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A Comparative study of sevoflurane and propofol for laryngeal mask airway insertion in adults.

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Abstract

Introduction: The laryngeal mask airway ensures better control of airway leaving the anesthesiologist's hands free and avoids the disadvantages of endotracheal intubation like pressor response, sore throat, croup, hoarseness postoperatively. Ideal induction agent for LMA insertion would provide loss of consciousness, jaw relaxation and absence of upper airway reflexes rapidly without cardiorespiratory compromise. **Materials and Methods**: A Comparative study of Sevoflurane and Propofol for laryngeal mask airway insertion in adults was done on 60 patients. The patients aged 18 to 60 years (ASA grade I and II) were randomized into two groups. Propofol 2 to 2.5 mg/kg was given in group P. Group S patients were induced with 8% Sevoflurane. Inj fentanyl 2µg/kg was given to both the groups after loss of verbal contact. Time taken for loss of eyelash reflex, loss of verbal contact, jaw relaxation and successful laryngeal mask airway insertion was compared. Also hemodynamic effects, ease of laryngeal mask airway insertion and side effects and complication were compared between the two groups. **Observations**: Time taken for Loss of verbal contact and loss of eyelash reflex were almost similar in both groups. Jaw relaxation had taken a longer time in Sevoflurane group (100.1 ± 7.4) seconds than Propofol group (88 ± 12.2) seconds with p value 0.0001 which was highly significant. With Sevoflurane group the LMA insertion has taken 116.3 ± 7.06 seconds while Propofol has taken 101.2 ± 13.2 seconds, with a P value 0.0001 which was significant. The number of attempts taken for LMA insertion in Propofol group (1.03± 0.18) was less compared with Sevoflurane (1.16 ± 0.37) but this was statistically not significant (p value 0.23). Systolic blood pressure showed no significant changes except at two minutes where the Propofol group showed a marked decrease (108.1±7.4) mmHg as compared to Sevoflurane (113.1 ± 9.4) mmHg with a significant p value (0.02). **Conclusion**: Sevoflurane took longer time as compared to Propofol for jaw relaxation as well as laryngeal mask airway insertion, but the hemodynamics was maintained better with Sevoflurane than Propofol. The quality, safety and reliability of Sevoflurane single vital capacity breath induction anaesthesia made it an alternative to intravenous Propofol for the insertion of LMA in adults.

Key Words: Laryngeal mask airway, Propofol, Sevoflurane, Induction

Introduction

The laryngeal mask airway is an ingenious supraglottic airway device that provides and maintains a seal around the laryngeal inlet for spontaneous ventilation and controlled ventilation at modest levels (<15cms of H_2O)[1]. It ensures better control over airway than the facemask, leaving the anesthesiologist's hands free and avoiding the disadvantages of endotracheal tube like pressor response of intubation, sore throat, croup, hoarseness postoperatively. Laryngeal mask provides an effective and simple solution to many difficult intubations. LMA insertion

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does not require muscle relaxants, laryngoscopy is avoided and hemodynamic changes are minimal[2].

Ideal induction agent for LMA insertion would provide loss of consciousness, adequate jaw relaxation and absence of upper airway reflexes rapidly without cardio respiratory compromise. Propofol with or without opioid is the induction agent of choice for laryngeal mask airway insertion because of rapid loss of consciousness, loss of laryngeal reflexes, adequate jaw relaxation, stable hemodynamics and overall its favorable recovery profile but is associated with pain on injection and cardiovascular and respiratory depression[3]. Sevoflurane a halogenated volatile anesthetic agent is non-irritating to the airways and induction with this agent is associated with a very low incidence of breath holding, coughing and laryngospasm. In addition, low lipid solubility allows a fast and smooth induction with predictably short recovery[4]. Sevoflurane as a single drug for the induction and maintenance of anesthesia would ease the transition period and lead to cost saving[5].

