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Comparative Study of Propofol Versus Thiopentone Using Glycopyrrolate as Anticholinergic Drug and Succinylcholine as Muscle Relaxant in Modified Electroconvulsive Therapy

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Abstract

Introduction : Electroconvulsive Therapy (ECT) induces seizure to treat depression and other psychiatric disorders .To prevent musculoskeletal injuries and to produce amnesia, anaesthesia is needed during ECT. *Aim*: To compare propofol and thiopentone in patients posted for modified ECT. *Materials and Methods*: Study was conducted on ASA Grade I and II patients (total 100) posted for ECT. They were randomly divided equally in Propofol Group (Group P) and Thiopentone Group (Group T) (n=50 for each group). Each patient underwent series of bilateral ECT. In both the groups, Inj. Oandansetron 4 mg and Inj. Glycopyrrolate 0.2 mg were given intravenously (iv) 3 minutes before giving the drug under study. Inj.Thiopentone (2.5%)was given in the dose of 2 mg/kg iv in Group T and Inj. Propofol (1%) was given in the dose of 1 mg/kg iv in Group P, followed by Inj Succinlyscoline 0.5 mg/kg iv in both the Groups. Onset of action(induction time), mean stimulus charge, duration of seizure, number of missed seizures, vital parameters (hemodynamic parameters), duration of recovery from anaesthesia (response to verbal command), complications were compared. All patients were evaluated by the psychiatrist on the BDI (Beck Depression Inventory) scale after completion of the treatment. *Results*: Mean seizure duration was shorter in Group P than Group T (44.18±1.24 seconds versus 55.52±1.05 seconds). Mean stimuls charge was 149.50±1.25 mC (Millicoulomb) in Group P and 136.22±0.96 mC in Group T. Number of ECTs required to attain therapeutic goal was higher in Group P than Group T (8.16±0.24 versus 6.46±0.21). Propofol was associated with lower increase in blood pressure. Induction time and Recovery were faster in Group P than Group T. There was no difference in treatment outcome. *Conclusion*: Propofol decreases seizure duration even with higher stimulus charge. Propofol increases number of ECT required for treatment. Induction time and recovery both were faster with propofol.

Keywords: ECT; Propofol; Seizures; Thiopentone; Hemodynamic Parameters.

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Introduction

ECT is given in conscious patient (direct ECT causing musculoskeletal complications) and in anaesthetized patient (Modified ECT) to induce brain for seizure activity [1]. Anaesthesia drugs given in Modified ECT should have rapid onset of action , short duration and early recovery because overdose can shorten seizure activity and optimum seizure activity is essential for treatment . Drug profile should help in fast tracking and early discharge of patient [2].

In ECT, the electrical stimulus results in generalized tonic activity for approximately 10 to 15 seconds followed by generalized clonic activity for variable period lasting up to 120 seconds. The seizure should ideally last for 25 seconds to 75 seconds at its optimum. Seizure duration less than 15 seconds is

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considered as inadequate and more than 120 seconds is not required. Modified ECT is typically administered as a series of treatments two to three times a week for 6 to 12 treatments, in its acute phase. Maintenance therapy can be performed at progressively increasing intervals from once a week to once a month to prevent relapses [3].

In ECT, Constant current devices automatically adjust strength of the current as per resistance in the circuit. Seizure threshold is around 50-100 mC (millicoulombs) initially. 50 to 100% suprathreshold is sufficient for bilateral ECT [4]. Repetitive ECT increases threshold for inducing seizure activity. Anaesthesia drugs can change seizure threshold .Propofol has short seizure duration, Thiopentone also reduces seizure activity [5]. Lower electrical doses fail to induce seizure activity and higher electrical doses cause cognitive dysfunction.

ECT has cardiovascular and cerebral effects which needs attention of anaesthetist. The cardiovascular effects result from autonomic nervous system (ANS) activation during ECT procedure. This leads to an initial 10–15 s of parasympathetic discharge resulting in bradycardia and occasional asystole (the tonic phase). This is followed by a pronounced sympathetic response of hypertension, tachycardia and other arrhythmias peaking 1 min after ECT stimulation and generally resolving within 5–10 min thereafter (the clonic phase). There is increased cerebral metabolic rate (CMR) and cerebral oxygen consumption which results in a marked increase in cerebral blood flow (CBF) and intracranial pressure (ICP). Furthermore, there is increased intraocular and intragastric pressure. Short-term memory loss is also common [6].

Non-memory cognitive functions (intelligence and judgement) are unaffected [7].

Anaesthesia is given for to produce amnesia and to prevent musculoskeletal /cardiac complications.

Materials and Methods

Study was approved by Institutional Ethical Committee and written informed consent obtained from patients and relatives for procedure and for to be part of the study.

