Comparison of Surgical Conditions During Propofol or Isoflurane Anesthesia for Endoscopic Sinus Surgery

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Received: December 30, 2012; Revised: April 14, 2013; Accepted: Jun 27, 2013

1. Background

Functional endoscopic sinus surgery (FESS) is a skillful surgical technique in chronic rhinosinusitis treatment (1). When FESS is performed under general anesthesia, controlled hypotension (mean arterial pressure between 60-70 mmHg) can provide better surgical field condition and decreases the time of operation. Also occurrence of important complications such as severe bleeding, defects in skull base, intraorbital bleeding and blindness decreases (1-3). During FESS, mucosal bleeding in surgical field, often interacts with surgeon’s vision of intranasal anatomy; then the time of operation increases and more complications may occur (1, 2). Many different methods have been used to control bleeding during the operation, such as local injection of vasopressors, head up position, using hypotensive drugs, and tight control of CO2 (1-4).

The anesthetic drugs also can affect the amount of bleeding and surgical field situation by vasodilation and reducing the blood pressure (BP). The general idea in many studies is based on that general anesthesia with propofol provides better vision of surgical field and less amount of hemorrhage during the operation compared to Isoflurane or Sevoflurane (5). A group of studies suggests that premedication with oral clonidine decreases intraoperative bleeding in some surgeries (6, 7). Metoprolol has shown to decrease bleeding in nasal sinuses (8). Propofol is one of the most common anesthetic drugs used in general anesthesia, which decreases sys-
temic blood pressure by vasodilation (9). In mainte-
nance phase of anesthesia, infusion of propofol reduces
the blood pressure for about 20-30 percent, compared
to preinduction BP (9). The inhalational anesthetics also
reduce arterial blood pressure related to their concen-
tration, but the mechanisms are different (10). In some
articles and studies, different methods and routes for
providing the better field of operation and surgeon’s
vision and less complications during FESS are reviewed
such as: Use of intravenous and inhalational anesthetic
drugs, administration of beta blockers for premedica-
tion in FESS, use of vasopressors in combination with
local anesthetics during the operation and the effect of
reverse trendelenburg position (3-5, 11, 12).

2. Objectives

With reviewing the previous articles and studies, we did
not find the use of remifentanil in anesthesia for FESS,
and with attention to the progressive use of FESS in our
country in recent years, we decided to compare the surgi-
cal conditions in anesthesia with propofol and remifent-
anil versus isoflurane anesthesia in endoscopic sinus and
rhino surgeries in Amir-Al-Momenin academic hospital
in Rasht-iran.

3. Patients and Methods

After writing the proposal and getting ethical ap-
proval, justification register number from vice-chan-
cellof research department of Guilan University of
Medical Science registration in Iranian Randomized
Clinical Trial site (IRCT) (No: IRCT 201102081138N7), we
started this single-blind clinical trial study. We recruit-
ed 44 patients (22 patients for each group) according
to sample formula with ASA class I and II and with ages
between 15-45 years candidate for elective endoscopic
sinus surgery (13) (Inclusion criteria). Exclusion crite-
reria were as follows: Patients with history of bleeding
conditions in anesthesia with propofol and remifent-
anil versus isoflurane anesthesia in endoscopic sinus and
rhino surgeries in Amir-Al-Momenin academic hospital
in Rasht-IRAN.

All of the patients with chronic sinusitis and with
minimally two paranasal sinuses involvement were in-
cluded in our study. Then the patients were divided into
two groups: 22 patients in (P) propofol group and 22 pa-
tients in (I) isoflurane group. Before starting the opera-
tion, paranasal sinuses and CT scan were estimated and
patients were graded based on the Lund Mackay scoring
system in CT scan. The scoring system de-


rs short a maximum score of 12 per side). For calculating
the amount of bleeding through the operation we
subtracted the amount of irrigating solution from to-
tal amount of fluids in suction bottle. Then patients
were divided into three groups based on the F rate of
patient’s blood loss to the maximal allowable blood
loss (MABL) (14): less than 10 percent, between 10 and
20 percent, more than 20 percent.

