European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 7, 2022

Comparison Of The Airway Response And Recovery Profile Of Desflurane For Ambulatory Anaesthesia With Those Of Sevoflurane

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Abstract

Background and Aims: Low blood gas solubility coefficients of desflurane and sevoflurane enable a quick recovery from anaesthesia. Desflurane, meanwhile, has a strong smell and might irritate the airways. While employing the ProSealTM laryngeal mask airway, we examined the effects of desflurane and sevoflurane on recuperation and the occurrence of adverse airway reactions in patients who were breathing on their own (LMA). **Methods:** In 94 adult patients who received hysteroscopic operations, sevoflurane (S) or desflurane (D) groups were created. Fentanyl 1 g/kg and midazolam 0.03 mg/kg were used as premedicators on the subjects. Adverse airway reactions, such as coughing, hiccups, laryngospasm, and breath holding, were observed after propofol 2.0-2.5 mg/kg was used to induce anaesthesia and a ProSealTM LMA was inserted. Time to awakening, verbal command response, orientation, the capacity to sit with support, and the Aldrete score for the recovery area were all noted during the post-operative interval. **Results:** Three patients in group S (6.4%) and six patients (13.3%) in Group D had adverse airway events. The mean time to eye opening (Group S-10.75 ± 7.54 min, Group D-4.94 ± 1.74 min), obeying verbal commands (Group S-13.13 ± 8.75 min, Group D-6.55 ± 1.75 min), orientation (Group S-15.42 ± 8.46 min, Group D-6.23 ± 2.4 min) and to sit with support (Group S-36.09 ± 12.68 min, Group D-14.35 ± 3.75 min) were found to be lesser with desflurane than with sevoflurane ($P < 0.001$). The mean time to recovery was delayed in Group S-46.00 ± 12.86 min compared to Group D-26.44 ± 5.33 min ($P < 0.001$). **Conclusion:** Desflurane, when combined with propofol and fentanyl while spontaneous breathing with a Pro^{Sea}lTM LMA, exhibits faster awakening qualities than sevoflurane without a rise in adverse airway outcomes.

Key words: Ambulatory Anaesthesia, Desflurane , Sevoflurane

Introduction

The development of minimally invasive surgical methods has increased the number of ambulatory surgeries, which has raised the requirement for quick tracking. This demands an early return to consciousness, regulation of the defensive airway reflexes, and adequate pain and emesis alleviation. As a result, the use of short-acting anaesthetic medications is required for a higher standard of recovery. Due to their similarities in the characteristics of an ideal

agent, sevoflurane and desflurane have both been used for mobile anaesthesia. Due to desflurane's lower blood gas solubility than sevoflurane, anaesthesia can be induced and recovered from more quickly .[2]

Nevertheless, sevoflurane may be a better option in circumstances of spontaneous respiration due to desflurane's pungent nature and potential to irritate the airway, which can result in coughing, breath retention, laryngospasm, and copious secretions[3,4].

Less research has been done on desflurane and spontaneous breathing. By employing the ProSealTM laryngeal mask airway (LMA) during ambulatory procedures, we chose to compare the effectiveness of desflurane and sevoflurane for maintaining and recovering from anaesthesia as well as to assess airway responses in patients who were breathing on their own. Desflurane, as compared to sevoflurane, may have a faster recovery profile, but it may also result in more airway events during spontaneous ventilation.

METHODOLOGY

At the Meenakshi Medical College and Research Institute in Kanchipuram, the department of anaesthesia treated 94 female patients in total for this study. For this investigation, the institutional ethics committee gave its blessing and the participants' written informed consent. Utilizing computer-generated codes stored in sealed, opaque envelopes, 94 female patients between the ages of 18 and 65 who were undergoing hysteroscopic gynaecological surgery under general anaesthesia and who met the American Society of Anesthesiologists' physical status I and II were divided into two groups at random. While Group D patients received desflurane for anaesthesia maintenance, Group S patients received sevoflurane for that purpose.

Patients who were at risk for stomach aspiration, had deformed airway architecture, or were morbidly obese were not included in the study. Ringer's lactate infusion was started once an intravenous (IV) line was established. After attaching non-invasive blood pressure, ECG, and pulse oximeter (SPO2) devices, pre-medication with intravenous midazolam 0.03 mg/kg and fentanyl 1 g/kg was administered. Preoxygenation with 100% oxygen was administered concurrently for 3 minutes. Anesthesia was induced with propofol 2.0–2.5 mg/kg after 3 minutes. A ProSealTM LMA of the proper size was inserted using the digital approach once the eye lash reflex had been eliminated and the jaw had relaxed enough.

