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COMPARISON OF RECOVERY PROFILE OF DESFLURANE AND SEVOFLURANE IN PATIENTS UNDERGOING LAPAROSCOPIC SURGERIES - A PROSPECTIVE RANDOMIZED CLINICAL STUDY

Anaesthesiology

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ABSTRACT

Background & Aim: The choice of anaesthetic agent significantly influences the recovery process following laparoscopic surgeries. This study aimed to compare the post-operative recovery profiles of Desflurane and Sevoflurane using the Fast Track Criteria (FTC), with a focus on speed and quality of emergence from general anaesthesia. **Material & Methods:** A prospective randomized clinical study was conducted at the Department of Anaesthesiology, Government Medical College and SSG Hospital, Vadodara, from August 2023 to July 2024. Sixty-six ASA I–II patients aged 18–65 years undergoing elective laparoscopic surgeries were randomly allocated into two groups (n=33 each) to receive either Desflurane (Group D) or Sevoflurane (Group S) for maintenance of anaesthesia. Depth of anaesthesia was titrated using Bispectral Index (BIS) monitoring (target 40–60). Post-operative recovery parameters including eye opening time, response to pain, limb movement, extubation time, and FTC scores were assessed and compared. Statistical analysis was performed using SPSS version 26.0 with $p < 0.05$ considered significant. **Results:** Patients in the Desflurane group showed significantly faster recovery times across all parameters. Mean time to eye opening, pain response, and limb movement was significantly shorter in Group D compared to Group S ($p < 0.001$). Extubation time was 8.93 ± 1.51 min in Group D versus 12.48 ± 2.82 min in Group S ($p < 0.001$). FTC scores at 10 and 15 minutes post-extubation were significantly higher in Group D, indicating earlier eligibility for PACU discharge. BIS values post-extubation also favored Desflurane. Incidence of postoperative nausea, vomiting, and pain was comparable in both groups. **Conclusion:** Desflurane provides a faster and smoother recovery profile compared to Sevoflurane in laparoscopic surgeries, making it a preferable choice in fast-track and ambulatory surgical settings. Both agents were well-tolerated without significant differences in side effects.

KEYWORDS

Desflurane, Sevoflurane, Fast Track Criteria, BIS monitoring, Laparoscopic Surgery, Recovery Profile

1. INTRODUCTION

Laparoscopic surgeries have revolutionized modern surgical practice by offering minimal invasiveness, reduced postoperative pain, shorter hospital stays, and faster recovery times. The choice of anaesthetic agents plays a pivotal role in ensuring rapid and smooth recovery, particularly when early discharge is desired. Among inhalational agents, Desflurane and Sevoflurane have gained popularity due to their favorable pharmacokinetic profiles, especially in day-care and minimally invasive procedures.[1,2]

Desflurane, characterized by its low blood-gas partition coefficient (0.42), allows rapid onset and recovery, making it suitable for procedures where swift awakening is necessary.[3] Similarly, Sevoflurane, with a slightly higher blood-gas partition coefficient (0.69), offers a smooth induction and recovery, and is known for its low pungency and minimal airway irritation.[4,5] Both agents are widely used in ambulatory and laparoscopic surgeries, yet there remains ongoing debate regarding their comparative efficacy in recovery outcomes.[6]

The "Fast Track Criteria" developed by White and Song provide an objective measure to evaluate early recovery characteristics in post-anaesthesia care units (PACU), incorporating parameters like consciousness, activity, haemodynamics, and pain control.[7] Evaluating patients based on this criterion offers a structured approach to analyze the clinical impact of different volatile anaesthetics on postoperative recovery.

Recent studies have shown that Desflurane may result in faster emergence and shorter PACU stay when compared to Sevoflurane, especially in high turnover environments like day-care surgeries.[8,9] However, other trials have reported negligible differences in overall recovery times, suggesting the need for context-specific evaluation, particularly in laparoscopic procedures where factors like pneumoperitoneum and Trendelenburg positioning can influence recovery dynamics.[10]

Therefore, this prospective randomized clinical study aims to compare the postoperative recovery profile of Desflurane and Sevoflurane in patients undergoing laparoscopic surgeries, using standardized Fast Track Criteria to provide clinically relevant insights for optimizing anaesthesia protocols.

2. MATERIAL & METHODS

This prospective randomized clinical study titled "Comparison of Recovery Profile of Desflurane and Sevoflurane in Patients Undergoing Laparoscopic Surgeries" was conducted in the Department of Anaesthesiology, Government Medical College and SSG Hospital, Vadodara, from August 2023 to July 2024. Ethical clearance was obtained from the Institutional Ethics Committee for Human Research, and the study was registered under CTRI/2023/06/069113.

