



Comparison of quality, recovery and satisfaction score of Sevoflurane with Propofol anaesthesia in spontaneously breathing patients using laryngeal mask airway in ambulatory surgeries

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Abstract

Background: Patient satisfaction is a highly sensitive quality measure of anaesthesia management; maintaining a good surgical plane and early recovery are important factors for the outcome of any procedure. We have designed this study to compare quality, recovery and satisfaction characteristics of sevoflurane with propofol on spontaneously breathing patients with laryngeal mask airway in ambulatory surgeries.

Methods: The patients were randomly divided into two groups of 30 cases each. First group was maintained on propofol and second on sevoflurane. Patients' experiences during the peri-operative anaesthesia period were asked along with operative surgeon's satisfaction to assess quality of anaesthesia.

Results: Results of the study suggest that jaw relaxation was significantly faster in the propofol group, conditions for laryngeal mask airway (LMA) insertion were similar in both groups, time taken for LMA insertion was less in propofol group, but post-induction apnoea period was significantly higher in propofol group. Emergence from sevoflurane was shorter and early recovery was achieved quickly in sevoflurane group while time taken for intermediate recovery was not significantly different. Patients experienced more nausea/vomiting in the post-operative period with sevoflurane but both groups were satisfied with quality. Surgeons were more comfortable with sevoflurane anaesthesia due to less muscle twitching with cautery and added muscle relaxation property.

Conclusion: Both techniques were similar in terms of quality, recovery and satisfaction scores and they have their own positive and negative features. Both techniques were acceptable for ambulatory anaesthesia.

Keywords: Quality, recovery and satisfaction scores, Laryngeal mask airway, Sevoflurane, Propofol.

Introduction

Implementation of newer medico-legal laws, increased awareness among the patient

population, and professional competitiveness to reduce the cost of treatment has mandated a quality control and satisfaction assurance in anaesthesia management. This study has been

designed to compare characteristics of two anaesthesia techniques and their acceptance to the both surgeons and patients. The aim of this study is to compare quality, recovery, and satisfaction characteristics of sevoflurane-nitrous oxide anaesthesia with propofol-nitrous oxide anaesthesia on spontaneously breathing patients using a laryngeal mask airway inserted for short duration surface surgeries in a prospective manner.

Materials and Methods

This was a prospective randomized clinical study, done after getting approval from institutional ethical and scientific committee of the hospital.

Sixty healthy ASA I and II consenting patients posted for elective surface surgery considered as an ambulatory surgical procedure by the surgical department such as lumpectomies, breast conservative surgeries, simple mastectomies and axillary clearances were included in this study. Clinically significant co-morbidity, lactating and pregnant patients, and patients with contraindications to the use of spontaneous anaesthesia technique; for example, cases with anticipated difficult intubation, were excluded from the study.

Patients were randomized into 2 groups of 30 patients each according to a computer-generated randomized table.

GROUP P - Propofol group: (N = 30) and GROUP S - Sevoflurane group: (N= 30)

Group P: All patients in this group were induced with intravenous propofol which was administered at the rate of 5 mg/sec (maximum dose 2mg/kg) until adequate jaw relaxation was achieved. Spontaneous respiration were observed and assisted breaths were given for apnoea of more than 25 seconds or to maintain an oxygen saturation of more than 95%. Once adequate jaw relaxation was achieved, laryngeal mask airway insertion (LMA) was attempted and scored according to LMA Insertion score. Appropriate position of LMA was confirmed. Observation were made for jaw relaxation time, LMA insertion

time, LMA insertion conditions grading and apnoea time.

Fentanyl 1 mcg/kg was given for intra-operative analgesia intravenously after induction. Patients were then maintained on spontaneous respirations with oxygen: nitrous-oxide and propofol infusion which was started at the rate of 100-300mcg/kg/min, adjusted according to vital parameters.

