ABSTRACT: INTRODUCTION: Electroconvulsive therapy is associated with hemodynamic responses similar to that of laryngoscopy and intubation. Alpha adrenergic agents have been tried to attenuate this stress response effectively among which dexmedetomidine is of special interest as it is highly selective α2 agonist.

MATERIALS AND METHODS: Hundred patients belonging to American Society of Anaesthesiology (I-II) were allocated randomly in to two groups as group D and group C to receive dexmedetomidine (0.6 μg/kg) or saline diluted to a volume of 10 ml with 0.9% saline intravenously over 10 minutes before induction. Group c received 1mg/kg lignocaine 90seconds before induction. Heart rate (HR), systolic blood pressure (SBP) and mean arterial pressure (MAP) were recorded at baseline (T0) and 1, 3, 5 and 10minutes after the seizure (T1, T3, T5 and T10 respectively). The motor seizure duration was recorded.

RESULTS: HR in dexmedetomidine group was lower than that in the control group at 5 and 8 min after the start of drug infusion, and at 1, 3, 5 and 10min after the ECT shock (P<0.05). Peak HR and MAP were lower in the dexmedetomidine group compared with that in the control group (P<0.05) after ECT shock. There was no significant difference in motor seizure duration (group C - 39.56±8.1, group D - 34.23±9.0) in both groups.

CONCLUSION: Dexmedetomidine at a dose of 0.6µg/kg is as effective in blunting the stress response of ECT without altering motor seizure duration and recovery

KEYWORDS: Dexmedetomidine, liognocaine, Seizure, Recovery.

INTRODUCTION: Electroconvulsive therapy (ECT) is a procedure where a generalized epileptic seizure is purposely induced for the treatment of psychiatric disorders (Including acute and chronic depression/mania) that are resistant to medical management. The initial reaction following application of the electric current is a parasympathetic response resulting in bradydysrhythmias and possibly sinus pause.1,2 The parasympathetic response is followed by a sympathetic response associated with tachycardia and hypertension. During the sympathetic response, systolic blood pressure may increase by 30-40% and heart rate may increase by 20% (or more). The typical effective seizure should have duration of 20 to 50 seconds. Patient with co-existing disease like hypertension, coronary artery disease may develop complications like disturbance of heart rhythm, pulmonary edema, left ventricular failure, myocardial infarction and cardiac arrest. The commonest causes of mortality associated with ECT are the acute changes in heart rate and blood pressure that follow ECT.3 As a result of the cardiovascular morbidity associated with ECT,4,5 a wide variety of drugs have been administered in an effort to minimize
the acute hemodynamic changes. Studies involving trimethaphan, nitroprusside, nitroglycerine, alfenanil, clonidine, propranolol, esmolol, labetalol, urapidil, dexmedetomidine, and diltiazem have reported varying degrees of success in attenuating the acute hyperdynamic response associated with ECT.

Alpha-2 (α2) adrenergic agonists attenuate stress induced sympathoadrenal responses to painful stimuli, improve intraoperative hemodynamic stability, and reduce anesthetic requirements during surgery. Clonidine and dexmedetomidine are centrally acting α2 adrenergic agonist with well characterized antihypertensive properties. Among α2 agonists both clonidine and dexmedetomidine have been studied. However, the effect of dexmedetomidine on the acute hemodynamic response and duration of seizure activity during ECT has not been well characterized.

Dexmedetomidine is highly specific and selective α2 adrenoceptor agonist with α2:α1 binding selectivity ratio of 1620:1 compared to 220:1 for clonidine. The advantages of intravenous dexmedetomidine as premedicant in anaesthesia setting include sedation, analgesia, anxiolysis and improved haemodynamic stability. It also effectively reduces the requirement of anaesthetics.

Lignocaine is relatively short acting drug with elimination half-life of 90–120 min. It alters signal conduction in neurones by blocking voltage gated sodium channels in the neuron cell membrane that are responsible for signal propagation. With sufficient blockage the membrane of the postsynaptic neuron will not depolarize and will thus fail to transmit an action potential, thus blunting the sympathetic response. The recommended dose for this purpose is 1–1.5 mg/kg.

The primary aim of this study was to compare the efficacy of two pretreatment regimens: Dexmedetomidine and lignocaine (1mg/kg) in attenuating stress response to ECT and their effects on seizure duration.

