RESEARCH ARTICLE

Comparison of Recovery Time and Complications During the Use of Etomidate and Thiopental Sodium in Anesthesia in Children for Electroconvulsive Therapy; A Double Blind Randomized Clinical Trial

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Background: Electroconvulsive therapy (ECT) is usually given to people with severe depression which has not responded to other forms of treatment such as anti-depressants. ECT may be accompanied by potentially significant medical complications including prolonged seizures, prolonged apnea, or cardiac or pulmonary complications. Modification of ECT with brief anesthesia and muscle relaxants should be accomplished. Present prospective randomized study is designed to compare Thiopental Sodium and Etomidate for their effect on hemodynamics, seizure duration, respiratory arrest, and recovery after electroconvulsive therapy and various adverse effects on Sick children in ECT.

Methods: A total of 64 patients with psychiatric disorder were examined in a prospective randomized double-blind study. The patients were randomly divided into two groups as group T (n= 32, Thiopental sodium 2 mg kg^{-1}), and group E (n = 32, Etomidate 0.1 $mgkg^{-1}$).

effects of etomidate versus thiopental in electroconvulsive therapy on cardiovascular system parameters (heart rate, blood pressure, and blood oxygenation), seizure variables, adverse effects and recovery variables were recorded at every session, on prespecified time points, and the findings were used in this evaluation.

The methods used were descriptive study, cross tabs, Chi-square test, independent sample t-test, paired sample t-test, Fisher and repeated measure analysis of variance (ANOVA). It should be noted, the results are statistically significant at 95% has been mentioned.

Results: Both groups were comparable in sex, weight and ASA physical status, with no statistically significant differences ($p > 0.05$). There was no difference in the Systolic blood pressure (DBP) between the two groups.

Patients in etomidate group showed little change in mean Diastolic blood pressure 5th minutes after ETC (DBP5) and mean arterial pressure 5th minutes after ETC (MAP5), and heart rate 1th minutes after ETC (HR1), arterial blood oxygen saturation 1 and 5 minutes after ETC, compared to thiopental ($p> 0.05$).

Based on statistical analysis, the relative superiority of etomidate compared to thiopental the anesthetic induction in the treatment of ECT, was seen in Four variables, duration of seizures, Recovery time, Reach verbal response after seizure and apnea durations (Back spontaneous breathing after a seizure).

In addition, Pain on injection, nausea and vomiting and Myoclonus was more in etomidate group while Muscular pain activity was higher in thiopental group ($p> 0.05$).

Conclusion: It seems that etomidate compared with thiopental has no conflict with ECT therapeutic effects in psychiatric patients. In addition, it probably can be used as a safe and effective drug for controlling ECT-induced hemodynamic changes and seizure variables. Drawback etomidate Compared with thiopental had a high incidence of myoclonus, Pain at injection site and nausea and vomiting.

Keywords: thiopental sodium; etomidate; electroconvulsive therapy

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Electroconvulsive Therapy (ECT) is a medical procedure in which a brief electrical stimulus is used to induce a cerebral seizure under controlled conditions. ECT is used most commonly to treat severe depression, especially when other treatments have not worked. The remission rate for optimized ECT in psychotic depressed patients is very high, reaching greater than 90% [1].

The mechanism of action of ECT is not fully known. ECT affects multiple central nervous system components,

including hormones, neuropeptides, neurotropic factors, and neurotransmitters. The induction of a bilateral generalized seizure is required for both the beneficial and adverse effects of ECT [2].

ECT treatment usually requires three sessions per week for two to four weeks and about six to twelve treatments total. There is evidence that supports the direct relationship of seizure duration and the effectiveness of ECT. Seizures of less than 15 seconds are associated with postictal autonomic complications and poor clinical results, but convulsions lasting 30 to 60 seconds are conventionally considered to be of optimal length, and generally are achieved by applying routine ECT technique [3].

ECT is frequently associated with hemodynamic disturbances including tachycardia, hypertension, arrhythmia or other undesirable hemodynamic changes [4]. These hemodynamic changes are among the hazardous complications of general anesthesia [5-6].

