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Research Article

COMPARISON OF THIOPENTONE AND PROPOFOL- AS BETTER ANAESTHETIC AGENT FOR MODIFIED ELECTROCONVULSIVE THERAPY

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ABSTRACT

AIM: To compare a better choice between thiopentone and propofol for Modified electroconvulsive therapy.
METHOD: 100 patients of ASA grade I and II of both sexes, aged 18 years and above scheduled to undergo electroconvulsive therapy under general anesthesia were studied in this crossover study. Thiopentone (2.5%) in dosage of 5 mg/kg and propofol (1%) in dosage of 2 mg/kg were given intravenously for anaesthesia. The two drugs were examined for induction and recovery time, effect on serum potassium and duration of seizure and incidence of side effects during induction and post ECT recovery period.
RESULTS: Mean induction and recovery time significantly less in propofol as 40.4 seconds and 22.1 minutes while in thiopentone as 49.4 seconds and 28.9 minutes. Mean seizure duration was 25.6 seconds in propofol and 28.1 seconds in thiopentone. The difference in mean seizure duration was statistically non significant. Incidence of side effects during induction and recovery was significantly very less in propofol. In conclusion propofol is a better choice for Modified-ECT.

Keywords: Modified-ECT, Thiopentone, Propofol, Anaesthesia

INTRODUCTION

Electroconvulsive Therapy (ECT) is established and effective mode of treatment for many psychiatric disorders[1]. Like any medical treatment, ECT also had risks and side effects. To reduce the risk of complications conventional mode of Direct-ECT had been replaced by Modified-ECT. Modified electroconvulsive therapy (Modified-ECT) was started under short acting intravenous general anesthesia and muscle relaxant[2].

In Direct-ECT, electric shock was given directly without anaesthesia in conscious patient that may result in complications like bone fracture, joint dislocation, dental complication, tongue biting, tearing off muscle fiber, heart attack, irregularities in heart rate and rhythm, stroke, respiratory difficulty or continuous seizure. Moreover, it was very inhuman to look at convulsing and frothing patient who were held by several persons to avoid injury to patient. With modern technique of Modified-ECT, patient remains relaxed and dental complications, bone fractures or joint dislocations are very rare. In Modified-ECT, seizure duration is monitored by using electroencephalogram (E.E.G.) or the "cuff method". In cuff-method distribution of a muscle relaxant is blocked to the hand or foot via a tourniquet to maintain the potential for muscle contraction[2]. Routine monitoring is done for pulse, blood pressure and SpO_2 during ECT. Generally a patient receives 6 to 12 ECTs, given twice or thrice in a week. For adequate therapeutic response seizure duration should last for more than 15-20 seconds in each ECT and a total duration of 210 seconds of all ECTs received by patient in a course of treatment.

In Modified-ECT, duration of induction and recovery phase of anaesthesia, hemodynamic changes, hypocarbia, change in serum potassium, effect on seizure duration, post ECT confusion, amnesia, bodyache and headache remains matter of concern. There is always a need of ideal anaesthetic agent which has rapid, smooth induction, short duration of action, rapid recovery, minimal side effects minimal effect on seizure duration, minimal or no interaction with medicines used in psychiatric disorders.

For Modified-ECT an anaesthetic agent should be very short acting with smooth induction and recovery, and minimal effect on seizure duration. Initially only thiopentone was used in Modified ECT in India and later on propofol was also used. Both thiopentone and propofol has rapid smooth induction and anticonvulsant activity. Thiopentone has less effect on seizure duration but has prolonged recovery time and associated with side effects like respiratory arrest, laryngeal spasm, arrhythmias and post ECT nausea and vomiting. Propofol has rapid recovery and less hemodynamic changes but having slight decrease in seizure duration. So to make out a better choice between these two short acting intravenous general anaesthetic agents viz. Thiopentone and Propofol following prospective study has been undertaken. The two anaesthetic agents are compared in patients on two occasions in a repeated crossover study.

