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Original Research Article

Increased electro-convulsive therapy stimulus intensity and cognitive functioning in manic patients

A. Gopal[1], D. S. Rathor[2], S. Mohanty[3]*

Department of Psychiatry, Institute of Mental Health and Hospital, Agra, Uttar Pradesh, India

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***Correspondence:**
Dr. S. Mohanty,
E-mail: mohanty.imhh@gmail.com

ABSTRACT

Background: Temporary changes in cognitive functions after electro-convulsive therapy (ECT) have been documented. The researchers are exploring if increasing the stimulus intensity of ECT produce better recovery from psychopathology also trying to map effects of increased stimulus intensity on side effects profile including cognitive functions. In the present study, we are reporting effects of increased stimulus intensity of ECT on cognitive functions in manic patients.
Methods: The present study is a prospective analytical case control study conducted in the department of psychiatry, Institute of Mental Health and Hospital, Agra, after getting clearance from hospital ethical committee. The study included 60 patients with the diagnosis of manic psychopathologyfrom May 2018 to September 2019. Sample was divided into two groups: 1.5 times of threshold and 2.0 times of threshold. The ECT was delivered as per specified protocol of the study. The scores on Montreal cognitive assessment (MoCA) were compared both within and between groups at baseline and follow up.
Results: The results suggested that both level of stimulus intensity produced mild level of disruptions in cognitive functioning at follow ups and the higher stimulus intensity i.e. 2.0 times of threshold resulted in more impairment in cognitive functions.
Conclusions: The impact of ECT by increasing its current intensity for two times, on cognitive functions as seen clinically, suggested no serious adverse effects on any of the patients included in the sample.

Keywords: ECT, MECT, Stimulus intensity, Mania, Cognitive functioning

INTRODUCTION

Cognitive impairment is one of the most significant side effects of electroconvulsive therapy (ECT). It is suggested that cognitive function be monitored before, during and after a course of ECT which will detect cognitive changes at an early stage and allow better planning and also informed decisions about subsequent ECT courses.[1,2] A reduction in cognitive function is reported after ECT which may simply represent as a temporary amnesia and predict later development of a more long-lasting amnesia.[2-4]

The studies which evaluated memory functions after a course of ECT suggest that after one month of last ECT, there were significant improvement in mean scores of immediate memory, general memory, auditory immediate memory, auditory delayed memory and working memory.[5] A meta-analysis by Semkovska et al suggested that the cognitive decline after ECT did not persist beyond 15 days.[6]

No evidence claimed that ECT causes any permanent brain harm and it was known that ECT in fact stimulates neuroplasticity.[7]

There is an interest of researcher in examination of the effects of increasing the threshold stimulus value of ECT on remission of psychopathology as well as the side effects profile. Sackeim et al and that higher doses of stimulus intensity are associated with longer time to reorientation and they exhibited shorter seizures.[8-10]

The relationship of the stimulus intensity of ECT and cognitive functions need be studied thoroughly because there are findings that supports the hypothesis that increasing stimulus value of ECT produce faster recovery. In the present study, we are reporting effects of increased ECT stimulus on cognitive function profile of manic patients.

Objectives

Objective of the study was to evaluate and compare the changes in cognitive functioning at baseline and final assessment over completion of ECT among the patients given modified electric convulsive treatment (MECT) at the stimulus intensity 1.5 times of the threshold and 2.0 times of the threshold.

METHODS

Setting and design

The study was conducted at Institute of Mental Health and Hospital, Agra (IMHH). The institute is a postgraduate teaching hospital and it has an extensive outpatient department (OPD) and indoor facilities for psychiatric patients. It has a wide catchment area. The ECT unit is well equipped for delivery of MECT and management of post-ECT complications. Two group design with pre-post assessment was used. The study was conducted from May 2018 to September 2019.

Sample

A sample of 60 patients with international classification of diseases (ICD)-10 diagnosis of mania, who were in the age range of 18-55 years and having a score of 12 and above on young mania rating scale (YMRS) were included in the study.

The patients with history of raised intracranial tension, chronic pulmonary pathology, cardiovascular disease, with age <18 years/>60 years, with partial pressure of oxygen (pO_2) <98% were not included.

