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Original Research Article

Randomized Clinical Trial of Desflurane Vs Sevoflurane for Hemodynamic Stability and Recovery Profile in Laparoscopic Surgeries

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Conflict of interest: Nil

Abstract

Background and Aim: Inhalational anaesthetic agents are used for maintenance of general anaesthesia. Sevoflurane and Desflurane have been in use for ambulatory anaesthesia as both have properties of an ideal agent. This study was carried out to compare the effect of sevoflurane and desflurane anaesthesia on emergence and extubation in laparoscopic surgeries.

Material and Methods: Present Randomized Control Trial was done at the Department of Anaesthesia, GMERS Medical college and hospital, Sola, Ahmedabad, Gujarat from July 2019 to June 2021. Simple randomization technique was employed using a computer-generated random number table and final sample size calculated was 68. Two groups were created by Randomized Computer Sampling method. GROUP D: Maintenance anaesthesia with desflurane. GROUP S: Maintenance anaesthesia with sevoflurane. Perioperative hemodynamic parameters were recorded. Postoperative recovery was assessed by the time from discontinuation of inhalational agent to response to painful stimuli, to spontaneous eye opening, to verbal commands, stating name, able to lift limb. Modified ALDRETE Score was recorded at the time of arrival to PACU.

Results: Intra-operative systolic and diastolic blood pressure and SpO_2 did not differ in both the groups during course of anesthesia. Patients in group D were responding to verbal command at an average 4.9 min as compared to 7.46 min in sevoflurane group. Time to achieve MODIFIED ALDRETE SCORE of 9 was faster in desflurane (9.14) group then sevoflurane (10.17) group. $p<0.05$, the difference is statistically significant. ($p<0.05$)

Conclusion: Both Desflurane and Sevoflurane provide stable intraoperative hemodynamic, but the main difference lies in their recovery profile. Desflurane is associated with faster and better recovery as compared to sevoflurane.

Keywords: Desflurane, Diastolic Blood Pressure, Hemodynamic Parameters, Sevoflurane

Introduction

Role of laparoscopic surgeries as day care surgeries has increased many folds. More and more patients prefer laparoscopic approach over open approach due to the advantage of early ambulation. With the advent of minimally invasive surgical techniques, ambulatory surgeries are on the rise, leading to an increased demand for fast tracking.

Laparoscopy leads to ventilator changes as the Pneumoperitoneum created decreases thoraco-pulmonary compliance by 30% to 50% in healthy and obese patients. Reduction in functional residual capacity and development of atelectasis due to elevation of the diaphragm and changes in the distribution of pulmonary ventilation and perfusion from increased airway pressure can be expected. However, increasing Intra-Abdominal Pressure to 10-14 mm Hg with the patient in a 10- to 20-degree head-up or head-down position does not significantly modify either physiologic dead space or shunt in patients without cardiovascular problems.

In providing general anesthesia for ambulatory surgery, the goal is to achieve optimal surgical conditions while ensuring a rapid early recovery without side effects. This necessitates early recovery in the form of clear- headedness, control of protective airway reflexes and satisfactory relief from pain and emesis [1].

"Ambulatory anaesthesia" now contributes to a greater proportion of overall surgeries. This is because of addition of new short acting and rapidly metabolizing anaesthetic agents [2]. Short acting anaesthetic agents provide better quality of recovery. One of the major factors that determine speed of recovery from anaesthesia is the choice of anaesthetic technique. An ideal general anaesthetic agent, for the ambulatory patients, should provide smooth and rapid induction, optimal operating conditions, and rapid recovery with minimal side effects like nausea, vomiting, bleeding and postoperative pain.

Inhalational anaesthetic agents are used for maintenance of general anaesthesia. Inhaled anaesthetics allow rapid emergence from anaesthesia because of easy titrability with inherent neuromuscular blocking effects that make them more suitable for ambulatory anaesthesia [3].

Residual effects of inhalational anaesthetic agents may contribute to delayed emergence from anaesthesia thereby precluding an early assessment of post-operative neurological function.

