

Ease of Laryngeal Mask Airway Insertion – Comparison of Propofol versus Thiopentone and Lignocaine in Adult Patients

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ABSTRACT

Background: A patient is required to be fully relaxed and airway reflexes should be adequately suppressed to allow for smooth insertion of a laryngeal mask airway (LMA). Propofol and a variety of other induction agents and their combinations have been tried to ease its insertion. The use of cheaper alternatives in our environment is highly desirable. **Aims and objectives:** To compare the ease of insertion of LMA in patients given propofol alone versus thiopentone with lignocaine, as well as assessing the cost effectiveness of these agents in our hospital setting. **Methods:** This is a randomised single blind prospective study carried out in a Public Tertiary Academic Health Institution. Sixty-four ASA I and II patients equally randomized into 2 groups scheduled for short (not lasting more than one hour) elective gynaecological, orthopaedic, urological and general surgical procedures were recruited into this study. Patients were premedicated with 1g.kg^{-1} fentanyl intravenously and pre-oxygenated for five minutes. This was followed by an induction dose of either 2.5mg.kg^{-1} propofol (group A) or a sequence of 2mg.kg^{-1} lignocaine and 5mg.kg^{-1} thiopentone (group B) given by a trained assistant. With the patients in the sniffing position, LMA insertion was attempted immediately after induction of anaesthesia by the anaesthetist (researcher) who observed the ease of LMA insertion using presence or absence of adverse airway responses to LMA insertion such as coughing, gagging, laryngospasm, head and limb movement or inadequate jaw relaxation. These responses were graded as; no response, mild response, moderate response and severe response. Overall assessment of the ease of LMA insertion was then done combining these graded adverse airway responses as; excellent if there were no adverse airway responses, good if responses were mild, satisfactory if responses were moderate and poor if responses were severe with additional anaesthetic required to allow LMA insertion. **Results:** The average age in group A was 36.5 ± 14 whereas in group B it was 38.7 ± 05 with the $p=0.493$. There were 22 (56.4%) male patients in group A compared to 17 (43.6%) male patients in group B with $p=0.528$; whereas, there were 10 (40.0%) female patients in group A compared to 15 (60.0%) female patients in group B with $p=0.326$. Excellent LMA insertion were observed in 28 (87.5%) patients in group A compared to 27 (84.4%) patients in group B ($P=0.893$); Good LMA insertion in 2 (6.3%) patients in group A compared to 1 (3.1%) patient in group B ($p=0.564$); Satisfactory in 2 (6.3%) patients in group A compared to 4 (12.5%) patients in group B ($p=0.655$). **Conclusion:** Thiopentone together with Lignocaine provided optimum conditions for laryngeal mask airway insertion comparable to that provided by propofol alone.

Keywords: LMA, propofol, lignocaine, thiopentone

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Introduction

The laryngeal mask airway (LMA) is a supraglottic airway device used to maintain



the airway during anaesthesia, in difficult or failed intubation and in cardiopulmonary resuscitation^{1, 2}. The LMA is a good airway device in many settings, including the operating room, the emergency department, and out-of-hospital care, because it is easy to use and quick to place, even for the inexperienced provider. It has a success rate of nearly 100% in the operating room, although this may be lower in the emergency setting^{3,4}. Its use results in less gastric distention than with bag-valve-mask ventilation, which reduces but does not eliminate the risk of aspiration.

Propofol is the intravenous anaesthetic induction agent of choice for laryngeal mask airway insertion⁵. This is because of its rapid induction of anaesthesia and adequate depression of the airway reflexes which reduces or prevent airway responses from upper airway instrumentation. However, propofol is expensive, associated with hypotension, apnoea and causes pain with injection site⁵. The incidence of pain on injection is reduced with newer and more recent medium chain triglyceride propofol. There is therefore, a need for an alternative that will be affordable for majority of patients. Thiopentone is another intravenous anaesthetic agent that has been studied several times

either alone or in combination with other drugs like lignocaine, midazolam, succinylcholine

