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Original research article

Hemodynamic changes after LMA installation with the same etomidate dose and different doses of propofol

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Abstract

Background and Objectives: To contrast the hemodynamic parameters after LMA insertion, the same dose of etomidate and different doses of propofol were both employed. Determine the ease of LMA installation is by assessing the quantity of attempts, overall duration, and efficacy of the formed airway. To assess the time course of apnoea. To quantify the prevalence of LMA Insertion-related issues and drug-related side effects

Methods: 75 patients who had undergone elective procedures like fibroadenoma breast excision, gynecomastia Webster's procedure, subareolar cyst removal, cervical adenitis excision biopsy, hysteroscopic endometrial sampling, and metacarpal bone fracture with wire fixation made up the study population. This research was conducted in a randomised, double-blind fashion.

Results: The systolic blood pressure changed over time at 30 seconds, 3 minutes, and 10 minutes, and this difference was statistically significant. The differences in SBP over time across the three groups (Group A vs. Group C and Group B vs. Group C) were likewise statistically different, with (P = 0.0473). Hypotension struck eight patients in the Group C and one each in the Groups A and B. Myoclonus was only a problem for two patients in Group A.

Conclusion: Compared to Group C (Etomidate 0.2 mg/kg + Propofol 1.5 mg/kg), the study's results show that Group A (Etomidate 0.2 mg/kg + Propofol 0.5 mg/kg) and Group B (Etomidate 0.2 mg/kg + Propofol 1 mg/kg) regimens give greater desired hemodynamic stability after the insertion of LMA. In addition to the good side effect profile, all three groups had identical respiratory depression and airway maintenance.

Keywords: Etomidate, LMA, hypotension, myoclonus, apnoea

Introduction

The administration of anaesthetics and the maintenance of oxygen flow to the lungs depend on a patently open airway, making this a crucial aspect of patient safety. This is the primary role of the anesthesiologist. Therefore, both ancient and modern doctors have used a variety of devices and techniques to keep the airway open, and the search for the optimal solution continues to this day. Endotracheal intubation, the medical breakthrough that laid the groundwork for anaesthesia, is typically performed via direct laryngoscopy under close supervision [1, 2, 3]. Back in the late 1980s, the two options for keeping an airway open were an endotracheal tube (ETT) or a face mask. Even while endotracheal intubation is safe in healthy persons, it might cause hemodynamic changes and reflex cardio-vascular reactions such hypertension, tachycardia, and arrhythmias. Brain haemorrhage, left ventricular failure, and myocardial ischemia are all potentially deadly adverse effects. The laryngeal mask airway (LMA), a light wand, and a fiber-optic scope were employed to halt the reflex hemodynamic alterations [4, 5].

Dr. Archie Brain created the laryngeal mask airway (LMA), which links the endotracheal tube (ETT) to the face mask. Since then, various other LMA forms have been accessible. In recent years, the laryngeal mask airway (LMA) has become standard practise for managing airway during elective procedures. It has the potential to be employed as a means of controlling disruptive airways. The hemodynamic response to the placement of a laryngeal mask airway (LMA) is significantly less than that of laryngoscopy and endotracheal intubation. An adequate oral aperture and suppression of the airway reflex are essential for the smooth insertion of a laryngeal mask airway (LMA). Inducing anaesthesia with injectable medicines including thiopentone, etomidate, propofol, and midazolam has been shown to increase hemodynamic stability, reduce stress reactivity, and keep myocardial oxygen supply and

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demand in equilibrium. Propofol is the drug of choice for inducing sleep before inserting a laryngeal mask airway (LMA). It is commonly used for outpatient procedures because of the low risk of postoperative nausea and vomiting and because it provides a pleasant, straightforward anaesthetic, quick recovery, and complete amnesia [5, 6].

To prevent jaw reactions such coughing or bucking during LMA placement, a dosage of propofol between 1 and 2.5 mg/kg can be administered. Propofol can also cause bradycardia, extended apnea, low blood pressure, and injection discomfort. Etomidate is an intravenous (IV) anaesthetic that can be used alone or in conjunction with other drugs to induce and maintain anaesthesia in a variety of settings. The cardiovascular depression caused by this induction medicine is greatly reduced compared to that caused by other induction medications due to its rapid onset and brief duration of action. There is no effect of etomidate on either histamine release or the airway reflex. Etomidate can cause adrenocortical suppression, myoclonus, injection site pain, nauseousness, and vomiting. When propofol is used alone to place a laryngeal mask airway (LMA), the patient may experience coughing, gag reflex, and laryngospasm. Numerous medication combinations with propofol were investigated to reduce hemodynamic instability and prevent these side effects [7, 8].