However, with appropriate pre-ECT assessment, optimization of overall medical care, appropriate anesthetic management, and prompt attention to emerging medical concerns, such complications can generally be avoided or successfully managed [7-8]. Contemporary use of ECT including preoxygenation, brief anesthesia, muscular relaxation, use of bite block, and physiological monitoring is associated with a very low rate of morbidity and mortality. The violent muscular contraction during convulsion can be reduced by muscle relaxants. Generally used succinylcholine is used as a muscle relaxant injection, Recent estimates of the mortality rate associated with ECT are about 2 deaths per 100 000 treatments. Reports from several countries indicate that mortality following hospitalization is lower for ECT treated patients than for depressed patients who did not receive ECT [9-10]. Anesthesia during ECT is a complex procedure due to the goal of exciting the brain into a seizure immediately after sedation has been induced. The practice differs over the world and even between national sites as the optimal method for ECT-related anesthesia is still unclear [11].

Induction of anesthesia is a critical part of ECT practice. Sudden hypotension, arrhythmias, and cardiovascular collapse are threatening complications following injection of induction agent in hemodynamically unstable patients. It is desirable to use a safe agent with fewer adverse effects for this purpose.

Ideal unaesthetic used for electroconvulsive therapy should have characteristics that include rapid induction, shorter duration of action, minimal side effects, rapid recovery and no interference with electroconvulsive therapy efficiency.

Because of the brief period of unconsciousness required for the therapy, anesthetic agents with rapid recovery profile offer advantages. Intravenous anesthetic drugs have been used for this purpose each having advantages and disadvantages.

Etomidate an imidazole-derived, sedative-hypnotic agent that is frequently used for RSI. Etomidate acts directly on the gamma amino butyric acid (GABA) receptor complex, blocking neuroexcitation and producing anesthesia. For RSI, etomidate is given by intravenous push in a dose of 0.3 mg/kg, with a time to effect of 15 to 45 seconds and duration of action of 3 to 12 minutes. Doses are 0.2–0.4 mg/kg in adults and 0.1–0.2 mg/kg in children. Its effects start at the most within 15 s and end at the most within 15 min. It is the most hemodynamically neutral of the sedative agents used for RSI, and does not stimulate histamine release. The hemodynamic stability associated with etomidate makes it the drug of choice for the intubation of hypotensive patients, as well as an attractive option for patients with intracranial pathology, when hypotension must be avoided. Etomidate causes a mild increase in airway resistance, but may be used in patients with bronchospasm.

Etomidate It possesses unique desirable properties such as rapid onset and short duration of action, relative cardiovascular and respiratory stability, as well as neuroprotective effects [12].

Despite these benefits, one area of concern exists regarding etomidate use in anesthesia. It is believed that etomidate may cause profound and persistent adrenocortical suppression by inhibiting mitochondrial 11 β hydroxylase enzyme of the adrenal steroid synthesis pathway [13]. It depresses electroencephalography (EEG) activity and cerebral blood pressure similar to the effects of barbiturates. Because it does not affect the mean arterial pressure and decreases intracranial pressure without lowering cerebral perfusion pressure, it is especially useful in hemodynamically instable patients with increased intracranial pressure. Because etomidate is the only intravenous anesthetic agent that does not affect histamine release, it is also safe in patients with a reactive airway. For "rapid sequence intubation" and "procedural sedation and analgesia," it's intravenous adverse effects are as follows:

Nausea and vomiting

Injection site pain: For the treatment of pain along the intravenous route, opening of a large vascular access, saline infusion, and the use of a local analgesic are recommended (Etomidate provides no analgesic effect).

•Myoclonus: This can be seen in one-third of cases and is caused by interruption of the inhibitory synapses on the thalamocortical pathway. The use of opioid analgesics and benzodiazepines as premedication can decrease this side effect. Unfavorable effects of this side effect on patient's clinical status have not been reported so far [14,16].

Thiopental is the drug of choice for ECT anesthesia, thiopental is an ultra-short-acting barbiturate commonly used for the induction of anesthesia. It may cause dose-dependent decrease in systemic vascular resistance, stroke volume and CO, leading to compensatory tachycardia [15]. The ultra-short-acting barbiturates interact with the barbiturate component of the GABA receptor complex, causing profound amnesia and sedation. Thiopental was the barbiturate most commonly used for RSI [16]. The induction dose is 3 to 5 mg/kg IV, with a time to effect of less than 30 seconds, and a duration of action of 5 to 10 minutes [17].

