

Original Research Article

Comparison of postoperative recovery from desflurane and sevoflurane anaesthesia using laryngeal mask airway: a prospective randomized comparative study

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ABSTRACT

Background: Ambulatory surgeries necessitate safe anaesthesia and faster recovery. Sevoflurane and desflurane are proved as such effective inhalational anaesthetic agents. The aim of this study was to compare early postoperative recovery profile in patient undergoing elective ambulatory surgical operations and receiving anaesthesia with sevoflurane or desflurane using supreme LMA.

Methods: This prospective study was conducted at Jaslok Hospital and Research Centre, Dr. G. Deshmukh Marg, Mumbai, from August 2014 to April 2015. Patients were randomized into two groups receiving desflurane (Group D- n=40) and sevoflurane (Group S- n=40) for maintenance of anaesthesia. Patients were monitored for recovery by using fast track criteria (FTC) score at different time intervals.

Results: The demographic characteristics, hemodynamic parameters were comparable in both the groups and no statistical significance was seen among them ($p > 0.05$). The mean time taken for postoperative recovery characteristics were significantly lower in in Group D than Group S ($p = 0.00$). The FTC score was significantly higher in group D as compared to group S at all times ($p < 0.05$) for thirty minutes. The prevalence of consuming additional analgesic was 12.5% in group D and 15% in group S ($p = 1.000$). The additional antiemetic requirement was seen in 10% patients in both the groups ($p = 1.000$). The incidence of coughing was seen in among 5% of Group D patients and in none among Group S ($p = 0.152$).

Conclusion: The study concludes that desflurane is superior to sevoflurane with respect to time of eye opening, response to verbal commands, orientation, ability to sit, early recovery profile and duration of stay in recovery room.

Keywords: Ambulatory surgeries, Desflurane, Inhalational anaesthetics, Postoperative recovery, Sevoflurane

INTRODUCTION

Now-a-days ambulatory surgeries are becoming more popular due to the convenience and economy along with shortened hospital stay.¹ In providing general anaesthesia for ambulatory surgery, the goal is to achieve optimal surgical conditions while ensuring a rapid early recovery without side effects. In these surgeries, selection of safe and economical anaesthesia with faster recovery rate is very much challenging. Inhalational anaesthetic agents

such as sevoflurane and desflurane have been proved as an effective ambulatory anaesthetic agent.² They allow rapid emergence from anaesthesia because of easy titrability. Both the agents have rapid induction and recovery capacity due to low blood: gas partition coefficient (0.65 for sevoflurane and 0.42 for desflurane) and fat: blood solubility (48 and 27) respectively.^{3,4}

For administration of these inhalational anaesthetics, laryngeal mask airway (LMA) was the preferred device

because it supports airway, minimises dead space, may be inserted without use of muscle relaxants, provides partial seal of airway, can allow effective use of positive pressure ventilation, less stimulating than tracheal tube and can be used for short surgical procedures of one hour.^{5,6}

Because of increasing use of these two inhalational agents, this study was done to compare early recovery profile of sevoflurane and desflurane using fast-track criteria (FTC), when given in patients undergoing ambulatory surgical procedures using Supreme LMA in both the groups.

METHODS

This was a prospective randomized comparative study conducted for a period of 9 months from August 2014 to April 2015 at Jaslok Hospital and Research Centre, Dr. G. Deshmukh Marg, Mumbai. After getting approval from institutional ethics committee, adult patients (age > 18 yrs) of either sex, of Body mass index (BMI < 30 kg/m²), of ASA grade 1 and 2 were included in the study. Patients not willing to participate in the study, pregnant females, having history of gastro-oesophageal reflux, undergoing emergency surgeries and Surgeries of duration more than one hour were excluded from the study.

Sample size calculation

Sample size calculations were done based on a previous study by White et al.⁷ By applying the results of his study with an α error of 0.05 and β error of 0.2, the difference between the two groups for comparison a sample size of minimum 23 subjects was required in each group. Rounding up the number to 40, we included 40 subjects in each group randomly using computer generated non sequential numbers.

