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Quick Response Code:	Website: www.annalsafrmed.org
	DOI: 10.4103/1596-3519.134405
	PMID: *****

# Agents for facilitation of laryngeal mask airway insertion: A comparative study between thiopentone sodium and propofol

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## Abstract

**Background:** Development of endotracheal intubation to avoid deleterious effect on hemodynamic responses occurring during laryngoscopy and intubation compelled researchers to venture into alternative measures of airway management with subtle hemodynamic responses. This study was carried out to compare the conditions for laryngeal mask airways LMA insertion with widely used intravenous induction agents, thiopentone sodium and propofol, and also to compare the undesired responses occurring during LMA insertion with them.

**Materials and Methods:** The study was prospective, randomized, and double blind. All patients selected were randomly allocated into two groups: Group 1 (propofol) and group II (thiopentone). Preinduction heart rate and blood pressure were recorded. Sixty healthy adult patients of either sex belonging to age group of 20-60 years and ASA grade I or II, to undergo surgery less than 1 h, were selected for the study. Patients were randomly allocated in two groups, 30 in each group. Premedication with midazolam 0.04 mg/kg and fentanyl 2 mg/kg done in both groups. Thereafter, group 1 was induced with 2 mg/kg of propofol and group 2 with 5 mg/kg of thiopentone sodium.

**Results:** The study revealed that, ease of insertion of LMA, was statistically significantly greater in group 1 when compared with group 2 ( $P < 0.05$ ). The time required for successful insertion of LMA was lesser in group 1 patients ( $53.8 \pm 7.77$  s) than in group 2 patients ( $84.7 \pm 16.54$  s) ( $P < 0.001$ ).

**Conclusion:** Severity of undesired responses were more in group 2, as incremental boluses of respective induction agents were required in 20% patients in thiopentone group compared to only 6% patients in propofol group and 13% of patients in thiopentone group required rescue succinylcholine.

**Keywords:** Laryngeal mask airway, propofol, thiopentone

## Résumé

**Fond:** Développement d'intubation endotrachéale pour éviter un effet délétère sur les réponses hémodynamiques survenant au cours de la laryngoscopie et l'intubation contraint les chercheurs à s'aventurer dans des mesures alternatives de gestion des voies aériennes avec les réponses hémodynamiques subtiles.

Cette étude a été réalisée pour comparer les conditions de masque laryngé airways LMA d'insertion avec les agents d'induction intraveineux couramment, de thiopentone sodium et de propofol et aussi de comparer les réactions indésirables survenant lors de l'insertion de la CGL avec eux.

**Matériels et Méthodes:** L'étude est prospective et randomisée double aveugle. Tous les patients sélectionnés ont été répartis au hasard en deux groupes : groupe 1 (propofol) et du groupe II (thiopentone). Préinduction fréquence cardiaque et la tension artérielle ont été enregistrées. Soixante patients adultes sains des deux sexes appartenant au groupe d'âge des 20-60 ans et grade ASA I ou II, pour subir une chirurgie de moins de 1 h, ont été sélectionnés pour l'étude. Patients ont été répartis au hasard en deux groupes, 30 dans chaque groupe. Prémédication avec midazolam

0,04 mg/kg et le fentanyl 2 mg/kg dans les deux groupes. Par la suite, le groupe 1 a été induit avec 2 mg/kg de propofol et groupe 2 avec 5 mg/kg de sodium de thiopentone.

**Résultats:** L'étude a révélé que, de sa facilité d'insertion de CGL, était statistiquement significativement plus élevée dans le groupe 1 en comparaison avec le groupe 2 ( $P < 0,05$ ). Le temps nécessaire à l'insertion réussie de la CGL était moindre chez les patients de groupe 1 ( $53,8 \pm 7,77$  s) que dans le groupe 2 patients ( $84,7 \pm 16,54$  s) ( $P < 0,001$ ).

