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ICTAL RPP- A SUPPLEMENT TO CUFF METHOD IN DETECTING ECT- INDUCED CEREBRAL SEIZURE

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ABSTRACT

During electroconvulsive therapy (ECT), occurrence of seizure must be confirmed. Cuff method, although simple and reliable, can sometimes miss an adequate EEG seizure. Predictable cardiovascular response occurs during ECT seizure. We examined if this can be an additional guide to detect cerebral seizure. In 164 modified ECT sessions, EEG and cuff methods were used for seizure monitoring. Heart rate (HR in beats per minute) and blood pressure (BP in mm of Hg) were recorded before (baseline) and 20 seconds after the stimulus (ictal). The rate pressure product (RPP=HR x systolic BP) was computed. The ECT sessions consisted of three groups, viz., adequate EEG and motor seizure (n=126), adequate EEG but not motor seizure (n=21) and neither EEG nor motor seizure adequate(n=17). Significant elevation of RPP occurred from baseline to 'ictal' recording and this was different between the three groups. Ictal RPP did not differ between groups with or without adequate motor seizure if EEG seizure was adequate. The group with no adequate EEG or motor seizure had the least 'ictal' RPP. Findings suggest that RPP response can be an additional clinical measure to detect seizures during ECT.

Key words: Cardiovascular response, electroconvulsive therapy, seizure, cuff method

Elicitation of a cerebral seizure is necessary for therapeutic effects of electroconvulsive therapy (ECT) (Ottosson,1960). Therefore, occurrence of seizure must be confirmed during ECT session. In the former days of unmodified ECT, confirming seizure occurrence posed no problem, as the grand-mal convulsion was a dramatic behavioural event. However, with the introduction of anaesthetic modification, clinicians may fail to detect the seizure. Addersely and Hamilton (1953) introduced a novel 'cuff method' to monitor motor convulsion. Motor seizure duration by cuff method correlated well with electroencephalograph (EEG) (Fink and Johnson, 1982). More recently, however, Mayur et al.(1999) demonstrated some limitation of motor seizure monitoring. In a sizeable proportion of patients (7%), motor seizure would be considered either absent or inadequate (<15 sec) while an adequate EEG seizure (≥ 25 sec) would have occurred. This confirmed an earlier observation (Scot et al.,1989) that in the absence of EEG monitoring some patients would have

inadvertently received a repeat stimulus although an adequate seizure had been obtained. Recent guidelines on ECT have encouraged use of EEG during ECT for seizure monitoring (Freeman, 1995; American Psychiatric Association, 2001).

However, in most centres of our country, EEG monitoring is not available. EEG monitoring also calls for additional instrumentation and hence cost. In centres with high number of patients for ECT, EEG monitoring can also burden the clinicians and add to the time for each ECT session. For these reasons, it may be impractical to use EEG monitoring routinely. Are there alternative and simpler methods that can supplement motor seizure monitoring?

Predictable elevation in heart rate (HR in beats per minute), blood pressure (BP in mm of Hg) and hence rate pressure product (RPP= HRx Systolic BP) occurred during seizure of ECT (Abrams, 1997; Gangadhar et al., 2000). Some authors have implicated cerebral neurophysiological mechanisms for the cardiovascular response (Welch and Drop, 1989). The RPP response was not merely due to peripheral convulsions as there was no correlation with the extent of motor seizure modifications (Murali et al., 1999). Some evidence is available that RPP response may reflect the therapeutic potency of ECT (sarvanan et al., 1999; 2001). RPP response during seizure may be one of the additional clinical indices to confirm an adequate cerebral seizure. In the present study, we examined this question.

MATERIAL AND METHOD

Consecutive patients (n=164) prescribed ECT by the treating psychiatrist at National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, formed the sample for the study. Patients with cardiovascular (including hypertension) or neurological illnesses were excluded. Nearly half were not on any psychotropic medication. Psychotropic medications (antidepressants, antipsychotics, anticholinergics and benzodiazepines) prescribed by the treating psychiatrist were continued in the rest. Written informed consent for ECT was obtained. All patients were right-handed. Clinical details are listed in table.

TABLE

Clinical distribution of the sample (n=164)

Variables	Value
Age (in years)$	35.9±10.5
Sex (Male:Female)*	68:96
Diagnosis*	
Depression	144
Psychosis	20
Stimulus laterality*	
Unilateral:bilateral	121:43
Stimulus dose(mC)$	117.6±103.5
Seizure duration(sec)$	
Motor	38.3±23.5
EEG	53.8±25.7

Cell values are $ Mean±SD, *Number of patients.

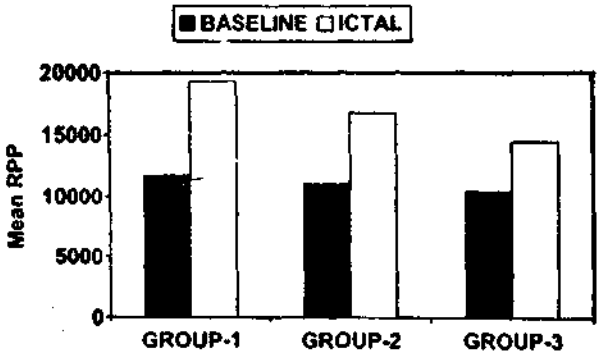

Fig-1. Mean RPP before (baseline) and at 20 seconds after (ictal) stimulus.
Group-1. EEG and motor seizure adequate (n=126)
Group-2. EEG adequate but not motor seizure (n=21)
Group-3. EEG and motor seizure inadequate(n=17)

