RESEARCH PAPER

A Comparative Study of Propofol and Thiopentone Sodium as Induction Agents in Patients Undergoing Electroconvulsive Therapy Under General Anesthesia

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Received: 25th May, 2026; **Revised:** 6th June, 2026; **Accepted:** 8th June, 2026; **Available Online:** 09th June, 2026

ABSTRACT

Electroconvulsive therapy (ECT) is a well-established and effective treatment option for several severe psychiatric disorders. The selection of an appropriate induction agent plays an important role in determining seizure quality, hemodynamic stability, and recovery characteristics. Thiopentone sodium and propofol are among the most commonly used anaesthetic agents for modified ECT.

Aim

To compare the effects of thiopentone sodium and propofol in adult patients undergoing electroconvulsive therapy under general anaesthesia.

Methods

This prospective randomized comparative study was carried out on 50 adult patients undergoing modified electroconvulsive therapy (ECT). The participants were randomly allocated into two groups comprising 25 patients each. Patients in Group T were administered thiopentone sodium for induction of anaesthesia, whereas those in Group P received propofol. Various parameters, including seizure duration, recovery characteristics, and post-ECT hemodynamic variables such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and oxygen saturation, were evaluated and documented. Statistical evaluation was carried out using the independent t-test, Mann–Whitney U test, and ANOVA, with a p-value of less than 0.05 considered statistically significant.

Results

The demographic variables and procedure duration were comparable between groups. Seizure duration was significantly longer with thiopentone (28.00 ± 16.53 sec) compared to propofol (12.47 ± 6.51 sec) ($p < 0.001$). Recovery duration was significantly shorter with propofol (7.30 ± 1.40 min) than thiopentone (10.40 ± 2.27 min) ($p < 0.001$). Post-ECT heart rate was significantly higher in the thiopentone group ($p < 0.001$). However, no statistically significant differences were observed between the two groups with respect to systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), SpO_2, energy delivered, or the number of attempts.

Conclusion

Thiopentone sodium and propofol were found to be safe and effective induction agents for modified electroconvulsive therapy (ECT). Thiopentone sodium was associated with a longer seizure duration, while propofol demonstrated quicker recovery and superior hemodynamic stability.

Keywords: Thiopentone, Propofol, Electroconvulsive Therapy, Induction Agent, Seizure Duration.

How to cite this article: Ramzan I, Thakur S, Nazir I, Shafi MU, Parvez A, Imtiyaz A, Bashir H. A Comparative Study of Propofol and Thiopentone Sodium as Induction Agents in Patients Undergoing Electroconvulsive Therapy Under General Anesthesia. Int J Drug Deliv Technol. 2026;16(57s): 1894-1899. DOI: 10.25258/ijddt.16.57s.191

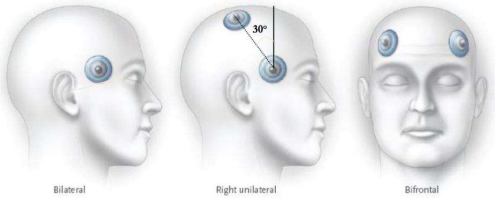
Source of support: Nil.

Conflict of interest: None.

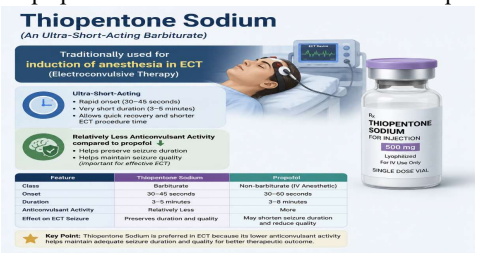
INTRODUCTION

Electroconvulsive Therapy (ECT) is an effective and widely accepted treatment modality for severe psychiatric disorders such as major depressive disorder, treatment-resistant depression, bipolar disorder, schizophrenia, catatonia, and acute suicidal states. Modern ECT is performed as modified ECT under general anesthesia with muscle relaxation, which improves patient safety, minimizes musculoskeletal complications, and enhances patient comfort.

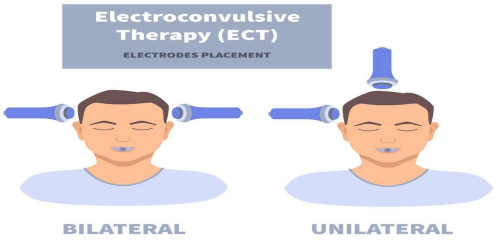
Thiopentone Sodium is an



ultra-short-acting barbiturate traditionally used for induction of anesthesia in ECT. It has relatively less anticonvulsant activity compared to propofol, which helps preserve seizure duration and seizure quality.



