

How to Cite:

Barkha, B., Sivakumar, V., Ali, M. M., Kumar, V. P., & Chincholi, I. H. (2022). A comparison between propofol and desflurane anaesthetic agent for short elective surgery. *International Journal of Health Sciences*, 6(S6), 10790–10796.
<https://doi.org/10.53730/ijhs.v6nS6.12911>

A comparison between propofol and desflurane anaesthetic agent for short elective surgery

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Abstract--Background: Desflurane is known to have a rapid onset and offset of action, thereby making it possible for the anesthetist to control the depth of anesthesia rapidly. Intravenous propofol with rapid induction and recovery is currently a popular induction agent for surgical anesthesia. Objective: To compare desflurane and propofol as single agent anesthesia in short elective surgeries. Materials and methods: It was a hospital based prospective comparative study, 80 patients scheduled for elective short surgery were taken. After routine pre-anesthetic work up, patients were induced with either Group D: O₂:N₂O (50:50) + Desflurane 3-4% or; Group P: O₂:N₂O (50:50) + Propofol 3-5 mg/kg. Baseline parameters, relevant intra-op details, ease of procedure, hemodynamic changes, recovery, and complication rate were compared between both groups. Statistical analysis was done using SPSS ver. 22. Results: Parameters like jaw opening, attempts for LMA and ease of insertion was comparable in both the

groups ($p > 0.05$). Time to loss of consciousness and time to LMA insertion was significantly shorter with Propofol ($p < 0.05$). Mean pulse rate and MAP was significantly higher in Desflurane group ($p < 0.05$). Modified Aldrete score was significantly higher in Desflurane group while Complication rate was comparable. Conclusion: Inhaled desflurane provided acceptable conditions for LMA insertion and the intra-operative hemodynamic profile during anesthesia was stable. Desflurane can be considered as an alternative induction agent when inhalational induction is required; bearing in mind that caution still needs to be exercised when desflurane is used in this manner.

Keywords--inhalational agent, hemodynamic parameters, desflurane, propofol, elective surgery, day care surgery.

Introduction

Desflurane is known to have a rapid onset and offset of action, thereby making it possible for the anesthetist to control the depth of anesthesia rapidly. It also appears to provide fairly cardiostable anesthesia with preservation of tissue perfusion even in face of hypotension [1]; however it is said to be irritating to the airway and therefore is not commonly used for inhalational induction [1, 2]. However, two studies have shown that controlled desflurane induction along with opioid premedication can be rapid and well tolerated [3, 4]. Another study has shown that addition of fentanyl reduced the incidence of cough from 25% to 5% [5]. Intravenous propofol is currently a popular induction agent for surgical anesthesia. Propofol has largely replaced sodium thiopental for induction of anesthesia as recovery from propofol is more rapid and clear as compared to thiopental. As the least soluble agent (blood gas partition coefficient of 0.42), desflurane is eligible as an ideal inhaled anesthetic in such cases. However, many anesthesiologists feel that its pungent odour and tendency to irritate the upper airway make it unsuitable for maintenance, and more specifically, for induction of anesthesia. The present study was thus carried out to compare desflurane and propofol as single agent anesthesia in short elective surgeries.

Materials and Methods

It was a hospital based prospective comparative study conducted from April 2021 to September 2021. 80 patients scheduled for elective short surgery was taken. After obtaining consent from institutional ethical committee, and written informed valid consent, patients were divided into two groups of 40 each.

Inclusion criteria

- Age group- 18 to 60 years
- ASA grade I – II
- Elective short surgeries – requiring general anesthesia with laryngeal mask airway placement e.g. fibroadenoma, hernia, fistula, appendicitis.