Observation were made for ease of surgery by the operating surgeon including bleeding and muscular twitching and ease of maintenance of a plane of anaesthesia. As soon as surgery was completed, infusion of propofol was stopped. Patients were given 100% oxygen until the patient opened her eyes spontaneously and opened her mouth using verbal commands without stimulation. The LMA was removed at this time. Observations made was emergence time taken from stopping of the propofol infusion to the time of to the removal of the LMA.

Group S: In the sevoflurane group, the Magill's circuit was primed with sevoflurane 8% in nitrous oxide: oxygen (50%:50%) at a flow rate of 8 L/min for 30 seconds. Each patient was asked to take maximal capacity breaths. After loss of verbal communicability, jaw relaxation was assessed and further induction was continued until adequate jaw relaxation was achieved. Adequately sized LMA insertion was attempted and position of the LMA was conformed. After successful LMA insertion, the sevoflurane concentration was reduced to 1%-3% with oxygen: nitrous oxide (50%:50%) at a flow rate of 2 L/min using a closed circuit. Injectable Fentanyl was given intravenously 1 mcg/kg for analgesia, watching for spontaneous respirations. During maintenance phase, concentration of sevoflurane was adjusted between 1-3% in order to maintain vital parameters within 20% of pre-induction values. Use of intermittent increase in concentration of Sevoflurane from 1-3% to 5- 8% (according to response) or fentanyl (up to a maximum dose of 2mcg/kg) was given at the discretion of the operating room anaesthetist to

maintain a constant plane of anaesthesia and analgesia.

As soon as surgery was over, sevoflurane was shut off. Patients were administered 100% oxygen. The LMA was removed at the time when the patient opened her eyes spontaneously without stimulus and responded to oral commands for mouth opening. Same observations were made as for the propofol group.

All patients were shifted to a post-anaesthesia care unit for monitoring of the recovery profile. Early recovery was evaluated every 5 min. after removal of the LMA by assessing the Modified Aldrete's Recovery Score. Time taken to achieve a score of 9 was taken as adequate early recovery. Thereafter, patients were assessed every 15 min for intermediate recovery using the Post Anaesthesia Discharge Scoring System (PADSS). Time taken to achieve a Post Anaesthesia Discharge Score of 9 represents home readiness of the patients. Recovery scoring was done by a blinded observer to prevent any bias during scoring.

Quality of anaesthesia was assessed by asking common patient perceptions of anaesthesia and common complaints of surgeons during the surgery. Answers were recorded as an affirmative or negative response of the patients and surgeons. Overall assessment was done by using a statistical test of significance.

Observations and Results

Statistical data

Table (1) Demographic data

	GROUP P	GROUP S	P value
No. of patients	30	30	
Age (yrs.) (mean±SD)	37.5±7.88	38.90±6.9	0.438
Weight (kg) (mean±SD)	48.43±7.75	49.93±8.82	0.470
ASA Gr. I/II	19/11	23/7	0.267
Duration of surgery (min) (mean±SD)	53.26±6.75	54.46±7.98	0.532

Table (2) Table for time taken to achieve different end points

	GROUP P	GROUP S	P Value
Jaw relaxation time (seconds mean±SD)	66.99 (±50.34)	117.0 (±32.86)	0.00
Time for Successful LMA insertion (seconds M±sd)	88.2 (±52.9)	148.9 (±34.8)	0.00
Apnoea time in seconds Mean ±SD	143.6 ±110.9	59.77 ±84.91	0.002
Emergence time Min. mean ±SD	5.4 ±2.54	4.04 ±2.49	0.035
Early recovery time (Aldrete score>9) Min. mean ±SD	12.50 ±2.86	8.83 ±2.52	0.00
Intermediate recovery time (PADSS>9) (min.±SD)	80.00 ±9.09	77.00 ±10.22	2.35

