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Original Article

Haemodynamic Changes at Induction during Laryngeal Mask Airway Insertion: Comparison of Propofol Versus Lignocaine-Thiopentone Admixture

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ABSTRACT

Propofol is considered the standard induction agent for laryngeal mask airway (LMA) insertion but the search for other cost-effective methods with haemodynamic advantages continue. The objective of this study was to determine the haemodynamic changes at induction and during LMA insertion comparing propofol alone versus lignocaine- Thiopentone admixture. In this comparative randomized study, patients of American Society of Anesthesiologists' (ASA)class I and II age between 18-60 years scheduled for short elective surgeries were assigned into two equal groups. Patients were premedicated with fentanyl 1ug.kg-1. Anaesthesia was induced with either 2.5mg.kg-1 propofol (group A) or a sequence of 2mg.kg-1 lignocaine and 5mg.kg-1 thiopentone (group B). Anaesthesia was maintained with 2% isoflurane and 100% oxygen. Haemodynamic variables [Heart Rate(HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP)] were measured non-invasively during three periods; before induction, immediately after induction, prior to insertion of LMA and after LMA insertion. Data was analysed using SPSS with $p<0.05$considered significant. We concluded that propofol and lignocaine-thiopentone admixture exhibited similar haemodynamic profile and therefore recommended that both drugs could be used for patients during induction of anaesthesia and LMA insertion.

Keywords: *Haemodynamics, lignocaine, LMA, thiopentone*

INTRODUCTION

The laryngeal mask airway is a supraglottic airway device used to maintain the airway during anaesthesia. It can also be used to maintain airway during difficult or failed intubation and in cardiopulmonary resuscitation.[1,2] While maintaining the airway, it allows the Anaesthesiologist have free hands to attend to other responsibilities. Different induction agents and adjuvants have been employed to facilitate placement of the LMA.[3,4] The optimal depth of anaesthesia for LMA placement is considerably less than that for tracheal intubation[5,6] Various induction agents and their combinations have been used to facilitate its insertion with least side effects as well as to blunt associated haemodynamic changes.[7,8] Thiopentone is an intravenous anaesthetic agent that has been studied several times either alone or in combination with other drugs like lignocaine, midazolam, dextometodimidine, succinylcholine or butorphanol as induction agent for LMA insertion.[9,10] The relative high

cost of propofol and associated pain on injection makes thiopentone an alternative[11,12]. Thiopentone on its own does not provide adequate suppression of airway reflexes for the device to be tolerated within the hypopharynx, thus combinations with various adjuncts are used with it. This study intends to compare the haemodynamics responses during LMA insertion with the two commonly used agents- propofol and thiopentone-lignocaine combination.

MATERIALS AND METHODS

This study was a prospective, single-blind randomized clinical trial, carried out in the modular theatre of the Jos University Teaching Hospital (JUTH), a tertiary health institution located in Jos, Plateau State, Central Nigeria. The study population was made up of patients of age group 16 – 60years 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.

Inclusion criteria were patients not at risk of aspiration, ASA class I and II patients and patients whose procedure do not require controlled ventilation or muscle relaxation. While exclusion criteria were patients at risk of aspiration, patients with low pulmonary compliance, limited mouth opening and those undergoing oral or nasal surgery. Also excluded from the study were patients with pharyngeal pathologies and patients allergic to propofol or lignocaine or thiopentone

From the elective operation list, both in and out patients that fulfilled the inclusion criteria were selected by simple random technique into the propofol group (group A) and lignocaine and thiopentone group (group B). Equal numbers of white and red cards in a container were blindly picked and then the selected patients received one of the combinations of drugs for induction of anaesthesia by the researcher. Preoperatively, the patients were assessed to determine fitness for anaesthesia according to institutional protocol.

Demographic data; Age, sex, weight and height was collected before the procedure by the researcher using a check list. Haemodynamic parameters; heart rate, blood pressure and mean arterial pressure were documented as preoperative baseline vital signs at zero (0) minute, post-induction vital signs at five (5) minutes, and post-insertion vital signs at ten (10) minutes.Sixty-four patients were randomized into two groups of 32 each as follows; propofol (group A) and lignocaine-thiopentone admixture (group B). Patients' airways were assessed using inter-incisor gap and Mallampati classification. 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.

