COMPARATIVE STUDY OF SEVOFLURANE AND PROPOFOL IN ELECTROCONVULSIVE THERAPY

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ABSTRACT

Background: Electroconvulsive therapy (ECT) is commonly used for treatment of depression, mania, affective disorder etc. Sodium thiopentone is commonly used for anaesthetic management of ECT. Recovery profile of propofol is faster compared to thiopentone. Sevoflurane produces rapid and smooth induction and is rapidly eliminated for ease of recovery. Therefore, we compared sevoflurane with propofol with aim to know acceptability and recovery profile of both the agents for ECT. Materials and Methods: A total of 100 patients scheduled for ECT were randomly divided into Propofol (P) group and Sevoflurane (S) group of 50 each. Group-P patients received Inj. Propofol 1mg/kg i.v. and inj.succinyl choline 0.5 mg/kg i.v. Group-S patients received Sevoflurane 8%, followed by Sevofluran 2% after loss of eye lash reflex and inj. succinyl choline 0.5 mg/kg was administered i.v. Onset of action, seizure duration, recovery profile, hemodynamics and side effects were noted. Results: Hemodynamics were comparable in both the groups. Seizure duration was 39±6.14 sec in Group P, compared to 30.32±7.31 sec in Group S and difference was statistically highly significant (p <0.0001). Recovery was assessed with time of following verbal command which was 343.42±63.77 sec in Group P compared to 367.28±37.30 sec in Group S and was statistically significant (p<0.05), suggesting faster recovery with propofol compared to sevofoflurane. Conclusions: Sevoflurane may offer an alternative anaesthetic induction agent for ECT especially when venous access is problematic from dehydration, agitation, disorientation, confusion or patients’ intolerance to venepuncture. Both sevoflurane and propofol are acceptable for management of ECT. Propofol induction was associated with better recovery profile.
KEYWORLDS: Sevoflurane, propofol, electroconvulsive therapy, recovery, seizure duration.

INTRODUCTION
Electroconvulsive therapy (ECT) is considered an acceptable treatment for major depressive disorder, schizophrenia, bipolar manic disorder, affective disorder especially when it has become resistant to pharmacotherapeutic and non pharmacotherapeutic treatment. ECT involves using anaesthesia plus neuromuscular blocking agents to alleviate its adverse effects. General anaesthesia is required to perform ECT and is induced with agents such as methohexital, propofol, thiopental, etomidate, ketamine, benzodiazepines, and sevoflurane. These agents are used in conjunction with neuromuscular blocking agents (NMBs) such as succinylcholine, mivacurium, atracurium, rocuronium, and rapacuronium. Succinylcholine is the most commonly used NMB to dampen the muscle contractions that are induced by ECT.[1] Since the ECT is a procedure with a short duration, the anesthetic agents should induce a rapid anesthesia and lead to a rapid recovery with minimum effect on seizure duration. Electrically produced seizures are characterized by an initial brief period of muscular contraction followed within 15 seconds by a tonic phase, persisting up to 20 seconds which is gradually replaced by clonic phases lasting few seconds to over 1 minute.[2] For a successful ECT, convulsion with a duration of 20-30 seconds should be induced. The energy dose in ECT is most important factor influencing the duration of seizure.[3] Modern ECT devices deliver a brief-pulse current, which is thought to cause fewer cognitive effects than the sine-wave currents which were originally used in ECT.[4]

Methohexital has been the drug of choice for ECT. However, because of the well-known anticonvulsant properties of and its nonavailability, other intravenous anaesthetics have been evaluated. Barbiturates are commonest agents used all over world as hypnotic agent. Studies show that they have problems of delayed recovery; their anticonvulsant action may increase the threshold & inhibit the spread of seizure, thus modifying seizure activity & shortening seizure duration.

Propofol has a very favourable recovery profile and also having significant antiemetic action for outpatients undergoing ambulatory surgery procedures[5] and has no anticonvulsant action. Sevoflurane is a volatile anaesthetic agent ideally suited for induction of anaesthesia as it induces minimal irritation to the airways, easily tolerated odour and induces rapid and smooth induction and is rapidly eliminated for ease of recovery. So we compared these two agents regarding recovery profile & their acceptability in ECT anaesthesia.
MATERIALS AND METHODS

The study was conducted in a randomized, prospective, crossover, single blinded manner to compare propofol and sevoflurane as anaesthetic agents for ECT in our institute. Ethical clearance was obtained from the institutional research. A total of 100 patients of either sex between age group of 15 to 60 years belonging to American Society of Anaesthesiologist (ASA) grade I or II who requires modified ECTs were included.

