IS ADDITION OF FENTANYL TO PROPOFOL USEFUL DURING ELECTROCONVULSIVE THERAPY?

Ahmed Mostafa Abd El-Hamid M.D.
Department of anesthesia& I.C.U., Benha faculty of medicine

ABSTRACT

Purpose: This study was designed to investigate the effect of addition of fentanyl to propofol on the patient outcome during electroconvulsive therapy. **Patients & Methods**: The study comprised 60 patients randomly allocated into 2 equal groups: Group I (30 patients): received Propofol (1%) - 2 mg/kg. Group II (30 patients): received Propofol (1%) - 2 mg/kg + Fentanyl 1.5µg/kg. All the patients were monitored for changes in hemodynamics HR, SBP, DBP, arterial oxygen saturation, ECG changes and respiratory rate throughout the procedure. Besides induction time, quality of induction, seizure duration, side effects, and complications were also recorded in both groups. Duration of recovery was recorded from injection of intravenous anesthetic agent to time taken to meet discharge criteria. **RESULT:** The demographic data show non-significant difference between both groups. Mean duration of induction was shorter in Group II compared with Group I and the induction of anesthesia was smoother in group II compared to Group I. Incidence of complications during induction was less in group II in comparison with group I. After application of ECT, significant rise in HR, SBP, and DBP was observed in group I than group II. The seizure duration was shorter in Group II compared to Group I. The recovery of cognition, orientation and neuromuscular coordination was significantly faster in Group I than Group II. **CONCLUSION**: Addition of fentanyl to propofol during application of electroconvulsive therapy will shorten the duration of induction, decrease incidence of complications, decrease the sympathetic response to ECT, but the seizure duration will be short and the recovery will be prolonged.

Introduction:

The electroconvulsive shock is applied to one or both cerebral hemispheres to induce a seizure. The goal is to produce a therapeutic generalized seizure 30–60 s in duration. Electrical stimuli are usually administered until a therapeutic seizure is induced. A good therapeutic effect is generally not achieved until a total of 400–700 seizure seconds have been induced [(1)]. Electroconvulsive therapy (ECT) is a safe and most effective treatment modality for major depressive disorders with suicidal tendencies. For this, one must have an ideal intravenous anesthetic agent for induction which provides rapid onset, short duration of action, attenuates adverse physiological effect of ECT, rapid recovery without adverse shortening of seizure duration.[(2)]

When an electrical current is applied to the brain via transcutaneous electrodes, the resultant electroencephalograpgic (EEG) spike and wave activity is accompanied by a generalized motor seizure and an acute cardiovascular response, which results in a marked increase in cerebral blood flow and intracranial pressure, as well as transient neurologic ischemic deficits, intracerebral hemorrhages, and cortical blindness. Short term memory loss is common after ECT, and more serious cognitive dysfunction has been described in the ECT literature, even though there is no scientific evidence of direct neuronal damage. However, use of brief pulse stimulation, unilateral non-dominant electrode placement, and individual stimulus titration have all been alleged to minimize cognitive dysfunction after [(11)].

The most commonly used IV anesthetic is propofol, an alkylphenol presently formulated in a lipid emulsion. Propofol provides rapid onset and offset. Its mechanism of action is thought to be potentiation of γ-aminobutyric acid (GABA) [(3)]. At therapeutic doses, propofol produces a moderate depressant effect on

ventilation [4]. It causes a dose-dependent decrease in blood pressure primarily through a decrease in cardiac output and systemic vascular resistance. A unique action of propofol is its antiemetic effect, which remains present at concentrations less than those producing sedation [5].

Fentanyl, an opioid agonist has an adjuvant action with intravenous anesthetics. In the presence of fentanyl, loss of consciousness occurred at a lower concentration of propofol than with propofol alone. This finding suggests that the hypnotic effect of propofol is enhanced by analgesic concentrations of opioids. [6]

This study was designed to investigate the effect of addition of fentanyl to propofol on the patient outcome during electroconvulsive therapy.

Patients and methods:

After approval from institutional ethical committee and consent from patient and relatives; 60 patients of ASA I and II of either sex, aged 18-60 years scheduled for electroconvulsive therapy. Patients with a history of full stomach, recent myocardial infarction (usually < 3 months), a recent stroke (usually < 1 month), an intracranial mass, or increased ICP from any cause, angina, poorly controlled heart failure, significant pulmonary disease, bone fractures, severe osteoporosis, pregnancy, glaucoma, and retinal detachment were excluded from the study. All the patients were randomly allocated into two groups:

Group I (30 patients): received Propofol (1%) - 2 mg/kg.