Electroconvulsive therapy (ECT) is a well-established and highly effective treatment modality for severe psychiatric disorders, including major depressive disorder, bipolar disorder, schizophrenia, catatonia, and other treatment-resistant psychiatric conditions.It remains an important therapeutic option, particularly in patients who are refractory to pharmacological therapy or present with life-threatening symptoms such as suicidality, severe psychomotor retardation, or acute psychosis. International clinical guidelines recognize ECT as a safe and evidence-based intervention when administered under controlled conditions with appropriate anaesthesia and monitoring .

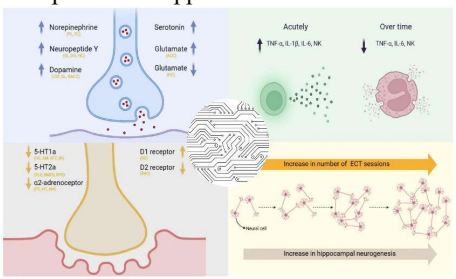


Mental health disorders represent a significant global public health challenge. Findings from the World Mental Health Survey and the National Mental Health Survey of India highlight the high prevalence of untreated psychiatric illnesses, underscoring the importance of effective and rapid therapeutic interventions such as electroconvulsive therapy (ECT). With advancements in practice, ECT has evolved into modified ECT, in which the procedure is conducted under general anaesthesia along with muscle relaxation to reduce physical trauma, minimize patient discomfort, and enhance overall procedural safety.Anaesthesia plays a crucial role in determining the safety and effectiveness of ECT. The anesthetic agent used for induction influences seizure duration, hemodynamic stability, recovery profile, and cognitive outcomes. An ideal induction agent should provide rapid onset and smooth recovery, maintain cardiovascular stability, produce minimal anticonvulsant effects, and allow adequate seizure duration to ensure therapeutic efficacy**.** Thiopentone sodium, a short-acting barbiturate, has been traditionally used as an induction agent in ECT due to its rapid onset and reliable hypnotic properties. However, it may be associated with delayed recovery and cardiovascular depression. Propofol, a widely used intravenous anesthetic, offers advantages such as rapid recovery, smoother emergence, and better hemodynamic control, but its anticonvulsant properties may shorten seizure duration, which may potentially affect treatment efficacy.

Numerous comparative studies have assessed thiopentone and propofol with respect to seizure parameters, hemodynamic stability, recovery profile, and adverse effects. Although propofol is commonly associated with faster recovery and better cardiovascular stability, thiopentone has been shown to produce longer seizure durations.

Physiological Basis of ECT Efficacy

The therapeutic efficacy of Electroconvulsive Therapy (ECT) is primarily linked to seizure-induced neurobiological alterations, including regulation of the hypothalamic–pituitary–adrenal (HPA) axis, increased expression of brain-derived neurotrophic factor (BDNF), and enhanced monoaminergic neurotransmission. Adequate seizure activity plays a crucial role in achieving optimal clinical outcomes and is commonly characterized by a motor seizure duration of more than 15–25 seconds and an electroencephalographic (EEG) seizure duration exceeding 35 seconds, along with post-ictal suppression.



Optimal ECT anaesthesia demands:
i. Rapid onset and short recovery duration following intravenous administration, with minimal anticonvulsant effect to maintain adequate seizure quality.
ii. Ability to attenuate sympathetic responses and reduce excessive increases in heart rate and blood pressure during ECT, thereby improving hemodynamic stability.
Emergence-related complications, such as delirium (20–30%) and myoclonus, may additionally interfere with smooth recovery. The use of Bispectral Index (BIS) monitoring, with a target range of 50–60, along with neuromuscular blockade assessment using train-of-four (TOF) monitoring greater than 90%, helps ensure standardized anesthetic depth and improved patient safety.Thiopentone sodium, a first-generation barbiturate (2-3 mg/kg IV), has been ECT mainstay since 1952 due to proconvulsant effects at sub-hypnotic doses, yielding longer EEG seizures (mean 42-52 s) and cardiovascular attenuation via sympathetic blockade. Its limitations include prolonged context-sensitive half-time (8-15 min), delayed orientation (Aldrete score recovery >12 min), and accumulation with repeated sessions . Propofol (1-1.5 mg/kg IV), an alkylphenol GABA A agonist introduced for ECT in the 1990s, excels in ultra-rapid redistribution (half-time 2-4 min), enabling eye-opening within 5-8 min and ambulation <15 min, but exhibits dose-dependent anticonvulsant activity, reducing seizure duration by 20-40% and increasing polyspike suppression.
Randomized trials consistently demonstrate thiopentone's superiority in seizure metrics (mean difference 10-15 s, $p<0.001$), with comparable reorientation times in single sessions but propofol's advantage in cumulative courses (Bai et al., 2019). Indian cohorts report higher seizure adequacy with thiopentone (92% vs. 72%) amid propofol's faster recovery, yet elevated post-ECT amnesia and hemodynamic lability in ASA II patients (Khan et al., 2020).

i. Limited evidence is available regarding BIS-guided dosing and the use of brief-pulse ECT in Indian adults aged 18–60 years.