Patients were 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 1ugkg^{-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 assistant (trained surgery resident) with either of the assigned drugs; 2.5mgkg^{-1} propofol (group A) or 2mgkg^{-1} lignocaine, followed 30 seconds later by 5mgkg^{-1} thiopentone (group B). All drugs were given intravenously over fifteen seconds by the same assistant, while the researcher (who was blinded) was not in the suite during induction. 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. Haemodynamic responses to LMA insertion observed were recorded.

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 mal-positioning, such patient received a subsequent dose of either propofol 0.25mg.kg^{-1} or thiopentone 0.5mg.kg^{-1} and his/her lungs ventilated using facemask. LMA 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. Patients were monitored using pulse oximeter, capnography, non-invasive blood pressure and ECG using GE DASH 4000 multiparameter monitor. Occurrence of hypotension (SBP < 90 and DBP <60 or 30% drop from baseline) was treated with Ringers Lactate at 4mls kg^{-1}hr^{-1}. At completion of surgery, N_2O 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. The 100% oxygen was continued via face mask till recovery. Parameters like heart rate, non invasive blood pressure and oxygen saturation were recorded pre-induction, immediately after induction, immediately after LMA insertion and later at one minute, three minutes and was maintained at five minutes interval until the end of the surgery. Continuous ECG monitoring was performed to record any arrhythmias throughout the surgery. Patients were monitored throughout the period of anaesthesia and surgery then followed up postoperatively to ensure full recovery from anaesthesia and also to check for any complications like nausea and vomiting.

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

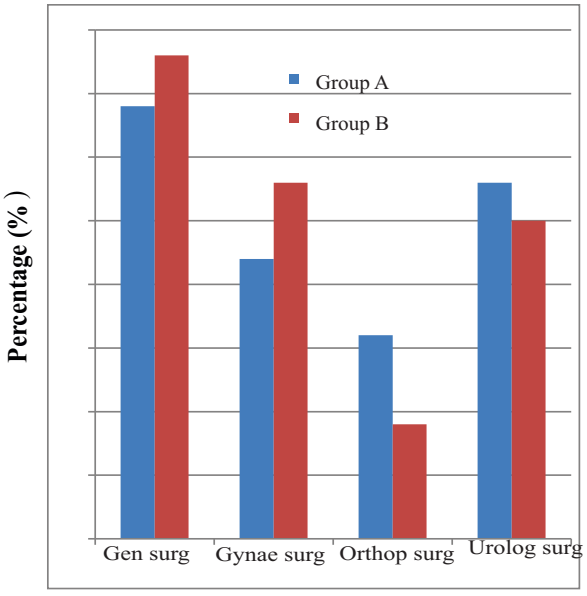

Figure 1: Types and percentages of surgeries done in groups A and B.

Data Analysis

All statistical analysis was performed using SPSS version

Table 2: Effect of propofol (Group A) on haemodynamic parameters

Parameters	Period			p-value
	Baseline (mean±SD)	Post-induction (mean±SD)	Post-insertion (mean±SD)	
Heart Rate (bpm)	92.3±11	100.7±09	98.02±13	0.765* 0.767**
Systolic BP (mmHg)	120.7±09	102.5±07	102.5±07	0-001* 0-001**
Diastolic BP (mmHg)	77.9±08	67.0±12	62.5±09	0.004* 0.0001**
MAP (mmHg)	92.6±01	79.7±01	76.2±07	0.008* 0.001**

NB: (*)=Post-induction P-value; (**)=Post-insertion P-value

Table 3 : Effect of Lignocaine-thiopentone (Group B) on haemodynamic parameters

Parameters	Period			P-value
	Baseline (mean±SD)	Post-induction (mean±SD)	Post-insertion (mean±SD)	
Heart Rate (bpm)	93.2±12	99.2±11	94.8±12	0.520* 0.989**
Systolic BP (mmHg)	120.7±13	115.9±12	117.5±13	0.139* 0.318**
Diastolic BP (mmHg)	80.6±14	75.2±11	76.6±13	0.636* 0.712**
MAP (mmHg)	94.3±01	87.5±01	88.3±01	0.779* 0.882**

NB: (*)=Post-induction P-value; (**)=Post-insertion P-value

Table 4: Comparing change (%) in haemodynamic parameters from baseline value at post insertion in group A and B.