Thiopental suppresses neuronal activity, making it a useful induction agent in hemodynamically stable patients with conditions that can elevate intracranial pressure (ICP), including seizures, intracranial bleeding, or trauma. However, thiopental is a venodilator with negative cardiac inotropic effects, and can induce profound hypotension in the doses used for induction of anesthesia. Clinicians must exercise great care when using it in hemodynamically unstable patients or patients prone to hypotension, such as the elderly. For emergency RSI, a dose of 3 mg/kg is used; a reduced dose of 2 or 1 mg/kg is used in the setting of hemodynamic compromise [18]. Reductions in ICP associated with thiopental may be caused in part by a decrease in mean arterial pressure, which decreases cerebral perfusion.

Thiopental causes histamine release and can induce or exacerbate bronchospasm [19]. Therefore, thiopental should not be used in patients with reactive airway disease. Thiopental suppresses white blood cell recruitment, activation, and activity, both in vitro [20-21] and in vivo [22-23]. This effect has been attributed to a number of causes, including suppression of nuclear transcription factor [24], an increase in apoptosis [20], and a decrease in phagocytosis [21], These immunosuppressive effects make barbiturates poor induction agents in the setting of sepsis.

There are few studies comparing the different drugs used for ECT. Since the response of children to anesthesia and complications of ECT by many factors change, therefore, the study was performed to assess the comparative effects of thiopental and etomidate on recovery profile, hemodynamic stability, and seizure duration in children. It was also done to study whether etomidate has a better recovery profile than thiopental and if it is hemodynamically stable.

Methods

This is a double-blind clinical trial study, in which 64 ECT-candidates, referring to psychiatric department of Alzahra Hospital in Esfahan (enrolment period May 2016 to October 2016), were selected using Simple random sampling. The inclusion criteria were as following: member of normal healthy human group, ASAI, 5-18 years old, without history of drug addiction (by asking from the patient and his/her family, and referring to the patient's profile), and without contraindications to ETC (Patients who have problems with immune system disorders, organ transplantation, porphyria, acute respiratory infection and hypo tension are excluded).

Beforehand, approval from Ethics Committee of the University and informed consents from the patients were obtained. This clinical trial was registered at www.irct.ir with an identification of IRCT (IRCT2016092826950N2).

The subjects were divided into two equal groups. Screening included an in-house developed screening manual for inclusion and exclusion criteria, demographic data, information from the medical record, and a MINI interview. All patients had been clinically investigated including normal physical examination and routine blood sampling. The variables investigated in this study included systolic and diastolic blood pressure, mean arterial pressure, arterial blood oxygen saturation, heart rate, seizure duration, apnea duration, recovery duration, effects of anesthetic drugs. In all cases under investigation, blood pressure, heart rate, and arterial blood oxygen saturation were measured as the basis, before undergoing ECT. None of the patients received other premedication. Preoperative preparation procedure, including being NPO (All patients were fasted for over 6 h and routine premedication was given.) and receiving fluids based on body weight, was similar in all patients.

The convenience sampling was used for enrolment in this study. Patients were then randomly allocated to groups "A" and "B" using sealed envelope to receive either etomidate or thiopental respectively for induction of anesthesia. For blinding purpose primary anesthesiologist was responsible for patient randomization and induction of general anesthesia while other investigator (unaware of group allocation) was responsible for data collection. For the purpose of double blinding, patients were also kept unaware of group allocation.

In all patients 0.5 mg/kg succinylcholine as a muscle relaxant injection, induction of anesthesia in two separate groups consisting of 2mg/kg thiopental and 0. 1mg/kg etomidate; randomly assigned to patients intravenously, and injected slowly.

All the patients received bilateral ECT, the blood pressure, heart rate, arterial blood oxygen saturation variables were measured and registered in respective checklist at 0,1, 5, and 10 minutes after ECT induction. Anesthesia complications, seizure, apnea, and recovery durations were attached to the checklist, as well. Electroencephalography (EEG) was also recorded during the procedure. Data obtained from checklists were collected based on the variables and then the average of mean arterial blood pressure difference, heart rate, and arterial blood oxygen saturation differences, pre-ECT and at fifth and tenth minutes post-ECT in both groups were measured and compared. To analyze the results, SPSS-22 was utilized. After checking the normality, data were analyzed using Chi-Square, t-test, and Fisher tests. P-value < 0.05 was considered significant.