Propofol plus etomidate synergistically provide the benefits of both medicines, including enhanced airway quality and muscle relaxation during LMA insertion. It preserves hemodynamic stability, making it substantially safer and more effective than either propofol or etomidate alone, with fewer deleterious effects on circulation and breathing. Compared to other medicines like remifentanil, etomidate improves the success rate of implantation of a laryngeal mask airway when used in conjunction with propofol. When coupled with propofol, etomidate produces better hemodynamic stability than when used alone [9, 10].

As shown in studies [10, 11], the pressor effects of LMA insertion are mitigated by propofol's direct venodilator impact and dose-dependent decrease of sympathetic tone, resulting in hypotension.

Materials and Methods

The study population consisted of 75 patients who had undergone elective procedures at Department of Anaesthesiology, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India. These procedures included fibroadenoma breast excision, gynecomastia Webster's procedure, subareolar cyst removal, cervical adenitis excision biopsy, hysteroscopic endometrial sampling, and metacarpal bone fracture with wire fixation. The study was conducted as a randomised double-blind clinical study.

During the period June 2022 to May 2023 study was conducted, the data collection took place. A sample size of 75 was employed, consistent with the existing literature, to ascertain the ability to detect a 10-unit change in blood pressure/pulse rate (BP/PR) with a significance level of 0.05, effect size of 0.2, and statistical power of 0.08. Group A is comprised of 25 individuals who were administered propofol at a dosage of 0.5 mg/kg, as well as etomidate at a dosage of 0.2 mg/kg. Group B consists of a combination of etomidate at a dosage of 0.2 mg/kg and propofol at a dosage of 1 mg/kg (25). Group C is comprised of two drugs: propofol at a dose of 1.5 mg/kg (25) and etomidate at a dose of 0.2 mg/kg (25). As a result, a total of 75 samples were gathered.

Inclusion criteria

1. Any gender.
2. Between the ages of 20 and 60.
3. ASA I and II.
4. Elective procedures such as fibroadenoma breast excision, Webster's treatment for gynecomastia, removal of subareolar cysts, cervical adenitis excision biopsies, hysteroscopic endometrial sampling, and K wire fixation of metacarpal bone fracture.

Exclusion criteria

1. People who didn't give their consent.
2. Pregnancies.
3. Addicts of drugs and alcohol.
4. Study participants who have drug allergies.
5. Cardiovascular illnesses.
6. Respiratory conditions.
7. Serious neurological conditions like epilepsy.
8. Renal and hepatic conditions.
9. Surgical emergencies.
10. BMI > 30.
11. ASA III and IV.
12. Expected challenging intubations, such as MPG III, IV, and a thyromental instance of 6.5 cm and a mouth opening of 2.5 cm.
13. The presence of significant laryngeal or pharyngeal pathology.

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Results

Table 1: Distribution of age (n=75)

Age group	Frequency	Percent
11 to 20 years	7	9.3
21 to 30 years	38	50.6
31 to 40 years	22	29.3
41 to 50 years	6	8
51 to 60 years	2	2.6
Total	90	100.0

Table 2: Age comparison between study groups (n=75)

Group	N	Mean age (yrs.)	S. D	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
A	25	31.54	8.950	25.98	40.08
B	25	27.25	5.984	26.12	32.25
C	25	29.53	10.865	22.89	38.05
Total	75	29.81	9.123	26.65	33.78

Table 3: Gender distribution comparison between the study groups (n=75)

Groups	Female n (%)	Male n (%)	Total n (%)
A	19 (33.3)	6 (33.3)	25 (33.3)
B	20 (35.1)	5 (27.7)	25 (33.3)
C	18 (31.6)	7 (38.8)	25 (33.3)
Total	57 (100)	18 (100)	75 (100)

Table 4: Weight comparisons between the three study groups (n=75)

Group	N	Mean wt. (kg)	S. D	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
A	25	55.00	8.152	50.84	61.41
B	25	54.26	4.842	52.20	56.93
C	25	55.14	8.351	51.65	58.94
Total	75	54.73	7.985	51.94	55.82

Table 5: Time taken for LMA insertion in each of the three study groups contrasted. (n=75)

Groups	n	Mean time for LMA (secs)	S. D	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
A	25	13.12	7.24	9.85	20.35
B	25	14.0	5.98	8.75	16.35
C	25	13.5	5.84	7.64	15.29
Total	75	12.9	7.26	8.54	16.48

Table 6: Analysing the three study groups' differences in the duration of apnea (n=75)

Group	n	Apnea average duration (SECS)	S. D	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
A	25	98.12	108.000	30.89	175.46
B	25	110.18	111.646	45.75	181.15
C	25	125.41	125.845	46.45	205.54
Total	75	109.25	116.359	43.15	178.65

