COMPARISON BETWEEN THE INDUCTION OF ANESTHESIA USING SEVOFLURANE-NITROUS OXIDE, PROPOFOL OR COMBINATION OF PROPOFOL AND SEVOFLURANE-NITROUS OXIDE USING LARYNGEAL MASK AIRWAY(LMA) IN HYPERTENSIVE PATIENTS

Mohamed Saad El-Din Tolba, Montaser S A El-kassem, Hussien M Agameya*

Department of Anaesthesia and Intensive Care, Faculty of medicine, Menofyia University, Alexandria University*

ABSTRACT

In a double-blinded trial, 90 patients with stable hypertension were enrolled in this study. Each group consisted of 30 patients. The induction in group S was by sevoflurane 4% + 50% oxygen +50% nitrous oxide by inhalation using the tidal volume technique. The induction in group P was by propofol 2mg/kg IV, and in group PS (combination group) was by propofol 1mg/kg followed by inhalation of 4% sevoflurane. The present study compared hemodynamic changes, laryngeal mask airway (LMA) insertion time and any complications occurred in the induction period between the three groups. LMA insertion time was significantly longer in the sevoflurane group than in the other two groups. Mean arterial blood pressure (MAP) was significantly lower within each group after induction in comparison to before induction. In all the groups, LMA was successfully inserted in all patients. According to patients induction was pleasant in 90% of patients in the propofol group and was 88% in the combination group and 40% in the sevoflurane group. This study concluded that in the combination group there is the advantage of patient satisfaction and rapid induction with no apnea which occurred with propofol and had the advantage of hemodynamic stability encountered with sevoflurane.

INTRODUCTION

The induction of anesthesia in hypertensive patients carries an increased risk of adverse cardiovascular events in hypertensive patients. Laryngoscopy is often followed by increased arterial pressure which may lead to myocardial ischemia, transient ventricular failure and arrhythmia[1-2]. LMA has been safely and effectively used in spontaneous and controlled ventilation. LMA can be inserted successfully after suppression of airway reflexes by deep anesthesia. Propofol is an appropriate intravenous anesthetic agent for rapid induction and suppression of airway reflexes. Sevoflurane is an alternative to propofol because it has a pleasant odor, does not irritate the airways and provides a rapid induction and recovery. Deeper anesthesia or premedication with various agents, such as beta blockade, opioids or calcium inhibitors may limit this hypertensive reaction but may be followed by hypotension which is equally deleterious in cardiac high risk patients [3-10]. Induction by low dose propofol followed by sevoflurane may be valuable in such patients. Indeed low dose propofol followed by sevoflurane has been shown to be effective and well tolerated.[11-12] The aim of this study was to compare, in hypertensive patients, the hemodynamic response to induction of anesthesia and the incidence of complications between these three methods of induction. (sevoflurane-nitrous, propofol, and propofol-sevoflurane methods)

PATIENTS AND METHODS

After consent of all patients, 90 ASA classII patients, scheduled for elective lower abdominal surgery were included in this randomized study. Patients with uncontrolled cardiovascular, pulmonary, renal, liver dysfunction or smokers were excluded from the study. Patients taking angiotensin converting enzyme inhibitors stopped taking the drug 24 hours before
the operation. The patients included in the present study had a history of hypertension for which they were being treated and the admission blood pressure was <160 mmHg systolic and <100 mmHg diastolic. Patients were well-controlled hypertension they normally continued their medication up to, and including, the day of surgery. Patients were allocated randomly to three induction groups each one consisted of 30 patients. Group S received 4% sevoflurane-N2O, group P received propofol 2 mg/kg IV and group PS received propofol 1mg/kg followed by inhalation of 4% sevoflurane.