Results

Based on the results, there were no significant differences among the groups in most cases in terms of effects on cardiovascular system variables, seizure variables, and cognitive functions. However, in cases where statistically (at 95%), there is a significant difference between the two groups, the results are presented.

Effects of etomidate versus thiopental in electroconvulsive therapy on cardiovascular system parameters (heart rate, blood pressure, and blood oxygenation), seizure variables, and recovery variables were recorded at 0,1, 5, and 10 minutes after ECT induction, were used in this evaluation, and results in Four segments presented below.

Characteristics of the patients

64 patients who (fit the inclusion criteria for this study) by psychiatric diagnoses were divided as follows: 32 patients were anesthetized with thiopental during ECT and 32 patients with etomidate (64 patients were completed the study after randomization in two groups). We have studied 64 patients of both sexes between 5-18 years of age posted for ECT.

Etomidate group mean age was 13.16 ± 3.33 Year while in thiopental was 15.16± 1.15 Year. This gender distribution was statistically significant (p< 0.003). For this purpose, the average age of both groups was used in the study (Age= 14.16).

Both groups were comparable in gender and weight of patients, with no statistically significant differences (p> 0.05) (Table 1).

Table 1- Comparison of Demographic characteristic of patients between two groups.

Variables	Etomidate (n = 32)	Thiopental (n = 32)	p-value
Gender (male/female)	16:16	10:22	0.06
Age (years)	13.16 ±3.33	15.16± 1.15	0.003
Weight (kg)	58.74± 19.84	57.35± 11.45	0.7

Hemodynamic changes

The average of heart rate was compared with that at zero, 1, 5th, and 10th minutes after ECT, in both groups are shown in (Table 2).

After induction the mean change of heart rate between groups was not statistically significant. The findings revealed a significant difference between the groups at first minute after ECT in that regard (p=0.011). Therefore, that at first minute after ECT, etomidate group mean Heart rate was 76.9± 5.23 BPM while in thiopental was 96.12± 14.64 BPM. In addition, the mean change in heart rate at 5 and 10 minutes after ECT was not statistically significant between thiopental and etomidate group. Such that, the heart rate changes in two groups anesthesia is usually variable. However, there is tendency to return to their baseline values (Table 2).

The results (Table 3), The Systolic blood pressure values 0, 1, 5, and 10 minutes after ECT, in both groups, were not significantly different. also, change in systolic blood pressure was not statistically significant over time within groups, However, the systolic blood pressure values change in thiopental at different times is variable and not uniform compared with etomidate.

According to the results presented in (Table 3), the differences between The Mean Arterial pressure (MAP) and Diastolic blood pressure (DBP) at 0,1, 5th and 10th minute after ECT, were significantly different in 5th minute after ECT (p=0.05). So that, the MAP and DBP values at 5 minutes after ECT, in etomidate is lower compared to thiopental.

Based on the results (Table 4), the mean percentage of blood oxygen saturation at 0 and 10 minutes after ECT, in both groups, were not significantly different. However, into difference mean of blood oxygen saturation 1 and 5 minutes after ECT it showed a significant difference between the groups, in that thiopental caused decrease in the difference mean of arterial blood oxygen saturation at that point of time.

Table 2- Comparison of heart rate between two groups at different times.

Dependent Variable					95% Confidence Interval		
Variables	Minute	group	Mean (BPM) (HR, min-1)	Std. Error	Lower Bound	Upper Bound	p-value
Heart rate	0	E	80.094a, b	3.283	73.494	86.695	0.223
		T	74.457a, b	2.908	68.609	80.305	
	1	E	76.900a, b	5.239	66.367	87.433	0.011
		T	96.128a, b	4.641	86.796	105.46	
	5	E	95.477a, b	5.67	84.076	106.878	0.841
		T	93.889a, b	5.024	83.788	103.99	
	10	E	79.336a, b	2.485	74.34	84.331	0.913
		T	78.955a, b	2.201	74.529	83.381	

Table 3- Comparison of Mean SBP, DBP, MAP between two groups at different times.

