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Original Research Article

Study of Efficacy of Propofol and Thiopentone Sodium as Induction Agents for Modified Electroconvulsive Therapy

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Abstract:

Background: Electro Convulsive Therapy (ECT) is still widely used as the least expensive, safest, and most successful therapeutic technique for several psychiatric disorders. Amnesia, airway control, preventing physical damage, achieving hemodynamic stability, and a smooth and quick awakening are the conditions for anaesthetics.

Aims and Objectives: The purpose of this study was to evaluate propofol and sodium thiopentone as potential anaesthetic agents in modified ECT.

Methods and Methodology: This study was conducted at Gandhi Medical College, Bhopal which included 60 patients of 18-40 years age, either gender, with ASA grade I or II posted for modified ECT after written and informed consent. Group P was given Propofol 1.5 mg/kg body weight and Group T was given 2 mg/kg body weight of thiopentone sodium.

Results: In this study, modified ECT was given to 60 patients who received alternately either propofol or thiopentone and the results evaluated. The mean weight of the patients was 57.79 kg and the mean age 29.35 years, difference was highly significant. Gender and body weight were comparable in both groups. In present study majority of patients were of Schizophrenia, mania depressive psychosis, paranoid schizophrenia and bipolar mood disorder. A statistically significant change ($p<0.05$) in heart rate post ECT at 1 min to 5min. between the two groups. A statistically significant change ($p<0.05$) in the systolic blood pressure post ECT at 3 minutes, 4 minutes and 5 minutes between the two groups.

Conclusion: When propofol is used for anaesthetic induction, shorter duration of motor seizure, significantly faster psychomotor recovery and faster Emergence from anaesthesia was noted with propofol as compared with thiopentone sodium for anaesthetic induction for modified ECT.

Keywords: Modified ECT, Propofol, Thiopentone sodium, Induction, Psychomotor recovery.

Introduction

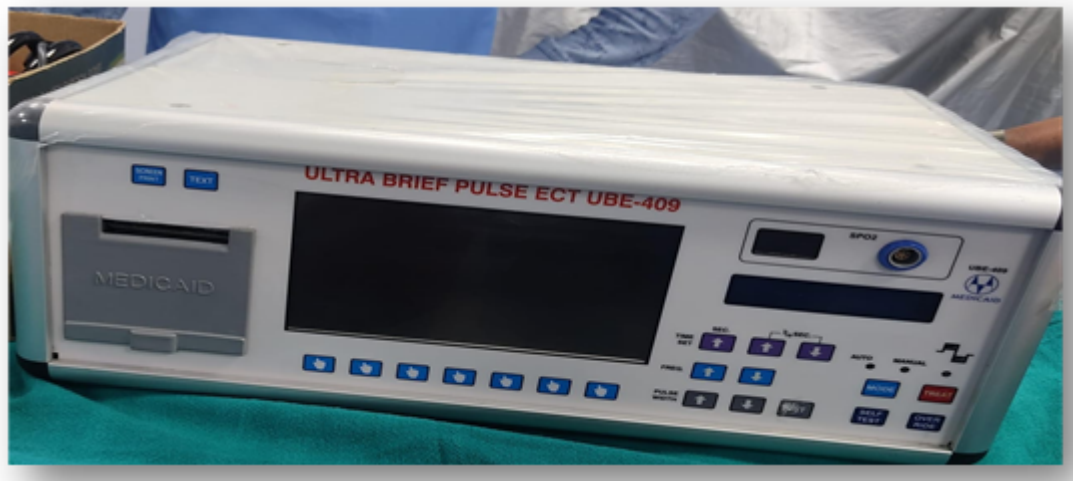
Psychiatric illnesses are common health problems due to the disability and functional impairment they cause. Electroconvulsive therapy (ECT) has been recognised as a safe and effective choice for treatment of mood disorders. Electroconvulsive Therapy (ECT) has evolved as a prominent treatment modality for a spectrum of psychiatric disorders, offering rapid relief when other interventions fall short. It involves induction of a seizure as a therapeutic method by the administration of a variable frequency electric stimulus. Electroconvulsive therapy also known as ECT introduced by Cerlitti and Bini in 1938, is acknowledged as a tried-and-true, sometimes life-saving technique for specific mood and cognitive disorders in cases where previous therapies have failed to produce any results. Severe mental conditions such bipolar disorder, schizophrenia, catatonic psychosis, delirium, and non-responders to pharmaceutical therapy are treated with it. [1-4]

It uses the application of a variable frequency electric shock via electrodes placed on the scalp above each temple to induce a seizure as a therapeutic technique. Although ECT is a very safe treatment and has no absolute contraindication, both the physician and the patient must be aware of a number of side effects, such as cognitive impairment (which rapidly resolves in most cases), the rare occurrence of seizures, short-term complications

such as headaches, muscle pain, nausea, vomiting, fatigue, transient hypertension (HTN) and tachycardia, which may result in severe hyperdynamic responses in patients treated with ECT. One of the short-term side effects of ECT is postictal agitation. Postictal agitation (PIA), or emergence agitation, is one of the multiple clinical syndromes that fits within the ECT-related cognitive side effects.