Standardized monitoring using non-invasive blood pressure, heart rate, electrocardiogram (ECG), oxygen saturation (SpO2) and end-tidal partial pressure of carbon dioxide (ETCO2) were done for every patient. Hemodynamic parameters were recorded before anesthesia was given (time 0). All patients were given 1µg/kg fentanyl IV and breathed 100% oxygen via a facemask for 3 minutes before induction. After this, group S received 4% sevoflurane (tidal volume technique) [13-14] + 50% nitrous oxide + 50% oxygen in 8L /min. Group P received propofol IV 2mg/kg at a rate of 40mg/10sec. Group PS received 1mg/kg propofol at a rate of 40mg/10sec. followed by 4% sevoflurane +50% nitrous oxide +50%oxygen in 8L/min.

Parameters studied times:
1. heart rate and blood pressure of the patients were measured before induction (time 0) and 3 minutes after induction of anaesthesia (time 1) and immediately after LMA insertion (time 2) and 5 min after LMA insertion (time 3).
2. Loss of consciousness was detected by loss of command communication and confirmed by loss of eyelash reflexes. The LMA was inserted after the eyelash reflex had been lost.
3. Success with LMA insertion was assessed by chest wall auscultation and capnography. In all patients anesthesia was maintained with sevoflurane adjusted initially at 1.5% end tidal concentration and adjusted during the operation according to the hemodynamic changes Rocuronium 0.6mg/kg was given to all patients and controlled ventilation done for all patients. Induction time was defined as the interval from the beginning of induction to loss of lid lash reflex.
4. Patient satisfaction was defined as unfavorable if patients after recovery stated that the induction was unpleasant and favorable if patients stated that the induction was pleasant.
5. The percentage of patients in whom the LMA was inserted from the first attempt was recorded.
6. The degree of jaw opening (good or not) was assessed. 7. Occurrence of laryngospasm, cough, hiccuppimg were assessed.
8. Apnea occurrence (cessation of respiration for 20 sec.) was also assessed.
9. the doses of Ephedrine sulphate requirements.

Statistical analysis
The data are expressed as mean (SD), percentage and numbers. Demographic data were analysed with one-way anova (ANOVA) and Chi Square. ANOVA and repeated measures ANOVA were used for the comparison of the hemodynamic changes between and within the three groups respectively. P <0.05 was considered to be significant.

RESULTS
All patients were comparable with respect to age, sex, weight (Table 1). Before the induction of anesthesia (time 0), there was no significant difference in MAP between the three groups (figure1). After induction (time 1), there was significant decline in MAP (Mean Arterial Blood Pressure) in each group compared to the MAP before induction and the propofol group showed significant decline in MAP compared to sevoflurane group and the combination group and there was no significant difference detected between the sevoflurane group and the combination group. After LMA insertion (time 2) and 5 minutes after the LMA insertion (time 3) there was significant
decline in MAP in the propofol group compared to the other two groups but no significant difference detected between the sevoflurane and the combination group. Within the propofol group at these times there was significant decline in MAP compared to preinduction level. At these two times, no significant difference was detected within the sevoflurane group or the combination group compared to preinduction level.

Before induction, there was no significant difference in HR between the three groups. After induction, there was a significant decline in HR in the sevoflurane group compared to preinduction level (figure 2). In the propofol group and in the combination group, there was no significant difference in HR compared to preinduction, also at this time there was significant decline in HR in the sevoflurane group compared to the other two groups but no significant difference was detected between the propofol group and the combination group. After LMA insertion and 5 minutes after the insertion there was significant increase in HR in the propofol group compared to the other two groups but no significant difference in HR was detected between the sevoflurane group and the combination group. Also at these two times, there was significant increase in HR in the propofol group compared to preinduction level and there was significant decrease in HR in the sevoflurane group compared to preinduction level, but no significant change was detected at these two times in the combination group compared to the preinduction levels. (Table 2)

**Induction time**

Induction time was significantly longer in the sevoflurane group compared to the propofol group and the combination group (figure 3).

But no significant difference was detected between the propofol group and the combination group (table 3).

**LMA Insertion from the first attempt**

LMA was inserted from the first attempt in 80% of patients in the sevoflurane group and it was inserted from the first attempt in all patients of the other two groups (table 3).

**Satisfaction**

Only 40% of patients in the sevoflurane group were pleasant with the induction but 90% of patients were pleasant in the propofol group and 88% of patients were pleasant in the combination group (table 3).

