

## ANALYSIS OF PHYSIOLOGICAL (PAO<sub>2</sub>, PULSE AND BLOOD PRESSURE) CHANGES DURING MODIFIED ECT UNDER GENERAL ANAESTHESIA

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### ABSTRACT

**Objective:** To study the changes in physiological parameters ie PAO<sub>2</sub>, pulse and blood pressure changes during ECT under GA.

**Study Design:** Quasi-experimental study.

**Place and Duration of Study:** Department of Psychiatry and Department of Anaesthesiology, Combined Military Hospital Abbottabad from Sep 2009 to Feb 2010.

**Patients and Methods:** A total of 50 patients with depression were given four separate ECT sessions each. All patients were anaesthetized using propofol 180-200 mg I/V and suxamethonium 50 mg ie 0.75-1 mg per kg I/V without atropine. They were stratified according to physiological changes including PAO<sub>2</sub>, pulse and blood pressure at 1, 2 and 5 min after ECT. Oxygen saturation was measured using a pulse oximeter, which measures saturations in the range of 65-100%.

**Results:** Age range was 19-65 years; mean 46 years (SD±13). Mean diastolic BP before ECT was 84.72 that decreased post ECT ie 78.02 and 77.46 and 74.44 at interval of 1, 2 and 5 minute respectively. Post-ECT pulse and PAO<sub>2</sub> behaved similarly. Post ECT systolic BP decreased at 1and 5 minutes. Pulse rate decreased after ECT.

**Conclusion:** ECT under propofol is one of the most effective and safe modality of treatment for psychiatric patients under the supervision of qualified psychiatrists and anaesthesiologists and it gives more stable hemodynamic changes.

**Keywords:** Anesthesia, ECT, Muscle relaxant, Physiological changes.

### INTRODUCTION

Convulsive therapy is one of the oldest treatment options for mental illness that has lately gathered a rising interest especially in modified safe form. Historical mention of convulsive therapy dates back to the 1500s when the Swiss physician Paracelsus (1493-1541) used camphor to treat mental illness. It was re-introduced in the late 1930s on the basis of the mistaken idea that epilepsy and schizophrenia do not occur together. At first, fits were produced either by using cardiazol, hypoglycemia - by insulin-induced coma (Van Meduna 1938) or by passing an DC electric current through the brain (Cerletti and Bini 1938)<sup>1</sup>.

Administration of electro convulsive therapy (ECT) requires general anesthesia and oxygenation. The depth of anesthesia should be as light as possible, not only to minimize adverse effects but also to avoid elevating the seizure threshold associated with many anesthetic agents. Methohexital (brevital) (0.75 to 1.0 mg/kg IV bolus) is the most preferred anesthetic because of its shorter duration of action and lower association with postictal arrhythmias than thiopental (pentothal) (usual dose 2-3 mg/kg IV). After the onset of the anesthetic effect, usually within a minute, a muscle relaxant is administered to minimize the risk of bone fractures and other injuries resulting from tonic as well as clonic motor activity during the seizure. Succinylcholine, an ultrafast-acting depolarization blocking agent, usually administered a dose of 0.5 to 1 mg/kg as an IV bolus or drip, has gained virtually universal acceptance for the purpose. The greatest concern about ECT is the association between ECT and memory loss. About 70

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percent of all patients given ECT say that the memory impairment is the worst adverse effect<sup>2</sup>.

Anesthesia for ECT should be administered by a specially trained anesthesiologist. Electrical current during ECT stimulates the autonomic nervous system and provokes unique hemodynamic changes in systemic and cerebral circulation. Excessive alterations in heart rate, blood pressure, and cardiac functions should be prevented by medications - with anticholinergic and antihypertensive agents. Ventilation should be adequately maintained to ensure the efficacy of the therapy and to stabilize the hemodynamics immediately after the electrical stimulation. ECT induces increased metabolism and elevates oxygen and energy demands, while more carbon dioxide is produced than usual<sup>3</sup>.

The cardiovascular response is secondary to activation of the autonomic nervous system. Beginning with the electrical stimulus, there is an initial parasympathetic discharge lasting 10–15s. This can result in bradycardia, hypotension, or even asystole. A more prominent sympathetic response follows during which time cardiac arrhythmias occasionally occur. Systolic arterial pressure may increase by 30–40% and heart rate may increase by 20% or more, generally peaking at 3–5 min<sup>4</sup>.