Sevoflurane and Desflurane have been in use for ambulatory anaesthesia as both have properties of an ideal agent. Desflurane has lower blood gas solubility than sevoflurane resulting in rapid induction and emergence from anaesthesia [4]. However, desflurane is pungent and can be irritant to the airway leading to coughing, breath holding, laryngospasm and copious secretions [5].

Hence, this study was carried out to compare the effect of sevoflurane and desflurane anaesthesia on emergence and extubation in laparoscopic surgeries.

Material and Methods

Present Randomized Control Trial was done at the Department of Anaesthesia, GMERS Medical college and hospital, Sola, Ahmedabad, Gujarat from July 2019 to June 2021. Study population included all patients undergoing laparoscopic surgeries as per inclusion criteria. Simple randomization technique was employed using a computer-generated random number table and final sample size calculated was 68. Sample size estimation is calculated according to study done by "Kajal Sachin *et al*" at Bhabha Atomic Research Center, Mumbai. Two

groups were created by Randomized Computer Sampling method.

GROUP D- Maintenance anaesthesia with desflurane

GROUP S- Maintenance anaesthesia with sevoflurane

Inclusion criteria

1. Age group of 18-50 years
2. ASA grade 1 or 2
3. Patients posted for elective laparoscopic surgeries

Exclusion Criteria

1. ASA grade 3 and 4
2. Patient refusal
3. Neurological and psychiatric disorders
4. Patients having respiratory disease (bronchial asthma and COPD)
5. Patient with kidney disease

Ethical approval was taken from the institutional ethical committee and written informed consent was taken from all the participants.

A through history and examination was done on all patients. Investigations including complete blood count, renal function test, liver function test, RBS, Urine routine micro, chest X-ray, ECG, ultrasonography were done on all patients.

I.V. line secured safely with precaution. Preoxygenation with 100 % oxygen for 3 minutes. All the patients were given premedication with Injection Glycopyrrolate 0.04mg/kg, Injection Ondansetron 0.15mg/kg, Injection Midazolam 0.1mg/kg, Injection xylocard 2mg/kg, Injection fentanyl 2 mcg/kg. Induction regimen was consisting of Injection Propofol 2.5mg/kg and Succinylcholine 2mg/kg. Patients were intubated with endotracheal tubes of appropriate sizes. And after confirmation of ET tube by stethoscope and $ETCO_2$, Injection Atracurium 0.5mg/kg was used as loading dose and 0.1mg/kg as maintenance dose of Muscle relaxant. Anaesthesia was maintained with 50% Nitrous oxide & 50% oxygen and Volatile agent and NDMR.

All the patients received Paracetamol 1g IV or diclofenac sodium 75 mg IV as analgesic intraoperatively. Intraoperative SpO_2, NIBP, ECG, Heart rate, $EtCO_2$ were monitored. All the patients were ventilated by close circuit to maintain an $EtCO_2$ of 30-35 mmHg. Rescue bolus dose of Fentanyl citrate 0.5mcg/kg was administered to control acute hemodynamic changes not controlled by a 50% increase in inspired concentration of inhalation agent. The volatile anaesthetic agent was discontinued at the end of the procedure and the Nitrous Oxide was discontinued after the last skin suture. Patients were reversed with inj. Glycopyrrolate 0.008mg/kg and inj. Neostigmine 0.05 mg/kg IV with reversal and extubation criteria. Perioperative hemodynamic parameters were recorded. Postoperative recovery was assessed by the time from discontinuation of inhalational agent to response to painful stimuli, to spontaneous eye opening, to verbal commands, stating name, able to lift limb. Modified ALDRETE Score was recorded at the time of arrival to PACU. Time to achieve the ALDRETE score of 9 was also recorded.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Table 1: Demographic Data of Study Participants

	Group D	Group S	P Value
Age	36.17±9.83	32.97±10.36	0.09
Weight	63.61±6.80	60.71±10.91	0.09
Sex	14/20(M/F)	13/21(M/F)	

The table shows that both the study group are comparable with respect to Age, Weight, Gender, Duration of anesthesia, and duration of surgery ($p>0.05$). 14 patients in group D are male while group S has 13 male patients. There are 20 female patients in group D while in group S females are 21 in numbers. Mean duration of anesthesia in group D is 109.38±6.91 and in group S is 114.97±3.58.