Additional bolus doses of propofol (20–40 mg) were given until the LMA could be implanted properly if it could not be done on the first try. After validating the installation of the ProSealTM LMA, the anaesthesia was maintained on a closed circuit with a mixture of 50% oxygen, 50% nitrous oxide, and either sevoflurane or desflurane (based on a random allocation). With vaporiser dial concentrations of 6% for desflurane and 2% for sevoflurane for the first six minutes, the total fresh gas flow was standardised and maintained at 6 L/min. Patients were initially ventilated intermittently under positive pressure. Patients were permitted to leave the room once the dial concentrations for desflurane and sevoflurane were decreased to 3% and 1%, respectively, at the end of the six-minute period.

Each patient got an IV dose of ondansetron 0.1 mg/kg. Volatile anaesthetic and nitrous oxide were switched off and 100% oxygen was administered at the conclusion of the surgery. The ProSealTM LMA was removed after respiratory gas monitoring confirmed that nitrous oxide had been eliminated from the circuit. Heart rate, systolic blood pressure, diastolic blood

pressure, SpO2, respiratory gas monitoring, end-tidal carbon dioxide, respiratory rate, minimal level alveolar concentration (MAC), and end-tidal concentration of volatile agent were all supervised intraoperatively every five minutes during the procedure.

We looked at how often people coughed, had hiccups, held their breath for more than 10 seconds, or experienced laryngospasm during anaesthesia maintenance and after surgery. Unaware of the inhalational medication used, a second licenced anaesthetist evaluated how long it took the patient to open their eyes, obey verbal commands (tongue protrusion), sit with support, leave the recovery room, and become oriented to time, place, and people after the vaporizer was turned off. One to three coughs were classified as mild, four to seven as moderate, and eight or more as severe. Breathing was assessed as 1 for 10–20 seconds, 2 for 20–30 seconds, and 3 for more than 30 seconds. Laryngospasm was graded as 1 for phonation and stridor <15s, 2 for phonation and stridor >15s and 3 for duration >15s requiring IV medication to treat.

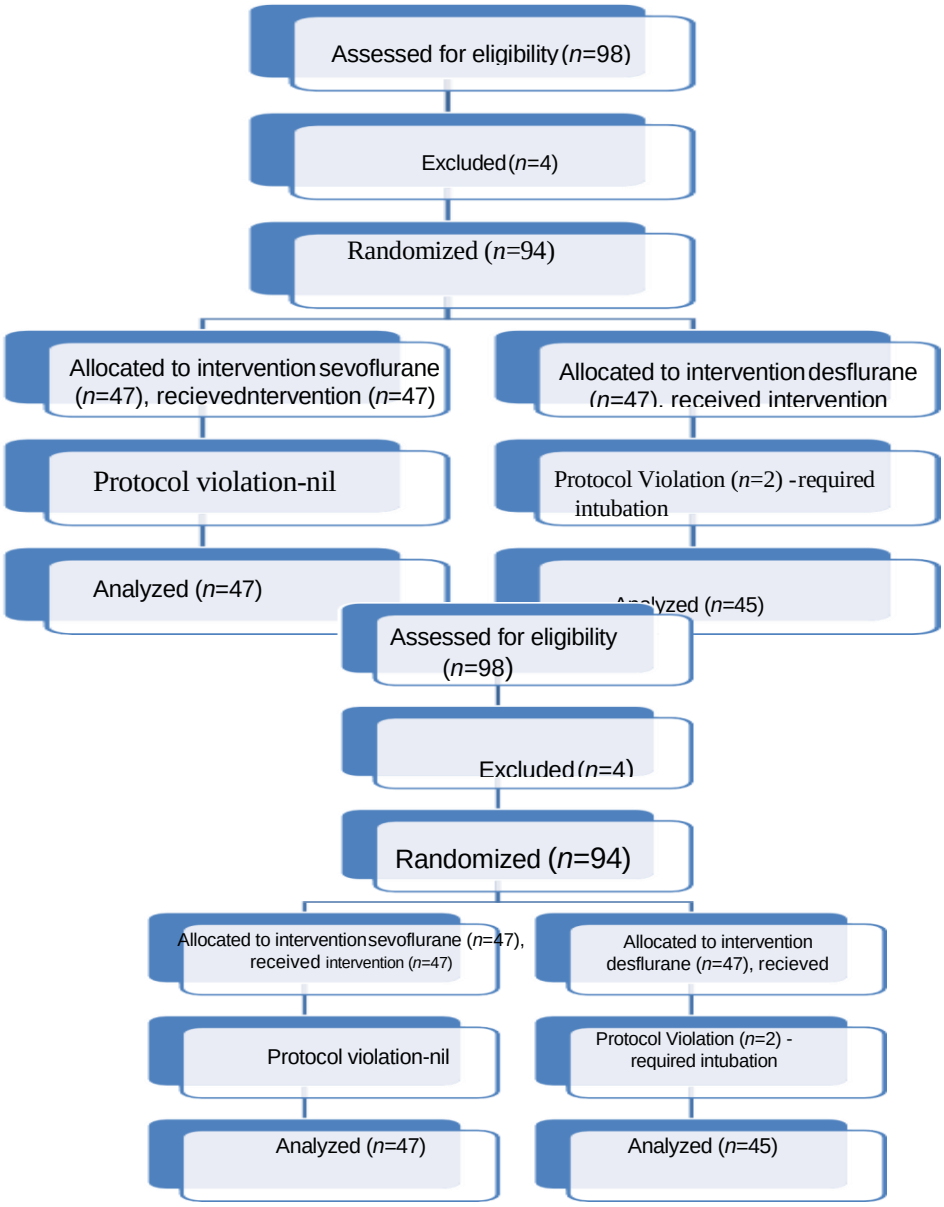
The propped-up patients were moved to the recovery room. A modified Aldrete scoring system was used to record recovery features every 5 minutes, and a score of 8 was deemed appropriate for releasing the patient from the post-anesthesia care unit and transferring them to the ward. Humidified oxygen was provided through a face mask.

