

# Comparative study of effect of sevoflurane and desflurane on hemodynamic parameters and recovery characteristics in patients undergoing laparoscopic gynecologically surgeries

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## Abstract

**Background:** The use of inhalational agents such as desflurane, sevoflurane made the postoperative recovery easy for the patients. These volatile anaesthetic agents give early postoperative recovery as compared with older ones. **Aim:** To study the effect of sevoflurane and desflurane on hemodynamic parameters and recovery characteristics in patients undergoing laparoscopic gynaecological surgeries. **Material and Methods:** A total 60 female patients scheduled for elective laparoscopic gynaecological surgery were randomly allocated into two groups of each with the help of a computer-generated table of random numbers. Group S (n=30): received inhalational agent sevoflurane induction and maintenance anaesthesia. Group D (n=30): received inhalational desflurane induction and maintenance anaesthesia. **Results:** The hemodynamic parameters observed intraoperatively and after creating pneumoperitoneum were comparable in both the groups. The difference between them was statistically non-significant. (p>0.05). Postoperative recovery profile was better with desflurane as compared with sevoflurane. Cognitive functions and Modified Alderate score were statistically significant between two groups. (p value <0.05). The achievement of modified alderate score was early in desflurane. **Conclusion:** Desflurane and sevoflurane does not differ in intraoperative and postoperative hemodynamic parameters, and postoperative adverse effects, however early recovery is achieved with desflurane. Desflurane is better choice in ambulatory laparoscopic gynaecological surgeries.

**Key Words:** Laparoscopic gynaecological surgeries, desflurane, sevoflurane, hemodynamic parameters, Modified Alderate score

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## INTRODUCTION

Most of gynaecological procedures can be performed laparoscopically. It reduces hospital stay of the patient, also improves the cosmetic results and patient satisfaction.<sup>1</sup> Ambulatory anaesthesia fastens the patient's outcome, recovery. Resuming early to day to day life chores gives cost effectiveness to this type of procedures. Anaesthesia plays utmost important role to the outcome and recovery of the patients undergoing these day care surgeries. We can use general anaesthesia, regional anaesthesia, monitored anaesthesia care for different type of surgeries as and when required. General anaesthesia is most commonly used because it is safe and familiar to most of anaesthesiologist. The use of inhalational agents

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such as desflurane, sevoflurane made the postoperative recovery easy for the patients. These volatile anaesthetic agents have low solubility, gives faster emergence early postoperative recovery as compared with older ones. Sevoflurane and Desflurane are not ideal anaesthetic agents but are fulfilling most of the criteria. Both these agents have lower solubilities permits more precise control over the delivery of anaesthesia and more rapid recovery from anaesthesia. At higher concentrations desflurane can cause airway irritability, sevoflurane may not. As for this reason sevoflurane is used in induction of paediatric anaesthesia.<sup>2</sup> In this study, we have used both the agents randomly on patients undergoing laparoscopic gynaecological surgeries. The effect of these agents on haemodynamic parameters, intraoperatively, postoperatively have been studied. As post-operative recovery is important for the success of ambulatory anaesthesia. It has been studied in both the agents and accordingly the best inhalational anaesthetic agent is decided.

## MATERIAL AND METHODS

This prospective, randomized, interventional, single blind study was conducted on patients undergoing laparoscopic gynaecological surgeries over a period of two years. Permission and approval was taken from ethics committee of the institution. Written informed consent prior to one day of surgery was taken. The patients were explained on the day prior to surgery that she is the part of study and the type of anaesthesia to be administered. A patient information sheet provided to her and relatives in the language she and relatives understands.

### Inclusion criteria

- Age: 18 years to 60 years
- Female patients
- ASA I and II
- Surgery duration less than 2hrs.

### Exclusion criteria

- Pregnant patients, breast feeding patients.
- Patients with significant cardiopulmonary diseases, hepatic and renal dysfunction, endocrine and neurological disturbances or psychiatric disorders.
- Patients with history of drug abuse or drug allergy
- Patient's refusal to consent.