MABL = Hb start-Hb target ÷ Hb start × EBV

This scoring system consists of a scale of 0-2 depend-
ent on the absence, partial or complete opacification
of the sinus system in CT scan. The scoring system de-


rives a maximum score of 12 per side). For calculating
the amount of bleeding through the operation we
subtracted the amount of irrigating solution from to-
tal amount of fluids in suction bottle. Then patients
were divided into three groups based on the F rate of
patient’s blood loss to the maximal allowable blood
loss (MABL) (14): less than 10 percent, between 10 and
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All of the patients with chronic sinusitis and with
minimally two paranasal sinuses involvement were in-
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two groups: 22 patients in (P) propofol group and 22 pa-
tients in (I) isoflurane group. Before starting the opera-
tion, paranasal sinuses and CT scan were estimated and
patients were graded based on the Lund Mackay scoring
system (High LM score > 12, Low LM score < 12). After
intravenous access line establishment, induction of an-
esthesia was performed with O2 6 lit/min, Midazolam
1.5 mg, Fentanyl 2.3 mic/kg, Propofol 2 mg/kg, and Cis
a trcurium 0.2 mg/kg. For maintenance of anesthesia, we
used Oxygen 50% Nitrous Oxide 50%, propofol (50 –
75 mic/kg/min) (DONGKOOK Pharmacy co. from Korea)
and remifentanil (0.1 mic/kg/min) infusion in P group
and isofurane (0.5-1%) in the second group (Primal criti-
cal care Inc. the USA).

Box 1. State of Surgical Field Throughout the Operation

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
</tr>
<tr>
<td>No bleeding, excellent for surgery</td>
</tr>
<tr>
<td>2-3</td>
</tr>
</tbody>
</table>
| Mild bleeding, simple surgery, not stopped opera-
| tion for hemostasis or suction                   |
| 4-5                                             |
| Mild bleeding, brief difficult surgery, once stop-
| ped operation for hemorrhage or suction          |
| 6-7                                             |
| Moderate bleeding, average difficult surgery, oc-
| casionally stopped operation for hemorrhage or su-
| cion                                       |
| 8-9                                             |
| Moderate to severe bleeding, very difficult sur-
| gery, multiple stop through surgery              |
| 10                                              |
| Termination of surgery due to severe bleeding in
| field                                             |
All of the subjects were monitored with Non-Invasive Blood Pressure, Pulse Oximetry, Electrocardiography and capnograph monitoring; through the operation. Patients’ systemic blood pressure was preserved in the mean arterial pressure (MAP) of 60-70 mmHg, and for maintaining this we used beta blockers and small doses of remifentanil. Patients’ ventilation were controlled (Tidal Volume = 10cc/kg, Respiratory Rate = 12 breath/min, FiO2 = 50%). They were subjected to 20 degrees trendelenburg position. Field of operation was scored based on the amount of mucosal bleeding and by a visual analogue scale according to Box 1.

Finally collected data was analyzed by statistical software (SPSS ver.16). Chi square and T-test were used for data analysis. P value less than 0.05 was considered significant.

4. Results
In this study, 44 patients (26 male, 18 female) candidate for FESS were recruited from 1389 to 1390 in the Amir-Al-Momenin academic hospital. They were enrolled randomly and divided into two groups. The Mean age in Isoflurane group was 34.18 ± 13.61 years and in Propofol group was 32.3 ± 15.4 years, and no statistically significant differences were seen in demographic characteristics between the two groups (Table 1).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Isoflurane, No. (%)</th>
<th>Propofol, No. (%)</th>
<th>Statistical Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>P = 0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12 (54.4)</td>
<td>14 (63.6)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>10 (45.5)</td>
<td>8 (36.4)</td>
<td></td>
</tr>
<tr>
<td>Responding age, y</td>
<td>P = 0.807</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>4 (18.2)</td>
<td>5 (22.7)</td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>8 (36.4)</td>
<td>7 (31.8)</td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>4 (18.2)</td>
<td>6 (27.3)</td>
<td></td>
</tr>
<tr>
<td>&gt; 41</td>
<td>6 (27.3)</td>
<td>4 (18.2)</td>
<td></td>
</tr>
<tr>
<td>Age, y, Mean ± SD</td>
<td>P = 0.673</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.18 ± 13.16</td>
<td>32.31 ± 15.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA class</td>
<td>P = 0.664</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>18 (81.8)</td>
<td>20 (90.9)</td>
<td></td>
</tr>
<tr>
<td>Class II</td>
<td>4 (18.2)</td>
<td>2 (9.1)</td>
<td></td>
</tr>
<tr>
<td>Lund-M</td>
<td>P = 0.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 12</td>
<td>18 (81.8)</td>
<td>14 (63.6)</td>
<td></td>
</tr>
<tr>
<td>&gt; 12</td>
<td>4 (18.2)</td>
<td>8 (36.4)</td>
<td></td>
</tr>
</tbody>
</table>