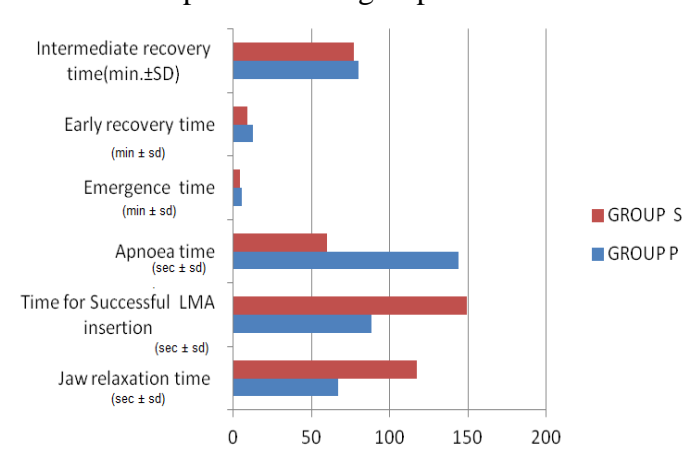
Table (3) Grading for condition of LMA insertion

Groups	GROUP P	GROUP S	P Value
Excellent	5/30	3/30	0.653
Satisfactory	24/30	25/30	0.649
Poor	1/30	2/30	0.360

Table (4) Quality of anaesthesia

PATIENT'S SATISFACTION	GROUP P	GROUP S	P value
Nausea/vomiting	3	9	0.05
Headache/ body ache	5	2	0.235
Dizziness/ discomfort	4	6	0.479
Intraoperative awareness/amnesia	0	0	0.00
Pain at insertion of IV site/soreness of oral cavity	9	6	0.250
Irritation/post-operative behavioural changes	3	4	0.659
SURGEON'S SATISFACTION			
Muscular 'tightness'	9	4	0.121
Cautery twitching	11	3	0.004
Wet/oozing surgical field	14	15	0.612

Graphical representations Time taken to reach different end points in two groups.



Result Analysis

The two study groups are comparable with respect to age, weight, ASA physical status, and nature of surgery as well as duration of surgery. (Table 1).

The time to adequate jaw relaxation in patients in Group P was 73.3 ± 62.9 sec. (Mean \pm SD) and in Group S was 128.7 ± 54.83 sec. (Mean \pm SD). This indicates that time taken for adequate jaw relaxation was significantly shorter ($p=0.00$) than the induction with sevoflurane. (table 2).

The time for successful LMA insertion in patients in Group P was 88.2 ± 52.9 sec. (Mean \pm SD) in comparison to Group S in which the time was 148.99 ± 34.83 sec. (Mean \pm SD). This indicates that the time taken for successful LMA insertion was significantly shorter ($p=0.00$) in the propofol group when compared to the sevoflurane group.

Conditions for the laryngeal mask airway insertion were excellent in five out of thirty patients in Group P and three out of thirty patients in Group S. Twenty-four out of thirty patient in Group P and twenty-five out of thirty patients in Group S had satisfactory conditions for LMA insertion. Only one patient in Group P and two patients in Group S had poor conditions for LMA insertion. This difference is statistically non-significant. (table3). However, in both groups, the LMA was successfully inserted in all patients. Thus, for the same end-point induction, which was jaw relaxation in this study, the conditions for LMA insertion (excellent/ satisfactory/ poor) were not significantly different in the two groups.

Post-induction apnoea period was 59.73 ± 84.91 sec. (Mean \pm SD) in Group S, while in Group P it was 143.67 ± 110.97 sec. (Mean \pm SD) indicating that patients in the propofol group had significantly longer duration of apnoea ($p=0.012$) (table 2), which required manual ventilation in comparison with the Sevoflurane group. Return of spontaneous respiration was delayed in the propofol group.

During the maintenance phase, haemodynamic responses were stable for both groups in all patients. After induction of anaesthesia, the heart rate mean arterial blood pressure, end tidal CO_2 , and SPO_2 values were comparable in both groups. Maintenance of a plane of anaesthesia was comparatively easy in Group S when compared with Group P, which needed frequent adjustment

of dose and additional bolus doses during surgery. Additional analgesic doses of fentanyl were not required in either of the groups.