Calculating the sample size took type I error into account, with alpha = 0.05 and power = 0.80. A minimum of 43 patients were needed in each group, assuming a 35% incidence of airway events with desflurane from a prior study[6] and a 10% incidence in the sevoflurane group from a pilot survey we conducted with sevoflurane. A total of 94 patients were involved in the study, which was expected to have a few dropouts (requiring endotracheal intubation and protocol deviation).

With the assistance of SPSS software version 22, data analysis was carried out. The mean and standard deviation were used to present quantifiable information. Unpaired t-tests or Mann-Whitney tests were used to compare the research groups. Both frequency and percentage tables were used to illustrate qualitative data. The association between study group members was evaluated using the Chi-square test. Statistics were deemed significant at P 0.05.

Results

94 subjects were randomly assigned, and 92 of them finished the study. Due to insufficient LMA seal, two patients in the desflurane group had to be intubated during surgery, hence they were excluded [Figure 1]. Participant demographic information like age, weight, and height were equivalent between the two groups [Table 1]. Additionally, the average MAC value in Group S was 1.09 and that in Group D was 1.10, and both groups had comparable total surgery times (in minutes) of 22.13 and 21.89 minutes.


Assessed for eligibility (n=98)
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Randomized (n=94)
Allocated to intervention sevoflurane (n=47), recievedntervention (n=47)
Allocated to intervention desflurane (n=47), received intervention
Protocol violation-nil
Protocol Violation (n=2) -required intubation
Analyzed (n=47)
Analyzed (n=45)
Assessed for eligibility (n=98)
Excluded (n=4)
Randomized (n=94)
Allocated to intervention sevoflurane (n=47), received intervention (n=47)
Allocated to intervention desflurane (n=47), recieved
Protocol violation-nil
Protocol Violation (n=2) - required intubation
Analyzed (n=47)
Analyzed (n=45)

Around 6.4% of patients in Group S and 13.3% of patients in Group D, respectively, experienced adverse airway episodes as coughing, hiccups, breath holding, and laryngospasm (P = 0.148). As a result, [Figure 2] there was no significant change in the occurrence of adverse airway outcomes. In Group S, the mean time to eye opening was 10.75 7.54 minutes, whereas in Group D, it was 4.94 1.74 minutes (P 0.001). Both the mean time to be oriented in time, location, and individual (15.42 8.46 in Group S and 6.23 2.4 in Group D) and the time (in min) to obey vocal orders (13.13 8.75 in Group S and 6.55 1.75 in Group D) happened earlier in the desflurane group when compared to the sevoflurane group (P 0.001). In Group S, the mean time (in minutes) to sit with support was 36.09 + 12.68, while it took Group D 14.35 + 3.75 (P 0.001) [Table 2]. Sevoflurane had a longer mean total recovery period (in minutes) than desflurane (26.44 5.33), P 0.001 [Table 2].

