

Comparison of surgical field - sevoflurane versus propofol based anaesthesia in functional endoscopic sinus surgery

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Abstract

Background: Functional endoscopic sinus surgery requires a bloodless surgical field in order to facilitate the ease and thoroughness of the surgery to produce good surgical results without complication. **Aim:** To compare sevoflurane with propofol based anaesthesia with respect to blood loss, surgical field visibility, haemodynamics and duration of surgery. **Materials and methods:** This randomized clinical study took place in a government-run teaching hospital in South India. Fifty ASA I or II patients aged between 18 and 60 years with chronic rhinosinusitis were randomly assigned to either of the two groups- Group 1-sevoflurane (n=25), Group 2-propofol (n=25). After induction with fentanyl 2 mcg/kg, propofol 2.5 mg/kg and rocuronium 0.6 mg/kg, anaesthesia was maintained in Group 1 with nitrous oxide and oxygen 2:1, sevoflurane 2 – 2.5% and in Group 2 with nitrous oxide and oxygen 2:1, propofol 10 mg/kg/hr for first ten minutes, 8 mg/kg/hr for next ten minutes followed by 6 mg/kg/hr. All patients received 0.5mcg/kg fentanyl bolus every thirty minutes. Target mean arterial pressure (MAP) was 60 to 70 mm Hg. If MAP was greater, titrated nitroglycerine infusion was used and if lesser, fluid bolus followed by ephedrine boluses were given. Blood loss was measured by subtracting the irrigation fluid from the blood collected in the suction canister and adding blood soaked in gauze. At the end of the surgery, the surgeon blinded to the anaesthetic technique assessed the surgical field based on Fromme-Boezaart scale. Statistical analysis was done using SPSS. Categorical data was analysed using chi-square test and continuous data using student t-test. $p < 0.05$ was considered significant. **Results:** The blood loss was 157 ± 91 ml in the sevoflurane group and 102 ± 59 ml in the propofol group ($p = 0.024$). One (4%) patient in the sevoflurane group and twenty one (84%) patients in the propofol group were scored 1 in the Fromme-Boezaart scale ($p < 0.01$). The remaining patients scored 2 in the scale ($p < 0.01$). The intraoperative mean heart rate in the sevoflurane group was 78 ± 4 bpm and 69 ± 5 bpm in the propofol group ($p < 0.01$). MAP and duration of surgery were comparable between the two groups. **Conclusion:** Though propofol causes lesser bleeding and better scores in the surgical field visibility, it is not significant in a clinically relevant manner. Thus propofol based anaesthesia is not better than sevoflurane based anaesthesia in providing good surgical field. **Keywords:** Otorhinolaryngologic surgical procedure, Controlled hypotension, Anaesthetic, Surgical blood loss.

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INTRODUCTION

Functional endoscopic sinus surgery (FESS) is nowadays being increasingly performed for medically refractory chronic rhinosinusitis. It is a surgery of small sinus spaces with complex anatomy. Therefore good surgical results without complications and patient symptomatic improvement requires dry surgical field with safe hemodynamic parameters to facilitate the ease and completeness of surgery. Various methods like 10 degree reverse Trendelenberg, local vasoconstrictors and anaesthesia manipulation are adopted to achieve dry

surgical field. General anaesthesia not only adds to the patient comfort but also provides controlled hypotension within safety limits. Eversince Blackwell *et al.*, suggested that propofol based anesthesia provides better surgical visualization¹, many studies have been done to compare total intravenous anaesthesia (TIVA) with inhalational technique. Many studies have shown statistically significant differences in favour of TIVA²⁻⁹, whereas others have not¹⁰⁻¹³. Except for the study by Ankichetty *et al.*, which has compared TIVA with isoflurane¹², all of them have been done outside India. Many of these studies do not replicate Indian conditions as they have used remifentanyl which is not freely available in India and target controlled infusion which is not commonplace use in India. So the aim of this study was to compare sevoflurane, which has better hemodynamic stability and faster recovery than isoflurane with TIVA in terms of blood loss and surgical field grading in a government run teaching hospital in South India.

MATERIALS AND METHODS

This study took place in a government run state hospital in an urban setting in South India. After obtaining approval from the ethics board of the institute and informed consent, 50 patients with chronic rhinosinusitis with or without nasal polyposis were recruited in our study. Inclusion criteria were patients with ASA physical status I or II or age between 18 to 60 years. Patients with hypertension, abnormal bleeding parameters, current NSAIDS or aspirin use or previous sinus surgery were excluded. Patients entering the study were randomly assigned to either of the two groups [Group 1- sevoflurane(n=25), Group 2-propofol(n=25)].