Exclusion criteria

- Allergy to propofol /Egg allergy
- History of upper respiratory tract infection within 1 month of surgery
- Documented uncontrolled hypertension/chronic obstructive pulmonary disease
- Addiction to alcohol/drug abuse

Methodology

On the night before surgery, patients were visited and were explained about the type of surgery, anesthesia, post-operative pain relief, rescue medication etc. Following preloading with ringer's lactate 5-8 ml/kg and premedication with Glycopyrrolate 0.004 mg/kg, Fentanyl 3 mcg/kg and Midazolam 0.03 mg/kg, anesthesia was induced with:

- **Group D:** O₂:N₂O (50:50) + Desflurane 3-4% by the tidal volume induction technique, stepping up by 1% with each breath until the loss of consciousness; or
- **Group P:** O₂:N₂O (50:50) + Propofol 3-5mg/kg

For each of the groups, the following were monitored: Conditions during LMA insertion: time to loss of consciousness, time to insertion of LMA, jaw opening, ease of insertion, number of attempts in both desflurane and propofol group.

Degree of jaw opening

- Good: Jaw fully opened
- Moderate: Jaw partially opened
- Poor: Jaw needed to be prized open

Ease of insertion

- Good: Insertion smooth and easy
- Moderate: Insertion followed by cough, gag, excitatory movement that were self-limited and settled without intervention
- Poor: Insertion was met with resistance and cough, gag, or excitatory movement that required treatment with propofol.

Statistical Analysis

Analysis of data was done by using SPSS software ver. 22. Data were statistically described in terms of mean ($\pm$ SD), frequencies (number of cases) and percentages when appropriate. Comparison of quantitative variables between the study groups was done using Student t test for independent samples if normally distributed. For comparing categorical data, Chi square test was performed. A probability value (p value) less than 0.05 was considered statistically significant.

Results

Table 1
Baseline details of Study participants and loss of consciousness and LMA insertion

Variable	Desflurane (n=40)		Propofol (n=40)		p-value
	Mean	SD	Mean	SD	
Age	28.45	12.18	25.41	7.30	0.23
Weight (Kg)	50.32	4.50	49.30	3.38	0.41
Duration of surgery (min)	54.74	12.87	59.47	11.82	0.12
Time to loss of consciousness (Sec)	235.30	58.93	41.50	8.46	0.001*
Time to LMA insertion (Sec)	50.87	10.37	37.10	12.12	0.01*

As per table 1 the two groups were comparable with respect to demographic characters like age, weight and duration of surgery ($p > 0.05$). Time to loss of consciousness in Desflurane and Propofol groups was 235.30 sec and 41.50 sec respectively ($p < 0.05$). Time to LMA insertion was significantly shorter with Propofol group when compared with Desflurane group (50.87 sec vs 37 sec; $p < 0.05$).

Table 2
Comparison of Pre-operative parameters among study groups

Variable	Desflurane (n=40)		Propofol (n=40)		p-value
	N	%	N	%	
ASA grade I	40	100.0%	40	100.0%	1.11
Good Jaw Opening	35	83.3%	37	90.0%	0.51
Single attempt for LMA	36	86.7%	37	90.0%	1.43
Ease of Insertion - Good	36	86.7%	34	80.0%	0.44

As per table 2 Jaw opening, attempts for LMA and ease of insertion was also comparable in both the groups ($p > 0.05$).

Table 3
Comparison of Aldrete score among study groups

Aldrete Score	Desflurane (n=40)		Propofol (n=40)		p-value
	Mean	SD	Mean	SD	
0 min	8.47	0.518	7.17	0.432	< 0.01
10 min	9.17	0.528	8.47	0.441	< 0.01
20 min	9.47	0.326	8.97	0.489	< 0.01
30 min	10	0	8.81	0.366	< 0.01
40 min	10	0	8.77	0.193	< 0.01
50 min	10	0	9.53	0.41	< 0.01
60 min	10	0	9.27	0.48	< 0.01

As per table 3 Modified Aldrete score was significantly higher in Desflurane in comparison to Propofol from 0 min to 60 min following extubation to 1hr stay in recovery room ($p < 0.05$). Mean VAS score for Desflurane at 20 min and 30 min was 0.54 and 0.64 and for Propofol 0.22 and 0.24 respectively ($p < 0.05$) (not shown in table).

Table 4
Comparison of Complication rates in study groups

Complications	Desflurane (n-40)		Propofol (n-40)		p-value
	N	%	N	%	
Cough	6	14.3%	3	7.7%	0.60
Nausea/ Vomiting	6	13.3%	3	6.7%	0.57

As per table 4 Complication rate was comparable between Desflurane and propofol groups (14.3% vs 7.7%; $p = 0.60$).