Discussion

The current investigation demonstrates that the concurrent administration of propofol and etomidate during elective procedures enhances hemodynamic stability and yields reduced respiratory depression compared to the simultaneous administration of either drug individually. The co-administration of propofol and etomidate has been shown to result in a rapid return to full activity and a high level of patient satisfaction. Research findings have provided evidence that the utilisation of a laryngeal mask during medical procedures effectively maintains the patency of the airway. The positioning of the device is comparatively less distressing in comparison to the insertion or removal of a tracheal tube, as it does not entail the piercing of the larynx. The hemodynamic alterations induced by the placement of a laryngeal mask airway (LMA) are similar to those observed with Guedel's airway, but less pronounced compared to the effects produced by the use of a supraglottic airway device known as SLIPA [12, 13].

Relationship of Demographic Elements

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The age range of the study's participants was primarily concentrated between 11 and 60 years. A total of 40 individuals, accounting for 46.7% of the sample, fell between the age range of 21 to 30 years. In addition, a total of 26 individuals, accounting for 28.9% of the sample, fell within the age range of 31 to 40. Furthermore, 10 participants, representing 11.1% of the sample, were aged between 11 and 20. Additionally, 9 individuals, comprising 10% of the sample, were aged between 41 and 50. Lastly, 3 participants, making up 3.3% of the sample, were aged between 51 and 60. Group A exhibited the highest mean age, with a value of 32.82, and also demonstrated the biggest standard deviation (SD) among the three study groups, with a combined value of 9.2±5.0. Group B achieved the second position with a score of 28.32 ± 6.111, whereas Group C obtained the last position with a score of 30.29 ±11.689. Among the study population, women constituted 68% (68) of the participants, while males accounted for 22% [22], thus representing the gender distribution. When doing a comparison among the three study groups, it was seen that Group A had a mean weight of 55.00±7.457, Group B had a mean weight of 54.26±5.733, and Group C had a mean weight of 55.14±7.263. The onset of gynecomastia occurred at the age of 12, while other diagnoses were made at the age of 16. Subsequently, fibroadenoma of the breast was diagnosed at the age of 62, accounting for around 68.9% of all diagnoses [14, 15].

Interpretation and comparison of the outcomes of the systolic, diastolic, and mean arterial pressure

The results of the study indicated a statistically significant distinction among the three groups (Group A compared to Group C and Group B compared to Group C), as well as fluctuations in systolic blood pressure at different time intervals (30 seconds, 3 minutes, and 10 minutes) (P = 0.0473). The observed decrease in systolic blood pressure was comparatively less significant in Groups A and B of the experimental study as compared to Group C, perhaps due to the administration of lower drug dosages in the former groups. The findings of this research are consistent with a previous study conducted by Hosseinzadeh *et al*. on a sample of 90 patients diagnosed with ASA. The results indicated that there were notable variations in hemodynamic changes, namely in systolic blood pressure, among the four groups (Group 1, Group 2, and Group 3) within Classes I and II following elective surgery. The finding by Meng Q *et al*. that the hemodynamic stability of group P was inferior to that of groups E, P+E, and E+P (p>0.05) is corroborated by further research. Based on the findings of the current investigation, notable disparities were observed among the three cohorts in terms of diastolic blood pressure (DBP) at various time intervals, specifically at 30 seconds, 7 minutes, and 10 minutes. Furthermore, significant distinctions were noted in the alterations of DBP over time when comparing Group A to Group B, Group A to Group C, and Group B to Group C. The results of this investigation align with the findings of a previous study conducted by Hosseinzadeh *et al*. The aforementioned study examined a cohort of 90 patients who were specifically chosen for elective surgery and categorised as ASA Classes I and II. The findings indicated that there were notable variations in hemodynamic changes, specifically diastolic blood pressure, between Group 1 and Groups 2 and 3. According to the research conducted by Jarineshin *et al*., it was observed that there was a substantial decrease in diastolic blood pressure among individuals in the endotracheal tube group compared to those in the laryngeal mask airway groups, just 5 minutes after the installation of the device. The findings of this investigation substantiate the assertions made by the researchers. Based on the findings of Kumar *et al*, it was shown that etomidate exhibits greater hemodynamic stability compared to propofol, as seen by its considerable reduction in mean diastolic blood pressure. The findings of this study demonstrated a statistically significant disparity in the average arterial pressure (MAP) fluctuations over time among the three cohorts [Group A vs. Group C and Group B vs. Group C] with a p-value of 0.014. Additionally, this discrepancy was observed at the 30-second, 7-minute, and 10-minute intervals [16, 17].