A total of 66 patients aged between 18 and 65 years, undergoing elective laparoscopic surgeries under general anaesthesia, were included. They were randomly divided into two equal groups using computer-generated randomization (randomizer.org) in a 1:1 ratio:

- Group D (Desflurane): received 3–6% Desflurane with medical air and oxygen at 3 L/min
- Group S (Sevoflurane): received 1–3% Sevoflurane with medical air and oxygen at 3 L/min

Inclusion Criteria

Patients aged 18–65 years, ASA physical status I–II, undergoing laparoscopic procedures lasting 1.5–2 hours, with BMI <30 kg/m² and Mallampati grade I–II.

Exclusion Criteria

Refusal to participate, uncontrolled systemic diseases, cardiac/renal/respiratory/neuropsychiatric disorders, history of drug abuse, or patients in shock or hypotension.

Preoperative Management

Patients underwent complete pre-anaesthetic assessment, necessary investigations, and were kept NPO for at least 8 hours. An 18G IV cannula was secured, and premedication was administered with glycopyrrolate, midazolam, fentanyl, ondansetron, and dexamethasone.

Anaesthesia Induction and Maintenance

Induction was achieved with propofol and vecuronium, followed by

tracheal intubation. Anaesthesia was maintained with either Desflurane or Sevoflurane, titrated to maintain BIS between 40–60. Intraoperative monitoring included HR, SBP, DBP, MAP, SPO_2, $EtCO_2$, BIS, and ECG. Fentanyl boluses (0.5 µg/kg) were given for acute hemodynamic variations.

Emergence and Recovery

After surgery, volatile agents and medical air were discontinued. Patients were reversed with neostigmine and glycopyrrolate. Extubation followed standard criteria (e.g., adequate tidal volume, spontaneous breathing, hemodynamic stability, eye-opening, sustained head lift).

Postoperative Assessment

Patients were monitored in the PACU. Fast Track Criteria (FTC) were assessed every 10 minutes for 1 hour post-extubation and further observed for 4 hours. Pain (VAS >4) was managed with IV paracetamol; PONV was treated with ondansetron; desaturation episodes (SpO_2 <95%) were managed with supplemental oxygen.

Statistical Analysis

All collected data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize demographics and clinical data. Continuous variables were expressed as mean ± standard deviation and compared using unpaired t-tests. Categorical data were analyzed using the Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1 shows the comparison of recovery times between the two groups. Patients receiving Desflurane exhibited significantly faster recovery milestones including eye opening (7.97 ± 1.75 min), response to pain (4.73 ± 0.76 min), and limb movement (11.57 ± 1.52 min) when compared to those given Sevoflurane (10.79 ± 2.89 min, 7.02 ± 0.78 min, and 15.24 ± 3.12 min respectively), with all p-values <0.001, suggesting superior recovery kinetics with Desflurane.

Table 2 presents the Fast Track Criteria (FTC) scores recorded post-extubation. The Desflurane group achieved scores >13 earlier than the Sevoflurane group, starting from 10 minutes onward. Mean FTC scores at 10 minutes were 13.06 ± 0.747 for Desflurane and 11.727 ± 0.801 for Sevoflurane, with consistently higher values observed across all measured intervals in the Desflurane group. The differences were statistically significant, indicating better and quicker eligibility for PACU discharge in this group.

Table 3 highlights the time to extubation in both groups. The Desflurane group had a shorter mean extubation time of 8.93 ± 1.51 minutes compared to 12.48 ± 2.82 minutes in the Sevoflurane group. This difference was highly significant ($p < 0.001$), reinforcing the faster offset and elimination of Desflurane, which aids in earlier airway recovery.

Table 4 shows BIS value comparisons at 0, 10, and 20 minutes post-extubation. BIS scores were consistently higher in the Desflurane group (66.3, 73.8, 78.4) compared to Sevoflurane (61.4, 69.2, 74.1), with all differences being statistically significant ($p < 0.001$). These values reflect a quicker return to consciousness and cognitive recovery with Desflurane.

Table 5 summarizes postoperative side effects like nausea, vomiting, and pain. Though slightly more frequent in the Sevoflurane group, the differences were not statistically significant (PONV p = 0.3715; pain p = 0.6437), suggesting both agents have a similar safety profile with respect to immediate postoperative complications.

