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## Research Article

# Comparison between two inhalational anesthetic agents (desflurane and sevoflurane) using i-gel in laproscopic cholecystectomy

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### ABSTRACT

**Background:** With the rise in day care procedures, the need for early recovery and stable hemodynamics is must for early discharge of the patient. So, we need agents with faster induction, early recovery with stable hemodynamics, with minimal side effects

**Material and method:** After CTRI registration and ethical committee clearance, a total of 74 patients were taken for the randomized prospective study. Patients were divided into two groups according to the Inhalational agent they received. Patient receiving Sevoflurane (group S, n=37) and Desflurane (Group D, n=37). After taking patient in OT, all the monitors were attached according to ASA guidelines and baseline parameters were recorded. Patient were preoxygenated and induced with Fentanyl 2mcg/kg, Propofol 2mg/kg and Vecuronium 0.1mg/kg. I-gel was secured and Ryle's tube of appropriate size was passed through the gastric port of I-gel. Continuous monitoring of HR, MAP, SPO<sub>2</sub>, was done and recorded. After application of last stitch, both inhalational and Nitrous were turned off. Recovery was assessed by Time to return of spontaneous respiration, Time to extubation of I-gel, and Time to return of consciousness (by recall of name). Emergence and complications were noted if any.

**Results:** The hemodynamic parameters were comparable amongst two groups. The recovery as assessed by Time to return of spontaneous respiration, Time to extubation of I-gel, and Time to return of consciousness was earlier in Desflurane group, but the data was not statistically significant. Similarly the MAS were greater with Desflurane group as compared to Sevoflurane group at 5 minutes suggesting earlier recovery with Desflurane. However MAS at 10 minutes were comparable amongst the two groups. The incidence of emergence agitation and complications were comparable amongst the two groups.

**Conclusion:** The Hemodynamic stability is comparable of Desflurane and Sevoflurane, However earlier recovery is better with Desflurane as compared to Sevoflurane, contributing to earlier fast tracking of patients and early discharge. Intermediate recovery is comparable amongst the two groups. Emergence agitation is higher with Sevoflurane than Desflurane but data is not statistically significant. The Complications are comparable amongst the two groups.

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### INTRODUCTION

In the today's world of trends, day care surgeries are trending. Leading to an increased demand for same day discharges. This necessitates early recovery in the form of clear-headedness, control of protective airway reflexes and satisfactory relief from pain and emesis. As a result, there is a need for the use of short-acting anaesthetic drugs for a better quality of recovery. Sevoflurane and Desflurane have been in use for ambulatory anaesthesia as they both have properties of an ideal agent.<sup>1</sup> Favourable emergence and recovery profile of newer volatile anaesthetics have made their use increasingly common because of ease of administration and predictable intraoperative and

recovery characteristics. Low blood gas partition coefficient of Sevoflurane (0.69) and Desflurane (0.42) leads to rapid emergence compared to traditional inhalation anaesthetics.<sup>6</sup> The more rapid awakening may contribute to a decrease in the period of time that the patients airway is left unprotected.<sup>2</sup>

Sevoflurane and Desflurane both are used widely as outpatient anaesthesia due to their excellent hemodynamic stability and low blood solubility, which allows rapid induction and emergence from general anaesthesia, as well as control of the depth of anaesthesia. However, when Sevoflurane is used alone it is associated with a higher incidence of emergence agitation, specially in children. The rapid removal of residual anaesthetics

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due to low blood solubility of Sevoflurane has been suggested to cause emergence agitation in some patients. Patients suffering from emergence agitation may harm themselves and dislodge drains or catheters, which affects the results of surgery. They may inflict a bodily injury on their care-givers or cause a paranoiac accident, which makes the management and monitoring of patients at the post anesthesia care unit difficult.<sup>3,4</sup>

However no studies exist in comparing the hemodynamics recovery profile, and emergence agitation of Sevoflurane and Desflurane in laproscopic surgery with i-gel. So, we have done the same to see the effects on hemodynamics, recovery and emergence agitation in i-gel to compare which inhalational agents Sevoflurane and Desflurane. As endotracheal tube and intubation in itself is very stressful procedure and carrying out study in GA with ET tube would not provide exact effects of hemodynamics and recovery. Similarly emergence can also be better studied in SGA devices, as extubation related sympathetic surge and post operative sore throat are relatively less with igel than with ET tube.<sup>5</sup>

## MATERIAL AND METHOD

After ethical committee approval of the university & written informed consent from patient, a randomized prospective clinical study was carried out in Gandhi Memorial and Associated Hospitals, K. G. Medical University, Lucknow. Patients of either sex, in age of 20 – 60 years, of ASA grade I or II were taken into the study. Any patient with Cardiac or lung disease, alcoholism, pregnancy, uncontrolled diabetes or hypertension, history of stroke or neuropsychiatric disease were excluded form our study.