All the patients were premedicated with oral alprazolam 0.5mg three hours before surgery and had nasal packing done with 4% lignocaine with oxymetazoline 30 minutes prior to procedure. All were preloaded with 10ml/kg of ringer lactate, induced with fentanyl 2 mcg/kg, propofol 2.5 mg/kg and rocuronium 0.6mg/kg, intubated, throat packed and positioned 10 degree reverse Trendelenberg. Anaesthesia was maintained in Group 1 with 2:1 nitrous oxide and oxygen, sevoflurane 2-2.5% adjusted according to the blood pressure and in Group 2 with 2:1 nitrous oxide and oxygen, propofol 10 mg/kg/hr for first ten minutes, 8 mg/kg/hr for next ten minutes followed by 6 mg/kg/hr. Both groups received fentanyl 0.5 mcg/kg boluses every 30 minutes. Target mean arterial

pressure(MAP) was 60 to 70 mm Hg. If MAP was more than 70 mm Hg, nitroglycerine infusion was started at 0.5 mcg/kg/min and titrated by increments of 0.3 mcg/kg/min. When MAP was less than 60 mm Hg, 200 ml fluid bolus was given, followed by ephedrine boluses of 3 mg till MAP was greater than 60 mmHg. Primary outcomes were blood loss and surgical visibility. Secondary outcomes were haemodynamics and duration of surgery.

Blood loss was calculated by subtracting the irrigation fluid from the blood collected in the suction canister with heparin added. Blood soaked by the gauzes was added up. Each gauze strip measuring 4 by 0.5 inch held 2 ml and partially soaked gauze held 1 ml.

At the end of the surgery, two experienced surgeons blinded to the anaesthesia technique were asked to assess the surgical field using the validated 6 point scale given by Fromme in 1986[], later adapted by Boezaart in 1995[] and also validated[].

- 0 - No bleeding.
- 1 - Slight bleeding; no suction of blood required.
- 2 - Slight bleeding; occasional suctioning required. Surgical field not threatened
- 3 - Slight bleeding; frequent suctioning required. Bleeding threatens surgical field a few seconds after suctioning is removed
- 4 - Moderate bleeding; frequent suctioning required. Bleeding threatens surgical field directly after suction is removed.
- 5 - Severe bleeding; constant suctioning required. Bleeding appears faster than can be removed by suction.

Sample size was calculated from previous studies with a power of 80% and alpha error of 0.05. Simple randomization was done. Surgeon was blinded by setting up propofol infusion pumps for all patients so that they were not aware of the anaesthetic technique. But anaesthesiologist was not blinded as it was not practical.

Statistical analysis was done using SPSS version 18. Data was screened for outliers and extreme values using Box-Cox plot and histogram(for shape of distribution). Summary statistics are given as mean, standard deviation, range and percentages. Categorical variables like Fromme-Boezaart scale were analysed using non-parametric chi-square test. Continuous data were analysed using student t test. P-value < 0.05 was considered significant.

RESULTS

Table 1: Patient demographics between two groups

Patient Characteristics	Group 1- Sevoflurane (n=25)	Group 2- Propofol (n=25)	p-value
Age(years)mean±SD	38±8	38±10	0.914
Weight(kg)mean±SD	63±6	62±7	0.512

Sex(M/F)	22/3	19/6	0.463
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Table 2: Comparison of intraoperative haemodynamics between two groups

	Group 1-sevoflurane (n=25)	Group 2-propofol (n=25)	p-value
SystolicBP (mmHg) mean±SD	94(15)	91(4)	0.420
Diastolic BP(mmHg)mean±SD	59(2)	61(2)	0.005
MAP(mmHg) mean±SD	70(2)	71(2)	0.019
Heart rate(/min) mean±SD	78(4)	69(5)	<0.01
Hypotension (No.)	6	1	0.098
GTN used(No.)	7	6	1.000

BP-Blood pressure, MAP-Mean arterial pressure,GTN-Nitroglycerine, Hypotension is MAP <60mmHg

Table 3: Comparison of blood Loss and surgical visibility score between the two groups

	Group 1-Sevoflurane (n=25)	Group 2-Propofol (n=25)	p-value
Duration of surgery (min)Mean±SD	65±17	71±15	0.195
Estimated blood loss (ml) Mean±SD	157±91	102±59	0.024
Fromme-Boezaart 1 No.(%)	1(4)	21(84)	<0.01
Fromme-Boezaart 2 No.(%)	24(96)	4(16)	<0.01