Written informed consent was taken from all the patients. All patients were assessed preoperatively. Investigations in the form of complete blood count, urine routine and microscopy, fasting blood sugar, chest X-ray and ECG were done. Patients were kept nil by mouth for six hours prior to surgery. Premedication in the form of Tab. Pantaprazole 40 mg was given 2 hours before surgery.

Study intervention

After performing a standard preoperative evaluation and confirming nil by mouth status and consent, an intravenous access was secured. Patient received pre-anaesthetic medication with glycopyrrolate (0.004 mg/kg) and midazolam (0.03 mg/kg), and opioid analgesic fentanyl (2 mcg/kg). Anaesthesia was induced with propofol (2 mg/kg IV) after 2 ml of 2% lidocaine to minimize propofol induced injection pain. After placement of well lubricated LMA, study patients were randomised to receive either desflurane 6%-8% (Group

D) or sevoflurane 2%-3% (Group S) in O₂:N₂O-50:50 for initial maintenance of anaesthesia at total gas flow rate of one lit/min and BIS of 40-60. The inspired concentration of desflurane or sevoflurane was subsequently adjusted to maintain clinically acceptable depth of anaesthesia i.e. providing good surgical conditions while maintaining stable hemodynamic values within 20% of pre-induction baseline values. Baseline and intraoperative hemodynamic parameters were noted.

The inspired and end tidal concentrations of desflurane or sevoflurane were monitored continuously with calibrated infrared analyzer.

Before the end of surgery, ondansetron (0.1-0.15 mg/kg), dexamethasone (0.1 mg/kg) was administered to all patients for antiemetic prophylaxis. Analgesia was provided with diclofenac (1.5 mg/kg) and paracetamol (20 mg/kg IV).

The inhalational agent and N₂O were discontinued after closure of surgical wound. On awakening from anaesthesia (i.e. eye opening on calling), the supreme LMA was removed.

Assessment of recovery time of patients with ability to open eyes on calling, following verbal commands e.g. squeezing investigators hand and orientation by uttering his/her name was assessed at 1 min interval on discontinuing volatile anaesthetic agent. It was done in the operation theatre itself.

After achieving the above parameters, patient was shifted to post anaesthesia care unit (PACU), where the time of sitting, achievement of fast track criteria (FTC) was assessed at 5 mins interval.

The discharge criteria from the post anaesthesia care unit (PACU) required patient to be awake and alert with stable vital signs, not experiencing any acute side effects like nausea and vomiting or moderate to severe pain which was assessed at every 5 mins in recovery room at time of discharge. The recovery room stay duration was noted by a blinded observer. Incidence of coughing, if any was noted. Side effects were recorded by recovery room nursing staff and rescue analgesic was administered in the form of injection Tramadol (1 mg/kg IV) with antiemetics, if required. Injection Metoclopramide (10 mg) was given as an additional antiemetic if postoperative nausea and vomiting occurred. Discharge criteria from PACU included fast track criteria (FTC) score ≥ 13 .

Statistical analysis

After data collection, data entry was done in Excel. Data analysis is done with the help of SPSS Software version 15 and Sigma plot version 12.

Quantitative data is presented with the help of mean, standard deviation, median and IQR (Interquartile range).

Comparison between study groups is done with the help of unpaired T test or Mann-Whitney test as per results of normality test.

Qualitative data is presented with the help of frequency and percentage table. Association among study group is assessed with the help of Chi-Square test and Fisher Exact test for 2x2 tables. P value less than 0.05 is taken as significant level.

RESULTS

Eighty adults undergoing elective short surgical procedures were enrolled in the study. They were randomised in two groups of forty each. Group D received desflurane while group S received sevoflurane. The demographic characteristics were comparable in both the groups (Table 1).