Ravikumar Koppula and Anitha Shenoy[3] compared the quality and ease of insertion of laryngeal mask airway following induction of anesthesia with either inhaled Sevoflurane 8% or i.v. Propofol 2.5mg/kg along with inj Fentanyl 2µg/kg and found that verbal contact and eyelash reflex lost faster with Sevoflurane but took similar times to jaw relaxation and clinical conditions for laryngeal mask insertion were equally good with both induction techniques. Goodwin[6] compared Sevoflurane 8% & 12%in adults and observed that both provided stable cardiovascular profile with no increase in respiratory complications. Time of loss of eyelash reflex was not significantly different between two concentrations of Sevoflurane. Priya V et al[7] compared conditions for LMA insertion after induction of anesthesia with either inhalation of Sevoflurane or i.v. Propofol and found that induction was more rapid with Propofol and excellent conditions for LMA insertion were obtained with Propofol. Ganatra SB, D'mello J, Butani M, Jhamnani P[8] compared Sevoflurane 8% and Propofol 2.5mg/kg with Fentanyl1µg/kg as co-induction agent and found that time taken from induction to successful laryngeal mask insertion was significantly shorter with Propofol compared with Sevoflurane. Systolic and diastolic arterial pressures were significantly lower in the Propofol group. So this study was designed to compare the intubating condition, efficacy, hemodynamic effects, the ease of insertion and side effects of induction with propofol and sevoflurane for laryngeal mask airway insertion.

Materials and methods

A prospective study conducted on 60 ASA grade I &II patients, between 18 to 60 years weighing 40 to 60 kgs of either sex undergoing minor surgical procedures under general anesthesia were randomized into two groups of 30 each i.e. Group S, Sevoflurane group and Group P, Propofol group. Patients with morbid obesity, known allergy to propofol or volatile anesthetics, impaired ability to communicate (e.g- confusion, poor hearing), requiring endotracheal intubation, smokers, ASA III, IV and V were excluded from the study.

An informed written consent was taken from all patients and nil per oral status was maintained for six hours. Patients were given tab. Ranitidine 150mg and tab ondansetron 4mg the night before surgery. On arrival to operation theatre inj glycopyrrolate 0.2 mg was administered intravenously to all patients. Patients were preoxygenated for 3min with 100% oxygen using a fresh gas flow of 6l/min. Baseline vital parameters like heart rate, NIBP, SPO2 were recorded. Group P received propofol 2 mg/kg body weight and increments of 10mg of propofol were given if necessary. Group S received sevoflurane 8% and were instructed to take vital capacity breath and hold it as long as they could. The point of start of injection of

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Propofol or introduction of Sevoflurane 8% was considered as starting point of induction. Loss of verbal contact was considered as the desired endpoint for induction in both techniques which was assessed by the response to calling out the patient's name. Fentanyl 2µg/Kg was given i.v. to all patients immediately after loss of verbal contact. Then the time of loss of eyelash reflex was noted. After this jaw relaxation was assessed and if not adequate, it was reassessed every 15 seconds. Once jaw relaxation was adequate, a standard Laryngeal mask airway (LMA size #3 for women and #4 for men) lubricated with lignocaine jelly on its posterior surface was inserted using Brains method.

The following data was recorded.

1. Time taken from start of induction to loss of verbal contact, loss of eyelashreflex, Jaw relaxation and successful LMA insertion.
2. Number of attempts of LMA insertion.
3. Total dose of requirement of Propofol in each patient.
4. NIBP, HR and SPO2 were monitored from beginning of induction upto 5 minutes of induction.

The conditions of insertion of LMA were graded by observer on a three point scale using 6 variable e.g. jaw relaxation, ease of LMA insertion, coughing, gagging, laryngospasm and patient movement. Overall conditions for insertion of LMA were assessed as excellent, satisfactory or poor on basis of total score obtained bysumming up the individual scores of each component. Maximum score of 18 (Excellent -18, satisfactory - 16-17, poor ≤16).

After insertion of LMA, anesthesia was continued with 66% N_2O + 33% O_2+sevoflurane. Intermittent positive pressure ventilation was employed if necessary. Any complication was noted and appropriately treated.

Statistical Analysis:

The Excel and SPSS (SPSS Inc, Chicago) software packages were used for data entry and analysis. The results were averaged (mean ± standard deviation) for each parameter for continuous data and numbers and percentage for categorical data presented in table and figure. The results are analyzed by Student's t test, Mann Whitney test (Non parametric test) and chi square test. In all the above tests a p value of less than 0.05 was accepted as indicating statistical significance.