Patients who were between 18 to 60 years of age with major depressive disorder, mania schizophrenia, schizoaffective disorder were included in the study [8]. ASA Grade III, IV and V patients were excluded from study. Patients with pheocromocytoma, recent myocardial infarction, recent stroke or intracranial surgery, angina, CHF, cardiac pacemaker, severe osteoporosis, major bone fractures, glaucoma, retinal detachment, pregnancy, history of allergy to drugs or any contraindication as like porphyria were excluded from the study [9].

Patients were subjected to pre-anesthesia check up and routine investigations as per protocol. Patients were kept nil by mouth for six hours as per protocol and had continued antipsychotic treatment until the day of the procedure. All patients were monitored for ECG, Heart Rate, blood pressure, SpO_2 from beginning up to 30 minutes following ECT.

All patients preoxygenated with 100% oxygen for 3 minutes and received Inj Glycopyrrolate 0.2 mg/kg iv and Inj Oandansetron 4 mg iv. Group P patients received Inj Propofol 1 mg/kg iv and Group T patients received Inj Thiopentone 2 mg/kg iv, followed by Inj Succinylscoline 0.5 mg/kg iv to patients of both the groups. Induction Time was noted from drug dose given to loss of eyelash reflex. All patients ventilated with Mapleson D breathing system (Bain's circuit). After fasciculations subsided, Bite block was inserted to prevent tongue bite. ECT given to produce seizures and seizure duration was monitored by isolated limb method. Subsequently, all patients ventilated until spontaneous breathing returned. Duration of recovery was recorded from injection of anesthetic agent to time taken to obey verbal commands such as opening of eyes.

Data was analysed by Graph Pad Prism 7 software. Value of $p<0.05$ was considered statistically significant.

Results

Data shows that patients taking ECT have male preponderance and in younger age group.

Mean Induction Time was 18.46±0.30 seconds for Group P and 20.05±0.26 seconds for Group T. P value < 0.0001 ($p < 0.05$ .Statistically it was significant).

Mean stimulus charge was 149.50±1.25 mC in Group P and 136 .22± 0.96 mC in Group T; p value < 0.0001 u Mean seizure duration was shorter in Group P than Group T (44.18±1.24 seconds versus 55.52± 1.05 seconds; $p < 0.0001$).

Number of ECTs required to attain therapeutic goal was higher in Group P than Group T (8.16±0.24 versus 6.46±0.21 P value < 0.0001 ($p<0.05$ significant difference statistically).

In Group P mean SpO_2 was 98.9 and in Group T it was 99. Statistically it was insignificant.

Table 1: Demographic data

Group	Male	Female
P	30	20
T	32	18

Table 2: Mean Age

Group	Mean Age
P	34.5
T	36.1

Table 3: Hemodynamic parameters (Mean Value)

Time	Pulse Rate		Systolic Blood Pressure		Diastolic Blood Pressure	
	Group P	Group T	Group P	Group T	Group P	Group T
Baseline	83.4	84.2	121.2	119.8	77.8	77.2
After Giving Inj.Glycopyrrolate	96.1	97.8	124.3	123.2	77.9	77.9
Induction	95.3	100.5	114.4	121.1	74.3	75.1
ECT	95.2	103.5	116.2	122.4	75.0	75.5
15 seconds after ECT	94.2	101.6	116.9	124.8	75.1	78.5
1 minute after ECT	98.2	102.1	124.6	132.6	80.2	83.3
2 minutes after ECT	99.4	105.2	129.3	135.2	86.9	87.9
3 minutes after ECT	102.2	107.6	139.6	146.7	88.2	89.4
5 minutes after ECT	99.1	103.7	130.2	136.4	86.4	86.3
10 minutes after ECT	94.4	100.6	125.3	128.5	82.8	84.2
30 minutes after ECT	88.2	90.2	120.2	122.6	78.9	79.1

Table 4: Complications

	Group P	Group T
Pain On Injection	13	1
Nausea-Vomiting	1	-
Rhythm Disturbance after Induction and ECT	3	3
Missed seizures or seizure duration<15 seconds	1	-
Short term memory loss	2	1
Musculoskeletal injury	-	-

P value – 0.2473 (P >0.05 , no statistical difference)

Mean duration of Recovery was 6.70±0.23 minutes in Group P versus 8.02±0.18 minutes in Group T, p < 0.0001 (p< 0.05 statistically significant difference).

In a patient of Group P, ECT could not elicit desired seizure activity at first shock and second shock with higher intensity was used to elicit seizures. In one patient of Group T loss of eyelash reflex could not be achieved with Thiopentone's dose of 2 mg/kg iv, additional 1mg/kg of dose was given for achieving hypnosis. 3 patients of Group T had occasional VPCs after ECT which resolved at their own. 2 patients of Group P had APCs and 1 patient of Group P had VPCs after ECT which subsided automatically.