or butorphanol as induction agent for LMA insertion^{6,7}. It is cheap, readily available, and not associated with pain on injection but can also cause hypotension and apnoea though, less than propofol. On the other hand, thiopentone does not depress the airway reflexes as much as propofol and so when used as an induction agent for laryngeal mask airway insertion, usually stimulates the

upper airway and produces responses like gagging, coughing and laryngospasm⁶. These can be minimized by the addition of lignocaine, midazolam or succinylcholine. The current study was carried out to compare the suitability of conditions for LMA insertion using thiopentone/lignocaine combination on the one hand and propofol alone on the other hand, in adult patients going in for short surgical procedures under general anaesthesia. We also compared the cost effectiveness of each group of induction agents.

Materials and Methods

The Study Area and Population:

This is a randomized single blind prospective study carried out in a Public Tertiary Academic Health Institution in north-central Nigeria. Ethical clearance was obtained from the institutional Ethical committee, and a written informed consent of each participant was obtained. The researcher was responsible for the drugs used for this study.

Patients within the age group 16 – 60years and of either sex belonging to ASA grade I and II scheduled for short (not lasting more than one hour) elective gynaecological, orthopaedic, urological and general surgical procedures under general anaesthesia and not requiring controlled ventilation and muscle relaxation were recruited into this study. Patients at risk of aspiration, the obese with BMI>35kg/m², those with pharyngeal pathology, and limited mouth opening (<2cm) were excluded. Patients allergic to thiopentone, lignocaine and propofol were also excluded.

Data Collection:

Demographic data; Age, sex, weight and height were collected before the procedure by the researcher using a check list. During



induction and insertion of LMA, adverse airway responses like gagging, coughing, limb movement, head movement, and laryngospasm were graded and documented in each group. The cost of using each of the drugs was determined as well.

Procedure and Intervention:

The sample size for this study was based on apredetermined formula⁸.The number of patients arrived at was 58. Allowing for an estimated 10% non-consent or drop-out rate, the total sample size for the 2 groups was therefore adjusted to 64 patients. The patients were randomized into two groups of 32 each as follows; propofol (group A) and lignocaine-thiopentone admixture (group B). From the list of patients who met the inclusion criteria, patients were selected by simple random technique into the propofol group(group A) and lignocaine and thiopentone group(group B) through balloting, by blindly picking a white or red paper from an opaque container containing equal numbers of white and red cards. The white papers represented group A while the red papers represented group B. This process was carried out by the research assistant and the investigator was blinded to the study drugs.

Patients' airway was assessed using inter-incisor gap. Prior to induction of Anaesthesia, LMA sizes were selected according to patient's weight. The cuff was deflated by placing the anterior surface on a flat firm surface to avoid wrinkling of the cuff. The cuff was then lubricated with water-based jelly on its posterior surface.

Routine machine/airway equipment check was carried out and baselineline vital signs were taken. Patients were then positioned supine on the operating table with the head in a sniffing position and received 0.01mgkg⁻¹ of

atropine (except patients with tachycardia) and 1gkg⁻¹ of fentanyl intravenously as premedication 5minutes and 2minutes respectively prior to induction of Anaesthesia. After preoxygenation for five minutes, anaesthesia was then induced by the trained assistant (anaesthesia resident) with either of the assigned drugs; 2.5mgkg⁻¹propofol (group A) or 2mgkg⁻¹ lignocaine, followed 30 seconds later by 5mgkg⁻¹thiopentone (group B). All drugs were given intravenously over fifteen seconds a 20ml syringe. Insertion of laryngeal mask airway was performed by the Anaesthetist (researcher) 60 seconds after the injection of each drug, using the classical technique (insertion of LMA with the cuff facing anteriorly and the index finger aiding it into the right position). The cuff was inflated with the required volume of air which is according to the size used as specified on the LMA [For instance; female adult size 3 (20mls) and male adult size 4 (30mls)]. Sizes of LMA used for other patients were based on their weight.