Observation

Table. 1 Demographic profile

Parameters	Propofol	Sevoflurane	P-value
Age	34.86±10.5	37.06±10.7	0.21
Sex (Male)	12 (40%)	14 (46.6%)	P value ≥0.5
(Female)	18 (60%)	16 (53.3%)	
Weight	53±6.1	55.8±7.9	0.12

The above table showed that the age, sex distribution and the weight were comparable between the two groups.

Table .2 Comparison of number of attempts at laryngeal mask airway insertionfor successful placement.

Group	N	Mean of no of attempts	Std. Deviation	'p' value
Propofol	30	1.03	0.18	0.2347
Sevoflurane	30	1.16	0.37	

The number of attempts for LMA insertion was compared using unpaired t test and was not

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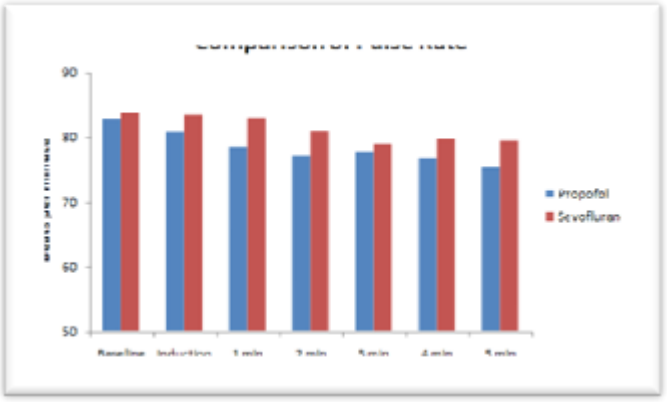
significant (p value 0.23).

Table 3: Comparison of time for laryngeal mask airway insertion between two groups.

	Propofol			Sevoflurane			P value
Loss of verbal contact	N	Mean	SD	N	Mean	SD	
	30	49.3	7.9	30	50.6	6.9	0.57
Loss of eyelash Reflex	30	73.5	12.8	30	74	8.34	0.85
Jaw relaxation	30	88	12.2	30	100.1	7.48	<0.0001
LMA insertion	30	101.2	13.2	30	116.3	7.06	<0.0001

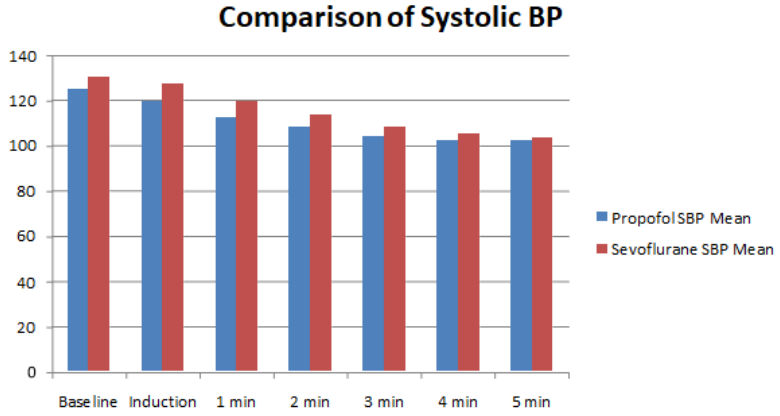
Sevoflurane took longer time for induction and LMA insertion. Time taken for loss of verbal contact and eye lash reflex showed no statistically significant difference between the two groups. Jaw relaxation was earlier in propofol group (88± 12.2) as compared to sevoflurane group (100.1± 7.48) with a p value (<0.0001) which was highly significant and LMA insertion was earlier in propofol group (101.2± 13.2) as compared to sevoflurane group (116.3± 7.06) with a p value (<0.0001) which was highly significant.

Figure 1: Comparison of pulse rate between Propofol and Sevoflurane groups



The heart rate at baseline and at the time of induction was not statistically significant. Heart rate at one minute after induction showed a fall with Propofol (p value 0.03) which was statistically significant. No statisticallysignificant difference was noted at 2minutes, 3 minute, 4 minute and 5 minutes after induction.

