

THE EFFECT OF ELECTROCONVULSIVE THERAPY USING PROPOFOL AND SUCCINYLBOLINE ON THE INTRAOCULAR PRESSURE

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Abstract

Purpose: Electroconvulsive therapy (ECT) is a therapeutic procedure in many mood and psychiatric disorders. After induction of general anesthesia by administering an induction dose of an intravenous anesthetic such as Propofol, intravenous succinylcholine is often used to prevent bone fractures and joint dislocations during ECT. Intraocular pressure (IOP) is raised by succinylcholine and tonic-colonic convulsion, and decreased by propofol administration.

To our knowledge, there is no published paper on the effect of ECT using propofol and succinylcholine on the IOP. This study for the first time shows the effect of ECT on IOP.

Keywords: Intra ocular pressure, Electroconvulsive therapy, Succinylcholine, Propofol

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Methods: One hundred patients 20 to 40 years old ASA class 1 or 2 without any ophthalmic disorders were enrolled. All of the psychiatric medications were discontinued 48 hours before ECT treatment. The baseline IOP values of the patients were checked after application of sterile eye drop tetracaine 0.5% by an applanation tonometer, and then the patients received atropine 0.5mg, propofol 0.75 mg/kg, succinylcholine 1mg/kg intravenously, with intervals of 1 minute. Then electrical stimulation was delivered via bi-frontal electrodes. IOPs were checked before any drug administration, before electrical application, as well as 1, 5 and 10 minutes after termination of the convulsion.

Results: The baseline IOP (14.81 ± 3.6 mmHg) decreased significantly after administration of propofol (13.18 ± 3.55 mmHg) but increased significantly after succinylcholine (15.52 ± 3.58 mmHg), one minute (18.32 ± 3.49 mmHg) and 5 minutes after convulsion (15.41 ± 3.46 mmHg). However, IOP returned to the baseline 10 minutes after convulsion (14.68 ± 3.57 mmHg).

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Conclusion: IOP increased after ECT but the IOP levels never reached to pathologic range in this study. Therefore, regarding IOP, ECT is a safe procedure in patients with normal eye condition. Further studies are recommended in older patients with ophthalmic diseases.

Introduction

Electroconvulsive therapy (ECT) is a treatment for acute or chronic schizophrenia, major depression, acute mania episodes and bipolar disorders¹. General anesthesia is considered as a mandatory procedure for performing ECT. Succinylcholine is the muscle relaxant of choice used for decreasing the severity of muscle contractions and risk of bone fracture during convulsive seizure after ECT. It also causes rising of intraocular pressure (IOP)². The regular dose of Succinylcholine for ECT is 1mg/kg intravenously with an onset of action of 30-60 seconds and duration of action of 5-10 minutes. Because of increasing blood pressure and decreasing venous return during ECT, increasing IOP is predictable³. On the other hand, propofol decreases IOP⁴. To our knowledge, there is no publication evaluating the effect of ECT using propofol and succinylcholine on IOP. This paper investigates the effect of ECT on IOP.

Methods and materials

After obtaining ethical approval from the institutional review board of the University Hospital Baharan, Iran, 104 patients (Physical status I-II according to the American Society of Anesthesiologists grading system), aged 20-40 yr, were scheduled for elective ECT. Written informed consent was obtained from all subjects or their guardians. Exclusion criteria included history of pheochromocytoma, pseudocholinesterase deficiency, increased intracranial pressure, recent cerebrovascular accident, cardiovascular conduction defects, aortic and cerebral aneurysms, need for endotracheal intubation (pregnancy, obese diabetic patient, hiatal hernia, gastroesophageal reflux), convulsive seizure duration less than 25 sec and known ocular disease (Table 1). According to the psychiatrist order, all of the psychiatric drugs were