The most common indication for ECT is major depressive disorder, for which ECT is the fastest and most effective available therapy. ECT is considered for use in patients who have failed medication trials, have not tolerated medications, have severe psychotic symptoms, are actually suicidal or homicidal, or have marked symptoms of agitation or stupor<sup>1</sup>.

## PATIENTS AND METHODS

This quasi-experimental study was conducted at Department of Psychiatry in collaboration with Department of Anaesthesiology, Combined Military Hospital Abbottabad from Sep 2009 to Feb 2010. Patients diagnosed as having Depressive Episode Severe according to the ICD-10 criteria were treated with ECT following which physiological changes including O<sub>2</sub> saturation (SpO<sub>2</sub>), pulse

and blood pressure were recorded. Informed consent was obtained from each patient. The approved protocol established by the clinical study committee was used in the study overseeing the ethics and legal aspects of clinical investigations. Fifty patients suffering from depression to whom ECT was prescribed, were selected. The patients' age ranged from 19 to 65 years and none of them had any known cardio-vascular or cerebrovascular complication or drug allergy. All patients were treated more than four times (three times per week).

General anesthesia was induced with propofol 180-200 mg I/V and suxamethonium in a dose of 50 mg i.e 0.75-1 mg per kg I/V without atropine. After loss of consciousness, succinylcholine chloride (1 mg/kg-1) was administered and ventilation was assisted by a face-mask with 100% oxygen. One minute after succinylcholine chloride injection, an electrical current was applied bilaterally. The electroshock stimulus was delivered by a trained psychiatrist using an ECT-stimulator.

Data was analyzed using SPSS version 20. Descriptive statistics were used to describe the data. Paired t -test was applied for the comparison of PAO<sub>2</sub>, pulse and BP before and after ECT. A *p* value <0.05 was considered significant

## RESULTS

Out of a total of 50 studied patients, 15 (30%) patients were female and 35 (70%) were male; mean age was SD 46±13 and the age range was 19 to 65. The range of oxygen saturations recorded before ECT was 69 – 99 %, and 92- 99% at 1 min, 92-99% at 2 min, 99-100% at 5 min . A *p* (*p* <0.004) value at 1 min, *p* (*p* < 0.01) at 2 min and *p* (*p* < 0.001) at 5 min. There was a continuous increase in diastolic pressure whereas in case of systolic pressure initial decrease was followed by increase finally reaching the baseline. There was a decrease in mean pulse after ECT procedure (table).

## DISCUSSION

In our studies there was a continuous increase in diastolic pressure whereas in case of systolic pressure initially there was a decrease

followed by increase and finally it reached baseline.

The present study used 1 mg·kg propofol for anesthesia induction. This was because for many patients, less than 1 mg·kg 1 propofol

blood pressure in hypertensive patients beyond the peri treatment period<sup>8</sup>.

Few studies have examined the cardiovascular response to pulse unilateral electroconvulsive therapy (ECT) performed

**Table:- Comparison of Physiological parameters with time (n=50).**

Pre ECT	1 min	2 min	5 min	Mean ± SD
Pulse (Bpm)	79±10	73.±3	75±6	74±3
BP (Syst) mmHg	122±11	*115±6	113±4	*114±6
BP (Dias) mmHg	77±7	72±5	73±5	72±5
O <sub>2</sub> Saturation %	96±2	*95±2	96±2	*97±1

was not sufficient to cause them to lose consciousness. Heart Rate did not change significantly throughout the ECT trial<sup>5</sup>. Whereas in our study the pulse rate decreased after ECT but there was overall stable changes in our studies where we used similar doses of 1 mg of propofol anaesthesia for induction.

Systolic pressure, diastolic pressure, and heart rate were consistently lower following propofol than methohexital (*p* less than 0.005). The mean maximum increase over baseline systolic pressure was 2.1 ± 2.9 mmHg with propofol, and 26.7 ± 4.5 mmHg with methohexital. In our study the pulse rate was decreased as compared with other findings<sup>6</sup>.

These flow velocities recorded post-ECT were considerably below the more than two fold increase recorded when no attenuating drugs were used. Systolic arterial blood pressure reached maximal values of 110-140 mm Hg and heart rate did not exceed 66 bpm whereas in our study the systolic blood pressure was initially decreased followed by increase in reading. Rapid awakening followed each treatment, no focal or global neurological signs were apparent, and the patient was discharged in remission<sup>7</sup>.

