Article *NIMHANS Journal*

Prolonged Seizures during Electroconvulsive Therapy

Volume: 15 Issue: 02 April 1997 Page: 139-142

M S Jayaprakash, B N Gangadhar .

Reprints request
, K Girish &, N Janakiramaiah,
- *Department of Psychiatry, National Institute of Mental Health & Neuro Sciences, Bangalore 560 029, India*

Abstract

Seizures were monitored using both cuff method and EEG, during the first ECT session in 89 consecutive patients. Six (7%) did not develop motor seizure but had adequate EEG seizures. In the group manifesting both EEG and motor seizure (n = 83), twenty-one (25%) patients developed EEG seizure 120 seconds more in duration (Group B) and the other 62 patients had adequate EEG seizure (Group A). The motor and EEG seizure duration correlated significantly in Group A (r = 0.8, p (0.01) but not in Group B (r = 0.4, p > 0.05). Linear regression analysis demonstrated that motor seizure could predict the EEG seizure in Group A (t = 10.42, p < 0.001), but not so in Group B (t = 2.0, p > 0.05). This suggests that motor seizure monitoring alone is unreliable to detect prolonged seizure and hence the need for EEG seizure monitoring. The seizure should be terminated by using intravenous diazepam when the EEG seizure duration exceeds 120 seconds.

Key words -
Electroconvulsive therapy,
Prolonged seizure,
EEG monitoring

Seizure is the essential ingredient of ECT procedure and its occurrence should be ascertained by either cuff or preferably EEG method. American Psychiatric Association (APA) task force defines adequate seizure as 20-30 seconds of EEG seizure duration [1]. However, in most patients seizure continues well beyond 30 seconds but terminates spontaneously. Seizure lasting longer than 180 seconds is defined as prolonged seizure and should be terminated [1]. Duration of seizure correlated modesty and significantly with retrograde and anterograde amnesia [2]. Therefore, it is desirable that prolonged seizures are detected early and/or prevented. In a retrospective study of 1233 ECT seizures in 126 patients, Greenberg [3], found that 4.3% of seizures lasted more than 120 seconds and 1.1% lasted more than 180 seconds. Royal College of Psychiatrists (RCP) [4], Greenberg [3], and Murugesan [5], suggest that seizures exceeding 120 seconds be considered as prolonged seizure and should be terminated.

Fink and Johnson [6] found that motor seizure durations correlated highly with EEG seizure durations and recommended the cuff method for seizure monitoring. Liston et al. [7] compared their findings with nine previous studies on the duration of motor and EEG seizure. The mean motor seizure duration (48 secs) was shorter than the mean EEG seizure duration (71 secs). The mean ratio of motor seizure and EEG seizure duration (M/E ratio) was 0.68 (range, 0.46 - 0.90). The M/E ratio was lowest (0.46) in seizures lasting beyond 120 seconds [3]. This suggests that motor seizure alone may be underestimating the duration of actual seizure and hence may not reliably detect those exceeding 120 seconds. The

author suggested that in these situations EEG monitoring had distinct merits [3]. This observation has not been replicated but supports the need to recognize the seizures beyond 120 seconds and terminate them.

Methodology

Sample

Sample consisted of 89 patients referred for ECT following informed consent. All first ECTs were administered with stimulus titration to determine the threshold. See table for sample characteristics.

ECT Technique

Thiopentone (3 mg/kg), Succinylcholine (0.75 mg/kg) and Atropine (0.6 mg) were used for modification. Patients were ventilated with 100% oxygen throughout the procedure until resumption of spontaneous and regular breathing. All patients received bilateral, brief pulse, threshold ECT. Threshold was defined as stimulus at which a patient obtained at least 25 seconds of EEG seizure. Stimulus was started at 60 millicoulombs (mC) and on subsequent steps increased by 60 mC in each step using NIMHANS-NIQR ECT machine which delivered constant current brief pulse stimulus was applied over standard bifrontotemporal electrode placement [8].

Seizure Monitoring

Seizure duration was monitored by cuff as well as EEG method. In cuff method, motor seizure was monitored by a clinician unaware of EEG seizure. Last convulsive movement of a cuffed limb or any other part of the body was defined as motor seizure endpoint. The EEG was recorded from frontal electrodes (F3 and F4) referenced to ipsilateral mastoids. EEG output was displayed on the computer screen and the duration was monitored by another psychiatrist. Unequivocal absence of seizure transient for five or more second on left side was taken as EEG seizure endpoint 9. Patients developing both motor and EEG seizure were divided into two groups, those with EEG seizure duration less than 120 seconds (Group A) and those with EEG seizure duration 120 seconds or more (Group B) - a cut off suggested by Greenberg [3] and Murugesan [4].

Results

All patients developed seizures of at least 25 seconds duration on EEG. Motor seizure however, did not occur in six (7%) patients. In those having both adequate EEG and motor seizures (n = 83), twenty-one (25%) patients had seizures longer than 120 seconds and nine (11%) had seizures longer than 180 seconds. Diazepam IV was used in these nine patients to terminate the seizure. The demographic, drug treatment and ECT variables of groups A and B are given in Table I. Patients of group B were younger. All patients in Group B, except one, were younger than 40 years. The two groups did not differ with respect to diagnosis, drug status, thiopentone and stimulus dose. The groups differed significantly on motor and EEG seizure duration as well as M/E ratio.