discontinued 48 hours before ECT. All patients were NPO 8 hours before ECT. After administration of 1 drop of sterile tetracaine 0.5% eye drop (Anestocaine 0.5%, Manufactured by: Sina Darou Co, Tehran-Iran) into each eye, bilateral IOPs were measured as baseline values. After installing standard monitors and taking an intravenous canula, an additional blood pressure cuff was inflated 20 mmHg above systolic pressure on the left calf for observation of peripheral seizure activity. All patients were anesthetized with the same anesthetic technique. At first, patients were preoxygenated via an anatomical face mask with a flow rate of 6l/m, then atropine 0.5 mg, propofol (Propofol 1% MCT/LCT Fresenius, Manufactured by: Fresenius Kabi Austria GmbH Graz, Austria) 0.75 mg/kg, and succinylcholine (Succyl 20, Manufactured by: Abureihan Pharmaceutical Co, Tehran-Iran) 1 mg/kg with one minute intervals were injected intravenously. After fasciculations were observed, electrical stimulus was applied via a bi-temporal electrode. Bilateral IOPs were measured by an applanation tonometer (Tonopen XL, Mentor O & O, Norwell, Massachusetts, USA) before any drug administration and electrical stimulation. Subsequently, these measurements were repeated 1, 5 and 10 minutes post termination of convulsive seizure. After each step, the mean IOP of both eyes were calculated and recorded as the IOP of that step.

Table 1
Demographic factors of the patients undergoing ECT.

Number	Weight (kg)	Age (year)	Sex
52	69.5 ± 8.07	31.38 ± 6.75	Male
48	67.56 ± 6.82	30.58 ± 6.61	Female

Normality of distribution was tested by Kolmogorov Smirnov test. Paired t-test and repeated measure analysis of variance were used to test the eye pressures in different stages. Also, Bonferroni post hoc test was applied to find the intra ocular pressure that was different from others. The descriptive statistics (mean, SD etc.) was also used for data analyses. The criterion for significance was considered as a P < 0.05. Data were analyzed by SPSS version 17 (SPSS, Chicago, IL).

Results

In this study, 100 patients with demographic factors as shown in table (1) underwent IOP measurement six times according to methods described above. 4 patients were excluded because of convulsive duration that lasted less than 25 sec. IOP values were measured and recorded before any drug administration (baseline value), after propofol, succinylcholine injection and 1, 5 and 10 minutes after convulsion, (Table 2).

Table 2
Intra ocular pressure in different stages of electroconvulsive therapy

ECT 10	ECT 5	ECT 1	A.Sch	A.P	Baseline	IOP
14.68	15.41*	18.32*	15.52*	13.18*	14.81	Mean
3.57	3.46	3.49	3.58	3.55	3.6	Sd

- A. P: After propofol;
- A. Sch. After succinylcholine;
- ECT 1:1 minute after convulsion;
- ECT 5: 5 minutes after convulsion;
- ECT 10: 10 minutes after convulsion;
- IOP: intra ocular pressure in mmHg
- : Statistically significant compared to baseline*

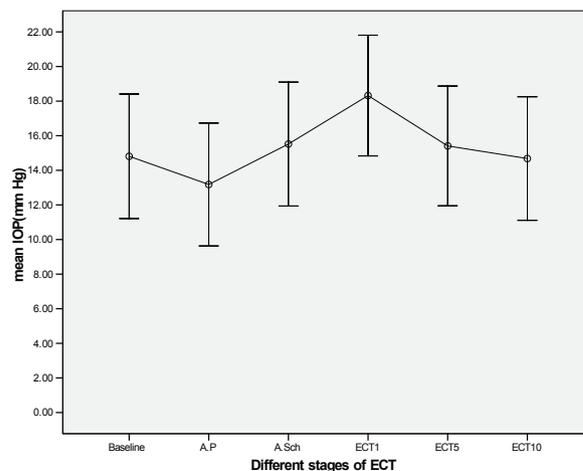
The mean of IOPs was significantly different between baseline and all of the measurements except ECT10.

Administration of propofol caused a significant decrease ($P = 0.0001$) in IOP value (13.18 ± 3.55 mmHg) compared to baseline level (14.18 ± 3.6 mmHg). After succinylcholine injection, IOP levels increased to 15.52 ± 3.58 mmHg, which is statistically significant in comparison with the baseline ($P = 0.0001$). One minute after convulsion (ECT1), the mean IOP was the largest (18.32 ± 3.49 mmHg), decreasing to (15.41 ± 3.46 mmHg) five minutes after convulsion (ECT5). Ten minutes after convulsion, IOP decreased (14.68 ± 3.57 mmHg) to near baseline level without statistically significant differences compared with baseline ($P = 0.113$).