In the study conducted by Albin et al, he retrospectively examined pre- and post-ECT blood pressures in hypertensive and non hypertensive patients. In neither group was there a statistically significant change in blood pressure with a course of ECT but our study showed changes in all the parameters. We conclude that a course of ECT does not worsen

using modern techniques. In a study of 30 patients with major depression, they determined the effects of pulse. Unilateral ECT on cardiac work load using the rate-pressure product (RPP), a product of pulse and systolic blood pressure. The mean RPP across all ECT treatments increased by an average of 96% from pre-ECT baseline, with the maximal RPP occurring typically during the seizure<sup>9</sup>. However in our study there was a decrease in mean pulse after ECT procedure.

Studies report a tendency toward improved cognitive performance after anesthesia with propofol as compared with methohexital, but with statistical significance in only 2 cognition trials. Therefore, propofol is a safe and efficacious anesthetic for ECT treatment<sup>10</sup>.

Taylor et al studied twenty psychiatric in-patients before and after five bilateral ECTs for major depression. There were significant memory and neuropsychological changes after treatment, and significant reductions in depression rating scores, but they did not correlate with various measures of blood pressure elevation during treatment<sup>11</sup>. On the other hand our study showed decrease in pulse, systolic and diastolic blood pressure after ECT especially at 1 and 5 minutes.

Ninety-three patients with schizophrenia underwent estimation of the seizure threshold by the dose-titration method, at the 1<sup>st</sup>, 2<sup>nd</sup>, 7<sup>th</sup>, 14<sup>th</sup> and 20<sup>th</sup> treatments over an index ECT course. The 3-week stabilization period was used as a response criterion. Eighty-six patients (92%) showed a rise in threshold. The

magnitude of increment was  $269 \pm 244\%$ . The rise in seizure threshold could be predicted by the number of treatments, initial seizure threshold and EEG seizure duration, and these factors explained 42% of the variance<sup>12</sup>.

The purpose of this study was to identify the effects of end-tidal CO<sub>2</sub> monitoring on hemodynamic changes in patients who received ECT under propofol anesthesia. ECT was prescribed to 40 patients under propofol anesthesia. Ventilation was assisted using a face mask and 100% oxygen, with or without end-tidal CO<sub>2</sub> monitoring. Heart rate was significantly increased in patients without end-tidal CO<sub>2</sub> monitoring at 1 to 5 minutes after electrical stimulation ( $p < 0.01$ )<sup>13</sup>.

Electrical current during ECT stimulates the autonomic nervous system and provokes unique hemodynamic changes in systemic and cerebral circulation. Excessive alterations in heart rate, blood pressure, and cardiac functions should be prevented by medications with anticholinergic and antihypertensive agents. Ventilation should be adequately maintained to ensure the efficacy of the therapy and to stabilize the hemodynamics immediately after the electrical stimulation<sup>14</sup>.

In recent years, ECT has assumed an increasingly important role in the treatment of severe and medication-resistant depression and mania, as well as in the treatment of schizophrenic patients with affective disorders, suicidal drive, delusional symptoms, vegetative dysregulation, inanition, and catatonic symptoms<sup>2,3</sup>. Typically, the acute phase of ECT is performed three times a week for 6 to 12 treatments. In successful cases, initial clinical improvement is usually evident after three to five treatments<sup>3,4</sup>. Maintenance therapy can be performed at progressively increasing intervals from once a week to once a month to prevent relapses<sup>4</sup>.

ECT can produce severe disturbances in the cardiovascular system, most commonly a transient period of hypertension. This study was designed to determine whether propofol, in comparison with methohexital, would attenuate this hypertensive response. Fifteen

patients were studied during courses of six ECT administrations, each patient receiving propofol or methohexital on different occasions. Arterial pressure, heart rate, and cardiac rhythm were recorded. The induction doses were  $1.08 \pm 0.03$  mg/kg-1 of methohexital, and  $1.60 \pm 0.04$  mg/kg-1 of propofol. Systolic pressure, diastolic pressure, and heart rate were consistently lower following propofol than methohexital<sup>15</sup>. In our studies there was a continuous increase in diastolic pressure whereas in case of systolic pressure initially there was decreased followed by increase and finally reaching the baseline.

### CONCLUSION

ECT under propofol is one of the most effective and safe modality of treatment for psychiatric patients under the supervision of qualified psychiatrists and anaesthesiologists and it gives more stable hemodynamic changes.

### CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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