Following successful insertion, LMA position was assessed by observing chest movement, square wave capnography tracing and reservoir bag movement with both spontaneous and assisted ventilation. To prevent dislodgement LMA was fixed properly using adhesive tape and bite block was fixed. Adverse airway responses to LMA insertion if any were observed and graded by same Anaesthetist (researcher). These graded adverse airway responses were then used to assess the overall ease of LMA insertion.

Apnoeic patients were noted and ventilated with 100% oxygen via face mask before laryngeal mask airway insertion. If the first attempt at LMA insertion was unsuccessful or resulted in malpositioning, such patient received a subsequent dose of either propofol0.25mg.kg⁻¹ or thiopentone



0.5mg.kg⁻¹ and is ventilated using facemask. Laryngeal Mask Airway re-insertion was attempted immediately after the induction of anaesthesia. If LMA insertion was unsuccessful after three attempts, patients' trachea was intubated with endotracheal tube after giving muscle relaxant (suxamethonium). Such patients were withdrawn from the study.

After successful insertion of the laryngeal mask airway, it was thereafter connected to the breathing circuit and anaesthesia was then maintained with 40% oxygen in 60% nitrous oxide and 1-2% isoflurane. Intraoperative monitoring included pulse oximetry, capnography, non-invasive blood pressure and ECG using GE DASH 4000 multiparameter monitor. On completion of surgery, N₂O and isoflurane were discontinued and 100% oxygen given for 10minutes before LMA was removed when patients showed signs of consciousness like obeying commands or hand grip. 100% oxygen was continued via face mask till recovery. Monitoring was continued postoperatively to ensure full recovery from anaesthesia and also to check for any complications like nausea and vomiting.

The following adverse airway responses were noted and graded on a four-point scale during LMA insertion:

Coughing (nil/mild/moderate/severe)

Gagging (nil/mild/moderate/severe)

Laryngospasm (nil/mild/moderate/severe)

And jaw relaxation on a three- point scale:

Jaw relaxation (well relaxed/slight relaxation/grossly not relaxed)

Overall assessment of ease of LMA insertion was assessed according to Silvalingham⁶ using these graded airway responses (Namely: Nil, Mild, Moderate and Severe).

Excellent: Nil gagging, coughing, laryngospasm and limb movement.

Good: mild gagging, coughing, laryngospasm and limb movement.

Satisfactory: Moderate gagging, coughing, laryngospasm and limb movement.

Poor: Severe gagging, coughing, laryngospasm and limb movement

We also compared the cost of agents used during induction in the two groups. Data analysis was performed using the Statistical Package for Social Sciences software (SPSS, version 16.020). Numerical data were analyzed by Students't test and categorical data using the chi-square test. The 5% level of probability ($p < 0.05$) was considered statistically significant. Demographic characteristics of the patients (age, weight and height) were presented as means \pm SD.

Results

The two groups were similar in terms of demographic characteristics. The average age in group A was 36.5 ± 14 whereas in group B it was 38.7 ± 05 with the $p = 0.493$. There were 22 (56.4%) male patients in group A compared to 17 (43.6%) male patients in group B with $p = 0.528$; whereas, there were 10 (40.0%) female patients in group A compared to 15 (60.0%) female patients in group B with $p = 0.326$.

It was observed that out of the surgical procedures performed in this study, 11 (34%) patients in group A had gynaecological surgeries compared to 12 (38%) patients in group B with a $p = 0.635$. Seven (22%) patients had orthopaedic surgeries in group A compared to 9 (28%) patients in group B with $p = 0.340$. (Fig 1). The number of attempts at LMA insertion for each group can be seen on figure 2 and the incidence of apnoea during LMA insertion for each group can be seen on figure 3.

