

## COMPARISON OF AIRWAY RESPONSES, HAEMODYNAMICS AND RECOVERY USING SEVOFLURANE AND DESFLURANE VIA LARYNGEAL MASK AIRWAY IN DAY CARE PAEDIATRIC SURGERIES

A. Satyanarayana<sup>1</sup>, K. Aparanji<sup>2</sup>, K. Gopalakrishna<sup>3</sup>

<sup>1</sup>Professor and HOD, Department of Anaesthesia, King George Hospital, Visakhapatnam.

<sup>2</sup>Associate Professor, Department of Anaesthesia, King George Hospital, Visakhapatnam.

<sup>3</sup>Senior Resident, Department of Anaesthesia, King George Hospital, Visakhapatnam.

### ABSTRACT

#### BACKGROUND

The general observation that children achieve better convalescence in the home environment supports the need for adoption of day care surgeries in them. Advantages of paediatric outpatient anaesthesia include- minimises parental separation, uninterrupted feeding schedule/sleeping patterns, less risk of nosocomial infections, reduced cost of hospitalisation, convenience and improved patient satisfaction.

The aim of the study is to compare the airway responses, haemodynamic parameters and recovery using sevoflurane and desflurane via laryngeal mask airway in day care paediatric surgeries.

#### MATERIALS AND METHODS

60 paediatric patients of both gender between the age group of 6 and 14 years with ASA grade 1 and 2 undergoing elective day care surgeries under general anaesthesia with LMA are divided into two groups. (Group S) sevoflurane group received sevoflurane 2% to 3% and (group D) desflurane group received desflurane 6% to 8% for maintenance of anaesthesia after induction with IV propofol 2 mg/kg. Airway responses, haemodynamics and recovery parameters are recorded.

#### RESULTS

Recovery parameters spontaneous eye opening, response to verbal commands, Aldrete score at 5 and 10 mins. showed statistically significant difference between two groups. Recovery is faster in desflurane group compared to sevoflurane group. The airway responses and adverse events were found to be more in desflurane group, but statistically not significant.

#### CONCLUSION

Recovery from anaesthesia was faster in patients maintained with desflurane (6% to 8%) compared with sevoflurane (2% to 3%).

#### KEYWORDS

Desflurane, Sevoflurane, Laryngeal Mask Airway, Day Care Surgery, Volatile Anaesthetics.

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#### BACKGROUND

The general observation that children achieve better convalescence in the home environment supports the need for adoption of day care surgeries in them.<sup>1</sup> Advantages of paediatric outpatient anaesthesia include- minimises parental separation, uninterrupted feeding schedule/sleeping patterns, less risk of nosocomial infections, reduced cost of hospitalisation, convenience and improved patient satisfaction.

The Laryngeal Mask Airway (LMA) is most commonly used airway device in day care surgery and has numerous

advantages for day care anaesthesia in children.<sup>2</sup> In experienced hands, tracheal intubation can be avoided for nearly all of the usual day care procedures by the use of LMA, thereby avoiding the use of neuromuscular blocking drugs and problems such as extubation stridor.

The ideal day care anaesthetic agent should provide smooth and rapid induction, optimal operating conditions and facilitate a fast-track recovery.<sup>3</sup> Propofol effectively obtunds upper airway reflexes and has a favourable recovery profile, therefore, appears to be the optimal intravenous induction agent for LMA insertion. The use of low-solubility inhalation agents can be of benefit to day care anaesthesia as they allow more rapid emergence and recovery. Sevoflurane (blood-gas partition coefficient 0.69) and desflurane (blood-gas partition coefficient 0.42) are relatively new inhalational agents that are widely used in both paediatric and adult anaesthesia by virtue of their superior recovery profiles.

Though desflurane possesses lower blood-gas solubility than sevoflurane, desflurane can be irritant to airways.<sup>4</sup>

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*Corresponding Author:*

*Dr. K. Aparanji,*

*No. 10-5-19, 21F, Srinidhi,*

*Kailasa Metta, Visakhapatnam-550003.*

*E-mail: aparanjikoduri15@yahoo.in*

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Therefore, sevoflurane is generally considered to be the agent of choice for day care anaesthesia with spontaneous respiration for short cases, despite possibly faster recovery with desflurane.

Thus, whether the effect of desflurane in paediatric anaesthesia is superior to sevoflurane remains controversial. So, we compared the efficacy of sevoflurane and desflurane for short day care procedures in paediatric surgery.

## MATERIALS AND METHODS

This is a prospective randomised study conducted at King George Hospital, Visakhapatnam, to compare the airway responses, haemodynamic parameters and recovery characteristics using desflurane and sevoflurane administered via LMA for maintenance in paediatric day care surgeries. After obtaining Institutional Ethical Committee clearance and written informed consent from the parents, randomisation was done based on computer-generated tables.