**Conclusion:** Gravité des réactions indésirables ont été plus dans le groupe 2, bolus supplémentaires des agents d'induction respectifs étaient tenus dans 20 % des patients dans le groupe thiopentone, comparativement à seulement 6 % des patients dans le groupe de propofol et 13 % des patients dans la succinylcholine de sauvetage thiopentone groupe requis.

**Mots-clés :** Airway de masque laryngé, propofol, thiopentone

## Introduction

The fundamental responsibility of an anesthesiologist is proper maintenance of a patent airway during surgical procedures. In the year 1981, Dr. A I Brain designed the modern laryngeal mask airway (LMA)<sup>[1]</sup> to avoid the common problems of airway management. LMA is superior to the face mask in providing a patent airway without pressure injuries to lips and gums. Laryngoscopy and intubation may result in injuries to soft tissues of pharynx, laryngeal inlet, as well as post extubation sore throat. On the contrary, LMA insertion does not require laryngoscopy, and hence is devoid of such complications. In difficult intubation cases, LMA may be life saving for the patient. In the year 1996, LMA was incorporated in ASA difficult airway algorithm.<sup>[2]</sup>

The present study was carried out to compare the responses occurring during LMA insertion with drugs like thiopentone sodium and propofol.

## Materials and Methods

The present study was conducted in the operating rooms of K. P. C. Medical College, Kolkata during the period of October 2010 - October 2011.

Permission from hospital ethical committee and was ratified by all concerned authorities. Every patient included in the study was fully explained about the nature of the study and informed consent was obtained.

The study was conducted in 60 healthy adult patients of ASA physical status grade I and II from either sex, in the age group of 20- 60 years, scheduled for elective surgery presumably of less than 1 h duration.

Exclusion criteria: Patients were excluded from the study if they had:

- Morbid obesity or likeliness of being a case for difficult intubation

- Uncontrolled hypertension
- History of smoking, chronic bronchitis, asthma, and upper respiratory tract infection (URTI).
- Emergency surgical condition
- History of allergy to any of the drugs used in this study.

The study was prospective, randomized, and double blind.

All the patients selected for the study were randomly allocated into two groups: –Group 1 (propofol group) and group 2 (thiopentone group), but they were unaware of the group in which they were allocated in. In all 60 patients selected for the study, the same observer assessed the condition for inserting LMA to prevent observer bias.

All patients selected for the study were visited the night before surgery and thorough preanesthetic checkup was done and the baseline investigations were recorded. They were prescribed tab. alprazolam 0.5 mg at night and were fasted from midnight till surgery in the morning.

In the preoperative holding area, a large bore 18 G intravenous cannula was inserted and infusion with a balanced salt solution (ringer lactate) started.

On arrival in the operating room, pulse oximetry, electrocardiogram (ECG) monitor, and noninvasive blood pressure (NIBP) monitor were attached. Preinduction heart rate, systolic, diastolic, and mean arterial blood pressure were recorded. One minute prior to preoxygenation, injection midazolam 0.04 mg/kg and injection fentanyl 2 µg/kg were administered to all the patients irrespective of the group they were allocated to. Preoxygenation was done for 3 min with 100% oxygen. Thereafter, induction of anesthesia was done with:

- 2.0 mg/kg of 1% propofol in group 1
- 5 mg/kg of 2.5% solution of thiopentone sodium in group 2.

Both induction agents were administered over 20 s times during which the patients were constantly

communicated with. The loss of verbal contact and eyelash reflex were assessed by the “blinded” anesthesiologist. After 30 s of completion of injection, the loss of any motor response to jaw thrust was assessed by the observer and if there was no response, then LMA insertion was attempted by standard technique.

The time from loss of eyelash reflex to completion of LMA insertion was recorded with the help of a stop watch and noted as the time taken for LMA insertion

The condition of LMA insertion was recorded by the observer on a three point scale using six variables as below [Table 1]. Parameters to be observed in response to drugs during LMA (laryngeal mask airway) insertion.