Hence, the present study is undertaken with the aim to study the comparative effects of thiopentone sodium and propofol in adult patients undergoing electroconvulsive therapy under general anaesthesia, in terms of hemodynamic parameters, seizure duration, recovery characteristics, and safety profile, so as to identify the more effective and safer induction agent for routine clinical practice.

Aim of the Study

To compare the effects of thiopentone sodium and propofol in patients undergoing electroconvulsive therapy (ECT) under general anaesthesia.

Objectives of the Study

1. To compare the effectiveness of thiopentone and propofol in patients receiving electroconvulsive therapy (ECT) under general anaesthesia.
2. To evaluate the impact of the study drugs on the conduct and outcome of ECT.
3. To assess and compare the hemodynamic responses in patients of both groups.
4. To analyse and compare the recovery and emergence characteristics of patients in the two groups.

5. MATERIALS AND METHODS

Materials:

6. The present study entitled “A study on the comparative effects of thiopentone sodium and propofol in patients undergoing electroconvulsive therapy under general anaesthesia” was conducted in the Department of department of anaesthesiology at Radiance Hospital Mohali.
7. A total of fifty patients aged 30–50 years, belonging to ASA grade I and II, with a BMI <28 kg/m², and of either gender, scheduled for electroconvulsive therapy were included in the study. The patients were randomly allocated into two groups: Group I and Group II, comprising 50 patients each.
8. Group I (25): Patients received injection thiopentone as the anesthetic agent. Group II (25): Patients received injection propofol as the anesthetic agent.
9. All patients diagnosed with schizophrenia, manic depressive psychosis, paranoid schizophrenia, bipolar mood disorders, depressive stupor and inanition, as seen in melancholic, catatonic, and psychotic depression, were included in the study.

Exclusion Criteria

1. Patients with raised intracranial pressure (ICP), intracranial space-occupying lesions, or post-burst abdomen were excluded.
2. Pregnant and paediatric patients were not included in the study.
3. Patients aged more than 50 years were excluded.
4. Patients belonging to ASA physical status grade III and IV were excluded.
5. Patients with known intolerance or hypersensitivity to narcotic drugs were excluded

Methods:

Use of Anaesthesia

An attending anaesthesiologist evaluated all patients before surgery. During the ECT process, non-invasive blood pressure , a three-lead

electrocardiogram, and pulse oximetry were all kept an eye on. All medications were given through an IV. A tourniquet was placed on the arm opposite the one used for intravenous drug administration to prevent the neuromuscular blocking action and enable the evaluation of seizure duration

Fentanyl (1–1.5 mg/kg) was administered intravenously as a bolus for induction, followed by either thiopentone sodium (2–3 mg/kg) or propofol (1–1.0 mg/kg) given as an intravenous bolus dose to induce anaesthesia. Bag-mask ventilation with 100% oxygen was done after the person lost consciousness and the eyelash reflex. After that, succinylcholine was injected (1–1.0 mg/kg bolus) to paralyze the muscles and keep seizures from causing injury.

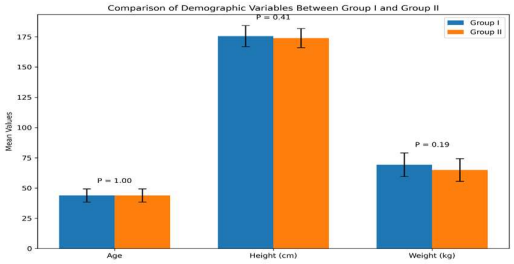
After the electric shock, manual ventilation assistance with a face mask with 100% oxygen was resumed until spontaneous respiratory activity returned. After psychomotor recovery was reached, the patients were moved to the recovery room.

RESULTS

A total of 50 patients were analysed, with 25 patients each in the Thiopentone and Propofol groups. The groups were compared based on key study parameters, including efficacy variables such as seizure duration, energy delivered, number of attempts required, and recovery time, as well as post-ECT hemodynamic parameters including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and oxygen saturation (SpO_2). Baseline demographic characteristics and procedural details were also evaluated.

Table 1: Comparison of Demographic Variables in both the groups

Demographic Variables	Group I	Group II	P value
Age	43.76 ± 5.41	43.76 ± 5.41	1.00
Height (cm)	175.52 ±8.78	173.88± 7.99	0.41
Weight (kg)	69.22 ± 9.78	64.9±9.35	0.19
ASA Grade (I/II)	14/11	15/11	0.86



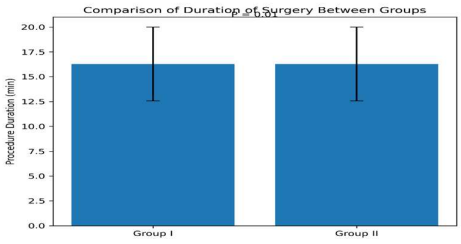
Comparison of Demographic Variables in both the groups

The mean age of patients in the thiopentone group was 43.76 ± 5.41 years, while in the propofol group it was 40.44 ± 5.85 years. Similarly, mean height, weight, and BMI were comparable between the two groups.

