



Hemodynamic Changes following Anesthesia Induction and LMA Insertion with Propofol, Etomidate, and Propofol + Etomidate

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ABSTRACT

Introduction: LMA is a simple supra-laryngeal device which is used to establish and maintain airway. Despite the common use of the LMA, there are no optimal methods for induction of anesthesia that can guarantee a proper insertion. The purpose of this study is comparing three methods of induction of anesthesia (Propofol, Etomidate, Propofol+Etomidate) in the hemodynamic stability after LMA insertion in elective surgeries.

Methods: A total of 90 patients with ASA classes I and II undergoing elective surgeries were randomly allocated into one of the following three groups. Before anesthesia induction, all patients were premedicated. Anesthesia induction methods included: Group P (propofol 2.5 mg/kg), Group E (etomidate 0.3 mg/kg) and Group P+E (propofol 1 mg/kg plus etomidate 0.2 mg/kg). Heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were measured before induction and 30 seconds after induction. Apnea time is recorded in all patients. Number of attempts to laryngeal mask insertion, ease of placement, were compared in three groups.

Results: There was no significant difference between demographic data and BIS, SaO₂, Etco₂ associated diseases, in three group ($P>0.5$).

There is significant difference in hemodynamic (Systolic, diastolic and mean blood pressures) changes between group 1 in comparison with group 2 and group 3. HR was significantly lower in group 1 than group 2 ($P=0.16$). There was significant difference in the number of attempts and ease of LMA insertion between group 2 in comparison with group 3 and group 1. The duration of apnea in group 2 was a (8.67± 6) min, where as it was (18.10±6.25) min in group 1 and (12.03±6.4) min group 3.

Conclusion: Etomidate plus propofol is an effective and alternative to propofol and etomidate for facilitating LMA insertion with the added advantage of lack of cardiovascular depression.

Introduction

Airway management and patient safety have always been of great importance for physicians of both modern and ancient medicine while numerous devices and methods have been devised to fulfill this goal.^{1,2} Laryngeal Mask Airway (LMA) is a simple supraglottic device which is placed without requiring direct laryngoscopy. It is an appropriate device for maintaining airway in both elective and emergency surgeries either in adults or in children. Several methods have been introduced for LMA insertion while no standard anesthesia induction method has been proposed to guarantee a proper placement of the device.^{3,4} LMA is a very safe device with the least complications.⁵ The most frequent anesthetic used for LMA placement is propofol which is widely used in out-patient surgeries due to its associated low postoperative nausea and vomiting

rate.^{6,7} The recommended dose of propofol for induction is 1-2.5 mg/kg which not only is associated with desired jaw relaxation but also prohibits reflexes such as coughing or bucking following LMA insertion. On the other hand, it is of some unwanted complications such as hypotension, bradycardia and prolonged apnea. With an elimination half-life of 4-7 hours, propofol is distributed rapidly in the circulation and enter central nervous system. Some of the complications of the propofol include pain on injection site, cardiovascular depression and probability of the infection due to its combination. When administered alone for LMA insertion, propofol could be associated with undesirable complications including coughing, gag reflex and laryngospasm.⁸ Numerous pharmacological agents and combinations have been introduced to decrease the hemodynamic instability throughout anesthesia.^{9,10}

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Etomidate is one of the IV anesthetics which are used alone or in combination with other anesthetics for anesthesia induction; it also has been used for anesthesia maintenance in different contexts.¹¹ However, it is mostly used in the cardiac patients in whom the risk of cardiovascular instability following the administration of other IV anesthetics such as propofol or thiopental cannot be underestimated. Etomidate is of a rapid onset and emergence from anesthesia and it is not associated with histamine release.¹² In addition, it has sedative and hypnotic characteristics with no analgesic effects.^{13,14} It provides a proper condition for LMA insertion in combination with fentanyl and mini-doses of succinylcholine; however, single administration of etomidate can cause nausea, vomiting, agitation and cortisol suppression. The main objective of this study was to compare the efficacy of three different anesthesia induction approaches [propofol (P), etomidate (E), propofol + etomidate (P+E)] in maintaining cardiovascular stability following LMA insertion in elective surgeries.

