If such a high-risk group can indeed be consistently identified by using the MMSE, it might be possible to minimize their memory deficits by several preventative measures such as education, altering concomitant medication, memory retraining etc. The MMSE can also be used to monitor the progress of memory deficits during a course of ECT, and for a few weeks after the treatments have ended. Apart from being a valid and reliable means of assessing cognitive function, there are several other features of the MMSE which can further add to its usefulness in this situation. It is simple to administer, can be carried out at the bedside, and takes only a few minutes to complete. It can be repeated during the course of ECT (and afterwards) and shows little practice effect. Thus it is an ideal tool for initial and for serial measurements of this kind as it can demonstrate worsening or improvement of memory impairment over time and with treatment (Folstein et al, 1975)

However, before concluding that the MMSE can be employed in this capacity among patients receiving ECT further studies will be required which need to avoid the methodological shortcomings of this investigation. The sample size of this study was rather small and since a large number of correlations were examined the possibility of Type I and Type II errors cannot be discounted. Further, it was a selective sample of patients all of whom were hospital attendees, had severe depression and received bilateral ECT. It might thus be difficult to generalize these results to other groups of patients receiving ECT. Finally, there are some concerns about the appropriateness of tests such as the Wechsler memory Scale (on which the PGIMS is based) in detecting ECT-induced memory impairment.

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