Table 1: Demographic characteristics.

| Parameters | Group D (Desflurane) | Group S (Sevoflurane) | P value |
|------------------------|----------------------|-----------------------|--------------------|
| Age in years (mean±SD) | 45.58±9.97 | 42.20±13.15 | 0.352 ^a |
| Sex (male/female) | 27/13 | 24/16 | 0.642 ^b |
| ASA status (I/II) | 25/15 | 27/13 | 0.815 ^b |
| BMI (mean±SD) | 26.27±2.07 | 25.55±1.77 | 0.100 ^c |

P value was calculated by different statistics. a=Mann-Whitney Test, b= Fisher's exact test, c= Unpaired T test.

Study participants in both the groups underwent different surgeries. Most of the patients in both groups underwent urological surgeries (Figure 1).

The preoperative hemodynamics in both groups were comparable and no significance was seen between them (p<0.05) as given in Table 2.

Table 2: Comparison of preoperative hemodynamic parameters between two groups.

| Parameters | Group D (Desflurane) | Group S (Sevoflurane) | P value |
|--------------|----------------------|-----------------------|---------|
| HR (per min) | 83.33±7.91 | 84.38±8.02 | 0.557 |
| SBP | 133.68±10.69 | 132.3±9.73 | 0.549 |
| DBP | 81.53±5.97 | 81.88±4.50 | 0.768 |
| MAP | 98.53±6.69 | 100.56±5.95 | 0.155 |

P value was calculated by unpaired T test.

Duration of anaesthesia was compared among the two groups (Table 3).

Table 3: Recovery characteristics.

| Characteristics | Group D (Desflurane) | Group S (Sevoflurane) | P value |
|-----------------------------|----------------------|-----------------------|--------------------|
| Duration of anaesthesia | 44.23±8.05 | 44.90±6.32 | 0.678 ^a |
| Time for eye opening (mins) | 7.93±1.21 | 10.48±1.18 | 0.00 ^b |
| Time for verbal commands | 8.98±1.31 | 12.30±1.34 | 0.00 ^a |
| Time for orientation (mins) | 9.95±1.15 | 14.43±1.57 | 0.00 ^a |
| Ability to sit (mins) | 28.65±2.90 | 34.98±3.01 | 0.00 ^b |
| Stay in recovery (in mins) | 36.90±2.89 | 46.18±2.62 | 0.00 ^b |

P value was calculated by different statistics. a=Unpaired T test, b=Mann-Whitney Test.

The mean time to open eyes, respond to verbal commands by hand squeeze, orientation by uttering his/her name, ability to sit and the mean duration of stay in recovery room was significantly lower in Group D than Group S (p=0.00). The duration of stay in recovery was determined by achievement of FTC.

Table 4: Comparison of FTC score among study groups.

| FTC score at different time intervals | Group D (Desflurane) | Group S (Sevoflurane) | P value |
|---------------------------------------|----------------------|-----------------------|---------|
| FTC at 5 mins | 12.08±1.00 | 11.03±0.58 | 0.000 |
| FTC at 10 mins | 12.23±0.80 | 11.20±0.56 | 0.000 |
| FTC at 15 mins | 12.63±0.81 | 11.65±0.62 | 0.000 |
| FTC at 20 mins | 13.05±0.64 | 12.15±0.62 | 0.000 |
| FTC at 25 mins | 13.53±0.55 | 12.7±0.61 | 0.000 |
| FTC at 30 mins | 13.7±0.46 | 13.2±0.41 | 0.000 |

P value was calculated by Mann-Whitney test.

Table 4 presents the FTC score and demonstrates that the score was significantly higher in group D as compared to group S at all times (p<0.05) for thirty mins. Discharge criteria from PACU in all patients was achieved at 20th min in group D while in group S, it was achieved at 30th min. The difference was significant statistically (p=0.00).

Necessity of additional analgesics and antiemetics for the study groups was given in Table 5. The prevalence of

consuming additional analgesic was 12.5% in group D and 15% in group S (p=0.745), and the difference was not

significant. The additional antiemetic requirement was seen in 10% patients in both the groups.