A 60 paediatric patients were divided into two groups. Sevoflurane group (group S) received sevoflurane 2% to 3% and patients in desflurane group (group D) received desflurane 6% to 8% for maintenance of anaesthesia.

Patients of both gender belonging to age group of 6-14 years with ASA grade I and II undergoing elective surgery under general anaesthesia lasting for 30 to 90 mins. duration were included in the study.

Children with active airway disease, known allergy to sevoflurane or desflurane were excluded from the study.

All patients underwent a thorough pre-anaesthetic evaluation and kept nil by mouth as per the American Society of Anaesthesiologists (ASA) fasting guidelines. A peripheral Intravenous (IV) access was established and antibiotics administered.

In the OT, pre-induction monitoring including ECG, Non-Invasive Blood Pressure (NIBP) and pulse oximetry were used. Baseline Heart Rate (HR) and Mean Arterial Pressure (MAP) were recorded.

All patients were preoxygenated with 100% O<sub>2</sub> at 6

litres/minute. Prior to induction of anaesthesia, premedicated with IV glycopyrrolate 0.01 mg/kg, IV midazolam 0.05 mg/kg, IV fentanyl 2-3 µg/kg and IV ondansetron 0.1 mg/kg. General anaesthesia was induced with IV propofol 2 mg/kg. After loss of consciousness (confirmed by loss of eyelash reflex) and after assessing jaw relaxation, LMA placement was attempted.

Following LMA placement, patients were randomised to receive either sevoflurane 2%-3% or desflurane 6%-8% in a 50% N<sub>2</sub>O/O<sub>2</sub> mixture for maintenance of anaesthesia. Patients were maintained on spontaneous ventilation.

Ringers lactate as maintenance fluid at a rate of 4 mL/kg/hr. during the intervention. MAP and HR were recorded before induction, before LMA insertion, immediately after insertion, then every minute for 5 minutes, at 10 minutes after insertion and thereafter every 10 minutes until removal of LMA.

Inhalational agent was discontinued at the end of the procedure and after thorough suctioning of throat; LMA was removed under deeper planes and assisted with mask ventilation with 100% O<sub>2</sub> till complete recovery.

Time to eye opening and response to verbal commands were noted. Recovery characteristics were rated by the modified Aldrete score at 5 and 10 minutes and time to reach discharge criteria, which is defined as an Aldrete score  $\geq 9$  was observed. Incidence of adverse events including bronchospasm, desaturation, coughing, laryngospasm, nausea, vomiting and shivering were noted. Demographic data like age, sex, weight and height were recorded in both the groups.

The intraoperative variables heart rate, mean arterial pressure, O<sub>2</sub> saturation, duration of procedure and duration of anaesthesia were recorded.

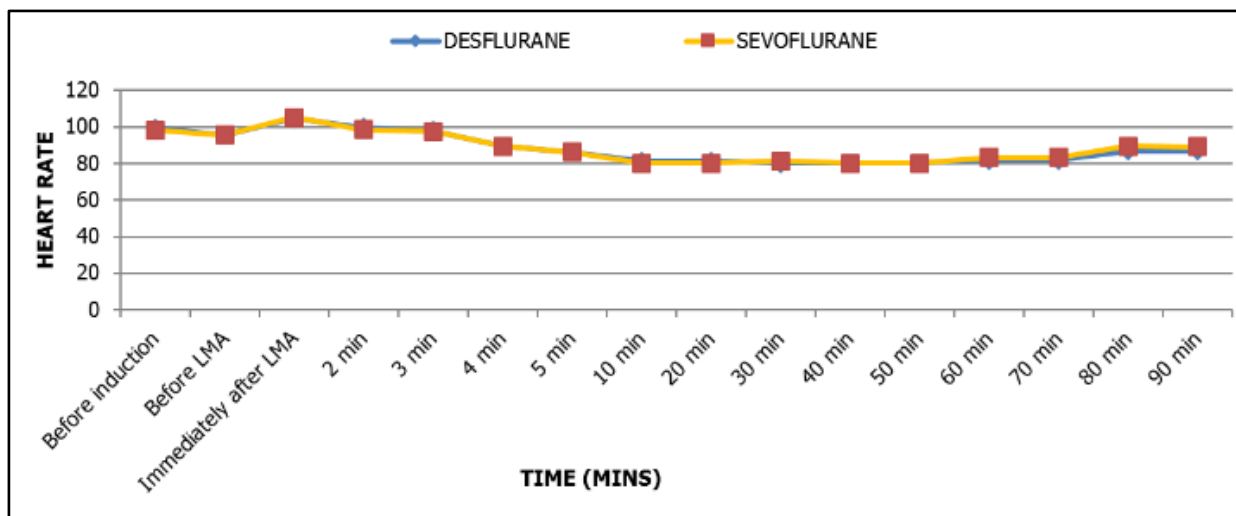
Descriptive statistics was done for all data and suitable statistical tests of comparison were done. These included the mean and Standard Deviation (SD) for quantitative variables analysed by Student's t unpaired test. P value  $\leq 0.05$  was considered statistically significant.