Materials and Methods

In a double-blind randomized clinical trial, 90 patients (18-70 years old; ASA class I and II) scheduled to undergo elective surgeries were studied in three equal groups (n=30). The study was conducted in Imam Reza Hospital, Tabriz, Iran in a period of 12 months from Jan 2011 to Jan 2012. Based on the literature, to discover a 10 unit change in HR/BP ($\alpha=0.05$, $\beta=0.2$ and power=0.8) sample size of 90 was considered. Patients were randomly divided into three groups using Randomly Permuted Blocks and an online software (<http://www.randomization.com>). Inclusion criteria were patients with ASA class I or II. Exclusion criteria were existence of a considerable pathology in the larynx or pharynx, mouth opening less than 2.5 cm, bronchial asthma, cardiovascular diseases and Mallampati scores of 3-4. Prior to anesthesia induction, all patients received 6 mL/kg of normal saline 0.9%. The anesthesiologists administering the medications and inserting the LMAs were unaware of the content and quantity of the used medications as they were prepared by the third anesthesiologist. All patients received fentanyl 2 microgram/kg IV, midazolam 0.025 mg/kg IV and lidocaine 1 mg/kg IV. Later, group P received propofol 2.5 mg/kg IV, group E received etomidate 0.3 mg/kg IV and group P+E received propofol 1 mg/kg IV and etomidate 0.3 mg/kg IV which was mixed in a 10 mL syringe. The volume of the medications and the speed of the injection (10 seconds) were equal in all three groups. Prior to induction and 30 seconds after induction hemodynamic variables were recorded. Later, 60 seconds after loss of consciousness, which was confirmed by inability to reply to verbal commands and loss of eyelash reflex, LMA was inserted by the second anesthesiologist. Proper placement of the LMA was approved by chest expansion and capnography. Following successful LMA insertion, anesthesia was

maintained by isoflurane 1-1.5% and an equal mixture of O₂-N₂O (6 L/min). In cases with apnea, manual ventilation was continued. In all three groups, blood pressure, heart rate, pulsoxymetry and capnography values were recorded and compared. The obtained data were compared and presented as Mean±SD, frequency and percentage. Categorical variables were evaluated using contingency tables and Chi-square or Fisher's Exact test. To compare the quantitative variables, repeated measures analysis was used. $P \leq 0.05$ was considered statistically significant.

Results

Demographic characteristics of the patients in three groups have been presented in Table 1. No significant difference could be observed regarding demographic characteristics of the patients in three groups. Hemodynamic changes (SBP, DMP, MAP and HR) at different stages of anesthesia in all groups have been presented in Table 2.

Discussion

The current study has been conducted on the hemodynamic stability in elective surgeries. In our study, decrease in systolic blood pressure, diastolic blood pressure, and mean arterial pressure were significantly more frequent in group P compared with other groups. Hemodynamic stability was more visible in groups E and P+E. Etomidate is a hypnotic of choice in most cardiac diseases and also an excellent option to be used in combination with other anesthetics.¹¹ Uzun *et al.*, in a study on 50 patients, compared etomidate and remifentanyl with propofol in LMA insertion.¹⁵ They reported decrease in MAP in 25 patients having received propofol 2.5 mg/kg and remifentanyl 0.05 mg/kg in comparison with the patients having received etomidate 0.3 mg/kg and remifentanyl 0.05 mg/kg. They later concluded that etomidate would provide a better hemodynamic stability.