The overall ease of insertion of LMA was graded as excellent in 28 (87.5%) patients in



group A compared to 27 (84.4%) patients in group B ($P= 0.893$). The LMA insertion was good in 2 (6.3%) patients in group A compared to 1 (3.1%) patient in group B ($p= 0.564$). Patients that had satisfactory LMA insertion were 2 (6.2%) in group A and 4 (12.5%) in group B ($p= 0.655$). (Table 2). There was no coughing/gagging in 28 (87.5%) patients in both groups A and B ($p= 1.000$). However, coughing/gagging was mild in 4 (12.5%) patients in group A compared to 3 (9.4%) patients in group B ($p= 0.705$); while it

was moderate in 1 (3.1%) patient in group B. (Table 3).

Twenty-nine (90.6%) patients in group A had no laryngospasm on LMA insertion compared to 28 (87.5%) patients in group B ($p= 0.895$). Laryngospasm was mild in 3 (9.4%) patients in group A compared to 2 (6.3%) patients in group B ($p= 0.655$). Twenty-eight (87.5%) patients in group A had good jaw relaxation compared to 27 (84.4%) patients in group B ($p= 0.893$). (Table 3). The total cost of drugs for group A was \$12.56, while that of group B was \$3.11 (Table 4).

Table 1: Demographic characteristics of respondents

Characteristics	Group A	Group B	P-value
Age(years) mean±SD	36.5±14	38.7±05	0.493
Male n (%)	22 (56.4%)	17 (43.6%)	0.528
Female n (%)	10 (40.0%)	15 (60.0%)	0.326
Weight(Kg) mean±SD	63.9±05	61.6±06	0.301
Height (m) mean±SD	1.5±04	1.5±08	0.557

Figure 1: Types and percentages of surgeries done in groups A and B.