METHODS

This crossover study was planned to include 100 patients of ASA grade I and II of both sexes, aged 18 years and above scheduled to undergo electroconvulsive therapy under general anesthesia. A written informed consent was taken from all the patients and their relatives. Patients with major medical illness, drug abuse, drug allergy and epilepsy were excluded. The study was done in repeated crossover pattern. Same sample of patients received thiopentone in one ECT and propofol in second ECT. In ECT room every patient allotted a serial number by lottery method. The lottery box was containing 100 slips of paper of equal size and color on which 1 to 100 serial numbers were written. Every patient was asked to pick up a slip from the box and that number was assigned to the patient for the purpose of study. Odd numbered patients received thiopentone (Drug A) in first and propofol (Drug B) in second Modified-ECT while even numbered patients received propofol (Drug B) in first and thiopentone (Drug A) in second Modified-ECT. All the patients when received thiopentone (2.5%) were allocated Group A and same patients when received propofol (1%), were allocated Group B. The dose of thiopentone was 5mg/kg and propofol as 2mg/kg.

All the patients were investigated for routine investigations for fitness to general anaesthesia. In ECT room, before starting the procedure blood sample was taken for measurement of baseline serum potassium. Multipara was attached to patients for measurement and monitoring of saturation of oxygen (SpO_2), end-tidal carbon dioxide ($ETCO_2$), pulse, blood pressure and respiratory rate. Normal $ETCO_2$ level is 35 to 45 mm Hg. In this study $ETCO_2$ was taken as 40 mm Hg for all patients.

Premedication was given as glycopyrrolate 0.2 mg and pre oxygen was given as 100% oxygen by mask for 3 minutes. General anaesthetic agent thiopentone or propofol was given intravenously till loss of eyelid reflex. Induction time and incidence of side effects like pain on injecting anesthetic drug, gag reflex, coughing and tears were noted during induction. One hand of patient was having intravenous line and, on another hand BP cuff was applied and mercury raised up to 250 mm to prevent circulation of succinylcholine in that hand for monitoring of seizure duration (cuff method for monitoring of seizure duration). Then succinylcholine

0.5 mg/kg was administered for neuromuscular relaxation. Bi-temporal ECT electrodes were placed and connection to ECT Machine with proper setting was done. When fasciculation subsided, adequate neuromuscular relaxation obtained and $ETCO_2$ was maintained at 40 mm Hg, patient was ready to receive ECT. Adequate size Guedel's airway was inserted to prevent tongue bite and then an ECT stimulus was given for 2 seconds to produce seizure of adequate duration[5]. All parameters for ECT stimulus given by "Brief Pulse ECT Machine (BPE-791)" were kept constant for all patients as amplitude of 0.8A, pulse width of 1ms and pulse frequency of 70Hz for all ECT. Duration of seizure was recorded in seconds by clinical method from start of electrical impulse to the end of clonic contraction in hand with BP cuff tied on arm.

When seizure subsided, again the patient was ventilated with 100% oxygen at the rate of 12 breathes per minute till spontaneous breathing returned and full recovery. A second blood sample was taken after 2 minutes of ECT for post ECT measurement of serum potassium. Duration of recovery (cognitive, orientation and neuromuscular co-ordination) was recorded from injection intravenous anesthetic agent to time taken to obey verbal commands like opening of eyes, protrude tongue and move limbs. Incidence of side effects like delirium, laryngospasm, bronchospasm, headache, body ache, pyrexia, nausea, vomiting and thrombophlebitis were noted in post ECT and recovery period.

In second Modified-ECT, the hand used for I.V. line and anesthetic drug were changed and rest of the procedure was kept same.

The data was collected for seizure duration; change in serum potassium level, induction and recovery time and post ECT side effects. The master chart of collected data was prepared and the results were analyzed by percentage, mean, standard deviation and t-test, Chi-square and Fisher's exact probability test. P value < 0.05 is taken as significant.

RESULTS

The demographic characteristics of study population were same for both groups as shown in table no 1. The sample was consisting of 52 males and 48 females with mean age 28.2 years, mean body weight 58.9 Kg and BMI as 22.8.