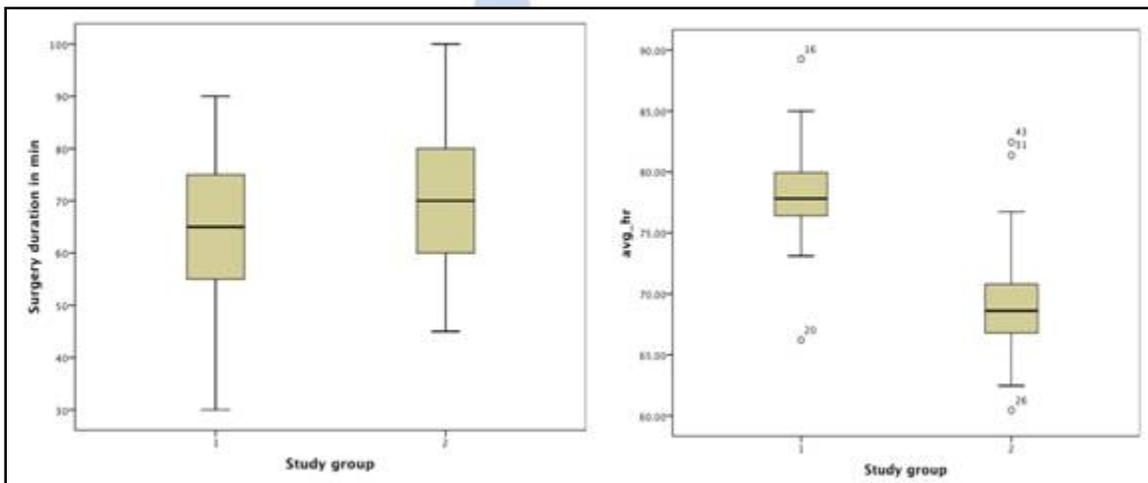


Figure 1

Figure 2

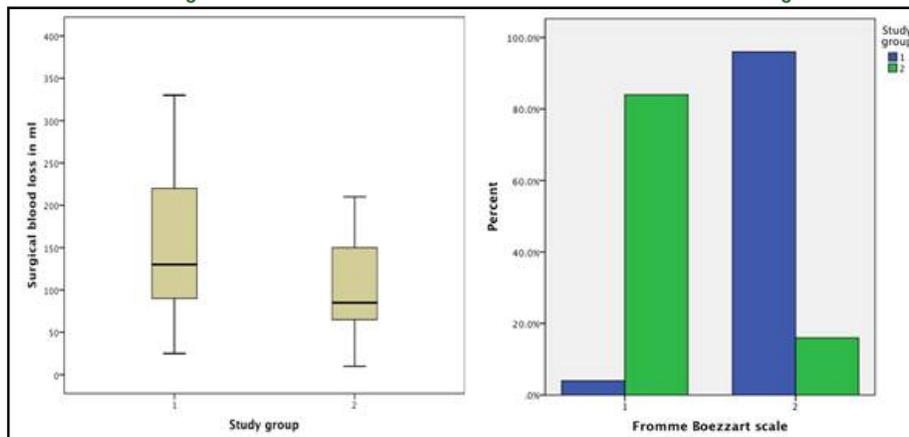


Figure 3

Figure 4

Legend

Figure 1: Box-plot of surgery duration between two groups, 1-sevoflurane group, 2- propofol group; **Figure 2:** Box-plot of heart rate between two groups. 1-sevoflurane group,2-propofol group; **Figure 3:** Box-plot of blood loss between two groups, 1-sevoflurane group,2-propofol group; **Figure 4:** Histogram of distribution Fromme-Boezaart scale between two groups, 1-sevoflurane group,2-propofol group

The demographic information like age, sex and weight were not significantly different between the two groups. Majority were males in both groups (Table/Figure-1). The average duration of surgery was similar in both groups (Table/Figure-2). All patients were operated for chronic rhinosinusitis with or without nasal polyposis. The two groups were comparable in all the respects.

Maintaining intraoperative mean arterial pressure between 60 and 70 mm Hg was with equal ease in both groups as the number of patients requiring nitroglycerine infusion or having hypotension were not significantly different between the two groups (Table/Figure-3). The heart rate in the propofol group was found to be significantly lower 69 ± 5 bpm in comparison to the sevoflurane group 78 ± 4 bpm (Table/Figure-4).

The blood loss from the sevoflurane group ranged from 25 to 330 ml with a Mean \pm SD of 157 ± 91 ml. In the propofol group blood loss ranged from 10 to 210 ml with a mean \pm SD of 102 ± 59 ml (Table/Figure-5,6). This difference was significant ($p=0.024$). 1(4%) patient in the sevoflurane group and 21 (84%) patients in the propofol group were assigned a score of 1 in the Fromme-Boezaart scale. The remaining patients, 24(96%) in the sevoflurane group and 4(16%) in the propofol group were assigned a score of 2 in the Fromme-Boezaart scale (Table/Figure-7). None of the patients received a score greater than 2, thereby neither group had bleeding that threatened the surgical field.