Table 5: Requirements of additional drug treatment among study groups.

| Additional drugs required | | Group D (Desflurane) (n=40)% | Group S (Sevoflurane) (n=40)% | P value |
|---------------------------|-----|------------------------------|-------------------------------|---------|
| Analgesics | No | 35(87.5%) | 34 (85%) | 1.000 |
| | Yes | 5 (12.5%) | 6 (15%) | |
| Antiemetics | No | 36 (90%) | 36 (90%) | 1.000 |
| | Yes | 4 (10%) | 4 (10%) | |

P value was calculated by Fisher's exact test.

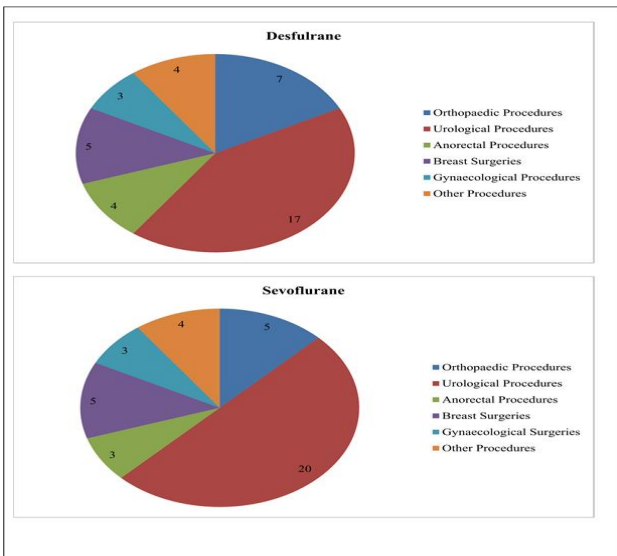


Figure 1: Types of surgeries among study groups.

The incidence of coughing was seen in among 5% of Group D patients and in none among Group S (p=0.152), and the difference in incidence was not significant (Figure 2).

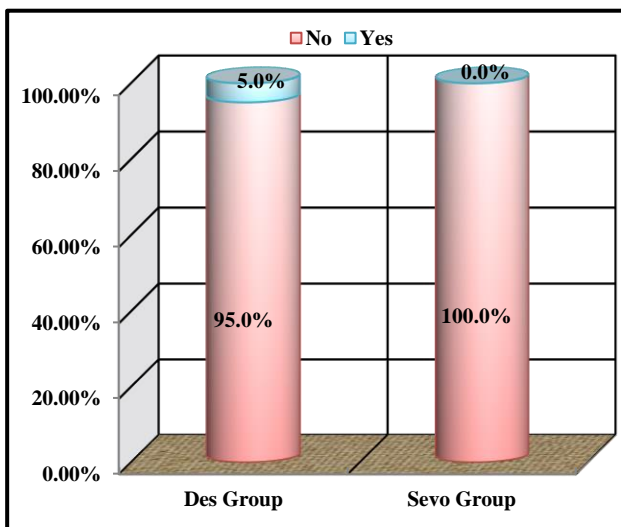


Figure 2: Comparison of incidence of coughing among study groups.

DISCUSSION

In our study, we have done a comparison between Sevoflurane and Desflurane with supreme LMA in both the groups, in eighty patients undergoing elective short surgical procedures and have assessed postoperative recovery characteristics. The findings of the study confirms that early recovery from anaesthesia was faster in Group D compared to Group S. Time to eye opening is defined as time in minutes between discontinuation of volatile anaesthetic agent to eye opening on calling. The mean time to eye opening on calling in group D was 7.93±1.21 min, which was significantly shorter than in group S which was 10.48±1.18 min (p<0.05). These findings are consistent with the observations made by White et al.⁷

Time of response to verbal commands is defined as time between closure of anaesthetic agent and response to verbal command by hand squeeze. The mean time of response to verbal commands e.g. squeezing the hand in group D was 8.98±1.31 min, which was significantly shorter than in group S which was 12.30±1.34 min (P<0.05). Similar findings were seen in study of Strum et al.⁸ Similarly in another study by Jindal et al, time for response to verbal commands in desflurane group was 3.48 mins and in sevoflurane was 5.04 mins which was statistically significant (p<0.05), similar to our study.⁹ But the mean duration was much shorter than our study. Not using benzodiazepine may have been the reason for this difference.

