

## ECT INDUCED EEG SEIZURE: VALIDITY OF DURATION ESTIMATION BY LAST SPIKE

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### SUMMARY

*The seizure EEG records of 25 depressives receiving ECT were 'blindly' rated by two trained raters using a uniform definition of seizure endpoint. The EEG seizure duration estimates were validated against five expected relationships. EEG seizure duration correlated with and was more than motor seizure duration, reduced over the course of ECTs, was consistent within subjects, and negatively varied with age. Within clinical constraints, the method of seizure duration estimation by the last spike is valid.*

### INTRODUCTION

EEG monitoring during modified ECT has certain merits (Scott et al, 1989). This is important as a seizure duration of less than 20-30 seconds is thought to be inadequate (American Psychiatric Association, 1990). The inter-rater reliability of seizure duration estimates from single channel EEG, however, vary from good (Warmflash et al, 1987) to poor (Guze et al, 1989). Objective definition of seizure termination has been attempted, such as the onset of isoelectric line or, in its absence, the last spike (McCreadie et al, 1989). A spike is an unequivocal index of a seizure and has an established definition (Klonas, 1987). Hence, identification of the last spike was used to estimate seizure duration from single channel EEG records. Preliminary investigations have demonstrated a good inter-rater reliability using this method (Gangadhar et al, 1992). This report examines the validity of seizure duration estimates by last spike method.

### MATERIALS AND METHODS

Twenty five consenting endogenous depressive patients (15 females), receiving bilateral sine wave ECT, formed the sample. Their age range was 22 to 55 years. Thiopentone (200-250mg), succinylcholine (20-40mg) and atropine (1.3mg) were used intravenously for modification. The ECT stimulator was coupled to the MECTA Model D to facilitate EEG recording during ECT. On these patients, 161 seizure EEG tracings were available.

EEG was monitored from the vertex (Cz of 10-20 system), referenced to right mastoid at a paper speed 16.6mm/sec. Also, the motor seizure was monitored using the cuff method on all these occasions. While monitoring the motor seizure, the psychiatrist had no access to the EEG recording; however, the motor seizure duration was marked on the EEG in 75 tracings. Besides the motor seizure duration in these 75 records, no clinical information was made available. The coded tracings were rated independently by two raters. The seizure duration was estimated to the nearest 0.5 second from the start of post stimulus EEG record to the last spike. A spike was defined as a surface negative sharp transient of less than 70 msec width at zero crossings (Klonas, 1987).

### RESULTS

The inter-rater reliability (Pearson's 'r') of seizure duration estimates was 0.97 for all records (n=161), 0.97 for records without marking of motor seizure ending (n=86), 0.99 for all 1st records of each patient (n=25) and 0.98 for all 1st records of each patient without motor marking (n=19). All correlations were significant at a probability level of 0.1 per cent or less. Five expected relationships of EEG seizure were examined to validate the duration estimates.

a) The EEG seizure should correlate with motor seizure. The EEG seizure duration estimated by both raters from 86 tracings without information about motor seizure was correlated with the motor seizure duration (rater 1, 'r'=0.59, p < 0.01; rater 2, 'r'=0.6, p < 0.01).

b) EEG seizure duration should not be less than motor seizure duration. Mean (SD) of EEG seizure duration from 1st available records (n=24) of each patient was 48.9 (18.7) secs and 50.1 (18.3) secs for the two raters respectively. This was significantly longer than the corresponding mean (SD) motor seizure duration [33.4 (9.3) secs] for both rater 1 (t=4.2, p < 0.001) and rater 2 (t=4.6, p < 0.001).

c) EEG seizure duration should be consistent within patients. In 22 patients the first and the fourth ECT's EEG tracings were available. The seizure duration of these two sessions correlated significantly for both raters (rater 1, r=0.45, p < 0.05 and rater 2, r=0.47, p < 0.05).

d) The EEG seizure duration should decrease after consecutive ECTs. The mean (SD) EEG seizure durations of the fourth ECT session from 24 patients for both rater 1, [35.6 (12.5) secs] and rater 2, [35.6 (12.6) secs] were significantly less than that of the first ECT session [rater 1, 46.7 (18.4) secs, t=3.3 p < 0.01 and rater 2, 47.2 (18.1) secs, t=3.4, p < 0.01].

e) The EEG seizure duration should decrease with age. The EEG seizure duration correlated negatively with age (25 records) in both raters, though not significant statistically (rater 1, r = -0.35; rater 2, r = -0.34).

### DISCUSSION

Spikes during a seizure are unequivocal indices of seizure. Hence, the last spike can be considered to herald the termination of an unequivocal seizure. Seizure dura-

tion estimates by last spike method have a high inter-rater reliability (Gangadhar et al, 1992), and this study confirms the same. The validity of such a measure of seizure duration was examined and five characteristic relationships of the EEG seizure duration were demonstrable as expected.

Validation of seizure duration estimates from surface EEG records should theoretically be done against intracerebral recordings. As this is not practical, limitations with the other measures of validation should be accepted. However, a further confirmation of this validity should be sought under other conditions, viz., concomitant recording of an EMG to monitor motor seizure, and when unilateral ECT is given with recording made from the unstimulated hemisphere. It is also relevant to examine the adequacy of seizure on parameters other than duration.

Scott et al (1989) and Krystal et al (1992) have suggested that seizure generalization as revealed by multi-channel EEG recording may be one such aspect. While such a practice has merits for research, it should be noted that many ECT devices with EEG facility allow only one channel EEG recording. Given this limitation, the last spike method can be a reliable and valid method to estimate EEG seizure duration during ECT.

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