**Jaw opening**

20% of patients in the sevoflurane group had difficulty in jaw opening. No patient in the other two groups had such difficulty (table 3).

**Apnea**

40% of patients in the propofol group had apnea but no patient had apnea in the other two groups (table 3).

**Laryngeal spasm**

No patient in the present study had laryngospasm (table 3).

**Cough**

Only one patient had cough during the induction in the sevoflurane group no patient had cough in the other two groups (table 3).

**Hiccups**

Only one patient had hiccough during the induction in the sevoflurane group, no patient had hiccough in the other two groups (table 3).

**Ephedrine requirements**

There was significant increase in ephedrine requirements in the propofol group compared to the other two groups (P<0.05), but no significant difference was detected between the sevoflurane group and the combination group.
Table (1): Demographic criteria of the studied groups.

<table>
<thead>
<tr>
<th></th>
<th>Group S (n=30)</th>
<th>Group P (n=30)</th>
<th>Group PS (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Y)</td>
<td>60.2(4.4)</td>
<td>60.3(4.3)</td>
<td>59.8(4.9)</td>
</tr>
<tr>
<td>Gender M/F</td>
<td>15/15</td>
<td>16/14</td>
<td>14/16</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>72.9(2.2)</td>
<td>71.8(2.9)</td>
<td>70.9(2.7)</td>
</tr>
</tbody>
</table>

Data are expressed as Mean(SD).

Table (2): Changes in heart rate and Mean Arterial Blood Pressure in the studied groups at various times.

<table>
<thead>
<tr>
<th></th>
<th>Time 0</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group S</td>
<td>110.3(10.4)</td>
<td>90.6(8.3)*</td>
<td>115.8(7.2)</td>
<td>112.5(7.4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Group P</td>
<td>108.1(9.6)</td>
<td>80.8(10.2)*</td>
<td>90.4(9.3)*</td>
<td>80.6(10.3)*</td>
<td>0.0001</td>
</tr>
<tr>
<td>Group PS</td>
<td>109.3(10.2)</td>
<td>92.6(9.3)*</td>
<td>114.2(6.8)</td>
<td>110.3(7.8)</td>
<td>0.001</td>
</tr>
<tr>
<td>Group S</td>
<td>80.3(8.4)</td>
<td>65.6(7.4)*</td>
<td>66.4(9.2)*</td>
<td>68.8(7.2)*</td>
<td>0.001</td>
</tr>
<tr>
<td>Group P</td>
<td>80.2(8.6)</td>
<td>78.9(8.4)</td>
<td>90.6(7.3)*</td>
<td>92.2(8.1)*</td>
<td>0.001</td>
</tr>
<tr>
<td>Group PS</td>
<td>80.6(7.9)</td>
<td>80.1(6.7)</td>
<td>80.2(9.9)</td>
<td>82.3(7.8)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Data are expressed as Mean(SD).

*P<0.05 within the group in relation to preinduction (time0).

Table (3): Incidence of complications in the studied groups:

<table>
<thead>
<tr>
<th></th>
<th>Group S</th>
<th>Group P</th>
<th>Group PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction time (sec.)</td>
<td>150.6(15.2)</td>
<td>65.9(14.7)*</td>
<td>70.1(13.9)*</td>
</tr>
<tr>
<td>LMA insertion from the 1st attempt</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Patient satisfaction (percent)</td>
<td>40%</td>
<td>90%</td>
<td>88%</td>
</tr>
<tr>
<td>Jaw opening difficulty (no.)</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apnea (percent)</td>
<td>0</td>
<td>40%</td>
<td>0</td>
</tr>
<tr>
<td>Laryngospasm (no)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cough (no)</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hiccupping (no)</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ephedrine requirements (mg)</td>
<td>2.1(1.1)</td>
<td>9.3(4.2)*</td>
<td>2.2(0.8)</td>
</tr>
</tbody>
</table>

Data are expressed as Mean(SD). And as percentages in in LMA insertion and Apnea.