As per table no 2 our study found mean induction and recovery time significantly less in propofol as 40.4 seconds and 22.1 minutes while in thiopentone as 49.4 seconds and 28.9 minutes respectively. Average rise in serum potassium after ECT was 0.26 in thiopentone and 0.23 in propofol. Mean seizure duration was found slightly less in propofol as 25.6 seconds while in thiopentone it was found 28.1 seconds and on comparison this difference was found non significant.

As seen in table no 3 induction of anaesthesia was found smooth in significant number of patients in propofol as compared to thiopentone except pain while injection was significantly higher in propofol. Incidence of pain while injection was reported only in propofol as 16%, gag reflex and coughing were significantly less in propofol in comparison to thiopentone as 18% vs 34%, and 2% vs 15% respectively. Incidence of tearing was 6% in propofol while 11% in thiopentone and found non significant on comparison.

Table no 4 showing incidence of side effects in post ECT and recovery period of anaesthesia. This duration was found smooth in significant numbers of patients in propofol. Most of the side effects were reported in thiopentone only as delirium in 12%, laryngospasm in 1%, bronchospasm in 6%, pyrexia in 2%, nausea in 6% and vomiting in 1% patients. 1% patient in thiopentone needed endotracheal intubation while thrombophlebitis was reported in few patients in propofol group only as 3%. Headache and body ache reported in both thiopentone and propofol as 11% vs 3% and 14% vs 4% respectively. Incidence of delirium, bronchospasm, headache, body ache and nausea were found significantly less in propofol on comparison

Table 1: Demographic profile

Parameters*	Group A (Thiopentone) (N = 100)	Group B (Propofol) (N = 100)
Age (in Yrs)	28.2 ± 6.9	28.2 ± 6.9
Weight (in Kg)	58.9 ± 8.7	58.9 ± 8.7
BMI	22.8 ± 1.1	22.8 ± 1.1
Sex (as M/F)	52/48	52/48

***Age, weight and BMI represented as mean ± s.d.**

Table 2: Induction time, Recovery time, Rise in Serum Potassium after ECT and Seizure duration

Parameters*	Group A (Thiopentone) (N = 100)	Group B (Propofol) (N = 100)	Significance
Induction time (seconds)	49.4 ± 3.8	40.4 ± 3.1	P = 0.044*
Recovery time (minutes)	28.9 ± 3.2	22.1 ± 2.5	P = 0.015*
Rise in serum K^+ (mmol/L)	0.26 ± 0.07	0.23 ± 0.08	P = 0.186
Seizure duration (seconds)	28.1 ± 2.7	25.6 ± 2.5	P = 0.445

***Significant**

Table 3: Incidence of side effects during induction

Side effects	Group A (Thiopentone) (N = 100)	Group B (Propofol) (N = 100)	Significance
Pain while injection	0 (0%)	16 (16%)	P < 0.0001*
Gag reflex	34 (34%)	18 (18%)	P = 0.010*
Coughing	15 (15%)	2 (2%)	P < 0.0001*
Tears	11 (11%)	6 (6%)	P = 0.218

***Significant**

Table 3: Incidence of side effects during post ECT and recovery period

Side effects	Group A (Thiopentone) (N = 100)	Group B (Propofol) (N = 100)	Significance
Delirium	12 (12%)	0 (0%)	P < 0.001*
Laryngospasm	1 (1%)	0 (0%)	P > 0.999
Bronchospasm	6 (6%)	0 (0%)	P = 0.029*
Intubation needed	1 (1%)	0 (0%)	P > 0.999
Headache	11 (11%)	3 (3%)	P = 0.049*
Body ache	14 (14%)	4 (4%)	P = 0.024*
Pyrexia	2 (2%)	0 (0%)	P = 0.497
Nausea	6 (6%)	0 (0%)	P = 0.029*
Vomiting	1 (1%)	0 (0%)	P > 0.999
Thrombophlebitis	0 (0%)	3 (3%)	P = 0.246