The patients in whom the condition of insertion according to the above scale seemed to be inadequate, an increment of induction agent 20 mg of propofol in group 1 and 50 mg of thiopentone in group 2, were administered. In patients exhibiting laryngospasm, 25 mg of succinylcholine was also given along with the incremental dose of induction agent. These undesired responses shown by the patients during LMA insertion were graded as none, mild, and severe depending on interventions (induction agent increment or succinylcholine) required for settling them 30 s after induction.

If apnea occurred after induction, ventilation was assisted by face mask. The hemodynamic parameters, namely: Heart rate, systolic, diastolic, and mean arterial blood pressure; after premedication, at 1, 2, and 3 min from LMA insertion; were recorded by the same observer who inserted the LMA.

## Results

There was no statistical difference with respect to age, sex, and body weight among the two groups of patients as is evident from Table 2. Table 3 shows the variables as observed during LMA insertion. We found that the number of patients exhibiting full jaw opening were more in group 1 (27 out of 30), but there was no statistical difference among the groups as  $P$ value  $> 0.05$ . The ease of insertion of LMA was greater in group 1 than in group 2 as number of patients presenting difficulty in LMA insertion was more (nine out of 30) in group 2 than in group 1 (two out of 30), this observation is statistically significant ( $P < 0.05$ ). Lesser number of patients (one out of 30) in group 1 exhibited gagging during LMA insertion. No statistically significant difference was found among the groups ( $P > 0.05$ ). There was no statistical difference in incidence of coughing among the two groups ( $P > 0.05$ ). Number of patients who had laryngospasm was much more

in group 2 (four out of 30) than in group 1 (nil). This difference was not statistically significant between the two groups ( $P > 0.05$ ). More number of patients (three out of 30) in group 2 showed moderate movements, but was not statistically significant as  $P$  value  $> 0.05$ . Table 4 compares the time taken for LMA insertion in both the groups. The time taken for LMA insertion in group 1 patients was less than that in group 2 which was statistically very highly significant ( $P < 0.001$ ) [Figure 1]. Table 5 shows that there was no statistically significant difference in undesired responses shown by patients in both the groups, but the severity of responses was found to be greater in group 2 than in group 1. Incremental boluses of respective induction agents were required in six patients in group 2 compared to only two patients in group 1. Out of six patients in group 2 who required incremental boluses, four patients exhibited laryngospasm; and required rescue succinylcholine to settle them. Table 6 shows the

**Table 1: The condition of LMA insertion was recorded on a three point scale using six variables**

Description	Grade
Jaw opening	
Full	3
Partial	2
Nil	1
Ease of LMA insertion	
Easy	3
Difficult	2
Impossible	1
Gagging	
Nil	3
+	2
++	1
Coughing	
Nil	3
+	2
++	1
Laryngospasm	
Nil	3
Partial	2
Total	1
Patient movement	
Nil	3
Moderate	2
Vigorous	1

LMA = Laryngeal mask airways

**Table 2: Demographic data**

Parameters	Group 1 (n=30)	Group 2 (n=30)	P value
Age (in years) (mean±SD)	36.6±9.4	36.4±10.9	0.94
Sex			
Male	13	11	0.68
Female	17	19	0.74
Body weight (in kg) (mean±SD)	57.53±10.55	55.63±7.48	0.42