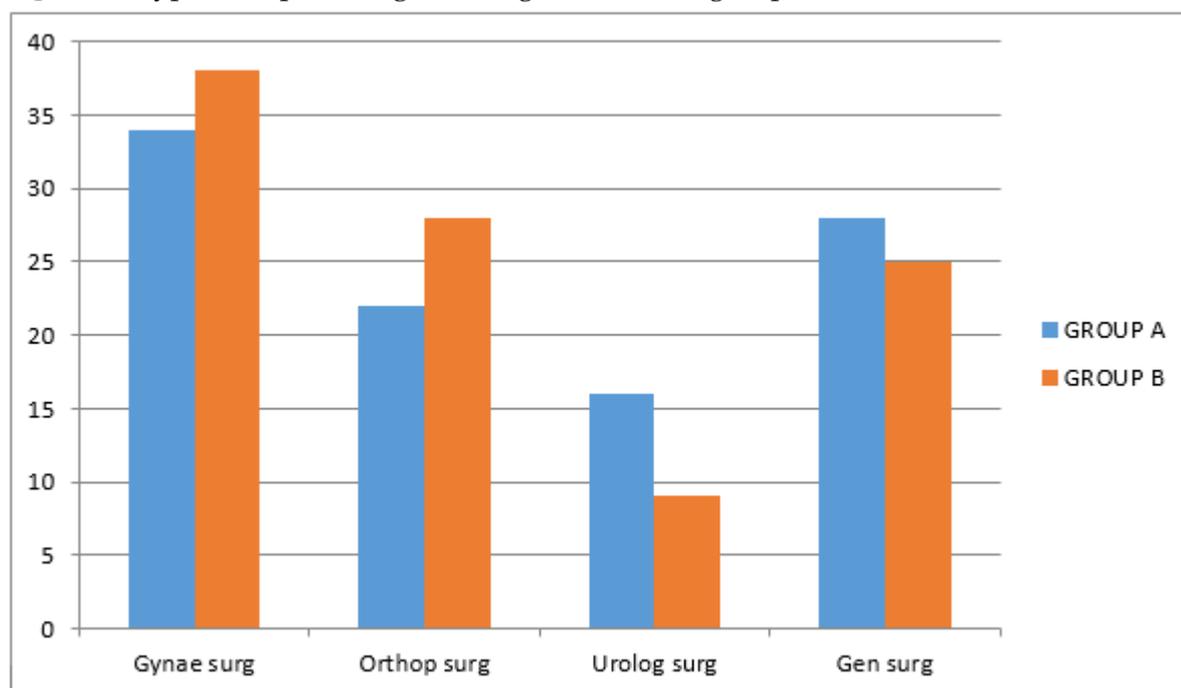
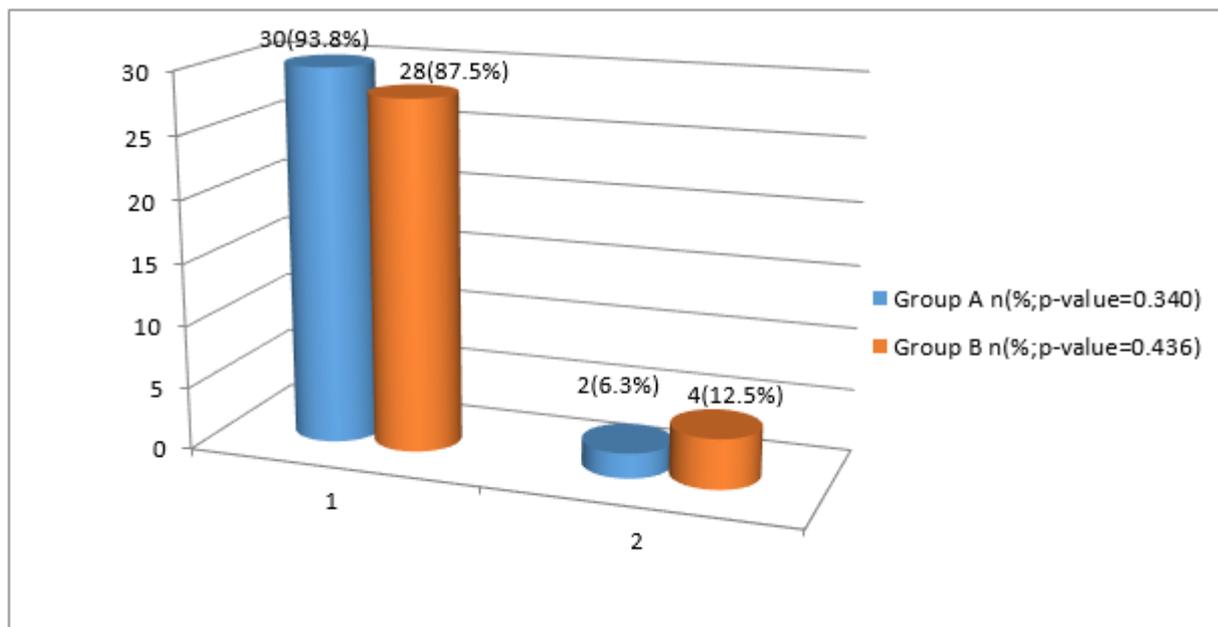
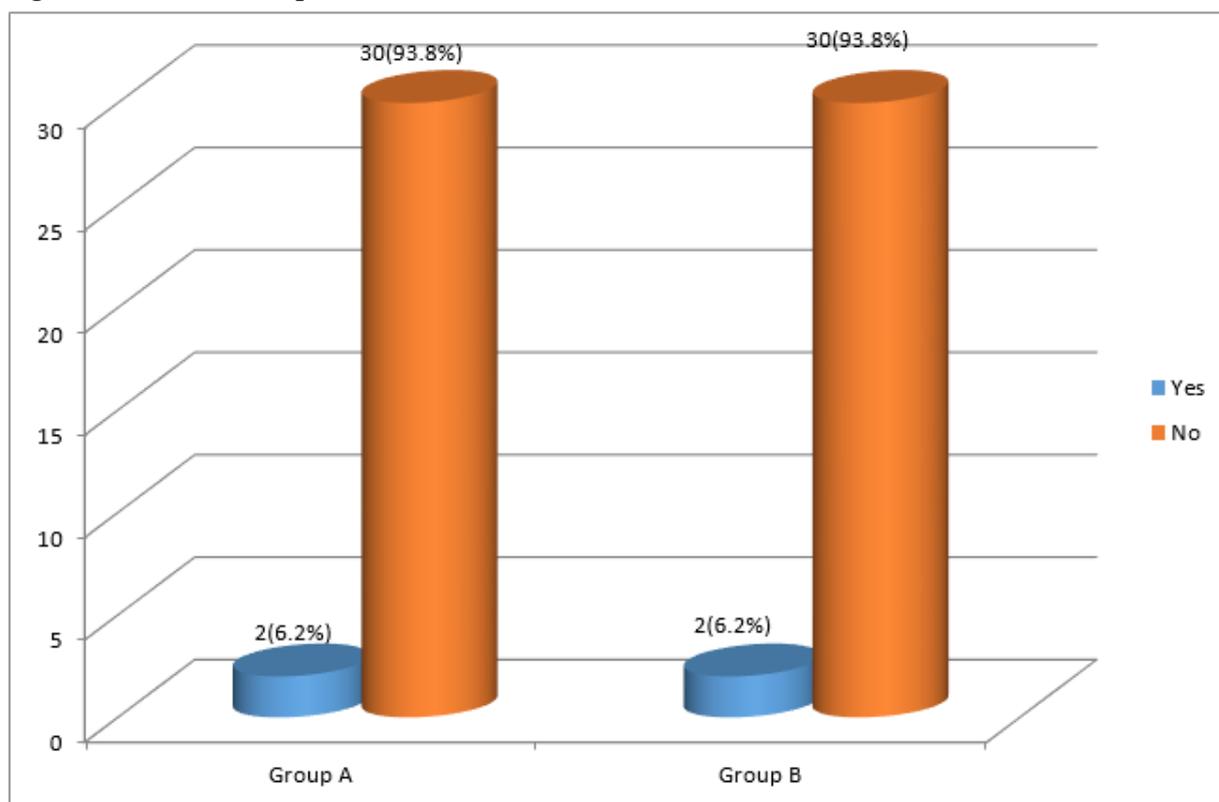