Propofol with the dose of 2.5 mg/kg is accompanied by appropriate relaxation and avoidance of complications such as coughing and bucking following LMA insertion. This, however, could be associated with undesirable decreased blood pressure, bradycardia, and prolonged apnea. Combination of etomidate with propofol would not only decrease the required dose of both medications but also provide us with the benefits of both agents including more

Table 1. Demographic characteristics of the patients in three groups

	Group P	Group E	Group P+E	P
Sex				
Male	24	26	21	0.282
Female	6	4	9	
ASA				
Male	27	29	28	0.585
Female	3	1	2	
Age	40 ± 16	38.5 ± 12.5	40.4 ± 16.5	0.865
Weight	71.5 ± 13	74 ± 9.9	73.5 ± 12.3	0.608

Table 2. Hemodynamic changes (SBP, DMP, MAP and HR) at different stages of anesthesia in all groups

	Groups	Before anesthesia	After anesthesia	P	Before LMA	After LMA	P
SBP	P	122.7 ± 19.2	104.6 ± 22.9	0.000	102.5 ± 14.4	99.4 ± 12.9	0.07
	E	131 ± 18.2	121.7 ± 14.9	0.326	111.1 ± 23.8	109.4 ± 15.8	0.231
	P+E	129.1 ± 16/5	117.4 ± 18.5	0.023	110.2 ± 14.5	110.8 ± 19.2	0.723
DBP	P	76.2 ± 10.1	64.7 ± 12.3	0.000	63.5 ± 14.1	59.4 ± 12.8	0.002
	E	80.5 ± 9.3	74.1 ± 9.2	0.010	69.7 ± 10.2	65.9 ± 11.3	0.000
	P+E	78 ± 11.1	72.2 ± 12.5	0.001	66 ± 12.7	65.8 ± 17	0.022
MAP	P	90 ± 10.89	77.4 ± 12.3	–	75.2 ± 15.1	73.3 ± 17.6	0.307
	E	97.6 ± 9.7	89.6 ± 11.4	–	84.3 ± 10.7	78.7 ± 8.6	0.020
	P+E	95.4 ± 12.8	86.5 ± 12	–	80.3 ± 12.2	80.7 ± 17.6	0.015
HR	P	78.2 ± 13.9	73.2 ± 13.3	0.019	70.9 ± 11.3	69.6 ± 11.5	0.000
	E	80.4 ± 18.7	82.4 ± 15.3	0.035	73.6 ± 14.6	66.8 ± 10.7	0.000
	P+E	82.9 ± 18.9	81 ± 17.2	0.563	71.8 ± 15.9	73.7 ± 12.1	0.007

Data are presented as Mean ± SD.

stable hemodynamic, enough muscle relaxation required for LMA insertion and better airway quality. Etomidate administration could lead to agitation and postoperative nausea and vomiting which could be eliminated by adding propofol. In our study, heart rate decreased significantly in group P compared with group E. However, no difference could be observed comparing groups P and P+E. MAP was more stable in groups E and P+E compared with group P while the difference between groups E and P+E was not significant highlighting the hemodynamic stability in these groups following decreasing the required propofol dose and addition of etomidate as an adjuvant. In a study, the effect of P, E and P+E were studied on 90 patients concluding that most hemodynamic variable were more stable in P+E and MAP was decreased more significantly in group P compared with other groups.¹⁶ The findings of this study are in line with ours; the most frequent decrease in blood pressure occurs in the group P while groups E and P+E are associated with the least changes in blood pressure. However, the combination ratio of 1:1 was used in their study; unlike our study in which the combinations were used on dose-basis.

The major finding of the present study is that P+E provides a more stable hemodynamic in comparison with either P or E. Hemodynamic stability is considered a prominent characteristic of a proper anesthetic; propofol reduces blood pressure and heart rate but P+E provides a desirable stable hemodynamic.

Conclusion

Quality of the maintained airway and LMA insertion was different in all groups. P+E is superior to E regarding the number of the attempts and insertion ease and considering the fact that it provides appropriate condition for LMA insertion, it could replace other agents.

Ethical issues: This study was reviewed and confirmed by the ethics committee of Tabriz University of Medical Sciences.

Conflict of interests: The authors declare no conflicts of interest.

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