This indicates that both groups were demographically homogeneous and statistically comparable, eliminating confounding due to baseline patient characteristics.

Comparison of duration of surgery in both the groups

Procedure	Group I	Group II	P value
Procedure Duration (min)	16.28 ± 3.72	16.28 ± 3.72	0.01



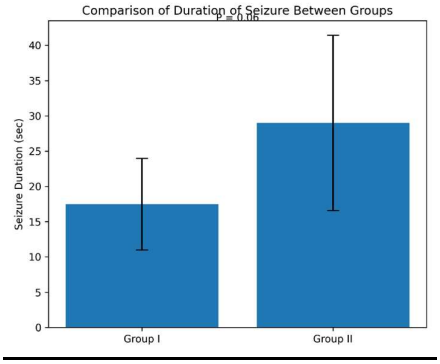
Comparison of Surgical Duration Between the Two Groups

The mean procedure duration was similar in both groups (Thiopentone: 14.92 ± 3.50 min; Propofol: 14.04 ± 3.60 min).

This suggests that the type of induction agent did not influence overall procedure time.

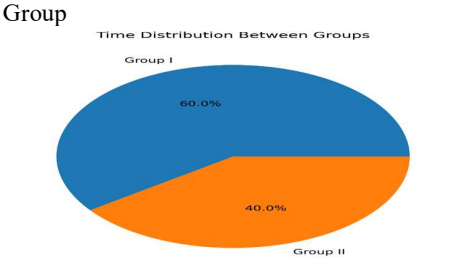
Comparison of Seizure Duration Between the Two Groups

Duration of Seizure	Group I	Group II	P value
Time(sec)	17.47 ± 6.51	29.00 ± 12.43	0.06



The mean seizure duration in the thiopentone group (29.00 ± 12.43sec) was markedly longer compared to the propofol group (17.47 ± 6.51sec).
This demonstrates that thiopentone produced significantly longer seizure activity, whereas propofol shortened seizure duration, likely due to its known anticonvulsant properties.

Recovery Duration Between the Two Group



The recovery duration was significantly shorter in the propofol group (7.10 ± 2.70 min) compared to the thiopentone group (11.30 ± 2.27 min). This finding suggests that propofol facilitates quicker recovery and earlier restoration of consciousness, making it more suitable for rapid patient turnover and early discharge.

DISCUSSION

The present study included 50 patients who were randomly divided into two groups of 25 patients each. Group I received thiopentone sodium, while Group II received propofol for induction of anaesthesia. The demographic characteristics were comparable between the two groups.. This demographic comparability demonstrates that both study groups were effectively matched, suggesting that the observed variations in study outcomes are mostly due to the anesthetic drugs employed, rather than patient-related confounding variables. The average duration of the procedure in the thiopentone group was 14.92 ± 3.50 minutes, while in the propofol group it was 11.04 ± 3.60 minutes; this difference was not clinically significant. This finding indicates that the selection of the induction agent did not affect the overall conduct or technical time of the procedure.
Seizure duration was one of the most important outcome measures evaluated in the present study. The mean seizure duration in the thiopentone group was 31.00 ± 16.53 seconds, whereas it was 15.47 ± 6.51 seconds in the propofol group. Thus, patients receiving thiopentone sodium demonstrated significantly longer seizure durations compared to those receiving propofol.

CONCLUSION

The study was conducted to compare effects of thiopentone sodium and propofol in adult patients undergoing electroconvulsive therapy under general anaesthesia. Fifty surgical patients in the age group of 28–50 years, belonging to ASA grade I and II, with BMI <27 kg/m², of either gender, were scheduled for electroconvulsive therapy and were divided into two groups, Group I and Group II (25 patients in each group).
The study demonstrated that thiopentone sodium produced significantly longer seizure duration when compared to propofol. These findings suggest that thiopentone is more effective in preserving seizure activity during electroconvulsive therapy. However, the recovery profile was significantly superior in the propofol group, as patients regained consciousness and orientation earlier compared to those who received thiopentone sodium.Based on the findings of this study, it can be concluded that thiopentone sodium offers the advantage of longer seizure duration, whereas propofol provides faster recovery and better haemodynamic stability. Therefore, both agents can be effectively used for modified electroconvulsive therapy, and the choice of induction agent should be individualised according to the clinical requirements and therapeutic priorities of each patient.

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