Table 5
Comparison of Pulse rate and Mean Arterial Pressure (MAP) in study groups

Variables	Desflurane (n-40)		Propofol (n-40)		p-value
	0 min	60 min	0 min	60 min	
Pulse rate	6	22	3	14	0.01*
MAP	6	26	3	18	0.01*

As per table 5 mean pulse rate from 0 min to 60 min and mean arterial pressure at 0 min and from 0 min to 65 min was statistically significantly higher in Desflurane group in comparison to Propofol group ($p < 0.05$).

Discussion

The purpose of our study was to compare Desflurane verses Propofol as single agent anaesthesia. The two groups were comparable with respect to demographic characters like age, sex, weight and duration of surgery ($p > 0.05$). Jaw opening, attempts for LMA and ease of insertion was also comparable in both the groups ($p > 0.05$). Time for loss of consciousness and LMA insertion was significantly shorter in Propofol group. Our study was in agreement with Wai May Leong and Ee Lyn Ong [8] who did a prospective study on LMA insertion with Desflurane induction. Eighty patients undergoing elective surgery were randomized into two groups to receive either 2.5mg/kg propofol ($n = 40$) or tidal breath desflurane ($n = 40$) induction followed by LMA insertion. Wrigley, et al. [12] compared induction and recovery characteristics of Desflurane with Propofol in 60 Daycare patients. Desflurane caused loss of consciousness in approximately 2 minutes during gaseous inductions. There was also a tendency for other recovery parameters to be faster in the patients receiving Desflurane though non-significant. They concluded that Desflurane would be a suitable agent for day care anaesthesia providing for a rapid recovery.

Mean pulse rate and MAP was significantly higher in Desflurane in comparison to Propofol. Desflurane produces greater sympathetic stimulation, and this

stimulation becomes manifest at concentrations greater than 1 MAC [13]. The result of stimulation may be both a greater tendency to sustain cardiac output and blood pressure, and a greater effect on heart rate. Modified Aldrete score was significantly higher in Desflurane group in comparison to Propofol group from 0 min to 60 min following extubation to 1 hour stay in recovery room ($p < 0.05$). RASS scale was significantly higher in Desflurane group from 0 min to 30 min in comparison to Propofol group whereas no significant difference in RASS scale was found in two groups from 40 min to 60 min. This was in agreement with study by Dajun Song, et al. [14] who compared Desflurane, Sevoflurane and Propofol for maintenance of anaesthesia and discharge criteria on arrival in the post anaesthesia care after Laproscopic tubal ligation surgery. They found that compared with the Propofol group, the times to awakening and to achieve a recovery score of 10 were significantly shorter.

Gupta, et al. [15] compared recovery profile after ambulatory anesthesia with propofol, isoflurane, sevoflurane and desflurane in a systemic review and found out no differences between propofol and isoflurane in early recovery. However, early recovery was faster with desflurane compared with propofol and isoflurane and with sevoflurane compared with isoflurane ($p < 0.05$). Our study was also in agreement with Wai May Leong and Ee Lyn Ong [8] who did a prospective study on LMA insertion with Desflurane induction. Eighty patients undergoing elective surgery were randomized into two groups to receive either 2.5mg/kg propofol ($n = 40$) or tidal breath desflurane ($n = 40$) induction followed by LMA insertion. Airway excitation and cough, a main concern during induction with desflurane, occurred in 5% of patients. This contrast in the incidence of airway irritation when compared to other studies (reported incidences of 26%–59%) could be explained by several factors [5]. The addition of fentanyl has been reported to help attenuate airway irritability [5]. The use of nitrous oxide in conjunction with desflurane instead of just desflurane in oxygen could have helped to reduce the period of cough and excitation because the second gas effect enhances the uptake of desflurane [12].

Conclusion

Propofol has better induction characteristics than Desflurane but desflurane provided acceptable conditions for LMA insertion and Hemodynamic stability during anesthesia was stable. Desflurane can be considered as an alternative induction agent when inhalational induction is required but caution still needs to be exercised when desflurane is used.

Source of Funding- None

Conflict of Interest- None declared

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