The hyperdynamic responses to ECT are associated with an acute increase in plasma epinephrine and norepinephrine concentrations. Therefore, there are a wide range of drugs prescribed to reduce acute hemodynamic changes due to cardiovascular complications associated with ECT. Numerous anaesthetic medications, such as opioids and alpha 2 agonists, can be used to modify these alterations. Because of their anticonvulsant qualities, several anaesthetics shorten the duration of motor seizures. Propofol may be advantageous for use in ECT because it lacks the potent anticonvulsant effect. The goal of anaesthetic agents in ECT is to get an unconscious patient with muscle paralysis and amnesia and to decrease its hyperdynamic response. [2]

The most commonly used iv anaesthetic is Propofol, an alkalyl phenol presently formulated in a lipid emulsion. Propofol provide as rapid onset and offset. Its mechanism of action is thought to be potentiation of γ-aminobutyric acid (GABA) [5]. At therapeutic doses, propofol produces a moderate depressant effect on ventilation. It has a short half-life with rapid onset and recovery, maintain hemodynamic stability and have no interference with seizure duration or seizure threshold. A unique action of propofol is its antiemetic effect, which remains present at concentrations less than those producing sedation. [6] Thiopentone sodium, also known as thiopental, is a potent short-acting barbiturate with a long history of use in anaesthesia, including its application in electroconvulsive therapy (ECT). This intravenous anaesthetic agent plays a crucial role in inducing and maintaining anaesthesia during ECT procedures. The mechanism of action of thiopentone sodium involves enhancing the inhibitory effects of gamma-aminobutyric acid (GABA), a neurotransmitter that reduces neuronal excitability. By facilitating GABAergic neurotransmission, thiopentone sodium produces sedation, hypnosis, and muscle relaxation, creating an optimal environment for the administration of ECT.



Material and Methods: Present study was hospital based, prospective, comparative study, conducted in Department of Anaesthesiology, Gandhi Medical College, Bhopal.

Inclusion Criteria:

- 18-40 years age
- Male and female
- ASA grade I/II

Exclusion Criteria:

- Patient/patient's relative refusal
- Patients aged below 18 and above 40 years
- Patients with risk of aspiration
- Cardiovascular disease
- Neuromuscular problems
- Major sicknesses like Bronchial asthma and tuberculosis
- Patients with implant
- Pregnancy
- Drug allergy

Those who were able to give written consent for ECT and anaesthesia, written consent was obtained, and for those patients who were deemed unfit to give consent by the treating psychiatrist, consent was taken from their relatives. Sixty scheduled for ECT

were randomly assigned to two groups of 30 patients each.

Group P: Received propofol 1.5mg/kg body weight as the anaesthetic agent.

Group T: Patients received Inj. Thiopentone sodium 2 mg/kg body weight.

In all patients a detailed history, physical examination and relevant investigations were done and medication noted. Patients who were on benzodiazepines had the drug discontinued 12 hours prior to ECT. The patients will receive nil per oral instructions before the surgery. After shifting the patients to the operating room, standard non-invasive anaesthetic monitoring ie blood pressure, five leads electrocardiography, pulse oximetry, and capnography will be connected to thepatient. Baseline vitals such as heart rate, bloodpressure, mean arterial pressure, and oxygen saturation of the patient will be recorded after 5 mins settling inthe operating room. An intravenous line will be established. Standard anaesthesia protocol will be followed and patients will be premedicated with IV Glycopyrrolate 0.2mg, Ondansetron 4mg, Pantoprazole 40mg and Dexmedetomidine 0.5mcg/kg body weight over 10 min before induction of anaesthesia and pre-oxygenated with 100% oxygen for 3 minutes. In both the groups muscle relaxation was achieved with intravenous administration of 0.75 mg/kg body weight of succinyl-choline. After establishing an I.V. line on the left forearm the calculated dose of Propofol or Thiopentone was given over a period of 20 seconds. Suxamethonium 0.75 mg/kg was given after the cuffed forearm was isolated. Patients were ventilated normally at the rate of 8-10 breaths/min with 100% O2. Once the fasciculation due to suxamethonium subsided a soft bite block was inserted, bitemporal electrodes were placed for ECT and bilateral ECT was administered using brief pulse bidirectional constant current stimuli above seizure threshold (sine wave type) was used to administer electric shock. The duration of motor seizure was recorded by a stopwatch as well as stimulus intensity and the number of re-stimulation required to achieve a motor seizure of at least 15 seconds was noted. Any patient who did not develop a bilateral tonic clonic motor seizure of at least 15 seconds were re-stimulated with higher stimulus doses by increasing the duration of pulses until on adequate seizure was achieved and maximum of 3 re-stimulations were permitted at each session. Oxygenation was performed between restimulations. Once the motor seizure subsided patient's ventilation was assisted with a facemask with 100% oxygen until the patient resumed spontaneous respiration. Any side effects like pain on injection, abnormal movement, and prolonged seizure (seizure duration >120sec), vomiting, bronchospasm or laryngospasm was noted. The presence of prolonged postictal restlessness or confusion was also noted in some patients. Data was collected by using a structure proforma. Data entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Comparison of mean and SD between two groups was done by using unpaired t test to assess whether the mean difference between groups is significant or not. A 'p' value of <0.05 was considered as statistically significant where as a p value <0.001 was considered as highly significant.