SD=Standard deviation

**Table 3: Variables observed during LMA insertion**

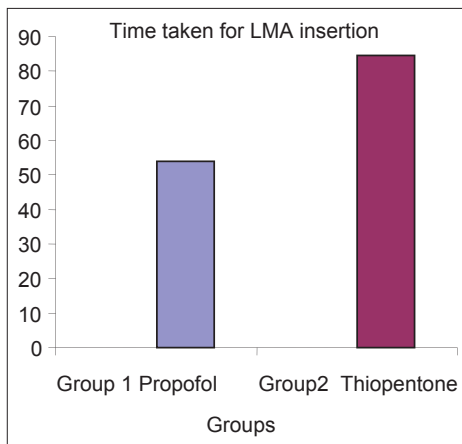
Variables	Observations				
	Description	Grade	Group 1 (n=30)	Group 2 (n=30)	P value
Jaw opening during LMA insertion	Full	3	27	23	0.57
	Partial	2	3	7	0.21
Ease of LMA insertion	Easy	3	28	21	0.32
	Difficult	2	2	9	0.035
Gagging	Nil	3	29	27	0.79
	+	2	1	3	Not obtained*
Coughing	Nil	3	30	29	0.90
	+	2	0	1	Not obtained*
Laryngospasm	Nil	3	30	26	0.59
	Partial	2	0	4	Not obtained*
Patient movement during LMA insertion	Nil	3	29	27	0.79
	Moderate	2	1	3	Not obtained*

\*When cumulative number of expected observations, taking both the groups together, was less than 10 or less than 5 in each group; no statistical analysis was possible in respect to that particular variable. LMA=Laryngeal mask airways

**Table 4: Time taken for LMA insertion (in seconds)**

Group 1 n=30	Group 2 n=30	P value
53.8±7.77	84.7±16.54	0.00

Values are mean±standard deviation. Compared using Student's *t* test. LMA=Laryngeal mask airways

**Figure 1:** Time taken for LMA insertion

comparison between the two groups in respect to heart rate changes at different points of time.

There was no statistical difference in heart rates between two groups before induction and after premedication ( $P > 0.05$ ), but a very highly statistically significant decrease in heart rate was noticed in group 1 as compared to group 2 at 1, 2 and 3 min after LMA insertion ( $P < 0.001$ ). Fall in heart rate from Preinduction levels to 3 minutes after LMA insertion in group 1 (15.07%) and group 2 (4.37%) was not of any clinical significance i.e.  $<30\%$  in both the groups. Table 7 shows the comparison between the two groups in respect to mean arterial pressure changes at different points of time. There was no statistical difference in two groups before induction and after premedication ( $P > 0.05$ ), but a very highly statistically significant decrease in

**Table 5: Undesired responses during LMA insertion**

Response	Group 1 n=30	Group 2 n=30	P value
None	28	24	0.58
Mild (incremental dose of induction agent required)	2	6	Could not be obtained*
Severe (succinylcholine required)	0	4	Could not be obtained*

LMA=Laryngeal mask airways

**Table 6: Heart rate changes during LMA insertion**

Values	Group 1	Group 2	P value
Pre induction	82.9±9.5	84.5±5.6	0.45
After premedication	78.6±8.46	77.1±6.2	0.45
At 1 min from LMA insertion	74.6±8.2	86.0±6.6	0.00
At 2 min from LMA insertion	73.0±7.93	83.2±5.4	0.00
At 3 min from LMA insertion	70.4±8.2	80.8±5.6	0.00

Values are mean±standard deviation. Compared using Student's *t* test. LMA=Laryngeal mask airways

mean arterial pressure was noticed in group 1 as compared to group 2 at 1, 2, and 3 min after LMA insertion ( $P < 0.001$ ). Fall in mean blood pressures from preinduction levels to 3 min after LMA insertion in group 1 (25.82%) and group 2 (16.21%) was not of any clinical significance.

## Discussion

The LMA is inserted under finger guidance into the hypopharynx which requires sufficient depth of anesthesia and depression of airway reflexes.<sup>[3]</sup>

Smooth insertion of LMA to avoid complications such as coughing, gagging, or laryngospasm with propofol is better suited for this purpose, as it has

**Table 7: Mean arterial pressure changes during LMA insertion**

Values	Group 1	Group 2	P value
Preinduction	96.8±7.2	96.2±7.6	0.74
After premedication	88.4±6.6	88.5±5.7	0.91
At 1 min from LMA insertion	78.3±5.8	86.9±5.1	0.00
At 2 min from LMA insertion	74.7±5.1	83.4±5.3	0.00
At 3 min from LMA insertion	71.8±5.3	80.6±4.9	0.00

Values are mean±standard deviation. Compared using Student's t test. LMA=Laryngeal mask airways

more depressant effect on airway reflexes in contrast to thiopentone which is associated with greater incidence of undesired response whether used alone or in combination with an opioid.<sup>[4]</sup>

The induction bolus of propofol was kept at 2 mg/kg which was associated with less incidence of laryngospasm in regards to successful LMA insertion in our study, as observed by Blake *et al.*,<sup>[5]</sup> in his dose response study to elucidate optimal dose of propofol for inserting LMA.