METHODS: After ethical committee clearance one hundred patients, scheduled for ECT belonging to ASA class I and II, aged 20-60 years were included in the study. The exclusion criteria included patients with cardiac, coronary, renal, hepatic, cerebral and peripheral vascular diseases, patients with hypertension and presence of 1st, 2nd or 3rd degree heart block, patients with HR less than 60 bpm, SBP less than 100 mm of Hg, patients with difficult airway, obese patients (BMI>30) and patients with endocrinal diseases like hyperthyroidism, hypothyroidism and diabetes mellitus.

The study population was randomly divided into two groups (group D and group C) containing 50 patients in each group using sealed envelopes containing the name of the group, and patient was asked to pick up the envelope. The envelope was opened by senior anaesthesiologist who was assigned to prepare the solutions and not involved with the study. Group D received dexmedetomidine 0.6µg/kg and Group C received 10 ml of normal saline intravenously over 10min, 10minutes prior to induction using syringe pump. Patients in group C received lignocaine 1mg/kg 90 seconds before ECT.

Pre-anaesthetic evaluation was done thoroughly. The required investigations were done in all patients which included hemoglobin, urine examination for albumin, sugar and microscopy, standard 12-lead electrocardiogram, X-ray chest/Screening of chest, blood sugar, FBS/PPBS,
blood urea and Serum creatinine. All patients were premedicated with tablet ranitidine 150 mg previous night before surgery and were kept nil orally 10 pm onwards on the previous night.

On arrival of the patient in the operating room, an 18 gauge cannula was inserted and an infusion of normal saline was started. The patients were connected to multiparameter monitor to record HR, non-invasive measurements of SBP, DBP, MAP, end tidal carbon dioxide (EtCO2) and continuous ECG monitoring and oxygen saturation (SpO2). After stabilization period of 5 minutes, H.R., S.B.P., D.B.P, MAP and SpO2 were measured as baseline parameter (T0) and after the administration of study drug were recorded at 5 and 8 minutes.

Patient was preoxygenated for 3 minutes via face mask with Bain’s circuit. Anaesthesia was induced with propofol 2mg/kg and 1mg/kg succinylcholine. An oral soft bite block was placed and ECT shock current was applied. All the patients were given the electrical shock current with a pulse of 60–80Hz of 0.75msec duration with total stimulus time of 1.25–2.5 seconds for each ECT. The effectiveness of ECT current was verified by appearance of tonic – clonic seizures. Controlled or assisted ventilation was continued with 100% oxygen until patient resumed adequate spontaneous breathing. The HR, SBP, DBP and MAP were recorded at 1, 3, 5 and 10 minutes after the ECT shock as T1, T3, T5 and T10 respectively. The times from the ECT stimulus to the cessation of the clonic tonic motor activity in the "isolated" foot (i.e., motor seizure duration) recorded.

**Statistical Analysis:** Data were analyzed and compared by using repeated measures analysis of variance (ANOVA). A p<0.05 was considered as significant and p<0.01 was considered as highly significant.

**RESULTS:** There were no significant difference between groups in age, weight, ASA PS and gender as shown in table 1.

<table>
<thead>
<tr>
<th></th>
<th>Group C mean±sd</th>
<th>Group D mean±sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36.8±9.7</td>
<td>36.42±9.36</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>27/23</td>
<td>22/28</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>56.12±6.15</td>
<td>55.34±7.56</td>
</tr>
<tr>
<td>ASA PS I/II</td>
<td>26/24</td>
<td>23/27</td>
</tr>
</tbody>
</table>

Table 1: Demographic data

Sd–standard deviation, M/F-male/female, Kg-kilogram, C-lignocaine group, D-Dexmedetomidine group

The basal heart rate were comparable in both groups (p=1.000). Statistical evaluation between the groups showed a significant fall in HR in group D at 5 and 8 minutes of drug administration. The mean HR increase observed at 1, 3, 5 and 10 minutes after ECT shock in group C was statistically highly significant compared to mean HR in group D (p=0.000).

The intergroup comparison of mean heart rate (bpm) changes in response to ECT shock, between Control group and Dexmedetomidine group is shown in table 2.
p>0.05) – Not significant (NS) ; AD – after drug administration T1,T3,T5,T10 – 1,3,5,10 minutes After electroconvulsive therapy;
(p<0.01) – Highly significant (HS); (p<0.05) – Significant (S);
The SBP, DBP and MAP were significantly lower in group D compared to group C after drug administration at 5 and 8 minutes. The increase in SBP, DBP and MAP in group C was statistically highly significant at 1 min and 3, 5 and 10 minutes after ECT shock (p=0.000) compared to group D as shown in table 3, 4, 5 respectively.