Group II (30 patients): received Propofol (1%) - 2 mg/kg + Fentanyl 1.5µg/kg.

All the patients were kept nil orally for six hours before procedure and allowed to continue respective antipsychotic treatment till the day of procedure. Intravenous line was secured and monitor was attached for monitoring heart rate, NIBP, RR, SpO_2 and the psychiatrist was allowed to place bitemporal ECT electrodes on forehead.

All the patients were premedicated with i.v. glycopyrrolate 0.2 mg and preoxygenated for three minutes. General anesthesia was induced with intravenous anesthetic agent as per the group allocated till loss of eyelid reflex. Then intravenous succinylcholine 0.5 mg/kg was administered to all the patients for neuromuscular relaxation. When fasciculations subsided and adequate neuromuscular relaxation obtained, adequate size oral airway was inserted to prevent tongue bite and brief pulse stimulus (90-120 volts MECT) for about 2 msec was given to produce seizure. Subsequently, all the patients were ventilated with 100% oxygen at the rate of 12 breaths per minute until spontaneous breathing returned and patients were fully recovered clinically. All the patients were monitored for changes in haemodynamics HR, SBP, DBP, arterial oxygen saturation, ECG changes and respiratory rate throughout the procedure. Besides induction time (i.e., from time of injecting intravenous anesthetic agent to loss of eyelash reflex) and quality of induction, seizure duration, side effects, and complications were also recorded in both groups. Duration of recovery (Cognitive, orientation and neuromuscular co-ordination) was recorded from injection of intravenous anesthetic agent to time taken to obey verbal commands (opening of eyes), ability to sit unaided and meet discharge criteria (Table I).

Table 1: Discharge criteria post-anesthetic discharge scoring system (PADSS)

Category	Status	PADSS
Vital signs	-Within 20% of the preoperative value -Within 20%:40% of the preoperative value -> 40% of the preoperative value	2 1 0
Respiratory status	O_2 sat.>94% on room air. O_2 sat.>94% on nasal prongs at 4 L/min or less. O_2 sat.>94% on face mask at 10 L/min or less.	2 1 0
Nausea & vomiting	Minimal treated with oral medication. Moderate treated with parentral medications. Continues after repeated treatments.	2 1 0
Pain	Acceptable to patient (with oral medications). Pain somewhat acceptable to patient. Pain not acceptable to patient.	2 1 0

A minimum score of 7/8(and/or return to same preoperative status) is achieved prior to transferring the patient to a phase III recovery area or home (Earlier minimum score of 9/10 was there in post anesthetic discharge scoring system (PADSS) but in the present study, category of surgical bleeding has been omitted as there was no need of this category.

Statistical analysis: was done using SPSS version 16, and the tests used are student T-test, Chi-squire and Z-test. A value of P<5% was considered statistically significant. The results are expressed as mean (SD).

Results:

As regard the demographic data all patients completed the study with a non-significant (p>0.05) difference between both groups in the terms of age, sex, weight, duration of induction and seizure duration (Table II)

Table II: Demographic data, induction time and seizure duration

	Group I(main± SD)	Group II	p
Age(Yrs.)	28.43 ± 8.06	30.23 ± 10.36	>0.05
Sex(M:F)	26:4	24:6	----
Weight(Kg.)	63.4± 5.92	61.7 ± 6.54	>0.05
Duration of induction(Sec.)	41.03 ± 6.11	30.5 ± 7.32	<0.05
Seizure duration(Sec.)	26.3 ± 2.79	19.73 ± 3.73	<0.05

Mean duration of induction was shortest in Group II compared with Group I (p<0.05) as shown in (Table II). Induction of anesthesia was smoother in group II compared to Group I.

Incidence of gag reflex, coughing and tearing during induction of anesthesia was less in group II in comparison with group I (p>0.05)(Table III).