Change in percentage from baseline

parameters	Group A	Group B	p - value
Heart Rate	+3.8%	+7.2%	0.407
SBP	- 2.5%	- 13.3%	0.001
DBP	- 20.1%	- 1.2%	0.0001
MAP	- 2.9%	- 9.2%	0.140

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 ±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 p=0.493. There were 22 (56.4%) male patients in group A compared to 17 (43.6%) male patients in group B 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.(Table 1). 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).

In group A, the baseline heart rate (92.3±11) was compared to the post-induction heart rate (100.7±09) with p=0.765 and post-insertion heart rate

(98.0±13) with p=0.767.(Table 2). Also, baseline SBP (120.7±09) was compared to the post-induction SBP (102.5±07) with p=0.001 and post-insertion SBP (102.59±07) with p=0.001. (Table 2). The baseline DBP (77.9±08) was compared to the post-induction DBP (67.0±12) with p=0.004 and post-insertion DBP (62.5±09) with p=0.001.(Table 2). The baseline MAP (92.6±01) was compared to the post-induction MAP (79.7±01) with p=0.008 and post-insertion MAP (76.2±07) with p=0.001.(Table 2).

In group B, the baseline heart rate (93.2±12) was compared to post-induction heart rate (99.2±11) with p=0.520 and post-insertion heart rate (94.8±12) with p=0.989. (Table 3). The baseline SBP (120.7±13) was compared to the post-induction SBP (115.9±12) with p=0.139 and post-insertion SBP (117.5±13) with p=0.318. (Table 3). The baseline DBP (80.6±14) was compared to the post-induction DBP (75.2±11) with p=0.636 and post-insertion DBP (76.6±13) with p=0.712. (Table 3). The baseline MAP (94.3±01) was compared to the post-induction MAP (87.5±01) with p=0.779 and post-insertion MAP (88.3±01) with p=0.882. (Table 3).

The change in the haemodynamic parameters at post-insertion in group A and B were also compared. This showed that in group A, there was a 3.8% rise in the heart rate from baseline value compared to a 7.2% rise in group B with a p=0.407. The SBP decreased from baseline value by 2.5% in group A compared to a decrease of 13.3% in group B with p=0. Also, there was a 20.1% decrease in the DBP from the baseline value in group A compared to a 1.2% decrease in group B with p=0.0001. The MAP decreased by 2.9% from the baseline value in group A compared to a 9.2% decrease in group B with p=0.140. (Table 4).

DISCUSSION

In this study, Patients of age group 16 – 60years of either sex belonging to ASA grade I and II scheduled for short (not lasting more than one hour) were selected. There was no difference in the demographic characteristics among the subjects in the two groups. Propofol is commonly used for insertion of LMA; compared to equi-anaesthetic doses of other induction agents, it causes significant decrease in systemic blood pressure which can be attributed to the severe dilation of the arteries.[13,14] Barbiturates, on the other hand, usually cause relatively less decrease in the systemic blood pressure compared to propofol[15]. Addition of lignocaine to barbiturates is said to improve conditions for LMA insertion and effects on the haemodynamic status. The current study was carried out to compare the effects lignocaine/thiopentone combination on the one hand and propofol alone on the haemodynamic status in adult patients going in for short surgical procedures under general anaesthesia.

In our study, the basal mean heart rate was 92.3±11beats per minute and 93.2±12 for groups A and B respectively. There was an increase in mean heart rate from baseline across all time period in both groups, especially in group A (propofol) compared to group B (STP). However, a slight increase in heart rate was noticed in the immediate post-insertion period in group A compared to B. This was more with the lignocaine-thiopentone group (99.2±11 bpm post-induction versus post-insertion heart rate; 94.8±12 bpm) compared to the propofol group (post-induction HR:100.7±09 bpm versus post-insertion HR: 98.02±13 bpm).The percentage increase in heart rate in the immediate post-induction period of 10.5% in group A and only 6.9% in group B were noticed. While in the post-insertion period, only a 3.8% increase in heart rate was noticed in group A compared to be B (7.2%). This could be compensatory as thiopentone and other barbiturates are known to cause compensatory tachycardia due to smooth muscle relaxation.[16] Also, this difference could be due to the injection of lignocaine before the thiopentone. It is common knowledge that the addition of lignocaine resulted in smooth muscle relaxation and its ability to depress myocardial automaticity. Central vagolytic effect cause by atropine premedication may also explain the tachycardia noticed in the immediate post-induction period across both groups.[17]