Discussion

In this research, the effect of ECT on IOP after using propofol and succinylcholine for induction of general

Fig. 1
Mean intra ocular pressure at different stages of ECT (standard deviation bars are shown)



- A. P: After propofol;
- A.Sch: After Succinylcholine
- ECT 1:1 minute after convulsion;
- ECT 5: 5 minutes after convulsion;
- ECT 10: 10 minutes after convulsion;
- IOP: intra ocular pressure in mmHg

anesthesia was studied. According to the results, IOP significantly decreased after administration of propofol and increased after succinylcholine injection and convulsion. The decrease in IOP level during general anaesthesia is explained by various mechanisms. Presbitero and colleagues suggest that since IOP is regulated by the hypothalamus, the inhibition of the hypothalamus during general anaesthesia results in the decrease of IOP⁵, while some others^{6,7} suggest that the reduction in IOP level may be related to a decrease of the aqueous humor. It is also reported that the diencephalon is a region which has significant influence on IOP and that any pharmacological agent that affects this region may significantly reduce IOP⁸. Therefore, general anesthetics such as propofol and sodium thiopental, which affect the diencephalon, are reported to facilitate the external flow of the aqueous humor, to relax the extraocular muscles and thereby to reduce IOP⁷.

The peak of IOP rise was one minute after convulsion, then IOP approached to baseline 10 minutes after convulsion. Also the changes in IOP were statistically significant but all of the IOP records were within normal limit (10-20 mmHg). Therefore, IOP changes do not have any ophthalmic hazard for

these patients with normal eye conditions.

In a study which was done in 1998 by Van Den Berg AA and his colleagues³, 21 patients who had been prescribed phenothiazines, tricyclic antidepressants or antiparkinson drugs for a long time and randomly suffered from closed angle glaucoma were enrolled. The effect of ECT on IOP was studied. The patients anesthetized by methohexitone (1 mg/kg) and succinylcholine (0.5 mg/kg). This study showed that IOP was decreased by methohexitone and increased by succinylcholine. Convulsion led to a slight increase in IOP levels compared to succinylcholine. They concluded that convulsion resulting from ECT did not have ophthalmic risk to patients who were treated for closed angle glaucoma.

In another study, Good MS and colleagues⁹ in 2004 described one patient that received ECT who had an operation in her right eye because of bilateral glaucoma. IOP increased 5 mmHg in the left eye and returned to near baseline value after 5 minutes, but there was almost no change in the right eye IOP during ECT. In this case, ECT did not exert any effect on IOP of the patient whose glaucoma was controlled by surgery.

In another study by Edwards RM and colleagues¹⁰ in 1990, ten patients without any history of systemic or ophthalmic disease underwent ECT. Although the increase in IOP after convulsion was significant when compared to baseline values, it did not reach pathologic levels and returned to near baseline values after 90 seconds. In our study, IOP returned to near baseline values 10 minutes after convulsion. One can suggest that this difference was caused by using lower doses of succinylcholine (0.5 mg/kg) and replacing propofol by sodium thiopental instead. Moreover Edwards RM and

colleagues studied only 10 patients, which is a small sample size.

Khosravi MB and colleagues stated that propofol (2.5 mg/kg) is more effective than thiopental (5mg/kg) to control increasing IOP following succinylcholine administration². Because of abolishing convulsion, which is mandatory for the treatment, using such doses in ECT is impossible.

Hoshi H and colleagues described the use of rocuronium and sugammadex, as an alternative to succinylcholine during electroconvulsive therapy. It seems to be an attractive method but it is soon to account it a safe method and needs more investigations¹¹.

It should be noted that our study was done on the 20 to 40-years-old patients, without any history of systemic or ophthalmic disease. These limitations may affect the final interpretations of this study. Further investigations on patients with a wider age range and with different systemic or ophthalmic diseases are required.

Furthermore, although measuring IOP with Goldman tonometer is a standard approach, implementing this procedure is almost impossible during ECT.

In conclusion, in this study we showed that IOP was increased during ECT but the rise in IOP level is to an extent that does not cause any damage to the eye. It is suggested that ECT should be implemented more cautiously in patients suffering from ophthalmic disorders.

Disclosure Statement

There is no commercial association or financial interest of authors.

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