Table III: Incidence of side effects during induction:

	Group I	Group II	p
Gag reflex	20%	10%	>0.05
Coughing	3.33%	1.7%	>0.05
Tearing	6.66%	3.9%	>0.05

After application of ECT, significant rise in HR, SBP, and DBP was observed in group I than group II. (Table IV), (Table V), (Table VI)

Table IV: Heart rate changes after ECT application

Heart rate	Group I	Group II	p
Basal	84.53 ± 4.27	83.8± 4.56	>0.05
After induction	84.7± 5.59	84± 4.91	>0.05
After ECT 1 min.	109.36± 7.83	94.1± 7.52	<0.05
2 min	107.2± 6.99	93.6± 6.73	<0.05
3 min	103.1± 7.1	90.5± 6.82	<0.05
5 min	90.23± 6.69	87.1± 6.32	>0.05
10 min	88.99± 5.43	84.8± 5.51	<0.05
20 min	85.4± 6.69	84.1± 6.62	>0.05
30 min	84.57± 6.23	82.9± 6.53	>0.05

Table V: Systolic BP changes after ECT application

Systolic BP	Group I	Group II	p
Basal	123.8± 7.33	123.1± 6.78	>0.05
After induction	120.9± 7.13	121.5± 7.73	>0.05
After ECT 1 min.	134,22± 9.28	125.1± 10.36	<0.05
2 min	130.66± 8.36	124± 9.53	<0.05
3 min	124.33± 8.11	123.8± 8.68	>0.05
5 min	122.67± 6.67	123.2± 6.97	>0.05
10 min	124.36± 7.68	123.1± 7.23	>0.05
20 min	121.22± 6.98	122± 7.96	>0.05
30 min	121± 6.25	122± 6.96	>0.05

Table VI: Diastolic BP changes after ECT application

Diastolic BP	Group I	Group II	p
Basal	78.32± 7.33	78.12± 9.25	>0.05
After induction	77.22± 7.13	77.53± 8.41	>0.05
After ECT 1 min.	93.15± 9.23	84.21± 7.25	<0.05
2 min	90.47± 8.36	82.43± 7.52	<0.05
3 min	88.81± 8.11	80.78± 6.88	<0.05
5 min	80.53± 6.67	80.61± 6.77	>0.05
10 min	80.67± 7.68	78.84± 8.82	>0.05
20 min	77.72± 6.98	77.91± 9.14	>0.05
30 min	77.51± 6.25	75.43± 9.23	>0.05

The seizure duration was shorter in Group II, compared to Group I ($p<0.05$) (Table II).
The recovery of cognition, orientation and neuromuscular coordination was significantly faster in Group I than Group II ($p<0.05$) (Table VII).

Table VII: Duration of recovery

	Group I	Group II	P
Time to obey verbal commends	4.56 min ± 1.11	6.65 min ± 1.24	<0.05
Time of sit up unaided	7.81 min ± 2.5	11.12 min ± 3.4	<0.05
Time taken to meet discharge criteria	11.59min ± 3.7	15.91 min ± 4.6	<0.05

Discussion:

The present study suggest that the use of propofol alone or in combination with fentanyl decrease seizure duration but more significant with addition of fentanyl, this goes with Brian et al [7], who studied the influence of methohexital and propofol on seizure activity and recovery profiles and found that the use of propofol was associated with a clinically insignificant decrease in seizure duration. However, propofol was associated with improved hemodynamic stability and an earlier return of cognitive function after ECT. Also,Hideya et al[8], studied the role of propofol on inhibition of epileptiform activity and found that propofol inhibit the adenosine neuromodulation through the A_1 receptor which may contribute to the anticonvulsant action of propofol. Weinger[9] and his colleague found that when fentanyl was administered with IV anesthetics the seizure duration was reduced which goes with the present study. On the other hand, Nguyen et al [10]found that there is increase in the seizure duration associated with the short-acting opioid analgesics alfentanil and remifentanil when given with propofol but this appears to be related to the reduction in the IV anesthetic dosage given during the study. As regards the duration of recovery, the present study suggests that addition of fentanyl to propofol will increase the duration of recovery, this goes with Nguyen et al [10] who studied the effect of methohexitione and propofol with or without alfentanyl on seizure duration and recovery in ECT and he found that recovery time was statistically shorter in patients receiving propofol compared with methohexitone-alfentanyl and methohexitone alone which goes with the present study. **Conclusion:** Addition of fentanyl to propofol during application of electroconvulsive therapy will shorten the duration of induction, decrease incidence of complications, decrease the sympathetic response to ECT, but the seizure duration will be short and the recovery will be prolonged. The study recommends that although addition of fentanyl will decrease seizure duration, it is useful to attenuate the cardiovascular and CNS responses to ECT in suspected patients.

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