DISCUSSION

This randomized clinical study shows that propofol based anaesthesia has statistically significant lesser blood loss and better surgical visibility. Propofol causes vasodilation by its central action of reduced sympathetic vasoconstrictor outflow¹⁴. This effect can be arrested by local vasoconstrictors. Whereas sevoflurane causes vasodilation by peripheral action¹⁵, therefore local vasoconstrictors might not be effective. Since the mechanism of vasodilation differs between the two techniques, propofol based anaesthesia is expected to provide better surgical field conditions. After Blackwell *et al.*, suggested that propofol based anaesthesia will improve the surgical visualization¹, many studies were done which showed a statistically significant difference though the magnitude of difference varied²⁻⁹. But these studies did not replicate our Indian situation except for one study by Ankichetty *et al.*, which compared isoflurane instead of sevoflurane with TIVA¹². Many studies had used remifentanyl which is not freely available

in India yet and target controlled infusion of propofol which is not commonplace use here.

Even this current study showed a statistically significant difference in favour of propofol based anaesthesia. But on closer observation we find that the difference in the mean blood loss between the two groups was only 55ml which actually translated into more of score of 2 in Fromme – Boezaart scale for sevoflurane based anaesthesia. In Fromme-Boezaart scale, a score of 1 or 2 the surgical field is not threatened, though in score of 2 occasional suctioning is required. Therefore in the hands of experienced surgeons, a score of 1 or 2 in Fromme-Boezaart scale is acceptable and is preferred for their surgical ease. So if we classify scores of 0-2 in Fromme-Boezaart scale as good scores and 3-5 as poor scores, all patients in our study belonging to both groups fall in the good score category. So the difference in the mean blood loss between the two groups of 55 ml has not been actually translated into better surgical field visibility. The lower heart rate 69 ± 5 bpm in the propofol group versus 78 ± 4 bpm in the sevoflurane group could have contributed to the lesser blood loss. This finding concurs with the finding by Ahn *et al.*⁴, who showed 62 ± 7 bpm in the propofol group versus 70 ± 11 bpm in the sevoflurane group. The lower heart rates in both the groups could be explained by the use of remifentanyl which has a bradycardic effect¹⁶.

Our study results concurs with the findings of five out of seven studies comparing TIVA with sevoflurane based anaesthesia when analysed in the clinically relevant manner. Beule *et al.*, did not find a difference in blood loss nor surgical field scoring between the two groups, though they were generally worse in both the groups attributable to the patient selection—redo surgery and patients with allergic fungal sinusitis were included (10). Yoo *et al.*, also did not find a difference in the surgical field scoring¹¹. Wormald *et al.*³ though he found a statistically significant difference in the Fromme-Boezaart scores, it was only a small effect size : 2.8 ± 0.12 in sevoflurane with fentanyl bolus group versus 2.2 ± 0.11 in TIVA with remifentanyl infusion group. This difference could be due to remifentanyl used only in the propofol group. Sivaci *et al.*, showed a significant difference in blood loss of 296 ± 97 ml in the sevoflurane group versus 128 ± 37 ml in TIVA group². But there was no controlled hypotension and both groups had an average MAP of 80 mm Hg. So the blood loss difference could have been exaggerated. As the surgical field condition was not studied we do not know whether it was translated into better surgical visibility. Similarly even

Milonski *et al.*, demonstrated a statistically significant difference in blood loss with sevoflurane-remifentanyl group having 340±150 ml and propofol-remifentanyl group having 225±92 ml blood loss⁶. However, surgical field visibility was not assessed and both treated and untreated hypertensives were included thereby maintaining a higher MAP, so the blood loss difference could have been exaggerated.

Our study findings differ from the study by Ahn *et al.*, and Chaaban *et al.*, who demonstrated a significant difference between the two groups both in surgical field scoring and blood loss^{4,5}. Nevertheless it was only in patients with high and low Lund-Mackay score respectively, probably representing skewed results from a reduced sample.

TIVA not only adds to the cost of set-up but also as observed by Beule *et al.*, fares less on the ease of anaesthesiologist when compared to the routine inhalational technique¹⁰. So in high turnover non-profitable low cost hospitals it is less feasible. Also there are no significant advantages offered by TIVA to offset these disadvantages.

CONCLUSION

Propofol based anaesthesia causes lesser blood loss and minimal improvement in surgical visibility. But this statistically significant difference is not actually translated into clinically relevant manner. Therefore propofol based anaesthesia is not better than sevoflurane based anaesthesia in providing a good surgical field. Thus the routine inhalational technique with sevoflurane can be preferred over propofol based anaesthetic technique.

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