Fig 2: Number of attempts at insertion



Number of attempts →

Fig 3: Occurrence of Apnoea



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Table 2. Overall assessment of LMA insertion conditions

Conditions	Group A n(%)	Group B n(%)	P-value
Excellent	28 (87.5%)	27 (84.4%)	0.893
Good	2 (6.3%)	1 (3.1%)	0.564
Satisfactory	2 (6.3%)	4 (12.5%)	0.655
Poor	0 (0.0%)	0 (0.0%)	-

n=number of subjects

Table3: Responses during LMA insertion

	Group A n(%)	Group B n(%)	P-value
Coughing/Gagging			
Grade 1(nil)	28 (87.5%)	28 (87.5%)	1.00
Grade 2(mild)	4 (12.5%)	3 (9.4%)	0.705
Grade 3(moderate)	0 (0.0%)	1 (3.1%)	-
Grade 4(severe)	0 (0.0%)	0 (0.0%)	-
Laryngospasm			
Grade 1(nil)	29 (90.6%)	28 (87.5%)	0.895
Grade 2(mild)	3 (9.4%)	2 (6.3%)	0.655
Grade 3(moderate)	1 (3.1%)	2 (6.3%)	-
Grade 4(severe)	0 (0.0%)	0 (0.0%)	-
Limbs movement			
Grade 1(nil)	28 (87.5%)	28 (87.5%)	1.000
Grade 2(mild)	2 (6.3%)	2 (6.3%)	1.000
Grade 3(moderate)	2 (6.3%)	2 (6.3%)	1.000
Grade 4(severe)	0 (0.0%)	0 (0.0%)	-
Jaw relaxation			
Well relaxed	28 (87.5%)	27 (84.4%)	0.893
Slight relaxation	3 (9.4%)	1 (3.1%)	0.317
Grossly not relaxed	1 (3.1%)	4 (12.5%)	0.180

Table4: Cost of drugs in each group

Drugs	Cost in Naira (*Nigerian currency)	
	Group A	Group B
Fentanyl (100ug) - 2ml	100	100
Propofol (200mg) - 20ml	2400	--
Thiopentone (500mg)	--	500
Lignocaine (100mg) - 10ml	--	20
Total cost	2500	620

*NB: exchange rate at time of study was \$1 = ₦199

Discussion

Propofol is particularly well suited for the insertion of LMA because of its greater depressant effect on airway reflexes than that of thiopentone⁹.