Table 1: Patient demographics

Demographic variables	Group S (*n*=47)	Group D (*n*=45)
Age (year)	51.77±8.94	51.04±9.62
Weight (kg)	63.68±8.84	61.56±10.87
Heigwht (m)	1.57±0.06	1.6±0.06

Figure 2: Comparison of airway responses amongst the study groups

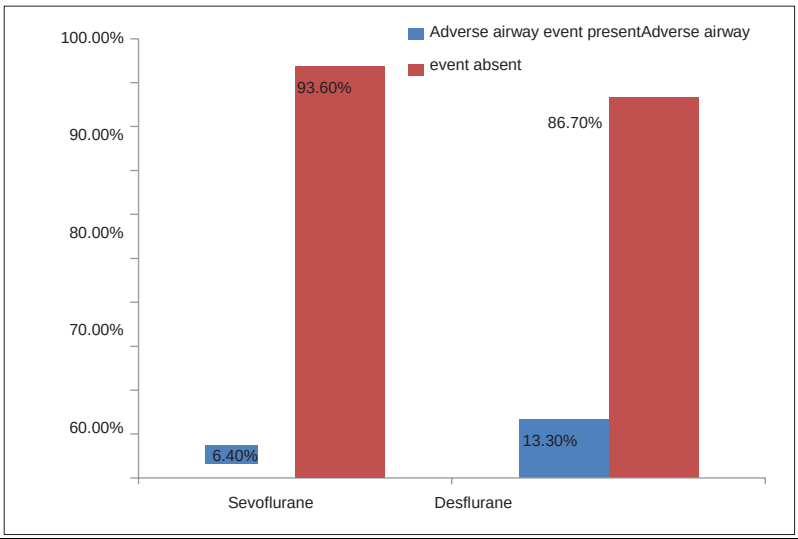

Table 2: Recovery variables

Recovery variables	Group S (*n*=47)	Group D (*n*=45)	CI (%)	*P*
Opening eyes (min)	10.75±7.54	4.94 ±1.7 4	>95	<0.001
Response to verbal commands (min)	13.13±8.75	6.55 ±1.7	>95	<0.0

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Orientation (min)	15.42±8.46	6.23 ±2.4	>9 5	<0 .0 01
Sit in bed with support (min)	36.09±12.68	14.35±3.75	>9 5	<0 .0 01
Total time in recovery (min)	46.00±12.86	26.44±5.33	>9 5	<0 .0 01
CI – Confidence interval				

Discussion

The outcome of our research revealed that, when utilised during spontaneous breathing with the ProSealTM LMA for brief gynaecological procedures, desflurane and sevoflurane do not vary in the incidence of airway reactions such as coughing, hiccups, breath holding, and laryngospasm. Additionally, we discovered that the desflurane group recovered more quickly than the sevoflurane group on the basis of less time needed to open eyes, responding to basic verbal commands like sticking out the tongue, orientation in time, place, and person, and clear-headed recovery with the ability to freely communicate.

The usage of a laryngeal mask during general anaesthesia, particularly in daycare, lowers the likelihood of post-operative airway issues as compared to an endotracheal tube[7]. Nonetheless, there are few research on airway events with desflurane and LMA during spontaneous breathing. Sevoflurane is thought to be the most ideal gas for inhalational induction and anaesthesia management because it smells pleasant and doesn't irritate the airway. Desflurane is the most pungent of all volatile anaesthetics, and although it is thought to have a faster recovery profile than sevoflurane[7], it is well known to occasionally irritate the airways.

Harmful airway events may occur when given in high concentrations over the threshold for respiratory irritation (1-1.5 MAC in 100% 02). We discovered that adverse airway events occurred in 13.3% in the desflurane group and 6.4% in the sevoflurane group, although this difference was statistically insignificant. However, irritation of the airway may not occur until end-tidal concentration of 5.4% (up to 1 MAC in 100% 02). We credit our standardised methodology, which included pre-treatment with fentanyl 1 g/kg in both groups and may have eliminated the airway reactions, for our results.