Patients having congestive cardiac failure, space occupying intracranial lesion, recent myocardial ischemia or cerebrovascular accident, arrhythmias, raised intraocular pressure, unstable major fracture, severe osteoporosis were excluded from study. Informed written consent was obtained from the patients (if applicable) and care takers in the prescribed form. A computer-generated randomization was done and ECT treatments were divided into 2 groups of 50 each. After the initial ECT patients who were on Sevoflurane will be crossed over to Propofol for the next ECT administration. After securing intravenous line, all patients were premedication with Inj.Glycopyrolate 0.004 mg/kg and Inj.Ondansetron 0.08 mg/kg intravenously (IV). Pre-oxygenation was done with 100% O₂ for 3 minutes. Then induction of anaesthesia was done according to the group assigned.

**Group-P:** Patients were induced with Inj. Propofol 1mg/kg IV. After lost eyelash reflex, Inj.succinylcholine was given 0.5 mg/kg IV. After passing out the fasciculation of succinylcholine, ECT was delivered bilaterally.

**Group-S:** At time zero, the anaesthetist turned the sevoflurane vaporizer to 8% (maximum) and assistant cannulated a vein in the forearm. Time to loss of eyelash reflex and verbal command, and occurrence of adverse airway events were recorded. After loss of eye lash reflex, inspired sevoflurane concentration was reduced to 2%. Succinylcholine was administered 0.5 mg/kg IV. After passing out the fasciculation of succinylcholine ECT was delivered bilaterally.

After giving Succinylcholine, patients were ventilated with 100% Oxygen with face mask using Magill's circuit till fasciculation subsided in both the groups. Later a rubber mouth gag was inserted into the oral cavity separating tongue and buccal mucosa and supporting chin. Modified ECT (MECT) was applied bitemporally after applying ECT Gel on to the electrodes. MECT was given using a constant current BPE-791 for 1 Sec.
If there were no signs of seizures out of the stimulus, then ECT was administered at 1.2 Sec and 1.4 Sec successively till the required seizure is obtained. If no seizure activity even after 3 stimuli, procedure was stopped and patients were recovered. All patients were given 100% Oxygen till regaining spontaneous respiration. Vital parameters (PR, SBP,DBP, SPO2) were recorded before induction (T0), and every minute till 5 min. Duration of seizure was recorded by clinical method from start of electrical impulse to the end of the clonic contraction using a stop watch. When there was no Seizure following optimal stimuli only the 'Masseter Spasm' was observed, wherein the patient bites the rubber gag tightly causing opening of mouth difficult, it is associated with other parameters like decreased Oxygen saturation, initial bradycardia followed by tachycardia, conjunctival congestion, pupillary dilation and EEG changes in definitive seizure.

Duration of time to recovery from anesthesia was determined by asking the patient to open his or her eyes at 1 min intervals and recording the time from the start of injecting the induction agent until a response was first obtained.

The recovery pattern was observed by the following parameters
1. Pulse rate
2. Blood pressure (Systolic and diastolic)
3. Time of eye opening
4. Time of following verbal command

**Statistical analysis**
The mean change in Systolic blood pressure, Diastolic blood pressure, Heart rate, Seizure duration and Recovery time with both agents were compared using student’s unpaired t test. Nominal variables were analyzed using Chi-square test. Results were expressed as Mean ± S.D. Power of study was 80%, p-value of <0.05 was considered significant.

**RESULTS**
In this study the demographic data were comparable for age and sex in both the groups (Table 1).

In our study, time to loss of eye lash reflex was longer in group S compare to group P which was statistically highly significant (p<0.0001), suggesting faster induction with propofol (Table 2).
The time of motor activity (seizure duration) was shorter in group S compared to group P which was statistically highly significant \( (p<0.0001) \) (Table 2).

Recovery profile suggested by time of eye opening and following verbal command was faster in group P compared to group S which was statistically significant \( (p<0.05) \) (Table 2, figure 1).

Haemodynamics were comparable in both the groups with no statistical significance \( (p \text{ value } >0.05) \) (fig 2). In this study, four patients of group P and group S had coughing which was statistically not significant \( (p \approx 0.5) \) (Table 3).
Table 1: Demographic profile

<table>
<thead>
<tr>
<th></th>
<th>Group P</th>
<th>Group S</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) (Mean ± SD)</td>
<td>33.52±10.70</td>
<td>33.96±10.23</td>
<td>0.83</td>
</tr>
<tr>
<td>Sex (M:F)</td>
<td>31:19</td>
<td>28:22</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

Table 2: Induction, seizure duration and recovery profile

<table>
<thead>
<tr>
<th></th>
<th>Group P Mean ± SD</th>
<th>Group S Mean ± SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to loss of eyelash reflex (sec)</td>
<td>39.32±6.84</td>
<td>53.8±5.50</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Seizure duration (sec)</td>
<td>39±6.14</td>
<td>30.32±7.31</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean time of eye opening (sec)</td>
<td>320.92±68.54</td>
<td>349.04±37.50</td>
<td>0.012</td>
</tr>
<tr>
<td>Mean time of following verbal command (sec)</td>
<td>343.42±63.77</td>
<td>367.28±37.30</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 3: Side Effects