The emergence time from discontinuation of primary anaesthetic agent to spontaneous eye opening and mouth opening on verbal commands was 5.4 ± 2.54 min. (Mean \pm SD) in Group P while in Group S, it was 4.04 ± 2.49 min. (Mean \pm SD). This indicates that the sevoflurane group had significantly shorter duration ($p=0.035$) for emergence from anaesthesia in comparison to the propofol group. (table 2).

Achievement of Modified Aldrete's Score of 9 was significantly earlier ($p=0.00$) in Group S which was 8.83 ± 2.52 min (Mean \pm SD) in comparison to the Group P, where it was 12.50 ± 2.85 . (Mean \pm SD) min. Most of the patients achieved an Aldrete's score of 9 before reaching the post-anaesthesia care unit in sevoflurane group, which suggests that fast tracking can be more suitable in this group.

Time taken for achievement of Post Anaesthesia Discharge Score (PADSS) of 9 was 80 ± 9.09 min. (Mean \pm SD) in Group P while in Group S it was 77 ± 10.22 min. (Mean \pm SD). This is not a significant difference ($p=2.35$), which indicates that time for home readiness is nearly the same in both groups.

The incidence of nausea was significantly higher after emergence in Group S (11/30) than with Group P (3/30). Pain, irritation, and dizziness were comparable in both groups. Satisfaction score for the type of anaesthesia was recorded on the spontaneous complaints of patients, after achieving an Aldrete's score ≥ 9 . Subjective recall of intraoperative events and anaesthesia experience was not present in either group.

Surgeons were more comfortable with Group S than with Group P due to better muscle relaxation and reduced muscle fasciculation with the use of cautery.

Most of the patients achieved criteria for home readiness after 80 min. (PADSS > 9).

Discussion

Both methods of induction of anaesthesia used in this study were well tolerated by all the patients. Despite sevoflurane's low blood gas partition coefficient, induction with inhalational sevoflurane was slower than using the intravenous agent propofol (66.99=50.34 v/s 117=32.86 sec) (table 2). Initial difficulty in jaw relaxation and mouth opening was reported in the literature although no reasons were postulated for it. The likely explanation for a longer time period taken for adequate jaw relaxation in the sevoflurane group was probably due to the lag time during which the alveolar concentration of sevoflurane equilibrated with the brain. Priming of the anaesthesia circuit with a concentration of 8% of sevoflurane, use of vital capacity breath method, and inclusion of nitrous oxide to produce a concentration (second) gas effect in the anaesthesia mixture were the strategies used in this study to facilitate rapid induction in sevoflurane. In spite of all this, the time for induction with sevoflurane was significantly higher than with the propofol group. Eventually, the LMA was inserted successfully in all of the patients in both groups after achieving adequate jaw relaxation.

Another possibility is related to the anaesthetic agent themselves. Propofol is known to have a relaxant effect on jaw muscles, whereas inhaled anaesthetics may cause an increase in muscle tone and spasticity. Therefore, for a similar depth of anaesthesia, there may be greater jaw relaxation with propofol than with sevoflurane. These findings were consistent with previous studies published in the literature by *Jenong*¹, *Smith*² and *Chow*³.

Time taken for successful LMA insertion, including the proper insertion of the LMA, confirmation of position was longer in the sevoflurane group in comparison to the propofol group. *Smith*² and *Chow*³ also concluded the same results in similar studies. There was excellent attenuation of laryngeal reflexes with both propofol and sevoflurane during the insertion and

conditions for LMA insertion after jaw relaxation and conditions for LMA insertion were found to be equally good in both groups. (Table 2).

Conditions for LMA insertion was studied by *Lian KT*⁵ and *Mary E M*⁶ in a similar study design and they also concluded that conditions for LMA insertion were favourable with propofol in comparison to Sevoflurane.