The mean time of orientation by uttering his or her name was 9.95±1.15 mins in group D and was 14.43±1.57 mins in group S which was statistically significant (P<0.05). This was in accordance with the findings of Mahmaud et al.¹⁰ In his study, time to orientation following anaesthesia was significantly faster in desflurane group of 4.8 min than in sevoflurane group 9.8 min (p< 0.0001). But the overall duration is more in our study. This might be due to use of benzodiazepine as an adjuvant in our study.

The mean time taken for ability to sit in group D was 28.65±2.90 min, which was significantly shorter than in group S which was 34±3.01 min (p<0.05). This

difference was similar to the findings of Dalal et al and Sjösvärd et al.^{11,12}

The duration of stay in recovery was determined by achievement of FTC. It was 36.90±2.89 min in group D which was significantly shorter than in group S which was 46±2.62 min (p< 0.05). Our results were similar to Mayer et al who reported faster recovery after desflurane anesthesia (36.2 ± 9.9 min) than after sevoflurane anesthesia (39.3 ± 8.1 min).¹³ They used Aldrete score ≥9 as criteria for discharge from PACU. Another study of Kotwani also observed similar results (18±8.4 min for Desflurane and 45.3 ± 9.7 min for sevoflurane). They used Steward recovery score as criteria for discharge from PACU.¹⁴

In our study, FTC score was significantly higher in group D as compared to group S at all times (p<0.05), which was measured every 5 minutes for 30 mins. Discharge criteria from PACU in all patients was achieved at 20th min in group D while in group S, it was achieved at 30th min. Our findings corroborate with the studies of White et al.⁷ All patients met fast-track recovery criteria (FTC score ≥12) upon leaving the OR. Sevoflurane group had median FTC score of 13, while desflurane group had median FTC score of 14. In our study, median FTC score on leaving OR was 13 in group D while 11 in group S.

Keles et al, observed that postoperative analgesic use in group (D+D) is statistically less than that in group (S+D), the prevalence of consuming analgesic drug as 4 % in Group (D+D) and 22.0 % in Group (S+D) (p=0.007).¹⁵ While in our study, analgesic consumption was 12.5% in group D and 15% in group S, which was statistically insignificant (p=0.745). In their study, they have used 50 mg dexketoprofen trometamol I.V. fifteen minutes before the end of surgery while in our study, we have used I.V. Paracetamol 1gm and I.V Diclofenac 75mg at the same time.

The incidence of postoperative nausea and vomiting was 10.0% in both group D and group S (P=1.000). This low incidence rates were due to the administration of two antiemetic regimen just before the surgery ended. This was comparable to the studies of Jindal et al.⁹ In contrast to this, study by Karlsen found that the postoperative nausea rate was higher in the desflurane group (67%) than in sevoflurane group (36%).¹⁶

Limitations of the study

- Blinding was not possible in our study as the operator was the person turning off the vaporizer and observing for data.
- We used midazolam in premedication in both groups and have not used muscle relaxants in both desflurane and sevoflurane group thereby may alter awakening time from anaesthesia.
- We did not calculate agent quantity required and hence the cost towards inhalational agent.

- Postoperative sedation levels were not studied.