Figure 2: Comparison of SBP between Propofol and Sevoflurane groups



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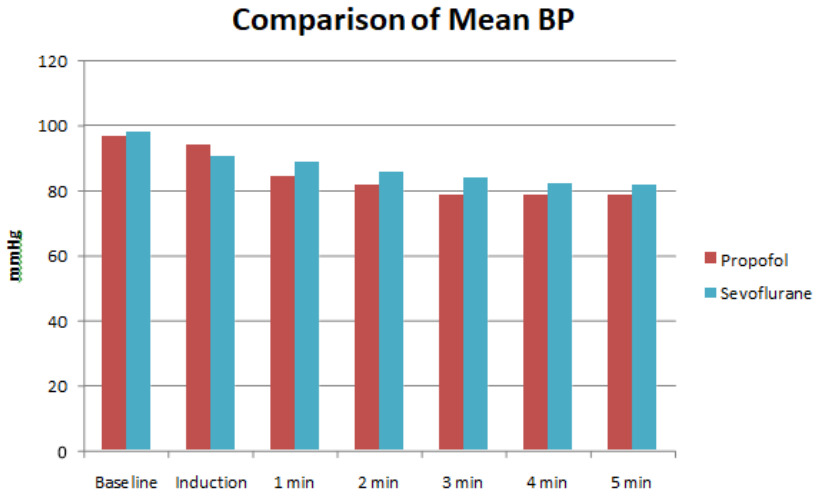
There was statistically significant difference (p value 0.02) in systolic blood pressure at two minute when compared between the two groups. A fall in the systolic blood pressure in group P (108.13 ± 7.94) was noted when compared to group S (113.3 ± 9.44). There is no statistically difference between the two groups at 3 minutes, 4 minutes and 5 minutes.

Figure 3: Comparison of Mean Arterial pressure betweenPropofol and Sevoflurane groups.



There was statistically significant difference in mean arterial blood pressure at one minute (p value 0.002).The propofol group (84.4± 5.7) had a larger decline in MAP as compared to sevoflurane (88.8 ± 6.2). At two minute P group (81.6 ± 4.3) had a greater decrease as compared to sevoflurane (85.6± 5.1) with a p value 0.004, whichis highly significant. At three minutes P group (78.5± 6.3) also had a greater decrease as compared to sevoflurane(84.0± 5.1) with a p value 0.0005, which is highly significant. There is no statistically significant difference between the two groups at 4 and 5 minutes.

Table 4: Grading of conditions for laryngeal mask airway insertion betweentwo groups

Parameter	Grade	Description	Group S	Group P
Jaw relaxation	3	Full	27	30
	2	Partial	03	00
	1	Difficult	00	00
Ease of LMA insertion	3	Easy	25	29
	2	Difficult	05	01
	1	Impossible	00	00
Coughing	3	Nil	30	30
	2	Transient	00	00
	1	Persistent	00	00
Gagging	3	Nil	30	30
	2	Transient	00	00
	1	Persistent	00	00
Patient	3	Nil	30	30
	2	Moderate	00	00

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movement	1	Vigorous	00	00
Laryngospasm	3	Nil	30	30
	2	Partial	00	00
	1	Total	00	00

Table 14 comparison of complication score between two groups during LMAinsertion

Group	Complication score			Total
	16	17	18	
Propofol	0	01	29	30
	0%	3.3%	96.7%	100%
Sevoflurane	04	02	24	30
	13.3%	6.6%	80%	100%
Total	4	3	53	60
	6.6%	5%	89.4%	100%

Complications like gagging, patient movement and laryngospasm did not show any significance during LMA insertion and did not reach statistical significance in our study. Only two cases of Sevoflurane group had coughing during LMA insertion while in Propofol group coughing was absent. The overall insertion was excellent with Propofol with 29 patients scoring 18. With Sevoflurane, 24 patients had excellent conditions for LMA insertion, 2 patients had satisfactory condition for LMA insertion and 4 patients had poor conditions for LMA insertion when grading was done using 18 point score.

Discussion

Satisfactory insertion of LMA after induction of anesthesia requires sufficient depth of anesthesia[9]. Propofol is a common intravenous anesthetic agent used for LMA insertion because of its greater depressant effect on airway reflexes[10]. Sevoflurane is suitable for inhalational induction technique in high concentrations because of its low blood gas solubility and minimal respiratory irritant effect. The vital capacity induction technique with Sevoflurane was used to make the technique similar to that of intravenous bolus injection of Propofol[11].

There was no significant difference between the two groups with respect to age, sex and weight. The mean age in group P was 34.8 ± 10.5 and in group S was 37.0 ± 10.7 and the mean weight in Propofol group was 53 ± 6.1 and in Sevoflurane group was 55.8 ±7.9.