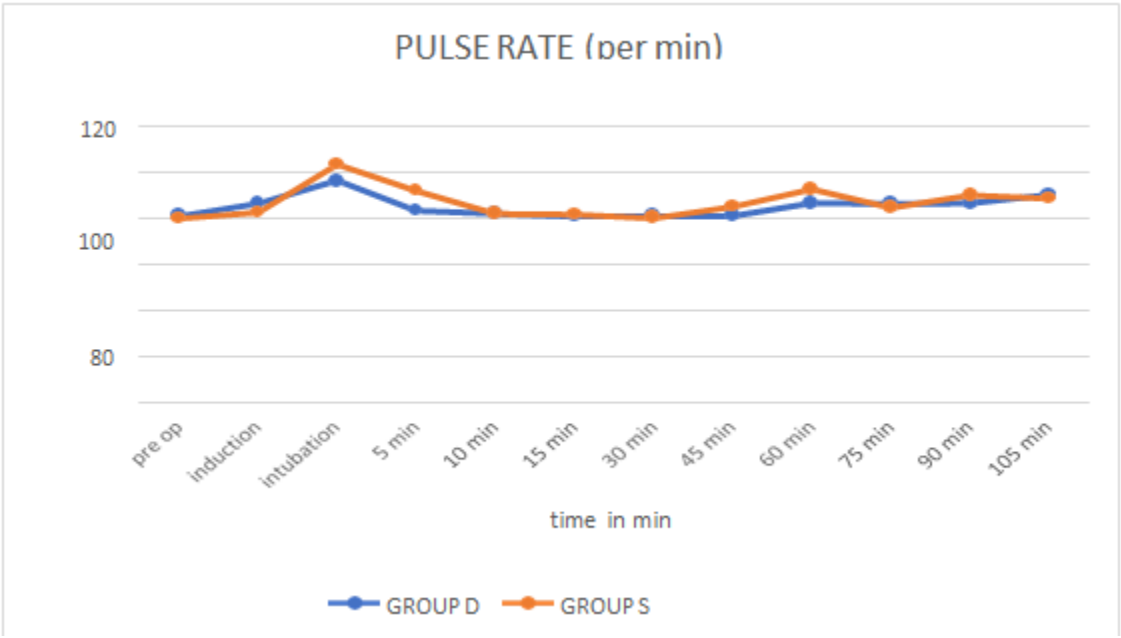

Figure 1

Preop pulse rate were comparable in both the groups. Even during the induction pulse rate did not differ in two groups. However, we observed increase in pulse rate during intubation in both the groups, this increase in pulse rate was within 20% of baseline value. Intra-operatively pulse rate did not differ in both the groups. (Figure 1)

Table 2: Comparison of Systolic Blood Pressure among both Groups (MM OF HG)

	Group D	Group S	P Value
Preop	120.76±1.70	118.9±2.0	0.07
Induction	122.85±2.03	119.8±1.80	0.1
Intubation	145.17±1.8	146.3±1.80	0.49
5 Mins	124.4±2.4	131.5±2.64	0.1
10 Mins	121.8±2.28	123.8±2.16	0.1
15 Mins	120.35±1.78	119.1±1.78	0.9
30 Mins	118.8±3.2	115.8±2.16	0.1
45 Mins	129.1±2.07	124.1±2.19	0.6

60 Mins	125.76±2.7	132.9±2.21	0.1
75 Mins	123.1±2.70	124.2±1.75	0.3
90 Mins	120.8±1.9	124.8±2.2	0.081
105 Mins	127±2.47	125±2.9	0.1

Table 3: Comparison of Diastolic Blood Pressure among both groups (MM OF HG)

