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Comparison of Dexmedetomidine Propofol with Fentanyl Propofol for Laryngeal Mask Airway Insertion in General Anesthesia Patients Undergoing Elective Surgeries

Abhishek K Manjunath[1], Dinesh Krishnamurthy[2], Ravi Madhusudhana[3], Kiran Nelamangala[4]

[1]Consultant, Department of Anesthesiology, Fortis Hospital, Nagarbhavi, Bangalore, Karnataka, 560072, [2–4]Professor, Department of Anesthesiology, SDUMC, SDUAHER, Kolar, Karnataka, 563101, India.

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Abstract

Context: LMA secures airway better than face mask and also causes less hemodynamic stress than endotracheal tube insertion. We have done a study on, comparison of dexmedetomidine-propofol with fentanyl-propofol for laryngeal mask airway insertion.

Aims: To compare efficacy of Dexmedetomidine–Propofol and Fentanyl–Propofol for LMA insertion in terms of ease of intubation using Muzi and colleagues scoring system; compare the hemodynamic responses to LMA insertion.

Settings and Design: Prospective randomized double blind study

Methods and Material: After obtaining institutional ethical committee approval, 110 ASA I and II patients were included. Group A patients were preoxygenated for 3 min, dexmedetomidine 1 mcg/kg over 2 min. 30 sec later propofol 2 mg/kg was given for induction, Group B patients were preoxygenated for 3 min, fentanyl 1 mcg/kg given over 2 min. 30 sec later propofol 2 mg/kg was given for induction. Parameters observed include HR, SBP, DBP, MAP, SpO_2 and RR before insertion of LMA and after insertion of LMA.

Statistical analysis used: SPSS (version 18.0) to analyze data (version 18.0), and Sigma-Stat 12.0 is used to decide sample size.

Results: Dexmedetomidine group had better LMA insertion conditions like better jaw mobility, lesser incidence of cough and fewer incidence of breath holding spells. Moreover, reduction of hemodynamic parameters like SBP, DBP and MAP was more with fentanyl group than dexmedetomidine group.

Conclusions: From our study we conclude that dexmedetomidine caused less respiratory depression and more stable hemodynamic conditions, compared to fentanyl. Thus we feel that dexmedetomidine can be used as an alternative to fentanyl with an advantage for LMA insertions in short surgical procedures.

Keywords: Dexmedetomidine; Hemodynamic responses; Laryngeal Mask Airway; Propofol.

Introduction

laryngeal mask airway (lma), one of the extra glottis airways (ega), was invented by dr. archie brain in 1981. but, it was available commercially only after 1988 in united kingdom and 1991 in united states. with the introduction of lma classic (clma) there was wide spread recognition and it had major impact on anesthesia practice and airway management.[1]

LMA secures airway better than face mask and also causes less hemodynamic stress than

Corresponding Author: **Ravi Madhusudhana,** Professor, Department of Anesthesiology, SDUMC, SDUAHER, Kolar, Karnataka, 563101, India.

E-mail: ravijaggu@gmail.com

endotracheal tube insertion. LMA is contraindicated in patients with risk of pulmonary aspiration, if peak inspiratory pressure is >20 cm of H_2O. American society of Anesthesiologists (ASA), in their difficult airway algorithm recommend the insertion of LMA when ventilation or intubation is difficult.[2]

During intubation of endotracheal tube with direct laryngoscopy, there are hemodynamic changes seen in the patient. Hemodynamic changes are in the form of transient increase in the arterial pressure and heart rate. These changes are due to mechanical stimulation of sympathetic system in the upper airway. Moreover, most episodes of myocardial ischaemia are seen with intubation response are mainly due to tachycardia. Hence, the use of LMA, a supraglottic airway device has advantage of not having intubation response that is associated with endotracheal tube insertion.[3]

Intubation response can be avoided with LMA insertion and there are less chances of myocardial ischaemia.[4] It is probably that stimulation of the trachea by a tracheal tube has a significant role in causing cardiovascular responses to tracheal intubation.[5] Moreover, there are several advantages of LMA over endotracheal tube placement. Apart from being benefit to the patients with cardiovascular disease, there is also less change in intraocular pressure and provides benefit to patients with glaucoma. Also lower incidence of cough at the time of emergence may benefit patients after Ent or open eye surgery, where, excessive straining is harmful. Lower incidence of sore throat and change in voice has benefits for professional voice users as well.[6]