Results

In this study, modified ECT was given to 60 patients who received alternately either propofol or thiopentone and the results evaluated. The dose of the drugs was titrated according to requirements. The mean dose of thiopentone (Group–t) used was 2.2mg/kg and that for propofol (Group–p) was 1.44 mg/kg. The mean dose of succinylcholine given 0.78 mg/kg ECT was given to patients with different age groups, weight and different psychiatric illness.

Table 1: Distribution according to Age

Age Group (Yrs)	Propofol		Thiopentone		P Value
	Frequency	Percent	Frequency	Percent	
18-30	11	36.7	23	33.3	
31-40	11	36.7	2	23.3	
Mean Age	32.37±13.00		26.33±9.97		0.004 (Highly Significant)

The mean weight of the patients was 57.79 kg and the mean age 29.35 years, difference was highly significant. Gender and body weight were comparable in both groups.

Table 2: Distribution according to Gender and Weight

	Propofol		Thiopentone		P Value
Gender	Frequency	Percent	Frequency	Percent	
Male	13	43.3	14	46.7	
Female	17	56.7	16	53.3	
Weight	56.53±10.35		59.07±9.43		0.326 (Not Significant)

The changes in systolic blood pressure, diastolic blood pressure, mean blood pressure and Heart rate from the baseline (preinduction) were calculated at various time intervals following ECT. A statistically significant change ($p<0.05$) in heart rate post ECT at 1 min to 5min. between the two group.

Table 3: Comparison of Heart Rate between Propofol and Thiopentone

Heart Rate	Mean±Standard Deviation		P Value	Inference
	Propofol	Thiopentone		
Pre ECT	87.67±12.60	87.67±12.60	1.000	Not Significant
After Induction	97.33±10.97	97.60±12.07	0.929	Not Significant
1 Min	117.53±14.13	128.07±12.46	0.003	Highly Significant
2 Min	119.07±12.99	132.40±13.51	0.0001	Highly Significant
3 Min	106.67±11.21	120.60±12.94	0.0001	Highly Significant
4 Min	98.13±10.21	112.87±10.63	0.0001	Highly Significant
5 Min	90.87±10.11	102.73±8.51	0.0001	Highly Significant

A statistically significant change ($p<0.05$) in the systolic blood pressure post ECT at 3 minutes, 4 minutes and 5 minutes between the two groups.

Table 4: Comparison of Systolic Blood Pressure between Propofol and Thiopentone

Systolic Blood Pressure	Mean±Standard Deviation		P Value	Inference
	Propofol	Thiopentone		
Pre ECT	120.93±9.41	121.27±9.90	0.894	Not Significant
After Induction	111.80±7.36	114.47±10.33	0.254	Not Significant
1 Min	151.52±11.84	155.40±17.67	0.327	Not Significant
2 Min	141.13±9.23	140.00±15.82	0.736	Not Significant
3 Min	132.07±8.25	126.27±11.78	0.031	Significant
4 Min	124.47±8.75	115.07±9.89	0.0001	Highly Significant
5 Min	117.20±9.66	108.80±8.56	0.0001	Highly Significant

A statistically significant change ($p<0.05$) in diastolic blood pressure was noted at post ECT 3 and 4 minutes, between the two groups.