## OBSERVATIONS AND RESULTS

Demography	Desflurane (n=30)		Sevoflurane (n=30)		p Value
	Mean	SD	Mean	SD	
Age (yrs.)	10.17	1.55	10.43	1.54	0.508
Weight (kg)	25.47	3.411	26.17	3.415	0.430
Height (cm)	95.10	2.59	94.17	2.32	0.147

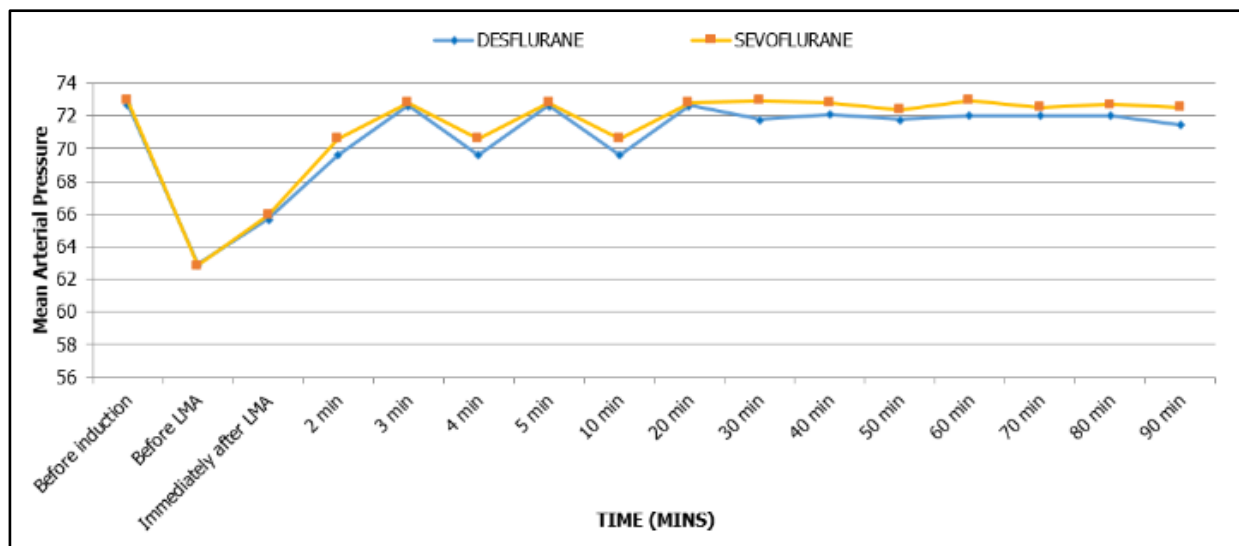
**Table 1. Distribution of Age, Weight and Height Among Desflurane and Sevoflurane Groups**

P value  $< 0.05$  is significant; p value  $> 0.05$  is not significant. There was no statistically significant difference between the groups with regard to age (p value = 0.508), weight (p value = 0.430) and height (p value = 0.147).



**Graph 1. Heart Rate Characteristics among Desflurane and Sevoflurane Groups**

There is no statistically significant difference in mean heart rates between the two groups.



**Graph 2. Mean Arterial Pressure Characteristics among Desflurane and Sevoflurane Groups**

There is no statistically significant difference in the mean arterial pressure between the two groups.

Aldrete Score	Desflurane (n=30)	Sevoflurane (n=30)	P Value
	Mean ± SD	Mean ± SD	
5 mins. of LMA removal	8.37 ± 0.615	7.63 ± 0.556	0.000*
10 mins. of LMA removal	9.30 ± 0.651	8.77 ± 0.679	0.003*

**Table 2. Mean Aldrete Scores among Desflurane and Sevoflurane Groups**

\*p value <0.05 is significant; p value >0.05 is not significant.

The Aldrete score was calculated in all patients at 5 mins. and 10 mins. following LMA removal. The mean Aldrete score at 5 mins. following LMA removal was 8.37 in desflurane group and 7.63 in the sevoflurane group. The mean Aldrete score at 10 mins. following LMA removal was 9.3 and 8.77, respectively in the patients who received desflurane and sevoflurane, respectively.

The difference in the Aldrete score in the two groups (5 mins. and 10 mins. following LMA removal) was statistically significant (p value <0.05).

Aldrete Score	Desflurane (n=30)	Sevoflurane (n=30)	P value
	Mean ± SD	Mean ± SD	
Time to reach Aldrete score of 9	10.03 ± 1.810	13.27 ± 1.741	0.000*

**Table 3. Mean Time Taken to Reach an Aldrete Score of 9 Among Desflurane and Sevoflurane Groups**

\*p value <0.05 is significant; p value >0.05 is not significant.

