Induction of Anesthesia in the Elderly Ambulatory Patient: A Double-Blinded Comparison of Propofol and Sevoflurane

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The increasing demographic age of the population has led to larger numbers of elderly patients presenting for ambulatory surgery requiring general anesthesia. Elderly patients have an increased incidence of coronary heart disease and an increased risk of perioperative cardiac morbidity. Minimizing this risk by maintaining a balance between myocardial oxygen supply and demand is best achieved by avoiding hypotension, tachycardia, and hypertension (1). Propofol and sevoflurane are perhaps the first choice induction anesthetics in the ambulatory setting (2,3). We compared the induction characteristics of propofol and sevoflurane in elderly patients presenting for ambulatory surgery in a randomized, double-blinded clinical trial.

Methods

We studied 45 ASA grade I-III patients undergoing ambulatory urological procedures. After obtaining Hospital Ethics Committee approval and written informed consent, patients were allocated randomly (by sealed envelope technique) to receive propofol 1% IV (10 mL.min⁻¹) by infusion pump, 8% sevoflurane or incremental sevoflurane induction. No premedication was given except for continuing medication. All patients were preoxygenated for 3 min with 100% oxygen. Noninvasive automated blood pressure (Cardiocap II, Helsinki, Finland), oxygen saturation (SpO₂), and electrocardiogram monitoring were commenced. A 50-mL syringe filled with 1% propofol or 10% intralipid (placebo) was administered IV at 10 mL/min until induction was complete and then reduced to a maintenance dose of 0.06 mL · kg⁻¹ · min⁻¹. All patients were asked to breathe normally 50% nitrous oxide in oxygen on a Bain circuit (fresh gas flow, 8 L/min). Vaporizers were concealed with a surgical drape. Induction time was signaled by the dropping of a 100-g weight held in the patient’s outstretched arm.

In the Sevoflurane 8% group, a nonblinded anesthesiologist added sevoflurane at 8%. In the Incremental Sevoflurane group, this anesthetist added sevoflurane 1% every 3 breaths until 8% was reached. In both Sevoflurane groups, anesthesia was maintained with 1.5% sevoflurane until the end of the study. In the Propofol group, dummy vaporizer movements were made. The patient’s airway was maintained using a mask and Guedel airway. Therefore, true apnea was clearly distinguishable from airway obstruction. If mean arterial pressure (MAP) decreased to < 50 mm Hg, 500 mL of crystalloid fluid was commenced.

An observer, unaware of the group allocation, made observations of heart rate (HR), MAP (determined from the output of the noninvasive device), and SpO₂ before induction and every min for 6 min after induction. Time to induction, volumes of injectate, and adverse events were documented. On awakening, patients were questioned about their satisfaction.

We decided that a 10% difference in percentage change of MAP relative to baseline between the groups would be clinically important. In a younger population, the sd for percentage change is 6% – 8% (4). Therefore, n = 15 patients in each group would be necessary to detect such a difference if α = 0.05 and β = 0.1. Analysis of variance, Kruskal-Wallis, and Fisher’s exact tests were used as appropriate for group comparisons.

Results

The three groups were comparable in terms of age, weight, gender, ASA grade, incidence of smoking and hypertension. Baseline systolic arterial pressure (SAP), MAP, HR, and SpO₂ were also comparable.

Induction of anesthesia was associated with a decrease in MAP compared with baseline in all groups (Fig. 1). This was significantly more in Propofol patients compared with both 8% Sevoflurane and Incremental Sevoflurane at all times (6 min, mean ± sd: 34

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± 7, 21 ± 6 and 22 ± 13%, P = 0.002). No significant difference in MAP was found between the Incremental Sevoflurane and 8% Sevoflurane groups.

HR initially increased and then decreased compared to baseline in all groups (Fig. 2). It was slower in the Incremental Sevoflurane group than the Propofol group at 3, 4 and 6 min (6 min, mean 62 ± 12 vs 77 ± 15 bpm, P = 0.02).

SpO₂ increased in all groups compared with baseline, but was lower at 6 min in the Propofol compared with 8% Sevoflurane group (98 ± 1 vs. 97 ± 2%, P = 0.04) (Fig. 3).