Table 1: Time of Recovery of Patients

Parameter	Desflurane (Mean ± SD)	Sevoflurane (Mean ± SD)	p-value
Time to Eye Opening (min)	7.969 ± 1.75	10.787 ± 2.89	<0.001
Response to Pain (min)	4.727 ± 0.76	7.015 ± 0.78	<0.001
Limb Movement (min)	11.575 ± 1.52	15.24 ± 3.12	<0.001

Table 2: Fast Track Criteria (FTC) Score

Time Post-Extubation (min)	Desflurane (Mean ± SD)	Sevoflurane (Mean ± SD)	p-value
10 min	13.06 ± 0.747	11.727 ± 0.801	<0.001
15 min	13.42 ± 0.567	12.575 ± 0.728	<0.001
20 min	13.66 ± 0.479	13.12 ± 0.621	<0.01
30 min	13.87 ± 0.341	13.57 ± 0.491	0.02

Table 3: Extubation Time

Parameter	Desflurane (Mean ± SD)	Sevoflurane (Mean ± SD)	p-value
Time to Extubation (min)	8.93 ± 1.51	12.48 ± 2.82	<0.001

Table 4: BIS Values Post-Extubation

Time Interval (min)	Desflurane (Mean ± SD)	Sevoflurane (Mean ± SD)	p-value
0	66.3 ± 5.6	61.4 ± 6.2	<0.001
10	73.8 ± 4.2	69.2 ± 5.4	<0.001
20	78.4 ± 3.1	74.1 ± 3.9	<0.001

Table 5: Comparison of Side Effects

Side Effect	Desflurane (n=33)	Sevoflurane (n=33)	p-value
Postoperative Nausea & Vomiting	4 (12.1%)	6 (18.1%)	0.3715
Postoperative Pain (VAS > 4)	5 (15.1%)	7 (21.2%)	0.6437

DISCUSSION

The present study was designed to compare the postoperative recovery profiles of Desflurane and Sevoflurane using Fast Track Criteria (FTC) in patients undergoing elective laparoscopic surgeries under general anaesthesia. The results clearly demonstrate that Desflurane offers a significantly more favorable recovery profile than Sevoflurane, particularly in the early postoperative phase.

One of the most critical findings was the shorter time to eye opening, response to pain, limb movement, and extubation in the Desflurane group. These results are consistent with the findings of Saha et al., who reported that Desflurane facilitated faster return of airway reflexes and cognitive function in patients undergoing laparoscopic cholecystectomy when compared to Sevoflurane.[11] The shorter emergence times with Desflurane can be attributed to its lower blood-gas partition coefficient (0.42), which allows for rapid elimination from the body upon cessation of anaesthesia.

The Fast Track Criteria (FTC) scores in this study further reinforce Desflurane's superiority. FTC score >13, the benchmark for safe discharge from the PACU, was achieved significantly earlier in the Desflurane group. Mahmoud et al. have previously emphasized the importance of rapid FTC attainment, especially in ambulatory surgical settings, where earlier discharge translates into reduced healthcare costs and improved patient turnover.[12] The consistently higher FTC scores at successive time intervals in our study indicate not only rapid emergence but also sustained recovery quality with Desflurane.

BIS monitoring data in the present study also support Desflurane's neurocognitive recovery advantage. The Desflurane group consistently exhibited higher BIS values in the immediate post-extubation period, reflecting quicker return to consciousness. Gangakhedkar et al. also highlighted Desflurane's ability to achieve better BIS recovery profiles compared to Sevoflurane, particularly when monitored during and after laparoscopic procedures.[13] BIS-guided anaesthesia has become increasingly important as it allows for individualized titration of anaesthetic depth, minimizing drug overdose and promoting faster recovery.

In terms of side effects, both agents demonstrated a favorable safety profile. There were no statistically significant differences in the incidence of postoperative nausea and vomiting (PONV) or postoperative pain, although the Desflurane group had slightly fewer events. These findings agree with Jindal et al., who observed comparable rates of adverse effects in both groups, indicating that rapid recovery with Desflurane does not come at the cost of increased complications.[14]

Additionally, Chinchkar et al. studied the combined effect of volatile anaesthetics with dexmedetomidine and reported that Desflurane consistently outperformed Sevoflurane in early recovery measures, even when adjuncts were used.[15] While our study did not include adjuncts like dexmedetomidine, the parallels in faster FTC scores and early discharge times reaffirm Desflurane's utility in both standalone and balanced anaesthetic protocols.

Overall, our findings provide strong evidence supporting Desflurane as the agent of choice in laparoscopic procedures where fast-track recovery is a clinical priority. While Sevoflurane remains a valid option, particularly in settings where airway irritation is a concern due to its smoother inhalational profile, the accelerated recovery times and better cognitive outcomes associated with Desflurane make it especially suitable for ambulatory and high-turnover surgical units.

These insights are especially relevant in the current clinical climate, where healthcare systems are increasingly focused on efficiency, patient safety, and early ambulation. Incorporating Desflurane into enhanced recovery protocols could contribute to shorter PACU stays, reduced resource utilization, and improved patient satisfaction.

CONCLUSION

Desflurane offers a significantly faster recovery profile than Sevoflurane in patients undergoing laparoscopic surgeries under general anaesthesia. Key advantages include earlier eye opening, response to stimuli, and higher Fast Track Criteria scores post-extubation. Both agents were well tolerated, but Desflurane's rapid recovery kinetics make it more suitable for fast-tracking protocols in minimally invasive procedures.

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7. Conflicts of Intrest
None

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