Tools

YMRS

The scale developed by Young is the most widely used scale to rate manic psychopathology.[11] There are 11 items which are rated on five-point scale. For the present study, YMRS was used as a screening tool and the patients with a score of 12 or more were included.

MoCA

This test was developed by Nasreddine et al[12] MoCA is a 30-item test which assesses cognitive functions such as orientation, short-term memory/delayed recall, executive function/visuospatial ability, abstraction, attention and so on. A score of 26 or above is considered as normal.

Procedure

The study was approved by ethics committee of IMHH. Purposive sampling was used for selection of cases who met diagnostic and inclusion criteria and did not fulfill exclusion criteria. Informed consent was obtained both from the patients, and for the patients with poor insight the informed consent was obtained from their responsible caregiver.

A semi-structured proforma was used to record demographic and clinical information. Appropriate and necessary investigations were performed to rule out severe medical illness which may lead to complications during the course of MECT. Patients were kept on fasting for at least 6 hours before ECT and pre-oxygenated with oxygen 100%. Modified, bi-temporal ECT was delivered to each patient three times a week. Anesthetist decided whether to use Propofol or thiopentone as anesthetic along with muscle relaxant (succinylcholine). Anticholinergic agents such as atropine or glycopyrrolate were not administered before or during the ECT to any of the patients.

Brief pulse ECT machine was used for delivery of ECT with a stimulus settings of brief pulse/constant current – 800 mA, pulse width – 1.5 ms, frequency – 140 pulse per second, and duration – 0.4–3.6 seconds which corresponds to 60–540 mC starting 2 days after the baseline manic symptoms on YMRS scales. All patients had their seizure threshold determined using the stimulus dose titration technique described by Sackeim et al.[8]

The seizure threshold was determined for each patient by giving stimulus doses for three times or less. Having determined the seizure threshold, the MECT were given on alternate days for 1.5 times of seizure threshold or 2.0 times of seizure threshold as applicable. The pharmacological treatment continued as usual during the course of ECT. The decision to discontinue the course of ECT was taken on the basis of patients' hospital stay, improvement in symptoms severity or if consent was withdrawn by the patients/caregivers. The baseline assessment of cognitive functions on MoCA was done for each patient on the day before the administration of first ECT and the post assessment on MoCA was done on the next day of the administration of last ECT.

Statistical analysis of data

Data were analyzed using statistical package for the social sciences (SPSS). To see the changes within the group,

paired t-test was used. And to see the changes between the groups, independent t test was used.

RESULTS

There were some complications, the ECT was discontinued and three patients had to be discharged from the treatment facilities. The sample count dropped to 57 patients in following two groups which completed the entire treatment protocol (1) 1.5 times of threshold; n=28 (2) 2.0 times of threshold; n=29.

Table 1 suggests that the mean age of group-A was 27.81±7.67 years whereas it was 27.07±6.34 years for group-B. Both the groups had more or less equal age level. The proportion of male was a little higher in group-B i.e. 68.7% then 53.5% in group-A. The distribution of educational level was more or less in both the groups. Overall, the groups were comparable on sample characteristics.

Table 1: Sample characteristics.

Characteris-tics	Group-A 1.5 times of threshold (n=28)	Group-B 2.0 times of threshold (n=29)
	Mean±SD/%	Mean±SD/%
Age in years	27.81±7.67	27.07±6.34
Gender		
Male	53.5	68.7
Female	46.5	31.3
Education		
Literate	89.3	89.6
Illiterate	10.7	10.4

Within group analysis

Table 2 suggests that the mean and SD score of cognitive functioning at baseline, among the patients who have received stimulus intensity at 1.5 times of threshold was 26.07±0.26 and the final assessment was 25.82±0.47. The t value was 2.55 which is significant at 0.05 level. The score at baseline was 26.07 at normal level, which deteriorated mildly to the level of 25.82 at post assessment.

Table 2: Within group comparison of MoCA at baseline and post assessment in group-A.

Assessments	Mean	S.D.	t-value
MoCA: baseline assessment	26.07	0.26	2.55*
MoCA: final assessment	25.82	0.47	

* Significant at 0.05 level

Table 3 suggest that the mean and SD score of cognitive functioning at baseline, among the patients who have received stimulus intensity at 2.0 times of threshold was 26.27±0.52 and the final assessment was 25.55±0.50. The t value was 5.55 which is significant at 0.01 level. The score at baseline was 26.27 at normal level, which deteriorated mildly to the level of 25.55 at post assessment.