**Study design:** Prospective Randomized study Patients was randomly assigned to two equal groups. Randomization was done according to a computer-generated list. GROUP S (Sevoflurane group)– group with Sevoflurane in maintenance of Anaesthesia. GROUP D (Desflurane group)– group with Desflurane in maintenance of Anaesthesia. A routine preanesthetic checkup was conducted one day prior to surgery. No preanesthetic medication that would affect the total anesthetic agent requirement and recovery profile were administered.

All the patients were kept fasting prior to procedure as per ASA fasting guidelines. In the operation theatre, after obtaining i.v. access, all the monitors were attached (ECG, Non invasive Blood Pressure, Pulse oximetry) and baseline hemodynamic parameters were recorded.

Patients were preoxygenated with 100% oxygen and induction was done by administering IV fentanyl 12 mcg/kg, propofol 2-4 mg/kg, and vecuronium in dose of 0.1 mg/kg in both the groups. After loss of consciousness ventilation of lung was manually assisted with help of a facemask using FGF of oxygen 6 L/min for 3 min. i-gel was inserted 3 min after administration of vecuronium. The volatile inhalational anesthetic agent was set at 1.3 times the agent minimum alveolar concentration (MAC), i.e. 2.5% Sevoflurane or 8% for Desflurane.

During maintenance phase of anesthesia, a minimum inspired oxygen concentration (FiO<sub>2</sub>) of 0.5 was maintained in the

minimal FGF mixture. The vaporizer dial setting was changed, if needed, after flow reduction to maintain MAC of 1 or more as required, but keeping the FGF constant. Top-up doses of vecuronium 0.01 mg/kg IV were given every 20 min and Paracetamol 1gm iv, Diclofenac 1 mg/kg IV, in 100 mL normal saline, local infiltration of liver bed and suture site, were given to all patients as a part of the multimodal approach to analgesia. The inhalational anesthetic vaporizer and nitrous oxide was switched off after the last stitch was applied.

The neuromuscular block was reversed with neostigmine 0.05 mg/kg and glycopyrolate 0.01 mg/kg iv administered 20 min of the last dose of relaxant or if the patient started spontaneously breathing. Thereafter, The I-gel was extubated once extubation criteria was met, and the patient was transferred to the post-operative recovery room. During recovery, patient recovery characteristics were defined by Modified Aldrete Score

The following parameters were recorded: hemodynamic characteristics (mean change in the heart rate, mean blood pressure, oxygen saturation, at 5, 10, 15, 30 min, and thereafter at 30 min interval till the time of extubation); recovery time and score; and any critical event or complication were recorded.

### Modified Aldrete Score Consciousness

- 2 = fully awake
- 1 = Arousable on calling
- 0 = Not responding

### Circulation

- 2 = BP  $\pm$  20 mm Hg Preop
- 1 = BP  $\pm$  20 to 50 mm Hg Preop
- 0 = BP  $\pm$  50 mm Hg Preop

### Activity

- 2 = able to move all four
- 1 = able to move two extremities
- 0 = unable to move extremities

### Respiration

- 2 = Able to take deep breath and cough
- 1 = Dyspnea/ shallow breathing
- 0 = Apnea

### O<sub>2</sub> Saturation

- 2 = maintains SPO<sub>2</sub> > 92% on room air
- 1 = needs O<sub>2</sub> inhalation to maintain saturation >90%
- 0 = O<sub>2</sub> saturation < 90 % even with supplemental oxygen

**Sample size Estimation:** sample size of 37 patients was required in each group which was determined using power calculated data obtained from earlier similar study, where  $\alpha = 0.05$ ,  $\beta = 0.08$  p value < 0.05 was considered statistically significant.

**Statistical Analysis:** The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 21.0 statistical Analysis Software. The values were represented in Number (%) and Mean $\pm$ SD. The following Statistical formulas were used: Arithmetic mean, Standard deviation, chi square test, student t test.

**RESULTS**

Both the groups were comparable with respect to Age, ASA grade, Duration of Surgery, BMI, Baseline HR, MAP, SPO<sub>2</sub>. Also the distribution of male and female patients followed female preponderance as seen in gall stone diseases.