In this study mean time taken from induction to successful laryngeal mask insertion was significantly shorter with Propofol compared to Sevoflurane. With Sevoflurane group the LMA insertion had taken 116.3 ± 7.06 seconds while Propofol had taken 101.2 ± 13.2 seconds, with a p value 0.0001 which was highly significant. Jaw relaxation took a longer time in Sevoflurane group 100.1 ± 7.4 sec than Propofol group 88 ± 12.2 sec with p value 0.0001 which was highly significant.

Priya et al[7] in their study noted that Propofol was known to depress laryngeal reflexes facilitating LMA insertion. They concluded that Propofol was better than Sevoflurane for LMA insertion using the loss of eyelash reflex as the end point of induction, probably due to better jaw relaxation. Even in our study Propofol took lesser time for induction in comparison to Sevoflurane. A Thwaites, S Edmends and Smith[5] observed that induction with Sevoflurane was significantly slower when compared with Propofol but was associated with lower incidence of

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apnea and shorter time to establish spontaneous ventilation. In contrast Ravikumar, Koppula and Anitha Shenoy[3] noted that verbal contact and eyelash reflex with Sevoflurane was lost earlier when compared to Propofol, but both Propofol and Sevoflurane took similar time to jaw relaxation and subsequent LMA insertion. Lian et al[4] achieved insertion of LMA with Sevoflurane in 127 sec almost similar to the time taken in our study (117 sec). They concluded that prolonged jaw tightness after Sevoflurane induction of anesthesia may delay LMA insertion. According to them Propofol was known to have a relaxant effect on jaw muscles, whereas inhaled anesthetics may cause increased tone and spasticity. For a similar depth of anesthesia, there might be greater jaw relaxation with Propofol. Muzi et al[11] reported jaw tightness after Sevoflurane induction, which resulted in failure to insert the LMA in several patients. Hall et al[12] reported longer time to jaw relaxation with Sevoflurane compared with Propofol, although they did not postulate any reasons for this.

In this study, inadequate jaw relaxation was found in 3 patients in Sevoflurane group and ease of LMA insertion was difficult requiring second attempt. Coughing was found in 2 patients in Sevoflurane group but was statistically insignificant. 28 patients in Propofol group had LMA inserted in first attempt and two patients in second attempt. In Sevoflurane group 5 patients had LMA inserted in second attempt, probably due to inadequate jaw relaxation. The mean number of attempts taken for LMA insertion in Propofol group (1.03 ± 0.18) was less compared with Sevoflurane (1.16±0.37) but this was statistically not significant (p value 0.23).

The overall condition of LMA insertion was graded as excellent in all 29 patients belonging to Propofol group. 24 patients in Sevoflurane group had excellent conditions (score of 18). 2 patient in Sevoflurane group had satisfactory condition (score of 17) and 4 patients had score of 16 with LMA insertion grading as poor. Priya et al[7] reported that features like coughing, gagging and patient movements did not reach statistical significance and noted that jaw relaxation with Propofol was much better. With Sevoflurane, induction took longer time because Sevoflurane has less relaxation properties. Ravikumar Koppula and Anitha Shenoy[3] found that both Sevoflurane and Propofol had similar quality for insertion of LMA and concluded that Sevoflurane is a good alternative to Propofol for LMA insertion. Lian et al[4] found that more attempts at insertion of LMA were required in patients in Sevoflurane group versus those in propofol group and suggested that this was primarily because of inadequate mouth opening. Beverly K Philip et al[13] noted more airway-related events (cough, hiccough) in the Sevoflurane group and more hemodynamic events in the Propofol group which was consistent with our study. The airway related incidents in our study was more in Sevoflurane group as compared to Propofol group but was not of any statistical significance. This cannot be commented as the study group is very small.

The mean dose of propofol required for successful LMA insertion in propofol group in our study was 2.35mg/kg. Koppula et al[3] mentioned that mean dose of propofol required was 2.76mg/kg. In our study it was not possible to measure end tidal concentration of sevoflurane. Koppula et al[3] mentioned that the mean end tidal concentration of sevoflurane required for successful LMA insertion was 4.435±0.45%. Lian et al[4] found that the cost of LMA insertion with Sevoflurane was marginally less than Propofol. But in our setup it was not possible to compare the efficacy between two agents. In contrast Ganatra et al[8] found that propofol fentanyl combination was more cost effective than sevoflurane fentanyl co induction.