Similar results were seen in a research where going beyond 1 MAC did not result in an increased incidence of coughing or breath retention. It's possible that by using fentanyl as a pre-medication, they were able to reduce the frequency of coughing or breath holding when using desflurane.[9]

Notwithstanding the the alleged greater airway irritability of desflurane, a different study that used 50 mcg of fentanyl found similar incidences of airway events in the two groups.[10] In an investigation that used fentanyl 1 g/kg as pre-medication, the incidence of coughing during induction of anaesthesia with desflurane was reduced by 80%. .[11]

A recent research that combined fentanyl and desflurane at 1 MAC discovered no difference in the frequency or severity of upper airway events.[12] However, even after the injection of fentanyl 1m/kg, desflurane at 12% concentration in 100% oxygen caused considerably more adverse reactions.

This could be caused by the high desflurane vapour concentration used.[3] Desflurane is suitable even in patients with reactive airways because of its pungency, and though because of its early onset properties, it may be a favoured agent in neurosurgical patients. No significant difference in airway irritation between desflurane and sevoflurane was found when used in smokers, even at higher concentrations of the agents (>1MAC) [14]

Three trials using quick procedures were found in a meta-analysis on desflurane recovery. The average surgery time in our study was 20 minutes. In one trial, the researchers were unable to demonstrate an advantage of desflurane for early recovery, which they credited to the short duration, and in the other two, they were unable to determine the effect of anaesthesia duration on outcome. Patients who took desflurane awoke noticeably more quickly than those who underwent sevoflurane. Desflurane was more quickly recovered from than sevoflurane in terms of eye opening, reaction to verbal directions, time to get oriented, and sitting with assistance.

Fentanyl was not added to speed up the healing process. Our observations of early recovery with desflurane are similar to different researches where they discovered that time to eye opening and obeying commands was earlier in desflurane than sevoflurane.[5,12,17] Awakening times in our study were similar to the another study where fentanyl was not a part of anaesthesia maintenance.

Similar research revealed that desflurane (9.0%) and sevoflurane (3.0%) have different anaesthetic kinetics at 2 and 4 hours of 1.25 MAC. They came to the conclusion that desflurane is more quickly eliminated from the body than sevoflurane, independent of the length of anaesthesia. They related this to desflurane's poor blood: gas solubility.[18] A different survey also reveals results that are similar, showing that desflurane and sevoflurane had faster recovery profiles (psychomotor, time to sit in bed) .[19]

When tried to compare to the sevoflurane group, we discovered that the mean total time spent in the recovery room was much lower in the desflurane group. According to the aforementioned early recovery findings, desflurane helped patients achieve an Aldrete score of >8 faster than sevoflurane due to its low blood gas solubility (blood: Desflurane has the lowest gas partition coefficient [0.45], accompanied by sevoflurane [0.65]), rapid eradication with little to no residual metabolites, and clear-headed recovery.

Our results are consistent with a recent survey that discovered comparable alterations in the immediate and intermediate recovery that occurred substantially more quickly following desflurane than sevoflurane anaesthesia, enabling early patient discharge and fast tracking. 20 Desflurane's increasing price may result in an increase in anaesthesia costs. Desflurane has been proven to be less expensive than sevoflurane when used with modest flows, nevertheless.[21]

Conclusion

When opposed to sevoflurane, desflurane often results in patients recovering more quickly. Desflurane use may be constrained by concern over potential adverse airway events, particularly in patients with LMA who spontaneously breathe. Despite the possibility that pre-treatment with fentanyl increased the risk of airway events, our investigation did not detect any such increase, even at MAC > 1. A thorough analysis could be done to determine whether fentanyl use lowers the frequency of airway incidents.

Future research will be needed to determine the prevalence of adverse airway events, particularly at higher MAC, in smokers, reactive airway patients, and obese individuals. The trial is underpowered to detect a difference since the incidence of airway events we observed with desflurane (13.3%) is lower than that predicted for sample size estimates. The generalizability of our findings is limited because we only analysed female participants undergoing hysteroscopic gynaecological surgery. Furthermore, because blinding was impossible, we were unable to account for any prejudice the administrator may have had toward either agent.

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