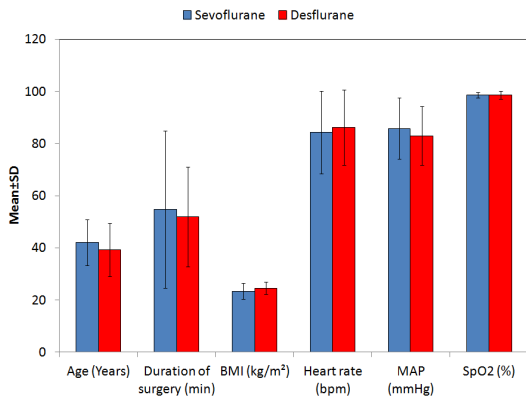
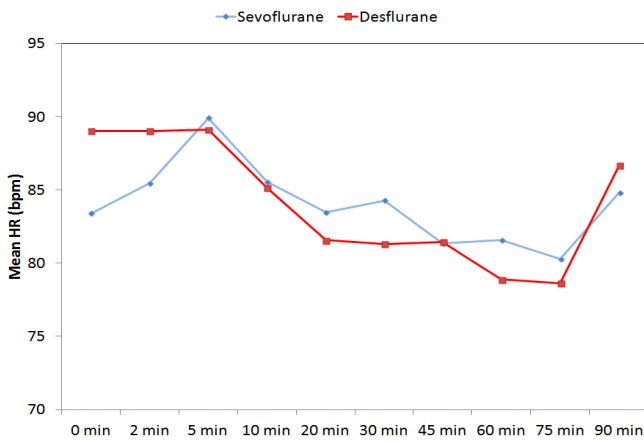
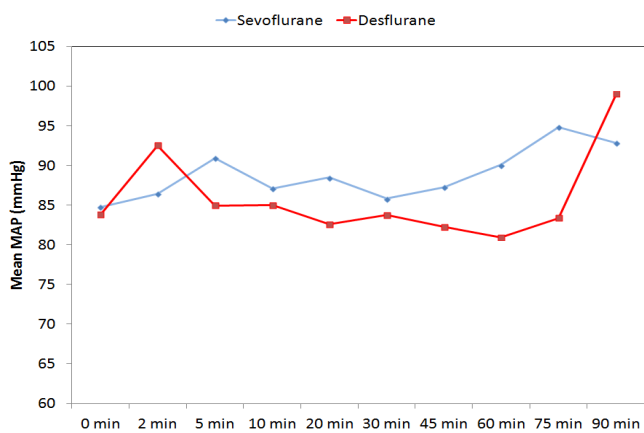


Figure 1 Showing comparison of demographic variables among two groups

Intraoperative hemodynamics were comparable amongst the two groups with no statistically significant change present in either Heart Rate and Mean Arterial Pressure in the intraoperative period. As shown in Graph 1 and Graph 2.



Graph 1 Comparison of trend in change of mean HR in two study groups at different time intervals



Graph 2 Comparison of trend in change of mean MAP in two study groups different time intervals

Table 1 showing comparison of recovery and MAS between two groups

SN	Variable	Sevoflurane (n=37)		Desflurane (n=37)		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
1.	Return of spontaneous respiration	4.17	1.46	3.66	1.48	1.49	0.139
2.	Extubation	5.60	1.57	5.05	1.66	1.44	0.153
3.	Complete consciousness	7.24	1.69	6.75	1.60	1.28	0.206
4.	MAS at 5 min	9.27	0.69	9.62	0.59	-2.34	0.022
5.	MAS at 10 min	10.00	0.00	10.00	0.00	-	-

Recovery was earlier in the Desflurane group as compared to sevoflurane group as Time taken for return of spontaneous respiration, extubation and complete consciousness was 4.17±1.46 min, 5.60±1.57 min and 7.24±1.69 min respectively in Sevoflurane group as compared to 3.66±1.48 min, 5.05±1.66 min and 6.75±1.60 min respectively in Desflurane group. So there was earlier recovery in Desflurane group, but statistically there was no significant difference between two groups for any of these recovery characteristics (p>0.05). Mean MAS at 5 min was 9.27±0.69 in Sevoflurane group as compared to 9.62±0.59 in Desflurane group. Statistically, mean MAS at 5 min was significantly higher in Desflurane group as compared to that in Sevoflurane group (p=0.022). Suggesting earlier fast tracking of patients in Desflurane group as compared to Sevoflurane group. At 10 min, all the patients in both the groups had MAS 10. (Table 1)