### Sample size

For desflurane (Group D), sample size was calculated by using the formula-  
 $N = \frac{Z^2 \cdot P \cdot (1-P)}{E^2}$  where,  $Z=95\% = 1.96$ . Sample size  $N = \frac{P(100-P)}{(S.E.)^2}$  Formulae for sample size Comparison of means (two group) ( $\alpha = 0.05$ ,  $\beta = 0.2$ , power

80%) -Between Group comparison (unpaired)  $n = 16 \times (S.D./M1-M2)^2$  -within group comparison (paired)  $n = 8 \times (S.D./M1-M2)^2$ .

As per above formula sample size for each group is 19. However, 19 sample size was not enough for most statistical analysis, and since resources like patient quantity, investigative tools, time for research exist in sufficient quantity, it was planned to enroll minimum of 30 cases for each group (total 60) for present study.

### Methodology

A total 60 female patients between 18 to 60 years of age with ASA I or II grade and scheduled for elective laparoscopic gynaecological surgery under general anaesthesia were included in this study.

These 60 Patients were randomly allocated into two groups of each with the help of a computer-generated table of random numbers.

- Group S (n=30): received inhalational agent sevoflurane induction and maintenance anaesthesia.
- Group D (n=30): received inhalational desflurane induction and maintenance anaesthesia.

Detailed history and systemic examination were done. Investigations (Complete blood count, X ray chest, urine routine and microscopy, ECG, LFT, RFT plus any other investigation carried out as per the requirement of surgery) checked and noted. After taking the patient in the operation theatre all the monitors were attached (Non-Invasive blood pressure cuff, pulse oximeter, Cardio scope) and baseline parameters noted. Monitoring included oxygen saturation, Systolic and Diastolic Blood pressure, Mean Arterial blood pressure, ECG, etco<sub>2</sub>, Gas flow for creating Pneumoperitoneum and Intra-abdominal pressure. An IV line was taken on the dorsum of the hand and an IV fluid (Ringer lactate) started. Fluids administered according to Holiday -Segar formula. Premedication Inj. glycopyrrolate (4µg/kg), midazolam (0.05mg/kg) and fentanyl (2µg/kg) was given to the patients. Patients preoxygenated for 3 minutes. Patient was induced with inj. Thiopentone sodium (5mg/kg). Only after confirming that the patient can be ventilated by mask (100% oxygen given for 2-3 minutes) a long acting muscle relaxant Inj Atracurium 0.5 mg/kg was administered. Direct Laryngoscopy done. After visualization of Vocal Cords an appropriately sized Portex cuffed endotracheal tube (no. 6.5 or 7 for females) was inserted under direct vision till cuff goes beyond the Vocal cords. Cuff inflated, Air entry checked. After confirming, clear and equal entry of air bilaterally, Tube secured in place and closed circuit connected. Anaesthesia was maintained on Oxygen + Air + Sevoflurane or Desflurane and intermittent bolus of muscle relaxant. Patient received Inhalational anesthetic

agent Sevoflurane 1-2% or Desflurane 5-6%. Patients was mechanically ventilated to keep carbon dioxide 30-40mmHg. Using flows of 2lit/min in closed circuit. Intra-abdominal pressure was always maintained below 14 mm of Hg in all patients. Intraoperatively, hemodynamic parameters such as Pulse rate, Blood pressure (Systolic blood pressure, Diastolic Blood pressure, mean arterial blood pressure, ETCO<sub>2</sub>) recorded before start of the procedure (Baseline parameters), After administering the inhalational agent to be studied. 1 minute after induction, 1 minute after intubation, after skin incision, after creating pneumoperitoneum, 1 minute later and once in every 15 minutes till deflation of pneumoperitoneum, after deflation and after extubation. All patients received Inj. Paracetamol 10 mg/kg over 20 minutes prior to extubation. After Skin closure, after meeting extubation criteria, Suctioning done, Inj. Glycopyrrolate (4µg/kg), Inj. Neostigmine (0.05mg/kg) given. Postoperatively, patient was assessed in PACU for the quality of recovery in terms of hemodynamic parameters (pulse rate, Blood pressure), sedation scale and any adverse effect such as nausea, vomiting. Patients assessed every 15 minutes for 1 hour, every 30 minutes for next 1 hour, every hourly for

next 2 hours (intermediate recovery). Totally for 4 hours quality of recovery profile assessed. After 4 hours of monitoring, patient was shifted from the recovery after achieving Modified Aldrete score of 9 or 10 out of 10. No additional intervention required in both the groups.

