Comparison of Propofol and Propofol-Isoflurane Anesthesia for Outpatient Surgery

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Abstract

Background: Outpatient surgery has recently grown at a substantial rate. The development and use of short acting anesthetic and analgesic agents have played a major role in the growth of outpatient surgery. This study was designed to evaluate the intraoperative hemodynamic responses and recovery characteristics, using propofol or isoflurane to maintain the anesthesia.

Methods: A total number of 30, ASA physical status I-II patients scheduled for outpatient surgery, all of whom were to undergo excision of breast mass. The patients were randomly allocated to receive either total intravenous anesthesia with propofol, or inhalation anesthesia with isoflurane after induction of anesthesia with propofol. All patients were ventilated via a laryngeal mask airway (LMA) using a mixture of oxygen and air so that the FiO₂ would be 0.4.

Results: There were no significant differences in hemodynamic changes during anesthesia in recovery time, or in complications between the two groups.

Conclusions: We conclude that both methods provide reasonably rapid and reliable recovery from anesthesia and are equally acceptable to the patients. (Korean J Anesthesiol 2000; 38: S 13−S 18)


INTRODUCTION

Outpatient surgery has recently grown at a substantial rate. The development and use of short acting anesthetics and analgesic agents have played a major role in the growth of outpatient surgery. Propofol is one of series alkyl phenol found to have anesthetic activity. It is a rapid and short acting intravenous anesthetic agent with fewer side effects.¹ Because of it’s character, propofol is extensively used in outpatient anesthesia as an induction agent.²,³

Isoflurane has a low blood solubility with rapid elimination and has been shown to be useful. It is probably the most popular inhalation anesthetic for outpatient anesthesia.⁴,⁵

This study was designed to evaluate the intraoperative hemodynamic responses and the recovery characteristics of the patients scheduled to undergo excision of breast mass using propofol or isoflurane for maintenance of anesthesia after propofol induction through LMA (laryngeal mask airway).
METHODS

For subsequent institutional approval of the study, each patient signed an informed consent form. All patients were from 20 and 40 years old and belonged to ASA category I or II. Patients with atopic or allergic diathesis patients who were pregnant, alcoholics, or drug addicts, and anyone incapable of clear communication with investigator were excluded. They were randomly divided into one of two groups each comprising 15 patients. Routine preoperative laboratory studies for outpatients undergoing anesthesia and surgery were done at the outpatient department (OPD). After surgery, these unpremedicated patients were asked to complete a questionnaire. All patients had an 18-gauge intravenous catheter placed on the hand opposite to the blood pressure cuff. The patients were monitored via EKG, blood pressure, pulse oximeter (Minimon 7138B, Kontron instruments, Watford, England), end-tidal carbon dioxide and respiration rate (5250 RGM, Ohmeda, Louisville CO, USA).

Both groups received 2–3 μg/kg of fentanyl one minute prior to induction. Induction of anesthesia was carried out by intravenous propofol (2–2.5 mg/kg) bolus injection over 20 sec followed by intravenous 1 mg/kg of lidocain in both groups. The time from the start of the bolus injection to the abolition of eyelash reflex was recorded as the induction time. When the patient became unresponsive, 100% oxygen was administered via a tight fitting face mask using a conventional circle absorber system. One minute later, LMA was placed for airway control.

In the propofol group, patients were manually ventilated using a mixture of oxygen and air so that the FiO₂ be 0.4. Anesthesia was maintained with a continuous propofol infusion driven by a syringe pump (STC-523, Terumo corporation, Tokyo, Japan). The initial infusion rate of 10 mg/kg/h was manually reduced 2 mg/kg/h every 10 minutes until it reached a rate of 6 mg/kg/h was reached. If the patient’s pulse rate or systolic blood pressure exceeded 130% of the starting baseline readings, or if the patient moved to a stimuli, an additional bolus of propofol 0.5 mg/kg was given and the infusion rate increased by 2 mg/kg/h. In propofol-isoflurane group, anesthesia was maintained on 0.5 – 2 vol.% isoflurane in oxygen and air in which FiO₂ was 0.4.

Muscle relaxation for both groups of patients was obtained by an intravenous bolus injection of vecuronium 0.04 mg/kg, the subparalytic dose. All patients were manually ventilated by controlled or assisted mode of ventilation. At the end of the operation, residual neuromuscular blockade was reversed with a combination of 1.5–2.5 mg of neostigmine and 1.0–1.5 mg IV of atropine and the maintenance anesthetic agents were discontinued.