The systolic, diastolic and mean arterial blood pressures were measured at intervals. After induction, there was a decrease in blood pressure in both groups, but the decrease

was more in the propofol group compared to the thiopentone group. The percentage decrease in the systolic blood pressure was up to 14.1% in the propofol group but minimal in the thiopentone group (3.7%), while the decrease in the diastolic blood pressure was minimal in the propofol group (3.9%) compared to the lignocaine-thiopentone group (12.3%). However, the decrease in mean arterial blood pressure was more in the propofol group (12.1%) compared to the lignocaine thiopentone group (7.2%).The changes noticed in the immediate post induction period could be due to the pharmacologic effects of the drugs or patient factors. It also shows better haemodynamic control in the drug combination group compared to the group that had monotherapy.

Following the insertion of the LMA, profound decrease of up to 20.1% of the diastolic blood pressure was observed in the propofol with minimal change in the systolic blood pressure (2.5%). This little decrease in the diastolic blood pressure showed that the airway manipulation had little effect on the arteriolar vasodilatation caused by the drug compared to the systolic blood pressure. Also minimal decrease in diastolic blood pressure was observed in the lignocaine-thiopentone group (1.2%) compared to the systolic (13.3%) signifying minimal effect on arteriolar vasculature when the airway was manipulated. This further showed that the combination of lignocaine-thiopentone provided better haemodynamic control and excellent condition for airway manipulation comparable to propofol. The advantage of combining two drugs from different classes is that lower doses are used and the risk of side effects is minimized.

A study conducted by Rao and Colleaques,[5] using the same drugs, but a dose of lignocaine of 1.5mg/kg body, showed a decrease in both the systolic and the diastolic blood pressure across all the groups but more in the propofol group compared to the other group and this continued till the end of the surgery. This could be due to the fact that the patients were premedicated with midazolam, fentanyl and lignocaine. The researcher also used physical signs such as loss of eyelash reflex to ascertain adequate depth of anaesthesia rather than time (post-induction and post-insertion) before manipulating the airway. Also, the overall mean arterial blood pressure was 88.23± 6.69 and 90.83±4.29 in the propofol and thiopentone groups respectively. This was not assessed in the index study where only the post-induction and post-insertion mean arterial blood pressure were compared for each drug group and the effect on respiration was not assessed in our study.

Another studyin children compared haemodynamic effect of ketofol (combination of ketamine with propofol) and propofol on ease of LMA insertion also showed a significant drop in mean arterial blood pressure and heart rate in the propofol group compared to the drug combination group.[18] This implied that combing propofol and ketamine provided a balanced effect of haemodynamic control; the vasodilatory effect of propofol was cancelled out by the sympathetic effect of ketamine. This could account for the slight decrease in the mean arterial blood pressure and the heart rate compared to the propofol. However, our study compared thiopentone-lidocaine combination to propofol.

A study done by Kumar *et al*[19] showed less haemodynamic changes after insertion of the LMA following thiopentone compared to propofol. This could be explained by the prior use of lignocaine spray which provided smooth conditions for the insertion of the LMA by obtunding the airway reflexes.[19] The participants were not premedicated prior to the induction of the anaesthesia which further contributed to the haemodynamic stability.

CONCLUSION

In patients premedicated with fentanyl/midazolam, propofol and lignocaine-thiopentone admixture exhibited similar haemodynamic profiles. Therefore recommend that where resources are limited thiopentone/lignocaine could replace propofol.

Limitation: The values of the haemodynamic changes were not taken every minute which would have been more accurate in detecting changes within this time period.

Conflict of Interest: None declared

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