Table 5: Comparison of Diastolic Blood Pressure between Propofol and Thiopentone

Diastolic Blood Pressure	Mean±Standard Deviation		P Value	Inference
	Propofol	Thiopentone		
Pre ECT	74.33±8.79	74.33±9.08	0.931	Not Significant
After Induction	69.27 ± 6.49	68.47±7.35	0.656	Not Significant
1 Min	112.52±11.84	118.40±17.67	0.327	Not Significant
2 Min	91.73±9.51	89.90±9.32	0.446	Not Significant
3 Min	84.33±8.19	79.07±6.74	0.009	Highly Significant
4 Min	78.53±9.41	73.13±6.25	0.011	Significant
5 Min	73.33±8.95	69.40±6.04	0.051	Not Significant

The mean seizure duration in the thiopentone–succinylcholine group was 50.83 ± 8.45 seconds while in the propofol – succinylcholine group it was 34.70 ± 8.68 seconds, difference was statistically highly significant. The time to eye opening in the thiopentone – succinylcholine group was 358.87 ± 51.11 seconds while in the propofol–succinylcholine group it was 326.57 ± 44.78 seconds, difference was statistically significant. Mean agitation score in Thiopentone group was 2.13±0.57 while in Propofol group was 1.63±0.49, difference was statistically significant.

Table 6: Duration of motor seizure, time for Eye opening were analysed

	Mean±Standard Deviation		P Value	Inference
	Propofol	Thiopentone		
ICTAL Time/Seizure Duration (Seconds)	34.70±8.68	50.83±8.45	0.0001	Highly Significant
Eye Opening (Seconds)	326.57±44.78	358.87±51.11	0.012	Highly Significant
Mean Agitation Score	1.63±0.49	2.13±0.57	0.003	Highly Significant

Discussion:

ECT is a mode of treatment used for patients with severe depression and other psychiatric disorders resistant to medical management. At present general anaesthesia with muscle paralysis is the most common anaesthetic technique used for ECT. During the procedure, it is important to maintain depth of anaesthesia and at the same time there should be adequate seizure duration to have desired

therapeutic effects. The treatment was modified by the use of intravenous anaesthetic agents, neuromuscular blockade and assisted ventilation with 100% oxygen. ECT is also associated with hemodynamic disturbances such as bradycardia followed by tachycardia and hypertension which may be deleterious especially in patients with coexisting cardiovascular diseases. An induction agent who effectively counteracts these hemodynamic changes without influencing the seizure duration is the most desirable one for ECT. Thiopentone sodium, an ultrashort acting barbiturate and an age old drug that is used as an induction agent in ECT, provides rapid and smooth induction but recovery is delayed and it may affect seizure duration due to its anticonvulsant effect. Propofol, a 2, 6-diisopropylphenol, has good hemodynamic stability during ECT owing to its vasodilatory effect but it also reduces seizure activity due to its anticonvulsant property. The ECT seizure causes widespread physiological changes due to autonomic stimulation. [7] The mechanism of the cardiovascular disturbances during ECT have been reviewed recently and are the result of intense stimulation of the autonomic nervous system with sequential increases in parasympathetic followed by sympathetic outflow and a large increase in circulating catecholamines. [8] The cardiovascular response to ECT noticed in this study following the administration of propofol correlates with the study of Hoyer et al., [9] and Jarineshin H et al., [10] who compared propofol and thiopentone for ECT. Manjula B et al., [11] studied propofol, thiopentone, etomidate as induction agent found a similar cardiovascular response with the administration of propofol. Amey A S al., [12] compared the haemodynamic responses between propofol and thiopentone during ECT and the cardiovascular response correlated with the change seen in this study with propofol usage. Seizure duration changes following ECT following Inj. Propofol and Inj. Thiopentone was noted. After propofol induction mean seizure duration was 34.70 ± 8.68 sec as compared to after thiopentone induction was 50.83 ± 8.45, difference was highly significant. These results are similar with previous studies done by Jarineshin et al., [10] Recovery characteristics were assessed by eye opening to verbal stimuli in absence of other stimuli. After propofol induction mean duration for eye opening was 326.57 ± 44.78 sec as compared to after thiopentone induction was 358.87 ± 51.11 sec, difference was highly significant. These results are similar with previous studies done by Lekprasert V et al. [6] and Mir A H et al. Each drug has its own advantages and disadvantages for ECT induction. Various adjuvants were used previously to deal with cardiovascular and endocrine changes induced with intravenous induction and ECT. Though there is no Ideal anaesthetic agent or combination of anaesthetic agents, propofol can be considered as sole agent for induction with comparatively stable hemodynamic parameters. [13]

Conclusion

Propofol group offers better hemodynamic stability, shorter duration of motor seizure, significantly faster psychomotor recovery and faster emergent planes from anaesthesia and less postictal agitation when compared to Thiopentone, while Ictal time is significantly more in Thiopentone group during modified ECT.

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