The time taken to reach the Aldrete score of 9 was also calculated. The mean time to reach an Aldrete score of 9 was 10.03 and 13.27 minutes in the desflurane and sevoflurane groups, respectively.

The difference in the time taken to reach Aldrete score of 9 was also statistically significant (p value <0.05).

Discontinuation of Volatile Anaesthetic	Desflurane (n=30)	Sevoflurane (n=30)	p value
	Mean ± SD	Mean ± SD	
Time taken to eye opening	5.03 ± 0.999	8.70 ± 1.149	0.000*
Time taken to obey verbal commands	6.23 ± 0.935	9.73 ± 1.112	0.000*

**Table 4. Time Taken to Open Eyes and to Obey Commands Following Discontinuation of Volatile Anaesthetic among Desflurane and Sevoflurane Groups**

\*p value <0.05 is significant; p value >0.05 is not significant.

Following discontinuation of the anaesthetic, the time taken to open the eyes and the time taken to obey the verbal commands was noted in both the groups. The mean time taken to open the eyes was 5.03 minutes in desflurane group and 8.70 minutes in sevoflurane group. This difference was statistically significant (p value <0.05). The mean time taken to obey commands was 6.23 minutes in desflurane group and 9.73 minutes in sevoflurane group. This difference was statistically significant (p value <0.05).

Postoperative Complications	Desflurane (n=30)		Sevoflurane (n=30)		P value
	Patients with Complications (n)	Percentage	Patients with Complications (n)	Percentage	
Bronchospasm	0	0	0	0	0
Excessive secretions	3	10	2	6.7	1.000
Nausea and vomiting	3	10	2	6.7	1.000
Desaturation	0	0	0	0	0
Coughing	7	23.3	5	16.7	0.748
Laryngospasm	0	0	0	0	0
Shivering	0	0	0	0	0

**Table 5. Postoperative Complications in the Desflurane and Sevoflurane Groups**

P value <0.05 is significant; p value >0.05 is not significant.

The postoperative complications noted in the two groups were bronchospasm and excessive secretions, nausea, vomiting, desaturation, coughing, laryngospasm, shivering and excessive secretions. This difference was not statistically significant (p = 0.748).

**DISCUSSION**

Airway responses, haemodynamic parameters and recovery characteristics were compared in the two study groups in whom anaesthesia was administered using either sevoflurane or desflurane via LMA.

In our study, the mean heart rate and arterial pressure at any point of time starting before induction to end of the procedure showed no statistically significant difference between the two groups. These findings were consistent with the studies by Jindal et al,<sup>5</sup> White PF et al,<sup>6</sup> Nathanson et al<sup>7</sup> and Bedforth NM et al.<sup>8</sup>

In our study, the mean duration of surgery and the mean duration of anaesthesia showed no statistically significant difference between the two groups.<sup>9,10,11</sup> In our study, recovery parameters noted are the mean time taken to open the eyes following discontinuation of volatile anaesthetic and the mean time taken to obey verbal commands following discontinuation of volatile anaesthetic, which showed statistically significant difference between the

two groups with desflurane group showed faster recovery than sevoflurane group. These findings were consistent with the studies by Kim JM et al,<sup>11</sup> Jindal et al,<sup>5</sup> Naidu-Sjosvard K et al,<sup>12</sup> Mahmoud et al,<sup>13</sup> Cohen et al<sup>14</sup> and Welborn et al.<sup>9</sup>

In our study, the mean Aldrete scores at 5 and 10 minutes following LMA removal showed statistically significant difference between the two groups with higher scores in desflurane group compared to sevoflurane group. This was in accordance with findings of Jindal et al<sup>5</sup> and Valley RD et al. In our study, the mean time taken to reach an Aldrete’s score of 9 following LMA removal showed statistically significant difference in the two groups with lesser time for desflurane group compared to sevoflurane group. This was in accordance with findings of Jindal et al<sup>5</sup> and Valley RD et al, whereas studies done by Song et al<sup>15</sup> and Coloma et al<sup>16</sup> found statistically no significant difference between sevoflurane and desflurane groups in their study comparing inhalational anaesthetics sevoflurane and desflurane with IV anaesthetic propofol.

In the present study, the incidence of complications like coughing, excessive secretions, nausea and vomiting showed no statistically significant difference between the two groups. This was in accordance with findings of Valley RD et al,<sup>17</sup> Song et al,<sup>15</sup> Gupta et al<sup>18</sup> and Stevanovic et al.<sup>19</sup>

**CONCLUSION**

The recovery from anaesthesia in paediatric day care procedures is faster with desflurane compared to sevoflurane. However, airway response are minimal with sevoflurane.

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