<table>
<thead>
<tr>
<th>Side Effects</th>
<th>Group S</th>
<th>Group P</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coughing</td>
<td>4</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Nausea &amp; Vomiting</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Bradycardia</td>
<td>0</td>
<td>0</td>
<td></td>
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DISCUSSION

All over the world there have been and there are a certain number of people suffering from personality disorder like chronic depressive illness who could not be cured by psychotherapy alone. Today 70% of the involutional depressives remit with electrical treatment-‘The Electro convulsive therapy’. The unmodified ECT is associated with complications like fracture-dislocation and strain on cardiovascular system. So fits of ECT are modified under general anaesthesia of high quality administered by a skilled anesthesiologist with a suitable IV induction agent or Inhalational agent so that passage from consciousness to unconsciousness should be short and pleasant for the patient without any hazards of life. For ECT there is a need for an induction agent which is rapidly metabolized, of short duration and free from significant adverse reaction, so that early recovery of consciousness together with rapid return of complete mental orientation and cerebral activity can be ensured in order that in patients and out patients may than resume their normal routine in the shortest possible time. Keeping into view ideal requirements of ideal and safe induction agent for anaesthesia in ECT, new modality of induction agents like propofol and sevoflurane have been tried.

Our study showed that induction was faster with group P compared to group S. On statistical analysis p value is <0.0001 which is very significant. Hula Ulusoy, et al.[6] (2012). Compared the anaesthetic and convulsive effects of sevoflurane/remifentanil versus
propofol/remifentanil combination in electroconvulsive therapy (ECT) and found that Propofol/remifentanil provides quick induction and recovery compared with sevoflurane/remifentanil. It is indicated that intravenous route of induction is always faster than inhalational agent.

In our study mean heart rate, systolic blood pressure and diastolic blood pressure were comparable in both the groups before ECT and throughout the procedure and there were no statistically significant differences. Matsubara T, et al\textsuperscript{[7]} compared propofol with sevoflurane for ECT and found no significant differences in hemodynamic parameter (MAP,HR) between the two groups. Study done by Hulya Ulusoy, et al (2012). also shows comparable hemodynamics. Nadeem A et al\textsuperscript{[8]} conducted study to compare thiopentone sodium and propofol for ECT and found that change in systolic, diastolic blood pressure and heart rates were significantly more with Thiopentone as compared to Propofol.

In our study, The mean Time of eye opening in group P (320.92 ± 68.54 sec) is significantly (p<0.012) shorter than group S (349.04 ±37.50 sec) and mean Time of following verbal command in group P(343.42±63.77 sec) is significantly (p<0.02) shorter than group S(367.28±37.30 sec), suggesting faster recovery with group P compared to group S. Rasmussen KG, Laurila DR\textsuperscript{[9]} (2007) Studied Time to first Breath after induction of Sevoflurane versus Thiopentone and found quicker recovery in sevoflurane group.

Chetna Jadeja et al.\textsuperscript{[10]} (2014). They have done a comparative study of sevoflurane and sodium thiopentone in ECT. They have concluded that Sevoflurane induction was well tolerated by patients, and it was associated with faster recovery.

Similar study done by Nadeem A. Zaidi, et al\textsuperscript{[8]} (2000) compared the Thiopentone Sodium and propofol for ECT and found that Propofol is superior agent as far as recovery is concerned.

Our study showed that Seizure duration was 39±6.14sec in group P compared to 30.32±7.31sec in group S suggesting that seizure duration is less in group P compared to group S which is statistically highly significant (p<0.0001). Toprak et al\textsuperscript{[11]} [2005] studied comparison between sevoflurane and propofol in ECT and found that the mean motor seizure duration was prolonged with sevoflurane compared to Propofol while in
our study seizure duration was shorter in sevoflurane group which may be due to the dose of propofol: 1.5mg/kg propofol in their study and 1mg/kg in our study.

RJ Davidow J Segal, [12] [2005] studied Sevoflurane as an induction agent for ECT and found that it is associated with shorter duration of motor seizure. Dr. T.M. Omprakash, mohd.Inayat Ali et al. [13] compared Thiopentone Sodium and Propofol in ECT and found mean seizure duration was sufficiently shorter in Propofol group compared to Thiopentone group.

So, from our study we speculate that sevoflurane may offer an alternative anaesthetic induction agent for ECT especially when venous access is problematic from dehydration, agitation, disorientation, confusion or patients' intolerance to venepuncture. We conclude that both sevoflurane and propofol are acceptable for management of ECT. Propofol induction was associated with better recovery profile.

REFERENCES