*P<0.05 is significant *P<0.01 in comparison to group S
Fig.1: Changes in MAP

Fig.2: Changes in heart rate
Discussion

Sevoflurane is an alternative anesthetic induction agent to propofol since it has a pleasant odor, does not irritate the airways, provide a rapid induction [8-9], however sevoflurane has a longer induction time than propofol [8]. In the present study, induction time with 4% sevoflurane was 150 (15) sec., and was 65 (15) sec. with propofol and was 70(12) sec. in the combination group. Thwaites et al, [15] reported that induction with propofol was pleasant in 70% of patients and was 45% in patients induced by sevoflurane. In the study done by Bapat et al, [16] 90% of patients induced by propofol preferred the method while only 25% of the patients induced by sevoflurane preferred the method. In the present study 90% of patients induced by propofol were satisfied, and 88% of patients induced by the combination of propofol and sevoflurane were satisfied, but only 30% of patients induced by sevoflurane were satisfied.

As regard hemodynamic changes Ti et al, [17] detected significant decrease in MAP and insignificant rise in heart rate (HR) after induction with propofol compared to induction with sevoflurane, while Fredman et al,[18] in his study comparing the induction by sevoflurane versus propofol detected a decrease in MAP and HR after induction in comparison to preinduction values, his study also detected that the decrease in HR in the sevoflurane group was more significant than that in the propofol group. Jellish et al,[19] detected significant decrease in MAP after propofol induction compared to sevoflurane induction in adult patients. The present study suggested that there was significant decrease in MAP in the patients induced by propofol compared to those induced by sevoflurane or those induced by the combination of propofol and sevoflurane, but there was significant decrease in HR in the sevoflurane group compared to the propofol and the combination group.

As regard the degree of jaw opening, Muzi et al, [20] encountered difficulty in jaw opening in 30% of patients induced by sevoflurane. Ti et al, [17] encountered difficulty in jaw opening in 45% with sevoflurane and in 21% of patients induced by propofol. In our study difficulty in jaw opening occurred in 20% of patients in the sevoflurane group. Jaw opening was adequate in all patients in the other two groups. LMA was inserted from the first attempt in all patients in the propofol group and in the combination...
group but was inserted in 80% of patients induced by sevoflurane from the first attempt, however LMA was successfully inserted in all patients.

In the study done by Ti et al.,[17], LMA was inserted after 1.2 (0.6) attempts with propofol and in 1.6 (0.7) attempts with sevoflurane and detected significant difference between the two groups. In the study done by Fleischmann et al.,[21], LMA was inserted from the first attempt with propofol in 85% of patients and in 75% with sevoflurane this differences in the results may be explained by the different doses and concentrations of propofol and sevoflurane used by the investigators.

The present study showed that laryngospasm was not encountered in any patient of the three groups but in the study done by Molloy et al.,[22] Laryngospasm was encountered in 10% of patients received propofol and in 20% of patients received sevoflurane this difference in the results may be explained by the higher rate of injection of propofol and the higher sevoflurane concentration (6%) used by Molloy et al.,[22].

In the present study cough was encountered in only one patient during induction in the sevoflurane group and no patient had cough during induction in the other two groups. In the study done by Molloy et al.,[22] Cough was encountered in 13% of patients received propofol and in 25% of patients received sevoflurane. This difference in the results may be explained by the higher rate of injection of propofol and the higher sevoflurane concentration (6%) used by Molloy et al.,[22].

As regard hiccups, in this study, only one patient had hiccups in the sevoflurane group and hiccup was not detected in any patient of the other two groups. In the study done by Philip et al.,[23] 6% of patients who received sevoflurane had hiccup and 2% of patients who received propofol had hiccups.

CONCLUSION

In our study it seems that induction with propofol 1mg/kg followed by inhalation of 4% sevoflurane is better than the induction with either sevoflurane or propofol alone because in the combination group there is the advantage of patient satisfaction and rapid induction with no apnea which occurred with propofol and had the advantage of hemodynamic stability encountered with sevoflurane.

REFERENCES


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