CONCLUSION

The findings of the study conclude that desflurane is superior to that of sevoflurane in terms of postoperative recovery characteristics. Higher post anaesthesia recovery score i.e. FTC score is seen in desflurane group than in sevoflurane group. There is no significant difference between two groups with respect to postoperative requirement of additional antiemetic or analgesic drugs. Though statistically insignificant, incidence of coughing was noted in 5% desflurane group as compared to nil in sevoflurane group.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Smith I, Skues M, Philip BK. Ambulatory (outpatient) anesthesia. In: Miller RD, editor. Miller's Anesthesia. 8th ed. Philadelphia: Elsevier Saunders. 2015:2613.
2. Kurhekar P, Vinod K, SheshaDhiviya Krishna J, Raghuraman M. Randomized comparison between dexmedetomidine and midazolam for prevention of emergence agitation after nasal surgeries. Saudi J Anaesthesia. 2018;12(1):61-6.
3. Eberts TJ, Schmid PG. Inhaled anesthetics. In: Barash PG, Cullen BF, Stoelting RK, Cahalan MK, Stock MC, editors. Clin Anesthesia. 6th ed. Philadelphia: Lippincott Williams and Wilkins; 2009:413-43.
4. Morgan GE, Jr Mikhail MS, Murray MJ. Clinical Anesthesiology. In: Inhalational anesthetics. 4th ed. New York: McGraw-Hill; 2006:155-78.
5. Luba K, Cutter TW. Supraglottic airway devices in ambulatory settings. Anesthesiol Clin. 2010;28:295-314.
6. Akbar AM, Muzi M, Lopatka CW, Ebert TJ. Neurocirculatory responses to intubation with either an endotracheal tube or laryngeal mask airway in humans. J Clin Anesth. 1996;8:194-7.
7. White PF, Tang J, Wender RH, Yumul R, Jameson Stokes O, Sloninsky A, et al. Desflurane versus Sevoflurane for maintenance of outpatient anaesthesia: The effect on early versus late recovery and perioperative coughing. Anaesth Analg. 2009;109:387-93.
8. Strum EM, Szenohradszki J, Kaufman WA, Anthone GJ. Emergence and recovery characteristics of desflurane versus sevoflurane in morbidly obese adult surgical patients: A prospective, randomised study. Anaesth Analg. 2004;99:1848-53.
9. Jindal R, Kumra VP, Narani KK, Sood J. Comparison of maintenance and emergence

- characteristics after desflurane or sevoflurane in outpatient anaesthesia. *Indian J Anaesth.* 2011;55(1):36-42.
10. Mahmoud NA, Rose DJ, Laurence AS. Desflurane or sevoflurane for gynaecological day-case anaesthesia with spontaneous respiration? *Anaesthesia.* 2001;56:171-4.
 11. Dalal KS, Choudhary MV, Palsania AJ, Toal PV. Desflurane for ambulatory anaesthesia: A comparison with sevoflurane for recovery profile and airway responses. *Indian J Anaesth.* 2017;61(4):315-20.
 12. Sjosvard NK, Sjoberg F, Gupta A. Anaesthesia for videoarthroscopy of the knee. A comparison between desflurane and sevoflurane. *Acta Anaesth Scand.* 1998;42:464-71.
 13. Mayer J, Boldt J, Röhm KD, Scheuermann K, Suttner SW. Desflurane anesthesia after sevoflurane inhaled induction reduces severity of emergence agitation in children undergoing minor ear-nose-throat surgery compared with sevoflurane induction and maintenance. *Anesth Analg.* 2006;102:400-4.
 14. Kotwani MB, Malde AD. Comparison of maintenance, emergence and recovery characteristics of sevoflurane and desflurane in pediatric ambulatory surgery. *Indian J Anaesth.* 2017;33(4):503-8.
 15. Keles GT, Ozer M, Dede G, Temiz C, Horasan GD, Civi M. Balanced anaesthesia with dexmedetomidine added desflurane or sevoflurane in spinal surgery. *J Anesth Clin Res.* 2012;3:216.
 16. Karlsen KL, Persson E, Wennberg E. Anaesthesia, recovery and postoperative nausea and vomiting after breast surgery. A comparison between desflurane, sevoflurane and isoflurane anaesthesia. *Acta Anaesth Scand.* 2000;44:489-93.

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