#### Statistical analysis

Data obtained was compiled on a MS Office Excel Sheet (v 2010, Microsoft Redmond Campus, Redmond, Washington, United States). Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 21.0, IBM). Descriptive statistics like frequencies and percentage for categorical data, Mean and SD for numerical data has been depicted. Normality of numerical data was checked using Shapiro-Wilk test and was found that the data followed a normal curve; hence parametric tests have been used for comparisons. Inter group comparison (2 groups) was done using t-test. Comparison of frequencies of categories of variables with groups was done using Chi-square test. For all the statistical tests,  $p < 0.05$  was statistically significant, keeping  $\alpha$  error at 5% and  $\beta$  error at 20%, thus giving a power to the study as 80%.

## RESULTS

In our study mean age of group D was  $29.6 \pm 6.3$  and group S was  $30 \pm 6.19$ . ASA status, in group D was  $1.07 \pm 0.254$  and in group S was  $1.03 \pm 0.138$ . The mean weight of group D was  $61.37 \pm 5.62$  and group S was  $61.4 \pm 4.87$ . The mean height in group D was  $157.73 \pm 6.08$  cm and group S was  $159.2 \pm 5.47$  cm. Table no.1 shows the comparison between age, weight, height, and ASA grading. The difference between group D and group S was statistically non-significant ( $p > 0.05$ ).

Table 1: Distribution of patient characteristics

	Group	N	Mean $\pm$ SD	Std. error Mean	T value	p value
Age (years)	D	30	29.60 $\pm$ 6.371	1.163	-0.247	0.806
	S	30	30.00 $\pm$ 6.192	1.131		(Not significant)
Weight (Kg)	D	30	61.37 $\pm$ 5.629	1.027	-0.02452	0.4902
	S	30	61.40 $\pm$ 4.874	.890		(Not significant)
Height (cm)	D	30	157.73 $\pm$ 6.080	1.110	-0.982	0.330
	S	30	159.20 $\pm$ 5.473	.999		(Not significant)
ASA	D	30	1.07 $\pm$ 0.254	.046	0.584	0.561
	S	30	1.03 $\pm$ 0.183	.033		(Not significant)

After intubation and after skin incision heart rate of both the groups have increased up to  $\pm 20\%$  of the baseline value. The heart rate in both groups were comparable. There was no statistical significance found by applying student t-test. ( $p > 0.05$ ) for all the time intervals mentioned above. After creating pneumoperitoneum, the heart rate in both groups were comparable for all time intervals. There was no statistical significance found by applying student t-test. ( $p > 0.05$ ) for all the time intervals mentioned above.

Table 2: Mean heart rate at various intervals

Time (min)	Desflurane Group D (n=30)	Sevoflurane Group S (n=30)	p value
Baseline	67.63 $\pm$ 4.460	69.03 $\pm$ 7.636	0.389
After pre-medication	66.77 $\pm$ 4.289	66.13 $\pm$ 7.157	0.679
After induction	65.53 $\pm$ 6.163	64.33 $\pm$ 6.635	0.471
After intubation	76.23 $\pm$ 6.88	75.07 $\pm$ 7.339	0.263
After skin incision	81.07 $\pm$ 7.492	78.00 $\pm$ 7.031	0.537
After pneumoperitoneum			
0	76.90 $\pm$ 7.988	75.67 $\pm$ 7.16	0.265

15	72.80±6.959	69.80±7.140	0.053
30	67.23±5.66	65.77±5.348	0.153
45	66.06±5.69	65.13±5.104	0.253
60	65.33±5.531	64.40±4.665	0.197
75	65.00±5.413	63.20±4.766	0.0884
90	64.46±5.34	62.73±5.324	0.106
After deflation	72.27±4.394	70.80±4.072	0.185
After extubation	67.43±4.376	65.63±4.6124	0.0632

After intubation and after skin incision SBP and DBP of both the groups have increased up to ± 20% of the baseline value. The SBP and DBP in both groups were comparable. There was no statistical significance found by applying student t-test. (p>0.05) for all the time intervals. (Table 3).