Dependent Variable				Std. Error	95% Confidence Interval		p-value
Variables	Minute	group	Mean (mmhg)		Lower Bound	Upper Bound	
Systolic blood pressure	0	E	121.319a	3.126	115.038	127.601	0.935
		T	120.970a	2.883	115.177	126.763	
	1	E	124.287a	2.875	118.51	130.065	0.063
		T	116.851a	2.651	111.523	122.179	
	5	E	125.167a	3.816	117.497	132.836	0.771
		T	126.685a	3.52	119.612	133.757	
	10	E	121.319a	3.237	114.815	127.824	0.125
		T	128.196a	2.985	122.198	134.195	
Diastolic blood pressure	0	E	77.615a, b	3.088	71.405	83.824	0.117
		T	84.471a, b	2.736	78.969	89.973	
	1	E	87.835a, b	3.181	81.44	94.23	0.268
		T	82.880a, b	2.818	77.214	88.546	
	5	E	78.640a, b	3.212	72.181	85.099	0.013
		T	90.159a, b	2.846	84.437	95.881	

Table 3- Comparison of Mean SBP, DBP, MAP between two groups at different times (Continued).

Dependent Variable		group	Mean(mmhg)	Std. Error	95% Confidence Interval		p-value
Variables	Minute				Lower Bound	Upper Bound	
Diastolic blood pressure	10	E	81.907a, b	3.462	74.946	88.868	0.121
		T	74.302a, b	3.067	68.134	80.469	
	0	E	91.910a, b	2.851	86.178	97.642	0.224
		T	96.796a, b	2.526	91.718	101.875	
	1	E	99.440a, b	2.505	94.403	104.477	0.164
Mean Arterial pressure		T	94.522a, b	2.22	90.059	98.985	
	5	E	94.215a, b	2.472	89.245	99.186	0.023
		T	102.295a, b	2.19	97.892	106.699	
	10	E	94.450a, b	2.684	89.053	99.847	0.625
		T	92.613a, b	2.378	87.831	97.395	

Table 4- Comparison of Mean peripheral capillary oxygen saturation (SPO2) in both groups at different times

Dependent Variable		group	Mean (Percent)	Std. Error	95% Confidence Interval		p-value
Variables	Minute				Lower Bound	Upper Bound	
O2 saturation	0	E	96.408a, b	0.348	95.708	97.109	0.519
		T	96.094a, b	0.309	95.473	96.714	
	1	E	92.184a, b	0.749	90.679	93.69	0.004
		T	89.019a, b	0.663	87.686	90.353	
	5	E	93.685a, b	0.662	92.354	95.017	0.002
		T	90.608a, b	0.587	89.428	91.788	
	10	E	96.291a, b	0.5	95.285	97.297	0.843
		T	96.429a, b	0.443	95.538	97.321	

Seizure variables

Results in (Table 5) shows that, significant difference was seen in comparison between Four indexes, duration of seizures, Recovery time, Reach verbal response after seizure and apnea durations (Back spontaneous breathing after a seizure) in the two groups under investigation.

So that, seizure duration in the etomidate group was significantly higher than that of thiopental group. Patients' average EEG-recorded seizure time was 26.09±1.349 seconds with thiopental, and 36.49±1.52 seconds with etomidate. In addition, Patients' average Reach verbal response after seizure time was 13.89±12.42 seconds with thiopental, and 21.65±19.99 seconds with etomidate. The results demonstrated that the apnea durations (Back spontaneous breathing after a seizure) in the thiopental group (60.15±1.46 seconds) was significantly higher than that of etomidate group (48.80±1.64 seconds). In addition, investigation into difference mean of Recovery time showed a significant difference between the groups. The results demonstrated that the Recovery time in the thiopental group (34.24±0.99 minutes) was significantly higher than that of etomidate group (41.07±0.88 minutes).

However, no significant difference was seen in comparison between variable, full consciousness after seizure in the groups under investigation, so that, incidence of full consciousness after seizure was similar in conclusion. Patients' average full consciousness after seizure time was 27.91±1.88 seconds with thiopental, and 28.27 ±1.67 seconds with etomidate.

Table 5- Comparison of Effective indicators of the seizure and recovery between two groups.

Dependent Variable	group	Mean (Seconds or minutes)	Std. Error	95% Confidence Interval		p-value
				Lower Bound	Upper Bound	
duration of seizures	E	36.491a, b	1.522	33.43	39.551	0
	T	26.099a, b	1.349	23.388	28.811	

Table 5- Comparison of Effective indicators of the seizure and recovery between two groups (Continued).