***Significant**

DISCUSSION

Present study was undertaken to examine ideal anaesthetic agent for Modified-ECT. For this purpose thiopentone and propofol were compared in same sample of 100 patients in repeated crossover pattern. The dose of the two drugs was calculated according to body weight which was adequate to reach the induction criteria i.e. loss of eyelid reflex and could not interfere with the ECT induced seizures. Ethical consideration dominated our decision not to use a placebo group. Induction time, recovery time and seizure duration may vary in first and successive ECT, so we designed this cross over study in such a pattern that 50% sample received drug A and remaining 50% received drug B in first ECT. In second ECT, the 50% patients who received drug A in first ECT were crossover to drug B and remaining 50% patients who received drug B in first ECT were crossover to drug A to control the effect of first or second ECT on variables under study. Seizure duration may be affected by ECT stimulus setting of ECT Machine. To control this factor all patients were given ECT by same Machine and with fixed ECT stimulus settings. Hypocarbia as monitored by End-tidal carbon dioxide ($ETCO_2$) may affect the duration seizure duration[3,4]. So this factor was also controlled by taking $ETCO_2$ as 40 mm Hg for all patients. This factor was not controlled in previous studies with these drugs. Moreover end-tidal carbon dioxide monitoring stabilized hemodynamic changes during Modified-ECT[4]. Induction and recovery time may vary in patints of drug abuse and duration of seizure may vary in epilepsy, so we excluded these patients from our study. In this way we minimized the confounding factors and difference in result was due to type of anaesthetic drug used. Seizure and succinyl choline both may raise serum potassium, so serum level was measured before and after ECT in all patients.

In present study induction was found rapid and smooth in propofol in comparison to thiopentone. The induction time was significantly short in propofol. Incidence of gag reflex and coughing was significantly less in propofol. Significant number of patients reported pain while injecting propofol which was absent in thiopentone. These findings were in agreement with Shah et al[5], Omprakash et al[6], Arya et al[7] and Singhal et al[8].

Mean seizure duration was shorter with propofol but on comparison with thiopentone this shortening was not found statistically significant in present study. Duration of seizure was sufficient in both the groups for effectiveness of therapeutic outcome of Modified-ECT. The shortening of seizure duration with propofol in comparison to thiopentone was also noted by Shah et al[5], Omparkash et al[6], Boey et al[9], and Zaidi & Khan[10], who found significant shortening of seizure duration in comparision to thiopentone. Present study differs with these studies in finding statistically non significant shortening of seizure duration in propofol.

There was increase in serum potassium in both the groups but the difference between two group was statistically not significant. The rise in serum potassium may be due to fasciculations in muscles produced by succinyl choline and seizure activity produced in one hand on which B.P. cuff was tied. The rise of serum potassium was also found by Bali[11] and Agarwal et al[12].

The recovery time was significantly short in propofol in comparison to thiopentone in present study and this is very useful nowadays to minimize hospitalization and day care procedures. Shortening of seizure duration in propofol was in agreement with finding of Shah et al[5], Arya et al[7], Singhal et al[8], Boey et al[9], and Zaidi & Khan[10]. The recovery was smooth in propofol. The incidence of most of the side effects like delirium, bronchospasm, nausea, vomiting, pyrexia and laryngospasm were reported only in thiopentone and absent in propofol. Absence of nausea and vomiting in propofol may be due to its anti-emetic activity. Endotracheal intubation was needed in only one patient of thiopentone group. Thrombophlebitis was reported in few patients in propofol group only. Headache and body ache were reported in both the groups. On statistical comparison incidence of delirium, bronchospasm, headache, body ache and nausea was significantly less for each in propofol. The lower incidence of side effects in propofol was also found by Shah et al[5].

CONCLUSION

Present study found that thiopentone in dosage of 5 mg/kg and propofol in the dosage of 2 mg/kg body weight were effective in Modified ECT in ASA grade I and II patients. On comparing both the drugs as better anaesthetic agent for Modified-ECT, it is concluded that propofol is better choice due to rapid and smooth induction, early and smooth recovery, anti-emetic property, no significant rise in serum potassium, no significant shortening of seizure duration and very less incidence of side effects. With these conclusions propofol is also a better choice for Modified-ECT where minimum hospitalization is needed and for ambulatory patients.

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