<table>
<thead>
<tr>
<th>Time</th>
<th>Group C</th>
<th>Group D</th>
<th>P VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>87.36±9.96</td>
<td>87.36±13.58</td>
<td>1.000 (NS)</td>
</tr>
<tr>
<td>AD – 5th min</td>
<td>86.62±9.08</td>
<td>78.64±13.47</td>
<td>0.001 (HS)</td>
</tr>
<tr>
<td>AD – 8th min</td>
<td>84.82±9.92</td>
<td>75.26±12.62</td>
<td>0.000 (HS)</td>
</tr>
<tr>
<td>T1</td>
<td>123.6±10.46</td>
<td>84.50±11.41</td>
<td>0.000 (HS)</td>
</tr>
<tr>
<td>T3</td>
<td>116.4±9.16</td>
<td>82.38±11.28</td>
<td>0.000 (HS)</td>
</tr>
<tr>
<td>T5</td>
<td>109.62±9.17</td>
<td>79.88±11.93</td>
<td>0.000 (HS)</td>
</tr>
<tr>
<td>T10</td>
<td>98.30±9.82</td>
<td>76.90±10.77</td>
<td>0.000 (HS)</td>
</tr>
</tbody>
</table>

Table 2: The intergroup comparison of HR (beats/minute) changes between Control group and Dexmedetomidine group
**DISCUSSION:** Hyperdynamic cardiovascular response that occurs after ECT is result of central activation of the autonomic nervous system. Plasma epinephrine increases to 15 times normal level, and plasma norepinephrine peaks can become three times higher than under normal resting conditions, with peak levels occurring within 60s of electrical stimulation. Systolic blood pressure is transiently increased by 30–40% and heart rate is increased by 20% or more, resulting in a two to fourfold increase in the rate-pressure product, an index of myocardial consumption. ECT induced cardiovascular changes with a parasympathetic-sympathetic sequence may be hazardous in patients with severe cardiovascular disease.

Similar to techniques used for tracheal intubation, many pharmacologic methods have been used in an attempt to blunt the hemodynamic effects of ECT. Blunting of these responses has been effected with beta blockers, calcium channel blockers, fentanyl and lidocaine. The drugs used for this purpose must also have minimal effect on seizure duration. Since the therapy can be completed within 10 minutes, the anaesthetics used for ECT should have a short action and rapid recovery profile. However, the ideal pretreatment regimen to attenuate the acute hemodynamic response after ECT has not been identified.

The purpose of our study was to blunt the hemodynamic insult associated with ECT and to find out whether lignocaine or dexmedetomidine provide an additional benefit on preventing hemodynamic surge associated with neurohormonal response of ECT. However not much studies have specifically targeted the two drugs used in our study.
In a study conducted at San Diego by Weigner MB et al. they concluded that lignocaine was not effective enough in attenuating the stress response associated with the ECT current.[13]

A study done by Fu Wen et al.[10] concluded that oral clonidine 0.2-0.3 mg given 60-90 minutes before ECT may be useful in preventing the acute hemodynamic responses after the procedure without altering seizure duration and recovery.

In another study by Zakine Begec et al, studied the effect of 1µg/kg dexmedetomidine to attenuate the hemodynamic response to ECT. They found that HR in the dexmedetomidine group was lower than that in the control group at 5 and 10 min after the start of study drug infusion. Peak HR and MAP was lower in the dexmedetomidine group compared with that in the control 0.6mg group (p<0.05) at 0, 1, 3 and 10 min after the seizure ended. Both motor and electroencephalography (EEG) seizure duration in the control group (35.65±14.89 and 49.07±9.94, respectively) were similar to that in the dexmedetomidine group (33.30±12.01 and 45.15±17.79 s, respectively) (p>0.05).

Similarly in our study the peak increase in HR, SBP, DBP and MAP was significantly high in lignocaine group when compared to dexmedetomidine after ECT shock at 1, 3, 5 and 10 minutes. The mean dose of propofol required for induction was significantly lower (43.23±8.0) in dexmedetomidine group than in lignocaine group (85±6.8). There was no significant difference in motor seizure duration in both groups.

CONCLUSION: Dexmedetomidine at a dose of 0.6µg/kg is effective in attenuating hemodynamic response to ECT without altering seizure duration.(29)

REFERENCES:
1. Paul F white and matthew Miller's anaesthesia 7th edition R Eng Chapter 78; p 2445-7.