The heart rate at baseline and at the time of induction did not show much difference between the two groups. Heart rate at one minute after induction showedafall in propofol group (78.5 ± 8.4) as compared to sevoflurane group (83.0± 7.6) which was statistically significant

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with p value of 0.03. No significant difference was noted at 2 minutes, 3 minute, 4 minute and 5 minutes after induction. Lian et al[4] found a significant fall in blood pressure at 2 minute and 3 minute in propofol group.

A significant fall in the systolic blood pressure in-group P (108.13±7.9) was noted at one and two minutes of induction when compared to group S (113.3± 9.4) with a (p value 0.02) which is statistically significant. There was no statistically significant difference between the two groups at 3 minutes, 4 minutes and 5 minutes post induction. Ganatra et al[8] found a significant reduction in SBP in propofol group as compared to sevoflurane group.

There was statistically significant difference in mean arterial blood pressure at one minute (p value 0.002). The propofol group (84.4± 5.7) mmHg had a larger decline in MAP as compared to sevoflurane (88.8 ± 6.2 mmHg). At two minute P group (81.6 ± 4.3) mmHg had a greater decrease as compared to sevoflurane (85.6 ± 5.1) mmHg with a p value 0.004, which was highly significant. At three minutes P group (78.5 ± 6.3 mmHg) also had a greater decrease as compared to sevoflurane (84.0 ± 5.1) mmHg with a p value 0.0005. There was no statistically difference between the two groups at 4 and 5 minutes. While comparing the baseline value, the propofol group had a significant reduction (13.2%) as compared to sevoflurane group (5.5%). While comparing the baseline value with 3 minute value, the propofol group had a significant reduction (18.9%) as compared to sevoflurane group (12.2%).

A Thwaites, S Edmends and I Smith[5] noted induction of anesthesia with propofol was associated with decrease of approximately 20 mmHg in MAP which occurred within 2 min and persisted for at least 5 min of anesthesia. In contrast decrease in MAP with sevoflurane was only 10 mm Hg. Lian et al[4] found that compared with baseline, average decrease in MAP during the study was 18.7% and 17% in propofol and sevoflurane groups respectively. Priya et al[7] observed the hemodynamic responses were stable with both groups. Ganatra et al[8] mentioned that hemodynamic response was better maintained with sevoflurane fentanyl co induction than propofol fentanyl co induction for LMA insertion, which supported our study. Ravikumar Koppula and Anitha Shenoy[3] observed that sevoflurane and propofol seemed to produce a small and comparable decrease in systolic and mean arterial pressure and a marked decrease in diastolic pressure.

ECG finding was normal in all patients in both the groups. SpO2 in both the groups also did not show any significant change (98 to 100%).

Only 7% patients in propofol group complained of pain during injection in our study. Lian et al[4] in their study found 31% patients complaining pain during injection of propofol despite the use of lidocaine. The difference may be due to a large study. Apnea (defined as failure to start spontaneous ventilation within 30 seconds of LMA insertion) occurred in only 1 patient in our study (3%) in propofol group but no cases in sevoflurane group. Lian et al[4] found apnea in 32% patients in propofol group in their study.

Drawbacks in the study

Depth of anesthesia between the two groups was not compared as it was difficult to compare the depth of anesthesia between inhaled and i.v. anesthetics.

The anesthetists who assessed induction side effects were not blinded to the Induction technique.

Hemodynamic measurements were recorded once per minute during induction, perhaps episodes of hypotension or hypertension were missed within this assessment interval.

Cost benefit calculation and patient satisfaction assessment could have been done.

Conclusion

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The quality of anesthesia provided by propofol was superior to sevoflurane as sevoflurane took longer time for jaw relaxation as well as LMA insertion. The number of attempts for LMA insertion was more in sevoflurane group as compared to propofol group. But the hemodynamic status of the patient was better maintained with sevoflurane. None of the patients had trauma during insertion as noticed by absence of blood in LMA after removal. Patients who received propofol complained of pain on injection and patients who received sevoflurane complained of odors. Sevoflurane was an acceptable alternative to propofol for LMA insertion in adults.

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