One of the major advantage of using LMA is that it requires lighter plane of anesthesia when compared to endotracheal tube insertion.[7] Coming to the type of anesthesia, inhalational anesthesia is more efficient than intravenous anesthesia, but, requires more time.[8] Amongst intravenous anesthesia, propofol was chosen over thiopentone. With propofol, passage of LMA is smoother as it suppresses the upper airway reflexes and also it has got shorter half-life than thiopentone.

But, propofol itself does not possess any analgesic property. Also, the high dose of propofol for LMA insertion itself can cause apnoea. Therefore, adjuvants are used along with propofol to decrease its requirement. There are some studies that report that fentanyl reduces the 50% or median effective concentration (EC50) of propofol used for various noxious stimuli. But, fentanyl combined with propofol also has a depressive effect on hemodynamics.[9]

Dexmedetomidine, on the other hand, is a pharmacologically active dextromer of medetomidine and is a selective alpha-2 receptor agonist activity. It has sedative and analgesic activity without causing post operative respiratory depression.[10] Also, dexmedetomidine is said to be a good anesthetic adjuvant that decreases the requirement of propofol and maintains stable hemodynamics intraoperatively.

Therefore, we have done a study on, comparison of dexmedetomidine-propofol with fentanyl-propofol for laryngeal mask airway insertion, in patients posted for elective surgeries under general anesthesia.

Aims

To compare the combination of dexmedetomidine – propofol and fentanyl – propofol for conditions of LMA insertion in short elective surgeries under general anesthesia.

Objectives

To compare efficacy of dexmedetomidine – propofol and fentanyl – propofol for LMA insertion in terms of ease of intubation using MUZI and colleagues scoring system; to compare the hemodynamic responses to LMA insertion with in terms of heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and saturation.

Materials and Methods

For our study entitled, 110 patients admitted for elective surgeries posted under general anesthesia during the duration of march 2015 to June 2016.

Inclusion criteria: All elective patients belonging to age group 18-60 years with adequate mouth opening and ASA Grade I, II undergoing operative procedure undergoing general anesthesia.

Exclusion criteria: Patient's refusal; full stomach patients; patients undergoing emergency surgeries; smokers; patients undergoing oral surgeries.

Sampling procedure

A prospective randomized double blind study was planned. After obtaining approval from the ethical committee and taking informed consent, the patients who meet the inclusion criteria were taken for the study. They were randomly allocated into two groups.

Group A patients were preoxygenated for 3 min, dexmedetomidine 1 mcg/kg diluted in 10 ml normal saline was given over 2 min. 30 sec later propofol 2 mg/kg was given for induction without neuromuscular blocking agents.

Group B patients were preoxygenated for 3 min, fentanyl 1 mcg/kg diluted in 10 ml normal saline was given over 2 min. 30 sec later propofol 2 mg/kg was given for induction without neuromuscular blocking agents.

Anesthesia was maintained with 50% nitrous oxide and isoflurane with oxygen. To decrease pain due to propofol injection, 20 mg of lignocaine was added to 100 mg of propofol. It is a double blind study and the anesthesiologist was not aware of the inducing agent and theadjuvant used. He was called to insert the LMA after giving the inducing agent and adjuvant.

Parameters observed: heart rate, non-invasive blood pressure, oxygen saturation and respiratory rate before insertion of LMA and 30 sec, 1 min, 3 min, 5 min, 10 min and 15 min after insertion of LMA. Response of the patient to LMA insertion like coughing, gagging or any movement was noted. To assess the tolerance of LMA insertion we followed the scoring system modified by MUZI and colleagues.