Dependent Variable	group	Mean (Seconds or minutes)	Std. Error	95% Confidence Interval		p-value
				Lower Bound	Upper Bound	
Reach verbal response after seizure	E	21.657a, b	0.829	19.99	23.324	0
	T	13.896a, b	0.734	12.42	15.373	
apnea durations	E	48.800a, b	1.647	45.488	52.112	0
	T	60.157a, b	1.46	57.222	63.092	
Full consciousness after seizure	E	27.919a, b	1.888	24.123	31.715	0.894
	T	28.270a, b	1.673	24.906	31.633	
Recovery time	E	34.245a, b	0.998	32.238	36.252	0
	T	41.071a, b	0.885	39.293	42.85	

Complications of anesthesia drugs

In our study, based on statistical analysis, using etomidate and thiopental, no adverse side effects including headache, cough and laryngospasm were observed. But, we observed that some patients experienced nausea and vomiting, muscular pain, pain at injection site and myoclonus.

Results (Table 6), 24 of the patients having received etomidate complained Pain at injection site compared to only four 4 patients in thiopental group ($p > 0.05$). Similarly, the frequency of nausea and vomiting, and myoclonus in the etomidate group compared with thiopental most occurred in patients., such that respectively, myoclonus and vomiting was determined in 28 and 7 patients in etomidate group and 5 and 1 patients in thiopental group.

Meanwhile, there was muscular pain in both the groups and difference was statistically significant ($p < 0.005$). In this case, this complication was more in thiopental group (13 patients) than etomidate group (5 patients).

Table 6- Comparison of Complications of anesthesia drugs between two groups.

Variables	Etomidate	Thiopental	p-value
	Number - (percentage)	Number - (percentage)	
Headache	4-(6.25%)	4-(6.25%)	F=.646
Cough	4-(6.25%)	4-(6.25%)	F=.646
Laryngospasm	1-(1.56%)	1-(1.56%)	F=.754
nausea and vomiting	7-(10.94%)	1-(1.56%)	F=.026
Muscular pain	5-(7.81%)	13-(20.3%)	0.01
Pain at injection site	24-(37.5%)	4-(6.25%)	0
Myoclonus	28-(43.75%)	5-(7.81%)	0

Discussion

Anesthetic recovery in ECT is a very important issue with practical implications for psychiatrists who work directly with ECT and for practitioners who prescribe it. The more comfortable the treatment, the better will be the patients' compliance and satisfaction.

With these goals, in this study the effects of intravenous injection of etomidate and thiopental, on hemodynamic parameters (the heart rate, mean arterial blood oxygen saturation, mean arterial pressure, systolic and diastolic pressures) and seizure variables (seizure duration, respiratory arrest, verbal response after seizure, full consciousness after seizure and recovery after electroconvulsive therapy were investigated) and complications of anesthesia drugs (headache, cough, laryngospasm, nausea and vomiting, muscular pain, pain at injection site and myoclonus).

The results of this study in which hemodynamic response to anesthesia induction in ECT was evaluated with the use of thiopental and etomidate, demonstrated that a significant difference between the groups in terms of using etomidate and thiopental in measuring mean arterial blood pressure at 5th, minute after ECT, Diastolic blood pressure at 5th, minute after ECT, heart rate at 1th, minute after ECT, arterial blood oxygen saturation 1 and 5 minutes after ETC. In all cases, the use of etomidate compared with Thiopental has a comparative advantage is.

According to the results, in any of the groups, the complication bradycardia and Tachycardia was not observed. However, in our study, we observed that thiopental caused significant hypoxia, at 1 and 5 minute after ECT in comparison to etomidate.

Induction of anesthesia is associated with hemodynamic variation of mild to moderate degree depending upon many factors. In our study, it was shown, that in cases using etomidate, compared with thiopental in ECT, its subsequent hemodynamic changes which usually occur after ECT reduces. The hemodynamic stability observed with etomidate may be due to its unique lack of effect on the sympathetic nervous system and on baroreceptor functions [25].

Mayer et al. [26] and Wu et al also concluded that etomidate preserve hemodynamic stability during anesthesia. Etomidate does not have its limitation in normotensive patients for its hemodynamic peculiarity. In various studies, etomidate shows less cardiovascular depression and minimize use of vasopressor agents than other induction agent in sepsis and critically ill patients. Although etomidate can cause adrenal insufficiency in these patients in postoperative period [27].