**DISCUSSION**

In today's era of day care surgery, patient wants early discharge after the surgery preferably the same day. For minimally invasive procedures like laproscopic cholecystectomy it is only possible to discharge the patient at earliest only if the patient has a speedy and uncomplicated recovery in the perioperative period. Also, endotracheal intubation in itself is a procedure, which needs adequate depth of anesthesia and greater amount and depth of anesthetics are needed to maintain an endotracheal tube. That's why we used I-gel instead of Endotracheal intubation, because it needs lesser depth of anesthesia. Moreover the sympathetic stimulation caused by direct laryngoscopy during intubation as well as extubation causing rise in heart rate and blood pressure which is not beneficial for patient and in many cases can cause surgical site bleeding. This was shown in the study by Badheka *et al* (2015).<sup>5</sup>

We have used I-gel the second generation LMA device as a means of airway as there were many studies suggesting its superiority than ET tube in laproscopic and open surgeries. Biswas *et al* (2015)<sup>13</sup> compared I-gel with ET tube in laproscopic cholecystectomy to determine the hemodynamic and metabolic stress response. They found that the hemodynamic response was much stable in patients in which I-gel was used also this was supported by increase in the levels of serum cortisol post intubation with ET tube. Badheka *et al* (2015)<sup>5</sup> similarly concluded superiority of I-gel as compared to ET tube in laproscopic surgery and there was no difference in ventilation amongst the two groups. Study conducted by Lai C J *et al* (2017)<sup>17</sup> proved lesser incidence of sore throat in patients in which I-gel was used as compared to those in which ET tube was used as airway.

we compared hemodynamics of the patient in our study there was no significant difference in the Heart rate, MAP, and SPO2 amongst the two groups at any point of time. Our study is supported by the studies of M Patel *et al* (2015)<sup>16</sup>, Lokesh *et al* (2015)<sup>14</sup> in both of these studies Desflurane and Sevoflurane were compared and hemodynamics were comparable in both the studies without any significant change, also recovery was seen significantly earlier in Desflurane group as compared to Sevoflurane group.

Recovery and emergence in our study were compared by Return Of Spontaneous Respiration, (ROSR), Time to Extubation, as well as Complete Consciousness (defined as able to recall name) from the point when inhalational anesthetic agent i.e. Desflurane or Sevoflurane was switched off was 4.17+1.46 mins, 5.60+1.57 mins and 7.24+1.69 mins in Sevoflurane group as compared to 3.66+1.48 mins, 5.05+1.66 and 6.75+1.60 mins in Desflurane group, was comparable amongst the two groups and no statistically significant difference was found among the two groups. Similarly we compared MAS amongst Desflurane and Sevoflurane group at 5 and 10 minutes interval in which there was improved MAS in Desflurane group at 5 minutes (p=0.022) which was statistically significant than the Sevoflurane group. Whereas the MAS at 10 minutes was comparable without any statistically significant difference. In Study by Lokesh *et al* (2015)<sup>14</sup> also there was statistically significant recovery by MAS at 5 minutes (p=0.049) was found in Desflurane group as compared to Sevoflurane group. In our study there was earlier recovery in Desflurane group measured in terms of ROSR, Extubation and Return of complete consciousness than Sevoflurane Group but this was not statistically significant.

Similar Studies exist in the literature such as by Jindal *et al* (2011)<sup>10</sup> in 100 laproscopic gynaecological surgeries to compare Desflurane, Sevoflurane, and Isoflurane which showed superiority of Desflurane in recovery. Also Fanelli *et al* (2006)<sup>9</sup> concluded that fast tracking of patients undergoing laproscopic cholecystectomy was possible in larger number of cases in Desflurane group than in Sevoflurane group.

The Incidence of Nausea and vomiting in Group S was 18.9 % and that in Group D was 13.5% respectively. The Incidence of Emergence agitation in Group S was 3 cases (8.1%) and there was no case in Group D (0%). Similarly the Incidence of Shivering in Group S was 16.2% and in Group D it was 18.9%. The Complications in both the groups were comparable and there was no statistically significant difference amongst the two groups. The Complications were similar to seen in studies by Magni *et al* (2009)<sup>18</sup>, Gupta Priyanka *et al* (2015)<sup>15</sup>, M patel *et al* (2016)<sup>16</sup> and were comparable with our study.

## CONCLUSION

The MAS was significantly more in Desflurane group as compared to Sevoflurane group at 5 minutes, indicating earlier recovery in Desflurane group. Also this suggests, that patients in Desflurane group can be fast tracked to ward earlier as compared to Sevoflurane group patients. Intraoperative hemodynamic parameters were comparable in both the groups. Incidence of Emergence agitation was more in Sevoflurane group as compared to Desflurane group and incidence of complications was also similar amongst two groups.

Thus conclude that both sevoflurane and desflurane can be used safely in patients undergoing for laproscopic cholecystectomy.

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