Appropriate time for attempting LMA insertion was guided by the loss of response to jaw thrust. In similar studies Drage *et al.*<sup>[6]</sup> in their study showed that jaw thrust was a reliable and better method to assess the adequacy of depth of anesthesia for uncomplicated insertion of LMA.

Full jaw opening in both the groups is not statistically significant in our study, yet it was of definite clinical significance. Our finding has resemblance with the findings in the study of Talwar *et al.*<sup>[7]</sup>

We observed that it was easier to insert LMA with propofol and difficulty in insertion of LMA was higher in thiopentone group which was statistically significant ( $P < 0.05$ ). This finding corroborates with the study of Acalovschi *et al.*,<sup>[8]</sup> where they observed that ease of LMA insertion was statistically very highly significant with propofol than with thiopentone ( $P < 0.001$ ). Similar observations were also made by Nishiyama and Hanaoka,<sup>[9]</sup> Nakazawa *et al.*,<sup>[10]</sup> and Talwar *et al.*<sup>[7]</sup>

There were fewer incidences of gagging, head movement, laryngospasm, and adequate relaxation observed in propofol group that corroborates with Talwar *et al.*,<sup>[7]</sup> Scanlon *et al.*,<sup>[11]</sup> and Brown and Ellis<sup>[12]</sup> as increased incidence of gagging, with thiopentone than with propofol.

In our study the time taken for LMA insertion with propofol induction was less as compared

with thiopentone induction which was comparable with study reported by Kati I *et al.*<sup>[13]</sup> with propofol vs. sevoflurane, the time taken for LMA insertion with propofol was (50+10 s) as compared with sevoflurane (120+30 s). Thus propofol induction results in better quality of anesthesia than thiopentone in terms of LMA insertion.

We observed that incremental boluses of respective induction agents were required in 20% patients in thiopentone group compared to only 6% patients in propofol group. Identical observation has been reported by Driver *et al.*<sup>[14]</sup>

The hemodynamic parameters as observed in our study showed that there was statistically very highly significant reduction in heart rate at 1, 2, and 3 min after LMA insertion in propofol group as compared to thiopentone group that may be due to lesser sympathoadrenal reflex suppression by thiopentone as compared to propofol.<sup>[15]</sup>

Mean blood pressures showed a statistically very highly significant fall in propofol group than in thiopentone group ( $P < 0.001$ ). Similar findings have been observed by Blake *et al.*,<sup>[5]</sup> Seavell *et al.*,<sup>[16]</sup> Nishiyama and Hanaoka,<sup>[10]</sup> Saengchote *et al.*,<sup>[17]</sup> and Talwar *et al.*,<sup>[7]</sup> and are in concordance with our study.

Thus, increased incidence of difficult insertion of LMA with thiopentone suggests that it is an unacceptable induction method with thiopentone alone, and that supplements of narcotics are required; whereas ease of LMA insertion with propofol serves the best.

## Conclusion

We conclude from the evidence based on our study that residual intact upper airway reflexes can be easily suppressed when propofol (2.5 mg/kg) is used as an inducing agent with adequate oxygen inhalation and can be suggested beneficial compared to thiopentone alone in managing the airway.

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**Cite this article as:** Sengupta J, Sengupta M, Nag T. Agents for facilitation of laryngeal mask airway insertion: A comparative study between thiopentone sodium and propofol. *Ann Afr Med* 2014;13:124-9.  
**Source of Support:** K.P.C Medical College, Kolkata,  
**Conflict of Interest:** None declared.