Scoring system to assess jaw mobility

1. Fully relaxed; 2. Mild resistance; 3. Tight, but opens; 4. Closed

Scoring system to grade coughing or movement

1. None; 2. One or two coughs; 3. Two or more coughs; 4. Bucking or movement

Others: spontaneous ventilation; breath holding; expiratory stridor; lacrimation

In each category scores less than two (<2) was considered optimum for LMA insertion

Statistical analysis

SPSS (version 18.0) to analyze data (version 18.0), and Sigma-Stat 12.0 is used to decide sample size. Statistical analyses were performed using the Chi-square test and Fisher's exact test for categorical data and One-Way ANOVA for continuous data. A p value of < 0.05 was considered significant.

Study design: a prospective, randomized double blind study with 110 patients, randomized into two groups, 55 in group A (dexmedetomidine) and 55 in group B (fentanyl) were taken to study the hemodynamic responses and conditions for laryngeal mask airway insertion.

Results

The mean age subject in the study was 35.2±11.7 years and in Group B was 38.7±15.1 years. There was no significant difference in mean age between two groups. In the study majority of subjects in both group a and Group B were females. 81.8% in Group A and 70.9% in Group B. There was no significant difference in gender between two groups. Mean weight of subjects in Group A was 57.2±5.1 kgs and in Group B was 59.3±8.4 kgs. There was no significant difference in mean weight between two groups.

Table 1: Heart rate comparison between two groups

	Group				P value
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre LMA	77.0	10.3	80.8	10.0	0.051
30 sec	73.0	9.8	75.0	9.4	0.280
1 min	67.8	7.2	72.3	9.2	0.006*
3 min	66.4	6.6	69.8	9.0	0.025*
5 min	68.7	9.7	68.6	8.8	0.975
10 min	68.5	9.7	67.9	9.0	0.745
15 min	68.5	9.6	67.6	9.1	0.626

In the study there was significant difference in mean heart rate between two groups at 1 min and 3 min. Mean HR was lower in group a than group B. No significant difference was observed between two groups at other intervals.

Table 2: SBPcomparison between two groups

	Group				P value
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre LMA	122.7	9.5	125.3	9.0	0.146
30 sec	118.0	9.2	117.1	9.4	0.623
1 min	115.2	9.1	113.3	8.5	0.273
3 min	112.5	9.2	109.7	8.2	0.099
5 min	111.1	9.4	106.4	7.0	0.004*
10 min	110.6	9.5	104.3	6.7	<0.001*
15 min	110.4	9.4	103.8	6.7	<0.001*

In the study there was significant difference in mean SBP between two groups was observed from 5 min and persisted till 15 min intervals. At other intervals there was no significant difference in mean SBP between two groups.

Table 3: DBP comparison between two groups

	Group				P value
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre LMA	68.4	6.3	70.6	7.3	0.091
30 sec	64.7	6.0	64.3	5.6	0.718
1 min	62.9	5.9	62.1	5.4	0.482
3 min	61.2	5.8	59.9	5.2	0.200
5 min	60.4	5.8	58.0	5.1	0.024*
10 min	60.0	5.7	57.1	5.0	0.005*
15 min	60.0	5.7	56.9	5.1	0.003*

In the study there was significant difference in mean DBP between two groups was observed from 5 min and persisted till 15 min intervals. At other intervals there was no significant difference in mean DBP between two groups. Table 4: MAP comparison between two groups.

Table 4: MAP comparison between two groups

	Group				P value
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre LMA	86.3	6.9	88.6	7.3	0.085
30 sec	82.4	6.6	81.8	6.2	0.645
1 min	80.0	6.5	79.1	5.8	0.404
3 min	78.0	6.4	75.7	7.4	0.080
5 min	77.1	6.5	74.2	5.5	0.016*
10 min	76.6	6.5	72.9	5.2	0.001*
15 min	76.5	6.4	72.8	5.4	0.001*

In the study there was significant difference in mean MAP between two groups was observed from 5 min and persisted till 15 min intervals. At other intervals there was no significant difference in mean MAP between two groups.

In the study there was no significant difference in Mean SpO_2 between two groups at all the intervals.

In the study there was no significant difference in mean respiratory rate between two groups at all the intervals.

In Group A 70.9% had fully relaxed jaw, 25.5% had mild resistance and in 3.6% jaw was tight and opens. In Group B 61.8% had fully relaxed jaw, 36.4% had mild resistance and in 1.8% jaw was tight and opens. There was no significant difference in jaw mobility between two groups (Table 5).