It is suggested that thiopentone increases airway irritability because of the relatively greater depressant effect of the drug on the sympathetic than on the parasympathetic reflex arch.

It is therefore clear that successful smooth insertion of LMA using thiopentone would require either adequate reflex suppression or deeper plane of anaesthesia.

So, in our study, propofol was compared to lignocaine-thiopentone to assess the ease of LMA insertion. Intravenous (IV) lignocaine is one of the commonest, inexpensive and readily accessible drugs used for suppression of airway reflexes; thus in this study it was



used to make up for the drawbacks of thiopentone^{10,11}.

There was no difference in the demographic characteristics among the subjects in the two groups. Successful insertion of LMA at first attempt was observed to be 93.8% in group A compared to 87.5% in group B. This high success rate of insertion observed in group B could have been due to the 2mg.kg⁻¹ of lignocaine used in this study which could have obtunded upper airway responses and therefore aided the insertion of LMA.

The patients had different surgeries ranging from urologic, orthopaedic, gynaecologic and general surgical procedures. It was however, observed that there were some slight differences in the number of patients in group A and group B for each surgery. For instance, 11 (34%) patients in group A had gynaecological surgery compared to 12 (38%) patients in group B. Similar differences also exist in the other surgeries. However, all these differences were not statistically significant and could not have affected the outcome of this study. Overall assessment of the ease of LMA insertion in our study showed that propofol provided excellent insertion of LMA in 87.5% of patients which is comparable to that of lignocaine-thiopentone admixture which was 84.4%. This result is similar to the study done by Amr and Amin¹² where two different doses of thiopentone (6mg.kg⁻¹ and 7mg.kg⁻¹) were compared with 2.5mg.kg⁻¹ propofol for the insertion of i-gel supraglottic airway device. They found that insertion condition using 7mg.kg⁻¹ using high dose thiopentone was similar. So, with this high dose of thiopentone, they were able to achieve adequate suppression of the airway reflexes comparable to propofol. In our study however, we did not use a dose as high as 7mg.kg⁻¹. Instead, 5mg.kg⁻¹ thiopentone was used which was preceded by 2mg.kg⁻¹ of

lignocaine. Lignocaine is known to blunt responses from upper airway instrumentation. Lignocaine 1.5mg.kg⁻¹ has been shown to suppress cough reflexes in both awake and in patients under anaesthesia¹³.

Therefore, the high percentage of excellent conditions for insertion of LMA observed in the lignocaine-thiopentone group may possibly have been due to the 2mg.kg⁻¹ lignocaine used before inducing with thiopentone in our study. In another similar study by Rao et al, pre-treating the patients with fentanyl (1.5 mcg/kg) IV, Midazolam (0.02mg/kg) IV and Lignocaine (1.5mg/kg) IV three min before the induction of anaesthesia, provided comparable insertion conditions in both thiopentone and propofol group¹⁴.

In their study, Scanlon P et al¹⁵ did a study where they compared thiopentone alone with propofol for ease of LMA insertion where they observed adverse airway response in 76% of patients in the thiopentone group compared to 26% of patients in the propofol group. Their outcome differs from our study and this could be attributed to our use of 2mg.kg⁻¹ lignocaine in combination with thiopentone which is known to obtund the upper airway response to LMA insertion.

The outcome in our study differs from the study done by Bapat et al¹⁶ where propofol was compared to lignocaine-thiopentone and midazolam-thiopentone for LMA insertion in one hundred ASA I and II patients. It was observed in their study that 46 (92%) patients had excellent insertion of LMA in the propofol group compared to 34 (68%) patients in the lignocaine-thiopentone group¹⁶.