Table 3: Within group comparison of MoCA at baseline and post assessment in group-B.

Assessments	Mean	S.D.	t-value
MoCA: baseline assessment	26.27	0.52	5.55**
MoCA: final assessment	25.55	0.50	

** Significant at 0.01 level

Between group analysis

Table 4 suggests that the mean and SD of baseline score of cognitive functioning in group-A (1.5 times of threshold) and group-B (2.0 times of threshold) was 26.07±0.26 and 26.27±0.52 respectively which is not significant statistically. Both the groups had equal level of cognitive functions at baseline.

Table 4: Between group comparison of baseline MoCA mean scores.

Groups	Mean	S.D.	t-value
1.5 times of threshold	26.07	0.26	1.84
2.0 times of threshold	26.27	0.52	

Table 5 indicates that on post assessment, there is some reduction in the mean scores of both the groups suggesting negative mild effect on cognitive functions. The level of scores dropped to some extent. The significant differences in mean scores suggest a little more negative impact on group-B which received 2.0 times of threshold ECT.

Table 5: Between group comparisons of final MoCA difference mean scores.

Groups	Mean	S.D.	t-value
1.5 times of threshold	25.82	0.47	2.07*
2.0 times of threshold	25.55	0.50	

** Significant at 0.05 level

DISCUSSION

The purpose of this study was to evaluate the cognitive functioning in patients suffering from mania when ECT was administered at higher stimulus intensity relative to their seizure threshold. The findings of the present study suggest mild deterioration on post assessment which was a little higher in 2.0 times of threshold group. At baseline, both the groups had above 26 scores which are considered normal for MoCA. The reduction in scores indicates reduction in cognitive functions. The mean scores reduced by a few points on post assessment leading to statistically significant impairment. The mean scores of 25.82 and 25.55 when rounded off would yield a value of 26 only. Hence, it can be concluded that there was only a mild impact of ECT on cognitive functions of the patients.

As a whole, the increased stimulus intensity of ECT can be considered more or less safe with regard to its impact on cognitive functions. Previous studies suggest that ECT may lead to some temporary changes in cognitive functions which gets recovered with time. Porter et al reported that the deterioration seen after ECT in cognitive functions improved and stabilized after two months.[2] Akambadiyar et al reported that when memory scores were compared between values, 30 days after the last ECT and shortly after a course of ETCs, there was a substantial rise in the mean scores of working memories, general memory, auditory immediate, auditory delayed, and immediate memories, subtests.[7] Similar results were found in a meta-analysis conducted by Semkovska et al in the year 2010 and concluded that there was no persistent 'cognitive deficits' in any studied variable beyond 15 days after ECT.[6]

The impact of ECT in current intensity on cognitive functions as seen clinically suggested no serious adverse effects on any of the patients included in the sample. The study however, did not attempt long term follow up. It would have been better had a follow up was integrated in the study to assess long term impact of increased stimulus intensity of ECT on cognitive functions. The little changes seen from baseline to follow up, would suggest a replication of the study with follow up assessment and incorporating more comprehensive neuropsychological assessment tools for mapping changes in cognitive functions due to ECT.

Limitations

However, the findings generated in the present study cannot be considered as finally conclusive. Still there is a scope for improvement in methodological and other aspects of the research. For example, a long term follow up should have been conducted to see the status of cognitive changes over months to further investigate delayed effects of ECT.

CONCLUSION

This study was conducted to address the issue of cognitive changes that may result from increasing the stimulus intensity of ECT. Temporary, cognitive changes after ECT is a documented and well known phenomena. The need for increasing the stimulus intensity of ECT is arising in view of the better response rate in persons with psychiatric illness. Hence, to catalogue the side effects of increased stimulus intensity is imperative. This study, focused whether increased stimulus intensity produce greater amount of cognitive changes compared to the routinely administered level of ECT stimulus in clinical practice. The findings of the present research did not suggest increased level of side effects with increased level of stimulus intensity and favor the application of higher level of ECT stimulus at least from the perspective of cognitive side effects.

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