	Group D	Group S	P Value
Preop	70.29±1.91	77.58±3.50	0.1
Induction	74.06±2.62	78.64±3.14	0.80
Intubation	85.47±2.32	90.47±2.03	0.7
5mins	72.65±1.82	81.29±2.82	0.1
10mins	71.65±1.66	76.88±2.15	0.1
15mins	71.82±2.47	74.23±1.75	0.1
30mins	71.88±9.36	71.52±1.48	0.429
45mins	77.84±8.52	75.88±2.25	0.0985
60mins	76.53±12.98	83.82±2.16	0.1
75 Mins	74.42±12.97	74.29±2.153	0.801
90mins	71.47±8.61	77.88±2.25	0.1
105mins	75.70±6.08	77.47±1.98	0.0537

Table 4: Comparison of SpO_2 among both groups

	Group D	Group S	P Value
Preop	98.29±0.46	98.5±0.50	0.054
Induction	98.58±0.49	98.58±0.49	0.0500
Intubation	98.47±0.50	98.35±0.48	0.058
5 Min	98.52±0.50	98.64±0.48	0.158
10 Min	98.5±0.50	98.58±0.49	0.0500
15 Min	98.5±0.50	98.61±0.49	0.181
30 Min	98.43±0.50	98.5±0.50	0.284
45 Min	98.5±0.50	98.64±0.48	0.385
60 Min	98.58±0.49	98.5±0.50	0.254
75 Min	98.67±0.47	98.44±0.50	0.256
90 Min	98.55±0.50	98.52±0.50	0.257
105 Min	98.64±0.48	98.47±0.50	0.0764

Intra-operative systolic and diastolic blood pressure and SpO_2 did not differ in both the groups during course of anesthesia. We observed rise in systolic blood pressure at the time of intubation in both the groups, but this rise is within 20% of baseline value with both the anaesthetics.

Table 5: Recovery (Min)

Variable	Group D	Group S	P Value
Respond to painful stimuli (min)	3.66±1.57	6.5±1.23	0.0001
Respond Verbal Command	4.9±1.86	7.46±1.40	0.0001
Spontaneous Eye Opening	5.53±2.14	6.63±1.68	0.0094
Stating Name	6.56±2.10	10.26±1.36	0.0001
Limb Lift	7.6±2.43	12.13±1.56	0.0001

Modified Aldrete Score (Arrival)	7.2±1.04	6.43±0.88	0.0001
Time to Achieve Modifeied Alderete Score of Nine	9.14±0.30	10.17±0.55	0.0001

The time to recovery of parameters like response to painful stimuli, respond to verbal command, spontaneous eye opening, stating name and place of stay, squeezing fingers and limb lifting are significantly shorter in group D than group S. Patients in group D were responding to verbal command at an average 4.9 min as compared to 7.46 min in sevoflurane group. MODIFIED ALDRETE SCORE at the time of arrival at the PACU was comparable in both the groups. Sevoflurane (6.43) group desflurane (7.2) group. Time to achieve MODIFIED ALDRETE SCORE of 9 was faster in desflurane (9.14) group then sevoflurane (10.17) group. $p<0.05$, the difference is statistically significant. ($p<0.05$)

2 patients in group D and 4 patients in group S had postoperative nausea and vomiting. Only 1 patient in group D and 3 patients in group S were drowsy post-operatively. There was no significant difference in both the group as far as the incidence of post-operative complications was concerned.

Discussion

Early mobilization and shorter hospital stay are the main advantages of laparoscopic surgery. Being minimal invasive surgery, laparoscopic surgeries has become very popular now days. The main drawback is intra-operative hemodynamic instability due to pneumoperitoneum. Now a day's many laparoscopic surgeries are conducted as a daycare surgery. Therefore, it is necessary that anesthesiologist must choose anesthetic agent which will provide hemodynamic stability as well as rapid recovery. We compared 68 patients of ASA physical status I-II undergoing either laparoscopic abdominal surgery under general anesthesia for hemodynamic stability and recovery characteristics of desflurane and sevoflurane.

In our study both the groups were comparable in terms of patient characteristics (age, gender and weight), duration of surgery and duration of anesthesia. Juvin P. *et al* [6] studied that emergence of elderly patients prolonged with desflurane, isoflurane or propofol anesthesia. They observed that prolonged duration surgery and anesthesia do not affect recovery in patients receiving desflurane or propofol. Because of low solubility of desflurane less desflurane needs to be released from the tissues and eliminated faster from body at the end of prolonged anesthesia.