ECT was administered under modification using thiopentone (4 mg/kg), atropine (0.6 mg) and succinylcholine (1 mg/kg). 100% positive pressure ventilation was maintained throughout the procedure. Stimulus was administered using NIMHANS-NIQR (National Institution for Quality and Reliability) machine. The machine delivered bi-directional, brief pulse, constant current stimulus of 800mA, 1.5 msec pulse width at a frequency of 125 pulses per second. The stimulus dose (mC) was selected by varying the stimulus

train duration (0.2 to 3.6 seconds). The referring psychiatrist chose the stimulus laterality. In case of bilateral ECT, the stimulus electrodes were applied one-inch above the mid point of the imaginary line joining the outer canthus of the eye and the tragus on both side (bifrontotemporal). In case of unilateral ECT, one electrode was placed as in bilateral ECT and the other half-an-inch lateral to the vertex on the non-dominant hemisphere (d'Elia position).

Threshold was assessed at the first ECT session using titration method. The starting stimulus dose was 20-30 mC. The increments, if required, were in terms of 15-20 mC. If the patient failed to obtain a seizure or had sub-shock, patient was re-stimulated at next higher dose after ventilation for at least 20 seconds or one minutes respectively. The adequate EEG seizure was defined as ≥ 25 seconds. Adequate motor seizure was ≥ 15 seconds of convulsion on cuffed limb (Freeman, 1995).

The motor seizure duration was measured using the 'cuff method' (Addersely and Hamilton, 1953). The cuff was tied to the right calf or arm and inflated 40-60 mm of Hg above systolic pressure just before injecting succinylcholine. The time interval from the stimulus to the last clonic movement was taken as the motor seizure duration. The hand electrode switch was released at the end of motor convulsions and the timer incorporated in the ECT device recorded the time in seconds, which was displayed in the front panel.

EEG was monitored using two channels. The EEG leads were placed on F_3 and F_4 referenced to ipsilateral mastoids on either side. The ground lead was placed on the middle of the forehead. The beginning of unequivocal absence of epileptiform transients for five or more seconds on both channels was taken as the end of EEG seizure (Gangadhar et al., 1995). The data acquired was replayed on the computer screen to confirm the end of EEG seizure duration if needed.

Pulse oximeter (Cardiocap II) was used to record heart rate (HR) and blood pressure (BP) during ECT. It is a non-invasive and automated cardiac monitor. The HR and BP were recorded, before injecting the anaesthetic drugs (baseline) and at 20 seconds after the stimulus (ictal). For each occasion, RPP was computed.

The ECT sessions were divided into three groups: adequate EEG and motor seizure duration (Group-1; n=126), adequate EEG but inadequate motor seizure duration (Group-2; n=21) and neither EEG nor motor seizure adequate (Group-3; n=17).

Repeated measures analysis of variance (RMANOVA) was used to measure changes in the RPP across two occasions (baseline and ictal) of ECT session and between the three groups using age as a covariate. ANOVA with Dunnette's posthoc test was used to test the difference in 'ictal' RPP between the ECT groups. Significance (alpha) was kept at 0.05.

RESULTS

The three groups were comparable on sex distribution (p=0.5) but were different on age (F=3.9; df=2,164; p= 0.022) being highest in Group-2. Ictal RPP increased significantly compared to baseline (Occasion effect F=11.1; df=1, 160; p=0.001) and the groups were different (Group effect F= 3.5; df=2, 160; p=0.031) with no interaction. The three groups did not differ on baseline RPP but were significantly different on 'ictal' RPP (F=3.64; df=2.161; p=0.028). Dunnette's posthoc test indicated that ictal RPP of the groups 1 & 2 were not different (p=0.3) but the groups 1 & 3 were different, being least in group-3 (p=0.029) (Fig-1).

DISCUSSION

There was significant increase in ictal RPP from baseline. 'Ictal' RPP did not differ in patients with or without adequate motor seizure once adequate EEG seizure occurred. When neither EEG nor motor seizure was adequate the 'ictal' RPP was the lowest. To our knowledge, there is no similar study examining the RPP response to

ECT in relation to motor seizure adequacy.

Increase in RPP following the convulsive stimulus is in accordance with other studies (Gangadhar et al., 2000). Automated Cardiocap II was used to record HR and BP and hence the readings were unbiased.

This finding suggests that monitoring cardiovascular response following stimulus can indicate a seizure. Elevations in RPP may be less pronounced if an adequate seizure is not produced. In the absence of EEG, if motor convulsion is not detected (due to deep muscle relaxation), robust rise in the cardiovascular measures may point to a cerebral seizure. Cardiovascular monitoring while mandatory during ECT (Freeman, 1995; American Psychiatric Association, 2001), can be also of help to aid seizure detection.

The study is limited by disproportionate number of patients in the groups and their age was different. The stimulus laterality was also not controlled. More number of Group-1 patients received bilateral ECT than other groups. The 'ictal' RPP of the group with no adequate motor and EEG seizure was also higher than the corresponding baseline as the patients had been given atropine as pre-medication. Though the sample was unselected and without control over stimulus laterality or medication status, the sample can be considered representative of ECT population. Therefore, the results may be translated to clinical application.

In conclusion, in the absence of EEG monitoring, RPP could be a supplement to cuff method to confirm adequacy of cerebral seizure. This is economical and can be practised conveniently when EEG facility is lacking.

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