The average length of operation (minute) was 124.31 ± 24.11 minutes in Isoflurane group and 96.36 ± 28.12 minutes in Propofol group (P = 0.001). Average level of blood loss for the subjects was 223.06 ± 157.79 ml (minimum blood loss was 50ml and maximal blood loss was 600ml). The patients were divided into 3 groups according to the amount of bleeding: less than 10 percent of MABL, between 10 and 20 percent of MABL, and more than 20 percent of MABL. Amplitude of distribution of surgeon’s satisfaction ranks among two groups was meaningful (P = 0.035). Pearson correlation analysis showed that there is a positive correlation between amount of intraoperation bleeding and operation time in Isoflurane group (Pearson correlation = 0.584, P = 0.004). There was a direct correlation between operation time and amount of intraoperation bleeding. Also a positive correlation was found between the amount of intraoperative bleeding and operation time in Propofol group (Pearson correlation = 0.544, P = 0.009) (Figure 1). Spearman correlation analysis showed that there is a positive correlation between the amount of intraoperative bleeding and operation time in Propofol group (Pearson correlation = 0.544, P = 0.009) (Figure 1).
bleeding and surgeon’s satisfaction ranks in Isoflurane group (Spearman correlation = 0.642, P = 0.001). And a positive correlation was shown in Propofol group too (Spearman correlation = 0.571, P = 0.006) (Figure 2, 3).

5. Discussion

In endoscopic sinus surgeries, establishment of controlled hypotension (MAP = 60-70 mmHg) is essential for improvement of the surgical field. This can lead to better surgical field and decrease surgical time and minimize the complications (1, 3, 4). Propofol is the most common intravenous drug, which is used in general anesthesia. Propofol provides the greatest reduction in systemic blood pressure by vasodilatation (9). Inhaled anesthetics decrease arterial blood pressure which is related to their concentration, but the mechanisms are different (10).

In this study, propofol was associated with better surgical field and less amount of hemorrhage compared to Isoflurane. It may be due to reducing effect of heart rate by propofol. In a study conducted by Palvin JD et al, propofol was compared with Isoflurane and was seen to reduce the amount of bleeding in endoscopic sinus surgery (12). In another study conducted by Wonmald et al, intravenous anesthesia was associated with better results in the surgical field (15). In a study conducted by Hassani et al in Iran University of Medical Sciences, the amount
of bleeding in two groups was evaluated (propofol and remifentanil versus isoflurane and remifentanil), and there was not any significant difference in the amount of bleeding between the two groups (16).

In a study conducted by Cho et al., propofol was compared with desflurane and was seen to reduce the intraparoperative bleeding for ESS in propofol based anesthesia especially in the high-LM score patients (17) and this result was similar to our study.

In another study conducted by Ahn et al., propofol was compared with sevoflurane and was seen to reduce the median blood loss especially in patients with high LM-scores (13) which was similar to our results. In our study the lower rate of bleeding was in propofol group and also surgeon’s satisfaction was more than isoflurane group. By using Numeral Logistics Regression Analysis, all of the factors were examined and it was found that surgical time (P = 0.013) was the only efficient factor on surgical bleeding. Therefore it appears that the infusion of propofol and remifentanil in comparison with isoflurane can be used in intravenous anesthesia for better vision in functional endoscopic sinus surgery.

Acknowledgements

The authors wish to sincerely thank the support of all the staff of nursing and all the colleagues in Amir-Al-Momenin Academic Hospital and also thank the vice chancellor for research and technology of Guilan University of Medical Sciences. Furthermore, our special thanks go to the patients, who wholeheartedly and actively assisted us to perform this research. No conflict of interest existed.

Authors’ Contribution

All of the authors had contribution.

Financial Disclosure

No financial interests.

Funding/Support

We had not any fund source.

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