Based on our results, the etomidate in the main parameters of anesthesia management including duration of seizures, apnea durations and recovery time has a comparative advantage compared with thiopental.

Very little is documented on clinical studies that correlate ECT effectiveness and seizure duration. There is evidence that supports the direct relationship of seizure duration and the effectiveness of ECT. It was thought that measuring the seizure duration and the knowledge of measuring such parameters can help explain its therapeutic effect. There has been research which suggests that motor seizures of less than 15 seconds in duration do not exhibit tonic-clonic phases and are ineffective in treatment [28].

Some of the studies in past years found a direct relationship between total seizure duration during a course of treatment and patient response to ECT [29].

However, the minimum times required for seizure for electroconvulsive therapy in both groups were created.

In addition, two drugs used in this study showed a very short time for recovery, comparative advantage was with etomidate.

A prospective study of a sample of male patients hospitalized at the Seventh Psychiatry Clinics of the Bakırköy Teaching Hospital for Psychiatry, Neurology, and Neurosurgery who were treated with ECT was investigated prospectively.

The effects on cardiovascular system parameters (heart rate, blood pressure, and blood oxygenation), seizure variables (duration and intensity of seizure), and recovery variables were recorded at every session, on prespecified time points, and the findings of the first session were used in this evaluation. In addition, clinical responses to treatment were evaluated with tests of cognitive functions before and after a course of ECT. Adverse effects were recorded.

A study conducted in 2015 by Canbek et al. Suggests that, there were no significant differences among the groups in terms of effects on cardiovascular system variables, seizure variables, and cognitive functions. The clinical response to ECT was good in all groups, without any significant differences [30].

But our results are confirmed in other studies, such that, in a retrospective chart review, Saffer and Berk (1998) compared etomidate with thiopental and found that etomidate was associated with significantly longer seizure duration [31].

In a study by Conca Et al, in 2003, in 13 patients, the paradigm of a single intra-individual crossover anesthesia during maintenance ECT was selected. Furthermore, significant differences in motor seizure duration and EEG seizure duration were observed. Our results confirm previous findings and reveal that after etomidate the quality of seizure can be improved only in terms of duration [32].

In addition, the results showed that, the side effect of etomidate is more than thiopental, such that, in patients receiving premedication in anesthesia, induction with etomidate, myoclonus, nausea and vomiting and pain at injection site incidence has been reported.

Etomidate is a short acting intravenous unaesthetic agent used for induction of general anesthesia. It can evoke myoclonus movements as a side effect in unpremedicated patients during induction. Although myoclonus does not impart any deleterious effect on patients as it is usually seen when the patient is already in a hypnotic state, it may interfere with the clinical evaluation of the depth of anesthesia so the patient is administered additional doses of inducing agent to combat the movements thus prolonging the recovery or impairing hemodynamic stability. Pretreatment of butorphanol and fentanyl in combination with intravenous midazolam can reduce the incidence as well as severity of etomidate-induced myoclonus movements [33].

It should be noted that despite, little research done on the use of etomidate in ECT, previous studies have reported the incidence of myoclonus with etomidate. As it was found in a study by Reves and Glass (2005), besides providing good cardiovascular stability, etomidate may also cause nausea and vomiting, injection pain, myoclonus and side-effects on the endocrine system [34]. The study results are similar to our expectations.

According to our PubMed/Ovid/Research Gate search, only a few articles have been published that compared these two anesthetics in ECT treatment. Which is referred to in various sectors? However, results of another study are in contrast with our findings.

A randomized double-blind study by Zahavi et al, compared the effects of propofol, etomidate and thiopental in ECT, thiopental might be the proper medication for induction in ECT when other medical considerations allow its use. We hope that this study will help medical professionals to choose the best anesthetic for each patient [35].

Conclusion

Etomidate is better for its hemodynamic stability and seizure variables over thiopental along with less incidence of pain on injection. However, the side effects of etomidate are more than thiopental and care should be taken with regard to this. (Drawback: Etomidate compared with thiopental had a higher incidence of myoclonus, pain at injection site and nausea and vomiting.). Thus, etomidate appears to be a suitable alternative induction agent for ECT anesthesia.

Ethical Issues

Ethics committee approval was received for this study from Ethics Committee of Isfahan University of Medical Sciences (2016/06). In addition, written informed consent was obtained from patients who participated in this study.

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