**Table 3:** Mean systolic and diastolic blood pressure (mmHg) at various intervals

Time (min)	Systolic BP		p value	Diastolic BP		p value
	Desflurane Group D (n=30)	Sevoflurane Group S (n=30)		Desflurane Group D (n=30)	Sevoflurane Group S (n=30)	
Baseline	120.40±6.089	118.00±11.033	0.301	72.37±5.359	69.57±8.443	0.6529
After pre-medication	117.93±5.765	116.07±10.511	0.198	70.07±5.179	67.30±8.209	0.0619
1 min after induction	115.83±5.372	114.00±10.171	0.193	71.70±5.324	69.23±7.877	0.0803
1 min after intubation	124.40±5.23	123.67±9.488	0.356	74.33±5.466	72.33±7.877	0.117
After skin incision	130.13±3.636	127.53±7.942	0.542	76.97±5.816	74.60±7.823	0.0944
After pneumoperitoneum						
0	126.63±3.134	124.23±7.911	0.0639	74.93±6.085	72.57±7.994	0.1010
15	124.03±3.200	121.60±7.907	0.0618	73.37±5.647	70.53±8.224	0.0953
30	122.00±3.184	119.57±7.775	0.0590	71.00±5.601	68.53±8.500	0.0634
45	119.97±3.347	117.67±7.857	0.0728	68.73±5.582	66.53±8.838	0.1268
60	117.90±3.477	115.67±7.410	0.0702	66.77±5.562	65.13±9.008	0.2000
75	115.83±3.373	113.67±7.0041	0.0701	65.43±6.350	63.27±8.581	0.1318
90	113.77±4.091	111.77±6.645	0.0729	63.73±6.378	61.47±8.173	0.1180
After deflation	122.73±5.669	122.93±6.659	0.901	76.17±4.316	73.97±6.128	0.113
After extubation	121.07±5.753	120.90±6.717	0.4590	73.70±4.3561	71.90±6.0648	0.0959

In present study, response to painful stimulus calculated for both the groups. It was achieved in the group D in (2.50 ± 0.799) minutes and in group S in around (3.89 ± 0.930) minutes. (p=0.000). The difference was statistically highly significant. It indicates that response to painful stimulus was achieved earlier in patients who received desflurane as compared to patients who received sevoflurane. For spontaneous eye-opening patients who received desflurane took (3.19±0.794) minutes and who received sevoflurane took (4.94±0.74) minutes. The difference was statistically significant between two groups (p=0.000). Obeying commands in group D was achieved within (2.78±0.67) minutes and in group S was achieved within (4.28±0.633) minutes. Limb lift in group D achieved within (5.04±0.834) minutes and group S achieved in (7.73±1.08) minutes. The difference was statistically significant between two groups (p<0.0001).

**Table 4:** Inter group Comparison of others and modified alderate score

	Group	N	Mean	SD	Std. Error	T value	p value
Response to painful stimulus (min)	D	30	2.50	0.799	0.146	-6.186	0.000*
	S	30	3.89	0.930	0.170		
Obeying commands (min)	D	30	2.78	0.670	0.122	-8.888	0.0001*
	S	30	4.28	0.633	0.115		
Spontaneous eye opening (min)	D	30	3.19	0.794	0.145	-8.803	0.000*
	S	30	4.94	0.741	0.135		
Limb lift	D	30	5.04	0.834	0.152	-10.812	0.000*
	S	30	7.73	1.081	0.197		
MAS 5 min	D	30	8.17	0.648	0.118	4.122	0.000*
	S	30	7.43	0.728	0.133		
MAS 10 min	D	30	8.60	0.563	0.103	5.031	0.000*
	S	30	7.80	0.664	0.121		
MAS 15 min	D	30	9.37	0.490	0.089	7.271	0.000*
	S	30	8.43	0.504	0.092		

Time to achieve modified alderate score (min)	D	30	10.83	4.170	0.761	-6.555	0.000**
	S	30	17.87	4.142	0.756		

Drowsiness were found out in 1 patient in group D and 1 in group S. There were 10 patients presented with PONV who received desflurane and 14 patients who received sevoflurane. Sore throat was present in 3 patients receiving desflurane and in 1 patient receiving sevoflurane. All these parameters were statistically analysed by using chi-square test in which result came nonsignificant for all the parameters  $p > 0.05$ .