In Group A 49.1% had no cough, 50.9% had one or two coughs and in 0% had two or more coughs. In Group B 56.4% had no cough, 41.8% one or two coughs and 1.8% had two or more coughs. There was no significant difference in cough between two groups (Table 6).

In Group A 72.7% had spontaneous ventilation, 27.3% had breath holding spells. In Group B 76.4% had spontaneous ventilation, 47.3% had breath holding and 1.8% had expiratory stridor. There was significant difference in breath holding spells between two groups.

In Group A, 14.5% of them were inserted on second attempt and 3.6% in Group B were inserted on second attempt. This difference was statistically significant.

Table 5: Jaw mobility comparison between two groups

		Group				P value
		Group A		Group B		
		Count	%	Count	%	
Fully Relaxed	0	16	29.1%	21	38.2%	0.313
	1	39	70.9%	34	61.8%	
Mild Resistance	0	41	74.5%	35	63.6%	0.216
	1	14	25.5%	20	36.4%	
Tight but Opens	0	53	96.4%	54	98.2%	0.558
	1	2	3.6%	1	1.8%	
Closed	0	55	100.0%	55	100.0%	–

Table 6: Cough comparison between two groups

		Group				P value
		Group A		Group B		
		Count	%	Count	%	
None	0	28	50.9%	24	43.6%	0.445
	1	27	49.1%	31	56.4%	
One or Two Coughs	0	27	49.1%	32	58.2%	0.339
	1	28	50.9%	23	41.8%	
Two or More Coughs	0	55	100.0%	54	98.2%	0.315
	1	0	0.0%	1	1.8%	
Bucking or Movement	0	55	100.0%	55	100.0%	–

Discussion

Laryngeal mask airway insertion, like insertion of any other airway device, requires certain prerequisites. If these prerequisites are fulfilled, there will be smooth insertion and correct positioning of LMA. The factors that affect the insertion and positioning of LMA are jaw relaxation, mouth opening, episodes of coughing or movement during insertion and the depth of anesthesia. If all these parameters are satisfactory, then there will be minimal hemodynamic stress response, which is required for LMA insertion.

Amongst intravenous anesthesia, propofol was chosen over thiopentone. With propofol, passage of lLMA is smoother as it suppresses the upper airway reflexes and also it has got shorter half-life than thiopentone.[7]

But, propofol itself does not possess any analgesic property. Also, the high dose of propofol for LMA insertion itself can cause apnoea. Therefore, adjuvants are used along with propofol to decrease its requirement. There are some studies that report that fentanyl reduces the 50% or median effective concentration (EC_{50}) of propofol used for various noxious stimuli. But, fentanyl combined with propofol also has a depressive effect on hemodynamics.[9]

Dexmedetomidine, on the other hand, is a pharmacologically active dextromer of medetomidine and has a selective alpha-2 receptor agonist activity. It has sedative and analgesic activity without causing postoperative respiratory depression.[10] also, dexmedetomidine is said to be a good anesthetic adjuvant that decreases the requirement of propofol and maintains stable hemodynamics intraoperatively. Thereby, we chose propofol as an intravenous anesthetic agent and we compared two adjuvants fentanyl and dexmedetomidine.

In our study, both the groups were comparable with respect to age, sex, weight and ASA physical status grading. Ismails et al. (2007) compared the effect of different age groups on hemodynamic response to LMA insertion. They divided 90 patients into 3 groups of 30 each. Group y (young) 18-25 years, group m (middle) 40-45 years and Group E (elderly) 65-80 years. To all the three groups they administered midazolam 7.5 mg orally one hour before induction, preoperatively. Then they were induced with propofol in the dose of 2 mg/kg and LMA was inserted. Here middle aged group had the greatest arterial pressure and heart rate changes, but when compared to the baseline, the change was very minimal. But our study didnot show any age related hemodynamic changes on LMA insertion.[11]