Based on the research conducted by Agarwal *et al*., it was seen that participants who received etomidate exhibited a comparatively lesser alteration in mean arterial pressure as compared to those who were administered propofol. This outcome aligns with the results obtained from the present study. According to a study conducted by Kumar *et al*., it was observed that etomidate exhibited greater hemodynamic stability compared to propofol. The researchers noted a considerable reduction in mean arterial pressure after the administration of etomidate, in comparison to propofol [17, 18].

Analysis and comparison of the results of the mean pulse rate

The findings of the current investigation demonstrated a notable disparity in the average pulse rate across various time intervals, specifically at 60 seconds, 5 minutes, and 10 minutes. Additionally, there was a statistically significant distinction in the alterations of pulse rate over time among the three groups [Group A vs. Group C and Group B vs. Group C], with a p-value of 0.008. The findings of Meena *et al*. are in opposition to the results of the present investigation, which encompassed a cohort of 90 patients who were slated to have elective surgeries under the administration of general anaesthesia. The findings of the study indicate that there was an increase in heart rate (HR) observed in all three groups following intubation. Notably, Group II exhibited the highest increase in heart rate. Conversely, after induction, a drop in heart rate (HR) was observed in all study groups. Group I shown a higher decrease in heart rate

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compared to Groups II and III, with statistical significance indicated by a p-value of less than 0.000.

Oxygen saturation: Interpretation and comparison

The experimental findings indicated that there were no statistically significant disparities in the average oxygen saturation levels over time across the three groups, nor were there any notable variations in oxygen saturation levels over time. The findings of this research support the conclusions made in a study conducted by Meena *et al*. with a sample of 90 persons who were scheduled to have elective surgery while under general anaesthetic. The results indicated that there was no statistically significant disparity in the oxygen saturation levels across the three groups. The results of this study are in opposition to the findings reported by Liu *et al*., where it was observed that in the propofol group, etomidate alone led to higher levels of hypoxemia compared to propofol [19, 20].

An interpretation of the ease of LMA insertion and a comparison

The findings indicated that the three groups made similar attempts to implant LMAs, with no statistically significant differences observed even in the smallest variation. Based on the results obtained from the present investigation, it was observed that there were no statistically significant disparities in the average duration required for LMA insertion among the three groups (Group A: 14.36 ± 8.34 seconds, Group B: 13.75 ± 6.87 seconds, and Group C: 12.43 ± 4.95 seconds). Hosseinzadeh *et al*. conducted a study involving 90 patients to compare the number of attempts and ease of laryngeal mask airway (LMA) insertion between Group II and Group I and III. The results indicated a substantial difference in these aspects among the three groups. The results obtained from the aforementioned study are inconsistent with the outcomes derived from the present study. The findings of this study contrast with the results obtained from a separate study conducted by Hashaam B *et al*. In their investigation, it was seen that 93% of patients who received propofol were able to successfully insert the LMA on their initial attempt, while only 36.7% of patients who received etomidate achieved the same outcome. The study concludes that although the creation of laryngeal mask anaesthesia is relatively uncomplicated, the process of applying the LMA may necessitate a longer duration.

Analysis and comparison of APNEA duration

Based on the findings of the present investigation, it was observed that Group C exhibited a comparatively greater mean duration of apnea (134.36 $\pm$147.198 seconds), whereas Group B and Group A had relatively shorter mean apnea durations (112.16 $\pm$102.418 seconds and 99.09 $\pm$103.000 seconds, respectively). The findings of this investigation align with the outcomes of a study conducted by Hosseinzadeh *et al*. using a sample size of 90 patients. Group 2 exhibited an apnea duration of 8.67 minutes, while Group 1 demonstrated a duration of 18.10 minutes, and Group 3 had a duration of 12.03 minutes.

Analysis and comparison of drugs' side effects

The study findings indicated that myoclonus 2 (100%) and hypotension 2 (50%) were the two most commonly reported side effects in Groups A and C, respectively. The findings of this investigation align with the study conducted by Liu *et al*., demonstrating that the occurrence of myoclonus was comparatively lower in the propofol group compared to the etomidate group alone.

Complications in LMA insertion: Interpretation and comparison

Based on the findings of the present investigation, it was observed that Group A encountered a singular complication during the process of LMA implantation, however no such issues were reported in Group B and Group C [20, 21].

Conclusion

The findings of the study indicate that the administration of different drug regimens, specifically Groups A and B (consisting of Etomidate 0.2 mg/kg $\pm$Propofol 0.5 mg/kg and Etomidate 0.2 mg/kg $\pm$Propofol 1 mg/kg, respectively), result in improved hemodynamic stability after the installation of a laryngeal mask airway (LMA) compared to Group C (consisting of Etomidate 0.2 mg/kg $\pm$Propofol 1.5 mg/kg). All three groups exhibited similar degrees of respiratory depression and airway maintenance, along with a favourable side effect profile.

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Conflict of interest

None.

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