Hemodynamic parameters in terms of pulse, systolic and diastolic blood pressure were compared in both the groups in our study. We observed mild rise in pulse rate and systolic blood pressure after intubation. But this rise was within 20% of baseline value in both anesthetics. Similar results were observed in study of Ravi Jindal *et al* [7], Amandeep Kaur *et al* [8], Akkineni Lokesh *et al* [9].

In our study response to painful stimuli for desflurane was 3.6 min and for sevoflurane was 6.5 min. Chaitali Shashikant patil *et al* [10] demonstrated response to painful stimuli for desflurane was 2.5 min and for sevoflurane was 3.8 min. This result are comparable to our study which shows a faster response to painful stimuli for desflurane than sevoflurane.

In our study the time to respond to verbal command for desflurane was 4.9 minutes and for sevoflurane was 7.46 minutes. We

have study by Ravi Jindal *et al* [7,11] which shows that the time to respond to verbal command for desflurane was 2.7 minutes while for sevoflurane was 6.4 minutes. These results are comparable to our study which shows a faster response to verbal command for desflurane than sevoflurane. Rachel *et al* [12] demonstrated a response to verbal command to desflurane was 3.35 minutes while in our study it was 4.9 minutes, whereas the response to verbal command in this study for sevoflurane was 5.49 minutes as compared to 7.4 minutes in our study. These results are comparable to our study which shows a faster response to verbal command for desflurane than sevoflurane.

In our study the time taken for the spontaneous eye opening in patient receiving sevoflurane was 6.63 minutes and 5.53 minutes for patient receiving Desflurane. This difference was statistically significant. Natheson *et al* [13] found that in their study the duration for spontaneous eye opening in the recovery profile was 8.2 minutes for sevoflurane while for desflurane it was 5.1 minutes. The time for spontaneous eye opening is significantly lower in desflurane group. The results in our study were comparable to their study which also showed less time for spontaneous eye opening in desflurane with respect to sevoflurane. Ravi Jindal *et al* [7] found that in their studies the duration of spontaneous eye opening in the recovery profile was 6.8 minutes for sevoflurane while for desf lurane it was 4.1 minutes. While in our study the time for spontaneous eye opening was 6.63 minutes for sevoflurane and for desflurane was 5.53 minutes. Hence, spontaneous eye opening in our study for desflurane is better than sevoflurane and is comparable to the study by Ravi Jindal *et al* [7].

In our study the limb lift for desflurane was 7.6 minutes and for sevoflurane was 12.13 minutes. Chaitali Shashikant patil *et al*10 performed a similar study which used the parameter of squeezing fingers in place of limb lift as a measure of motor function. In Karlsen KL *et al*14 the time for squeezing fingers for desflurane was 5.04 min minutes while for sevoflurane it was 7.73 minutes.

In our study the modified Aldrete score for desflurane were higher (9.14 minutes) compare sevoflurane were 10.16 minutes. Preet Mohinder singh *et al* [14]. performed a similar study which used the parameter of modified Aldrete score and conclude that Ald-I scores were higher/better with desflurane by 0.52.

In our study we found that the incidence of post -operative nausea and vomiting, sorethroat and drowsiness in both the groups, but the incidence of these complications was similar in both groups. Thus, the difference is clinically insignificant and $p>0.05$. Jindal *et al* observed that incidence of post-operative complications like nausea and vomiting, sore throat, drowsiness was similar in both groups. Karlsen *et al* [14] found that there is higher incidence of postoperative nausea, vomiting in desflurane group (67%) in comparison to sevoflurane group (36%) in patient undergoing breast surgery.

The limitation of our study was lack of investigator blinding for study drug and assessment of recovery status as the study design did not permit double blind comparison of the two volatile anesthetics. All the patients in our study underwent reasonably similar procedure.

Conclusion

Both desflurane and sevoflurane provide stable intraoperative hemodynamic, but the main difference lies in their recovery profile. Desflurane is associated with faster and better recovery as compared to sevoflurane.

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