In our study, propofol was chosen as an intravenous anesthetic agent. But, the dose of propofol that was needed to be administered was decided from the previous study done by Blake et al. they had used four doses of propofol for LMA insertion. 1.0 mg/kg, 1.5 mg/kg, 2 mg/kg and 2.5 mg/kg IV propofol for LMA insertion. They evaluated that a dose of 1.5 mg/kg iv propofol was not optimum for LMA insertion. Hence we considered using 2 mg/kg iv propofol for LMA insertion. But as explained earlier, if propofol was used alone without adjuvants, we would have required more amount of propofol and that would have caused cardio-respiratory depression.[12]

In a study, Lawrence and colleagues (1997) assessed the perioperative hemodynamic stability and anesthetic requirements in patients administered with single dose of 2 mcg/kg intravenous dexmedetomidine as a pre-induction dose. It was seen that the requirement of intraoperative anesthetics, intubation response, extubation response, requirement of post-operative analgesics and post-operative antiemetic's was reduced in patients receiving dexmedetomidine.[13]

Moreover, HSUYW et al. (2004) investigated the respiratory effect of dexmedetomidine and remifentanil. They assessed the respiratory response of the 6 healthy volunteers using a step wise target-controlled infusion of dexmedetomidine, remifentanil and a pseudo natural sleep session. The patients receiving dexmedetomidine, had respiratory pattern that mimics the natural sleep. Also, the patients receiving dexmedetomidine, did not have respiratory depression, decreased apnoea/hypopnea index and had natural sleep pattern.[14]

Wong CM et al. (2007) chose 21 male and 54 female healthy female patients to study the optimal dose and duration of fentanyl required along with propofol for insertion of LMA. Here they administered fentanyl in the dose of placebo, 0.5, 1.0, 1.5 and 2.0 mcg/kg. Propofol was given in the dose of 2 mg/kg. After 90 seconds of induction, LMA was inserted. Around 95% of the patients required fentanyl above the clinical dose and 65% of the patients required fentanyl in the dose of 1 mcg/kg. And 90 seconds was optimum duration after induction for LMA insertion. Therefore, in our study we used fentanyl in the dose of 1 mcg/kg.[15]

Also, Uzumcugil F et al. (2008) studied the effects of dexmedetomidine administered with propofol and fentanyl administered with propofol for laryngeal mask airway insertion in 52 patients. Group F received fentanyl in the dose of 1 mcg/kg with 1.5 mg/kg of propofol. Group D received dexmedetomidine in the dose of 1 mcg/kg with 1.5 mg/kg of propofol. They didnot use any neruromuscular blocking agents. After 90 seconds of induction, first attempt of LMA insertion was attempted. 50% nitrous oxide and sevoflurane in oxygen was used for maintenance of anesthesia. They observed jaw mobility, cough and other events like spontaneous ventilation, breath holding, expiratory stridor and lacrimation. The episodes of apnoea, reduction in systolic and mean blood pressure was more in fentanyl group than the dexmedetomidine group.[16]

When compared to this study, even in our study, dexmedetomidine group had better LMA insertion conditions like better jaw mobility, lesser incidence of cough and fewer incidence of breath holding spells. In Group A 72.7% had spontaneous ventilation, 27.3% had breath holding spells. In Group B 76.4% had spontaneous ventilation, 47.3% had breath holding and 1.8% had expiratory stridor. There was significant difference in breath holding spells between two groups.

Moreover, reduction of hemodynamic parameters was more with fentanyl group than dexmedetomidine group. This difference was statistically significant.

Conclusion from our study we conclude that dexmedetomidine caused less respiratory depression and more stable hemodynamic conditions, compared to fentanyl. Thus we feel that dexmedetomidine can be used as an alternative to fentanyl with an advantage, for LMA insertions in short surgical procedures.

Key Messages

Response to laryngoscopy and intubation which is not necessary because transient rise in the Heart rate and Blood pressures can be detrimental in undiagnosed hypertensives or Ischemic Heart disease patients. Laryngeal mask airway can be the choice which can be introduced with intravenous anesthetics along with opiods or alpha 2 adrenergic agents which produce sedation and analgesia and have an additive effect with propofol induction and with reduced airway manipulation and responses.

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