Time taken for return of spontaneous respirations after induction was greater with the propofol group. This prolonged apnoea time in the propofol group required assistance of manual ventilation for maintaining oxygen saturation in some patients. This reflects the advantage of sevoflurane in maintaining oxygen saturation better than with the propofol group during the induction period. In their study, *Smith* observed a post-induction apnoea period of 6.4±5.4 min in group P and 3.7±0.4 min. in group S. These results are different than our results of 143.61±10.9 sec in group P v/s 89.71 8±4.91 sec in group S. The probable explanation for this difference is that *Smith*² in their study had given injections of Fentanyl at 1mcg/kg before induction, while in our study, injectable Fentanyl 1mcg/kg was given only after return of spontaneous respiration.

Maintenance of a plane of anaesthesia was relatively easy with inhalational sevoflurane during spontaneous ventilation due to self-titration of anaesthetic dose by the subject on his own. As soon as the patient enters a lighter plane, the patient inhales more inhalational agent because of an increase in minute ventilation, while when patient was in a deeper plane, a reduction in minute ventilation reduces delivery of anaesthetic. This type of self titration with spontaneous ventilation was not present in group P. These results of our study are in accordance with results of *Fredman*⁴ and *Scott*⁷.

Emergence from anaesthesia, which was indicated by spontaneous eye opening and mouth opening on command was more rapid with sevoflurane in comparison with propofol (Table 2). This was in accordance with the findings of the *Jeon*¹,

*Smith*² and *Friedman*⁴ studies who all concluded that the emergence period was significantly greater in the propofol group than with the sevoflurane group. The explanation for early emergence from sevoflurane was self-titration to achieve a plane of anaesthesia may remain at a constant level and at the time of discontinuation of sevoflurane, it took a lesser time for emergence, while in the propofol group, the plane of anaesthesia may be deep due to empirical intermittent top-up doses of propofol which were guided by the vital signs, not by the plane of anaesthesia. That may have caused plasma concentration of the drug to be much higher.

Early recovery, as defined by achievement of Aldrete's Score of > 9 (table 2) was earlier in the sevoflurane group. *Beverly*⁸ and *Song*⁹ in their study found a higher percentage of patients receiving newer volatile anaesthetic agents were judged to be fast track eligible by virtue of their ability to achieve post-anaesthesia care unit (PACU) discharge criteria on arrival in the PACU as per Aldrete's score. This was found to be true in our study also. Although the propofol infusion rate and inspired concentration of volatile agent were not tapered near the end of surgery and because the primary anaesthetic agent discontinued abruptly at the end of surgery, it is possible that the use of newer intravenous drug delivery monitoring systems such as Target Controlled Infusion or Computer-assisted Continuous Infusion Systems for intravenous agents and end organ concentration monitoring for inhalational agents may have resulted in shorter early recovery times.

Jeong,¹ *Smith*², and *Freadman*⁴ independently in their studies concluded that there was no difference between time taken for home readiness between the Propofol and Sevoflurane groups. The observation of home readiness (PADSS >9) was early (90 min.) in this study in contrast to the above mentioned studies. The likely explanation for this is that many factors may have affected home readiness, as use the of a muscle relaxant, concurrent administration of opioids and other

drugs, premedication drugs, duration and nature of the surgical procedure, racial differences, metabolic rate, temperature, and tolerance of the subjects for pain and nausea.

Quality of anaesthesia from the patient's and surgeon's perspective was comparable in the two groups. Subjective recall of intraoperative events and anaesthesia experience was unaffected by the anaesthetic technique used. No patient had perioperative awareness of anaesthesia, but due to the incidence of post-operative nausea and a bad taste, patients were more comfortable with the propofol technique, while due to the muscle relaxation property of inhalational agents, surgeons were more comfortable with the sevoflurane technique. The sevoflurane group had the added advantage of providing muscle relaxation during the intra-operative period, which decreased muscular twitching with the use of electrocautery. However, patients in the sevoflurane group required anti-emesis earlier than those who received propofol.

Conclusion

For short duration breast surgical cases which were induced and maintained on spontaneous ventilation with laryngeal mask airway, both of the above techniques were safe and acceptable for ambulatory anaesthesia and they have their own positive and negative features. It is advised to choose a technique according to each individual case after considering all the factors.

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