Table I - Patients' clinical, drug treatment and ECT variables

Table I - Patients' clinical, drug treatment and ECT variables

Patients in group A had EEG seizures < 120 seconds and in group B (120 seconds.

* Values in these cells indicate number of patients & Fisher's test was used to test the properties of distribution of these variables across two groups.

Values in other cells refer to mean (SD) & Independent samples 't' test was used to compare the two groups on these variables.

S = Significant ($p =< 0.05$), NS = Not significant ($p > 0.05$)

* @ Some patients were on more than one psychotropic drug.

Motor seizure duration correlated significantly with that of EEG seizure duration in Group A (Pearson's 'r' = 0.80, $p < 0.01$ but not in Group B (Pearson's 'r' = 0.42, $p > 0.05$). Applying linear regression, motor seizure duration predicted the EEG seizure duration significantly in Group A ($t = 10.42$, $p < 0.001$) but not in group B ($t = 2.0$, $p > 0.05$).

Discussion

Prolonged seizure is defined as 180 seconds by the APA [1] and 120 seconds by the RCP [4]. Nearly half the seizures reaching 120 seconds also crossed 180 seconds. This suggests that prolonged seizure be defined by more conservative threshold of 120 seconds. This study attempted to validate the latter definition. The proportion (25%) of our patients having seizures > 120 seconds is higher than in Greenberg's study [3]. The patients of our study were younger and unlike earlier study our patients were investigated in the first ECT session only; Greenberg's [3] sample included data from first as well as later ECT sessions. Seizure duration is longer at first than at later ECT session 10. In our sample the mean motor and EEG seizure are slightly greater than in other studies [2], [6], [11]. This too could be due to lower mean age of our group. Mean M/E ratio is however comparable to that of earlier studies [7].

In Group A motor seizure duration correlated well with EEG seizure duration. In Group B however, motor seizure duration did not correlate with the EEG seizure duration. This fall in the correlation indicates that the motor seizure duration is unreliable for estimating EEG seizure duration particularly when the latter exceeds 120 seconds. Linear regression analysis demonstrated that motor seizure duration can predict EEG seizure duration only when the latter was less than 120 seconds. Using regression coefficient for Group A, motor seizure duration of 90 seconds predicts just more than 120 seconds of EEG seizure. This is also in keeping with a recent recommendation [3] that patients convulsing longer than 90 seconds need interventions to terminate the same. Although this criterion is useful in centres which cannot practice EEG monitoring, it can miss over half of the EEG seizures needing termination. In this series, only 8 out of the 21 seizures had motor duration of 90 seconds or more while EEG seizure was 120 seconds or more. The finding of this study compare with those of an earlier study 12 which also demonstrated the merits of EEG monitoring. Missing adequate seizure with a potential risk of restimulation can occur when only motor seizure is monitored [12], as were six sessions in our study which failed to produce any motor seizures but had adequate EEG seizures.

These findings of

a). poor correlation of "prolonged" EEG seizures (120 or more secs) with motor seizure,

b). inability for the motor seizure duration to predict EEG duration when it is prolonged, and

c). over half the prolonged EEG seizures had motor duration under 90 seconds (a threshold used to

guide intervention to abort prolonged seizure) suggest that EEG monitoring has distinct advantage in early detection of prolonged seizure and its prevention.

1.American Psychiatric Association, The practice of ECT : Recommendations for treatment, training and privileging
Convulsive Therapy Page: 6: 85-120, 1990
2.Miller A L, Faber R A, Hatch J P, Alexander H E, Factors affecting amnesia, seizure duration and efficacy in ECT
American Journal of Psychiatry Page: 142: 692-6, 1985
3.Greenberg L B, Detection prolonged seizure during electroconvulsive therapy: A comparison of electroencephalogram and cuff monitoring
Convulsive Therapy Page: 1: 32-7, 1985
4.Royal College of Psychiatrists, *The ECT Handbook. (Council Report CR 39), 1995; London, Gaskellrey*1995
5.Murugesan G, Electrode placement, stimulus dosing and seizure monitoring during ECT
Australian & New Zealand Journal of Psychiatry Page: 28: 675-83, 1994
6.Fink M, Johnson L, Monitoring the duration of electroconvulsive therapy seizures
Archives of General Psychiatry Page: 39: 1189-91, 1982
7.Liston E H, Guze G H, Baxter Jr L R, Richeimer S H, Gold M E, Motor versus EEG seizure duration in ECT
Biological Psychiatry Page: 24: 94-6, 1988
8.Fink M, *Convulsive Therapy : Theory and Practice New York Raven Press*1979
9.Gangadhar B N, Candade V S, Laxmana G, Janakiramaiah N, Mahapatra P K, Computers in ECT and Paperless EEG monitoring
Indian Journal of Psychiatry Page: 37:98, 1995
10.Janakiramaiah N, Jyothi Rao K M, Parvenu J, Sujatha B L, Gangadhar B N, Subbakrishna D K, Seizure duration over ECT sessions : influence of spacing ECTs
Indian Journal of Psychiatry Page: 27: 273-8, 1992
11.Larson G, Swartz C, Abrama R, Duration of ECT- induced tachycardia as a measure of seizure length
American Journal of Psychiatry Page: 141: 1269-71, 1984
12.Scott A I F, Shering A P, Dykes S, Would monitoring by electroencephalogram improve the practice of electroconvulsive therapy?
British Journal of Psychiatry Page: 154: 853-7, 1989