There was no significant difference in time to induction of anesthesia between Propofol and 8% Sevoflurane, but Incremental Sevoflurane was significantly slower than 8% Sevoflurane (130 ± 34 vs 97 ± 34 s, P = 0.02). All patients reported a high level of satisfaction. Apnea was more common with Propofol (n = 8, 53%) compared with Incremental Sevoflurane (n = 1, 7% P = 0.04) (Table 1).

Discussion

This is the first study to compare propofol and sevoflurane for anesthetic induction in an exclusively elderly population (mean age >75 years). Our results suggest that inhaled induction with sevoflurane results in higher MAP and less apnea than propofol. Interestingly, no significant difference in percentage decrease in MAP was found between the Incremental and Large-Dose Sevoflurane groups, suggesting that elderly patients are able to tolerate large initial inspired concentrations of sevoflurane. The decrease in MAP in Propofol patients was largely because of a decrease in SAP, as diastolic values were preserved.

Previous work on anesthetic induction in the elderly indicates increased sensitivity to both anesthetics (5,6). It is possible that the end point of anesthetic induction we chose (dropping the weight) did not correspond to peak serum propofol concentration because of pharmacokinetic differences in these very elderly patients. This may have resulted in a temporarily deeper level of anesthesia, accounting for our observations of decreased MAP and apnea. However, we believe that our infusion rate of propofol (10 mL/min) is slow compared with normal practice and that speed of induction of propofol was not responsible for our findings. We chose MAP rather than diastolic values because the former is more accurately measured by automated noninvasive blood pressure apparatus.

In our study, HR decreased in all groups. Patients receiving incremental sevoflurane had a significantly slower HR compared with propofol, but not patients in the 8% Sevoflurane group. Previous comparisons, in contrast to our study, found slower induction of anesthesia with sevoflurane compared with propofol (4,7,8) but the maximum inspired concentration of sevoflurane was only 5% as compared with 8% in our study (7), and sevoflurane was increased incrementally (8).

Previous comparisons found a more frequent incidence of apnea in propofol patients (9). Our study suggests that this is also true for an exclusively elderly
population, even with a slow propofol infusion. Studies comparing ease of laryngeal mask airway insertion after induction with propofol or sevoflurane found comparable conditions but longer duration with sevoflurane even if a vital capacity breath technique was used (10,11).

Patients presenting for ambulatory urological surgery often do so on repeated occasions. Two Sevoflurane patients in this study declined to have the same induction technique again because of distressing odor and severe nausea and vomiting. Satisfaction with both techniques was high, consistent with previous work (12), although propofol was superior in one report (13).

In conclusion, this study of elderly patients undergoing ambulatory surgery suggests that 8% sevoflurane inhalation is an acceptable alternative to propofol induction. It is associated with higher MAP than propofol and is as well tolerated as incrementally increasing sevoflurane levels.

References

Table 1. Induction Characteristics and Adverse Effects

<table>
<thead>
<tr>
<th></th>
<th>Propofol (n = 15)</th>
<th>Incremental Sevoflurane (n = 15)</th>
<th>8% Sevoflurane (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction time (s)</td>
<td>107 (23)</td>
<td>130 (34)*</td>
<td>97 (34)</td>
</tr>
<tr>
<td>Volume of injectate (mL)</td>
<td>18 (4)</td>
<td>22 (6)</td>
<td>16 (6)</td>
</tr>
<tr>
<td>Apnea</td>
<td>8 (53)†</td>
<td>1 (7)</td>
<td>3 (20)</td>
</tr>
<tr>
<td>Coughing</td>
<td>3 (20)</td>
<td>3 (20)</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Laryngeal spasm</td>
<td>1 (7)</td>
<td>2 (13)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Involuntary movements</td>
<td>3 (20)</td>
<td>2 (13)</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Patient satisfaction</td>
<td>15 (100)</td>
<td>14 (93)</td>
<td>14 (93)</td>
</tr>
</tbody>
</table>

Data shown are mean (sd) or No. (%). *P = 0.02, incremental sevoflurane versus 8% sevoflurane; †P = 0.04, propofol versus incremental sevoflurane.