The duration of the operation was recorded from the time induction was started to the completion of the surgery. Initial postoperative recovery times were evaluated at 30–90 s intervals and recorded as follows; ① emergence time (elapsed time from discontinuation of anesthetic until the patient spontaneously opened her eyes by order), ② recovery time (time from anesthetic off until the patient recalled address and phone number and was oriented to person and place), and ③ cognition time (time from anesthetic of off until patient had the ability to countdown ten to one); The elapsed time from discontinuation of anesthetics until the patient could pass the gait test (patient can walk unassisted along six meters straight line without deviating over one meter) was recorded as ambulation time. A nurse who was unaware which anesthetic method was adapted, measured the ambulation time. Incase of any side effects, patients were interviewed prior to discharge as to whether they had been awake during operation and if they had any other significant complaints.

The data were reported as mean values with measures of variability expressed as standard deviation (SD) in tables. The statistical analysis was performed using paired t-test at intergroup and independent t-test between groups. $P < 0.05$ was considered significant.
RESULTS

There were no significant differences in age, weight, hemoglobin, and duration of operation between the two groups (Table 1). The mean duration of operation was 32.9 ± 12.8 min for the propofol group (group P) and 26.1 ± 14.2 min for the propofol-isoflurane group (group I).

Table 2 shows the changes in systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP), and heart rate (HR) at preinsertion of LMA, postinsertion of LMA, and then 5 min, 10 min, 20 min, 30 min after LMA insertion. There were no significant differences in cardiovascular effects between the two groups, except HR (p < 0.05) at postinsertion 5 min of LMA.

Table 3 shows the recovery characteristics between the two groups. All the recovery characteristics show faster trend for the propofol group than for the propofol-isoflurane group. But there were no statistical differences between two groups concerning the recovery characteristics. The side effects during anesthesia and recovery are compared in Table 4.

The incidents of side effects during anesthesia or recovery were low and tended not to be significantly different between the two groups.

No patient expressed dissatisfaction with the anesthesia.

DISCUSSION

The practice of outpatient surgery was first documented in 1909 when J.H. Nicoll of Glasgow informed the British Medical Association that 8988 operations on ambulatory patients had been performed at the Glasgow Royal Hospital for sick children.\(^9\) Beginning in the early 1960s, improvements in anesthesia set the stage for substantial increase in the amount of out-

Table 1. Demographic Data, Hemoglobin and Operation Time in Two Study Groups

<table>
<thead>
<tr>
<th></th>
<th>Group P</th>
<th>Group I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Sex (m/f)</td>
<td>0/15</td>
<td>0/15</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>29.7 ± 8.2</td>
<td>34.1 ± 12.3</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>58.0 ± 5.4</td>
<td>56.4 ± 5.4</td>
</tr>
<tr>
<td>Hemoglobin (g/dl)</td>
<td>12.1 ± 1.0</td>
<td>12.1 ± 0.8</td>
</tr>
<tr>
<td>Duration of operation (min)</td>
<td>32.9 ± 12.8</td>
<td>26.1 ± 14.2</td>
</tr>
</tbody>
</table>

Values are expressed as numbers or mean ± SD. Group P: propofol group, Group I: propofol-isoflurane group.

Table 2. The Change of Arterial Blood Pressure and Heart Rate

<table>
<thead>
<tr>
<th></th>
<th>PRI</th>
<th>POI</th>
<th>POI-5</th>
<th>POI-10</th>
<th>POI-20</th>
<th>POI-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP</td>
<td>Group P</td>
<td>126.2 ± 11.5</td>
<td>121.2 ± 17.8</td>
<td>110.6 ± 7.8*</td>
<td>109.1 ± 16.3</td>
<td>116.9 ± 16.9</td>
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<tr>
<td></td>
<td>Group I</td>
<td>129.3 ± 9.2</td>
<td>119.7 ± 16.8</td>
<td>108.8 ± 15.4*</td>
<td>112.0 ± 14.1*</td>
<td>107.6 ± 11.3*</td>
</tr>
<tr>
<td>DAP</td>
<td>Group P</td>
<td>78.5 ± 10.9</td>
<td>68.2 ± 17.9</td>
<td>66.0 ± 13.7*</td>
<td>66.9 ± 18.7</td>
<td>74.1 ± 18.8</td>
</tr>
<tr>
<td></td>
<td>Group I</td>
<td>79.8 ± 10.3</td>
<td>70.4 ± 16.8</td>
<td>57.5 ± 12.6*</td>
<td>62.3 ± 10.3*</td>
<td>65.4 ± 11.9*</td>
</tr>
<tr>
<td>MAP</td>
<td>Group P</td>
<td>92.4 ± 12.1</td>
<td>86.6 ± 17.0</td>
<td>83.2 ± 10.3*</td>
<td>79.9 ± 15.9</td>
<td>86.3 ± 15.4</td>
</tr>
<tr>
<td></td>
<td>Group I</td>
<td>97.6 ± 9.4</td>
<td>87.7 ± 19.8</td>
<td>76.3 ± 13.6*</td>
<td>79.6 ± 9.3*</td>
<td>79.9 ± 11.1*</td>
</tr>
<tr>
<td>HR</td>
<td>Group P</td>
<td>80.3 ± 17.0</td>
<td>78.3 ± 11.7</td>
<td>67.3 ± 12.8†</td>
<td>67.3 ± 14.0</td>
<td>68.9 ± 12.9</td>
</tr>
<tr>
<td></td>
<td>Group I</td>
<td>89.9 ± 12.6</td>
<td>84.4 ± 15.2</td>
<td>84.9 ± 18.1</td>
<td>78.3 ± 14.7</td>
<td>72.7 ± 9.1*</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD. Group P: propofol group, Group I: propofol-isoflurane group. PRI: pre-insertion of laryngeal mask airway (LMA), POI: post-insertion of LMA, POI-n: n minute after insertion of LMA. SAP: systolic arterial pressure, DAP: diastolic arterial pressure, MAP: mean arterial pressure, HR: heart rate. *p < 0.05 compared with values of pre-insertion, †p < 0.05 compared with values of I-group.
Table 3. The Clinical Recovery Times