## DISCUSSION

In our study demographic parameters like age, body weight, height and ASA classification were noted and analysed statistically between two groups by using student 't' test. The difference between group D and group S was statistically non-significant ( $p > 0.05$ ). Chudasama PA *et al* who studied the Comparison of haemodynamic parameters and recovery characteristics between sevoflurane and desflurane in patients undergoing day-care surgical procedure. All demographic parameters are comparable in their study.<sup>3</sup> White PF *et al* studied desflurane versus sevoflurane for maintenance of outpatient anesthesia and the effect on early versus late recovery and perioperative coughing. The two study groups had comparable demographic characteristics.<sup>4</sup> Our findings were consistent with above study. The MAP in both groups were comparable for all time intervals. There was no statistical significance found by applying student t-test. ( $p > 0.05$ ) for all the time intervals. Jindal *et al* suggested that desflurane and sevoflurane both provide similar haemodynamic conditions during maintenance period.<sup>5</sup> Patel *et al* suggested that sevoflurane and desflurane both provide similar intraoperative haemodynamic condition during maintenance period.<sup>6</sup> Nathanson *et al* found that intraoperative haemodynamic parameters are same with both the groups.<sup>7</sup> Gergin *et al* concluded that desflurane, like sevoflurane, maintains haemodynamic stability during intraoperative period.<sup>8</sup> Our findings were consistent with all above studies. Intraoperative parameters studied by Chudasama PA *et al* depicts that desflurane gives more hemodynamic stable picture in day care surgeries. In our study the findings regarding intraoperative hemodynamic parameters were inconsistent with this study.<sup>3</sup> In our study we found out that achievement of modified Alderate score was earlier in desflurane group. In Jindal *et al* study time to achieve modified alderate score in group D was ( $10.8 \pm 3.77$ ) minutes and in group S was ( $16.2 \pm 3.87$ ) minutes. Our result is consistent with above study.<sup>5</sup> Patel *et al* study stated that the response to painful stimuli, spontaneous eye opening and limb lift has been earlier achieved in desflurane than sevoflurane.<sup>9</sup> Our findings were also consistent with above study. Jadhav *et al* studied recovery parameters in both the agents in 80 patients. In their study time to eye opening was achieved earlier in desflurane than sevoflurane. And overall early postoperative

recovery is achieved earlier with desflurane than sevoflurane. They used Fast track criteria for discharge from PACU.<sup>10</sup> Kotwani *et al* found out that recovery is achieved earlier in desflurane compared to sevoflurane. They used steward criteria for discharged from PACU. Our findings were consistent with this literature.<sup>6</sup> Study by Nathanson *et al* suggested that there in early recovery period desflurane has a faster recovery profile than sevoflurane. But overall recovery and readiness to home discharge is same for both the agents. Our study result was consistent with early recovery parameter.<sup>7</sup> Postoperative complications were statistically analysed by using chi-square test in which result came nonsignificant for all the parameters  $p > 0.05$ . Study by Nathanson *et al* suggested that postoperative side effects were similar in both the groups.<sup>7</sup> Study by Jadhav *et al* also suggested that there was no significant difference in postoperative complications in both the groups.<sup>10</sup> Study by Jindal *et al* suggested that there was no difference between complications between study drug groups.<sup>5</sup> Our results were consistent with above studies.

## CONCLUSION

Desflurane and sevoflurane does not differ in intraoperative and postoperative hemodynamic parameters, and postoperative adverse effects, however early recovery is achieved with desflurane. Desflurane is better choice in ambulatory laparoscopic gynaecological surgeries.

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