Mean BDI score was 6.94±0.20 in Group P and 7.08±0.15 in Group T at the time of completion of ECT sessions, which was statistically insignificant (p value 0.1570).

Discussion

The use of electroconvulsive therapy (ECT) to provoke a generalized epileptic seizure was first described in 1938 and was performed without anaesthesia for almost 30 years [10]. It was associated with fractures of bones, dislocation of the joints , biting of the tongue, tearing of muscle fibers and may be intense vasovagal shock in ECT. So, anaesthesia and muscle relaxation was needed; this anaesthesia based ECT is called as Modified ECT [11].

In so previous research articles , inclusion criteria and exclusion criteria of the patients are almost same. We had excluded pregnant patients and patients with pacemakers from our study. But recently published report by Michael Ho has stated that pregnant patients and patients with pacemaker can be given ECT. Anti tachydysrhythmia function of pacemaker should be disabled, magnet and external pacemaker should be kept available [12].

Both Tricyclic antidepressants & MAOIs can augment effect of barbiturates, increase sleep time and duration of anaesthesia, so lower doses of barbiturates is recommended [13]. We have used Inj Thiopentone sodium with dose of 2 mg/kg iv, so many of studies have shown 2 to 5 mg/kg iv thiopentone dosage for ECT but higher doses not needed as intubation is not required in ECT.

As per study by Maria Moral et al. higher doses of propofol is associated with strong anticonvulsant effect and reduced seizure duration [14]. ECT does not require usual induction dose of 1.5 mg/kg to 2 mg/kg of propofol as like in routine anaesthesia purpose and at the same time, dose of propofol should be adequate enough to produce hypnosis .

Glycopyrrolate is a quaternary compound and does not cross blood brain barrier, it does not increase seizure induced tachycardia [15]. In various studies, atropine is shown to produce more tachycardia during ECT which is harmful to the patient.

In ECT, paralysis need not to be complete as intubation is seldom required. So ,0.5 mg/kg dose of Succinylscoline is adequate [16].

Induction time in Group P was shorter than Group T. A study by Jignesh Patel et al., had similar result [17]. In our study we calculated induction time from the point at which full dose of drug given intravenously to loss of eyelash reflex (which roughly correlates with arm-brain circulation time). In various studies, induction time was calculated from initiation of infusion of drug (fixed 20 seconds of infusion time) up to loss of eyelash reflex.

In our study mean stimulus charge for Group P was 149.50±1.25 mC and for Group T was 136.22±0.96 mC. A study by Ka Fai Chung had similar results [18].

In a study by Villalonga A et al. had shown that seizure duration less than 15 seconds and more than 120 seconds produces less favourable response to ECT [19]. In our study, duration of seizure was adequate enough to produce desired treatment. one patient of Group P had registered very brief seizures following ECT, subsequent shock with higher stimulus charge was given to produce desired seizure duration. So many of research has proved that propofol has strong anticonvulsant activity.

In our study, we had observed that heart rate had reduced slightly during first 15 seconds after ECT due to parasympathetic stimulation. In around 3 minutes of ECT, heart rate and blood pressure had attained peak. Increase in heart rate and blood pressure started resolving within 5 to 10 minutes of ECT. A study by Maulik Gandhi et al. had similar results [20]. Group P had lower rise of heart rate and blood pressure than Group T . In certain studies , Inj atropine 0.6 mg/kg iv was used as anticholinergic which was associated with higher rise in heart rate than our study [21].

So many of the past studies have shown that sympathetic stimulation after ECT is associated with cardiac rhythm disturbances which can be fatal if it affects hemodynamics and persists for longer time. In our study also we had observed VPCs in both the groups and APCc in Group P. Group P had more complains of pain on injection and had nausea,vomiting in 2% of patients. Propofol has effect on Bundle of His conduction and causes Sinus node recovery time lengthening. Propofol can contribute bradycardia during initial parasympathetic predominance after ECT. In our study, we had not seen severe bradycardia which affects hemodynamics of the patient.

In a study by Anish Patel , it was shown than propofol is associated with higher stimulus charge and shorter seizures[22]. 2 patients of Group P had short term memory loss compared to 1 patients of Group T. Memory loss can be due to higher stimulus charge associated with Group P though seizure duration was less.

A study conducted by Alok Kumar stated that the total BDI score ranges from 0-63, with 0-9 being normal, rising to 10-18 during mild to moderate depression, 19-29 during moderate to severe depression, and rising to > 30 during an extreme severe depression [23]. His study had similar results on BDI. Almost identical BDI results show that no difference in outcome of treatment in both the Groups.

Conclusion

Propofol decreases seizure duration and requires higher stimulus charge. Propofol increases number of ECT required for treatment. Induction time and recovery both were faster with propofol. Incidence of minor complications are more with propofol though statistically insignificant.

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