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Group P</th>
<th>Group I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergence</td>
<td>7.5 ± 1.9</td>
<td>9.3 ± 4.1</td>
</tr>
<tr>
<td>Recovery</td>
<td>10.3 ± 3.9</td>
<td>12.9 ± 5.1</td>
</tr>
<tr>
<td>Cognition</td>
<td>13.4 ± 4.2</td>
<td>15.7 ± 6.6</td>
</tr>
<tr>
<td>Ambulation</td>
<td>68.5 ± 20.3</td>
<td>70.5 ± 26.4</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD. Group P: propofol group, Group I: propofol-isoflurane group. There was no significant difference between Group P and Group I.

Patient surgery performed. Today almost 60 percent of all elective surgery is performed in the outpatient surgical setting.7)

In the earliest days of anesthesia, both nitrous oxide and ether were used for day-case (outpatient) surgery. With the changing role of anesthesiologist and the development of new and shorter-acting anesthetic drugs, outpatient surgery has grown rapidly.8) Among many other anesthetics, propofol has many advantages such as rapid onset, smooth maintenance and faster recovery.9,10) Isoflurane has also been shown to be useful and probably the most popular inhalation anesthetic for outpatient anesthesia.11,12)

Although most studies had shown that propofol had significant advantages over isoflurane for outpatient anesthesia,11,12) some studies suggested that there were no significant differences between the two.13-15) A recent study has shown that isoflurane anesthesia was associated with a shorter recovery time compared with propofol infusion for outpatient anesthesia.16) We obtained similar results in hemodynamic changes during operation, in recovery characteristics, and in side effects between the two groups.

We have found that there was no hemodynamic change after LMA insertion. The placement of LMA which resulted in less hemodynamic response compared to placement of an endotracheal tube (ETT), implies that placement of LMA resulted in less nociceptive stimulation than laryngoscopy and insertion of ETT.17) Many other studies have shown that the patients with the LMA underwent much less hemody-

Table 4. Number of Patients Developing Complications during Anesthesia and Recovery

<table>
<thead>
<tr>
<th></th>
<th>Group P (N = 15)</th>
<th>Group I (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coughing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hiccough</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Movement</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Awareness</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pain on injection of propofol</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Nausea</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Confusion</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Group P: propofol group, Group I: propofol-isoflurane group.

mic response than those with an ETT.17,18)

In some studies,12,19) nitrous oxide was used as a part of the agents, and in the other studies,9) thiopental was used for induction of anesthesia in one group of patients and propofol in the other. We have used a standardized method where the only difference in techniques was the use of propofol for the maintenance of anesthesia in one group, and isoflurane in the other. And we used LMA for airway control instead of ETT.16) These factors may explain the difference in result between other studies and ours.

Pain on injection of propofol occurs in 28-90% of patients.20,21) Although the mechanism responsible for the propofol-induced venous pain is unknown, it has been suggested that it resulted from activation of the kinin cascade system.22) There are various clinical strategies for preventing the pain on injection.23,24) The incidence of pain on injection can be reduced by selecting a large forearm vein rather than a small vein on the dorsum of the hand and using intravenous lidocaine prior to propofol.25,26) We think that the incidence of pain on injection with propofol shown in our study was relatively low (6.7%) because of the use of intravenous lidocaine.

The common side effects after general anesthesia that commonly delay discharge are headache, dizzi-
ness, nausea, vomiting, weakness, inability to void, and pain. Propofol has been reported to decrease the incidents of nausea and vomiting. A more recent study reported there was no differences in the incidents of emesis after strabismus surgery when the anesthesia was managed with propofol or isoflurane. In our study, postoperative side effects were uncommon and patient acceptability was high.

In conclusion, both propofol and propofol-isoflurane technique proved to be satisfactory anesthesia methods for outpatient surgery for adults.

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