The differences seen in the results between Bapat et al¹⁶ study and our study could be the smaller sample size (64) used in our study

which could be responsible for missing/masking the detection of larger difference between the propofol group and the lignocaine-thiopentone group in our study.

Also, in this study, various airway responses to laryngeal mask airway insertion; including coughing, gagging, laryngospasm and limb movement in both groups were compared and found to be similar in the two groups. Coughing and gagging was observed in 12.5% in the propofol group and 9.4% in the lignocaine-thiopentone group which was however not statistically significant. However, Bapat et al¹⁶ in their study comparing propofol versus lignocaine-thiopentone and midazolam-thiopentone for LMA insertion observed coughing and gagging in 2% of patients in both the propofol and lignocaine-thiopentone group. The possible reason for the difference observed in the Bapat et al study and our study could be that in Bapat et al¹⁶ study, patients were ventilated with 2% isoflurane for two minutes after induction of anaesthesia before LMA insertion was attempted. In our study LMA insertion was attempted immediately after induction of anaesthesia. Kinirons et al¹⁷ in their assessment of the optimum time for LMA insertion also recommended that LMA insertion should be delayed after induction of anaesthesia; during which patient should be ventilated for two minutes with 2% isoflurane to minimize patient's response to laryngeal mask airway insertion. Stoneham et al¹⁸ in their study compared saline-propofol with lignocaine-propofol and observed difficult LMA insertion in 38% of patients in the saline-propofol group as a result of coughing and gagging. This is higher than that observed in our study. The patients in their study received propofol at a relatively slow rate of

600ml.hr⁻¹ (10mls.min⁻¹) which could be responsible for the difference between their study and our study. Kati et al¹⁹ compared propofol with sevoflurane for LMA insertion while; Chen et al²⁰ compared propofol alone with sevoflurane-Nitrous oxide and propofol-sevoflurane-Nitrous oxide combination for LMA insertion. They observed significant rates of coughing and gagging incidences in the sevoflurane group compared to the propofol group.

Our study showed that 12.5% of patients in the lignocaine-thiopentone group had inadequate jaw relaxation compared to 3.1% in the propofol group. This outcome is similar to the study done by Scanlon P et al¹⁴ where thiopentone was compared to propofol for laryngeal mask insertion. They found that 11% of patients in the thiopentone group had difficult laryngeal mask insertion due to inadequate jaw relaxation. Also, Ti et al²¹ compared sevoflurane with propofol for laryngeal mask airway insertion in adult patients. They observed difficulty in jaw relaxation in 45% of patients induced with sevoflurane and in 21% of patients induced with propofol. This difference was statistically significant and they concluded that propofol provided a better jaw relaxation than sevoflurane. The outcome of our study also showed that propofol provided a better jaw relaxation compared to lignocaine-thiopentone admixture as shown by the high percentage of subjects with inadequate jaw relaxation. This was however, not statistically significant.

One of the prerequisites for selection of drugs for use in patients in our environment is cost effectiveness.

The total cost of drugs for group A was \$12.56, while that of group B was \$3.11; the cost for the thiopentone group was four times less than that of the propofol group.



Limitations: This study was done as a single blind study because of the colour of propofol which is milky and distinct. So the researcher could not be blinded.

This could have been achieved by wrapping the syringes and blinding both the researcher and the patient or someone else mixing the drugs and hiding its identity without the knowledge of the researcher. A double blind study would have been more objective than single blind study.

Conclusion

The results from this study showed that 2mg.kg⁻¹ lignocaine followed 30 seconds later with 5mg.kg⁻¹ thiopentone was equally effective and comparable to 2.5mg.kg⁻¹ propofol in providing optimal conditions for the insertion of LMA in ASA grade I and II patients. Use of thiopentone is a cheaper and more affordable alternative for majority of patients in this part of the world.

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