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A Comparative Study of Recovery and Postoperative Cognitive Dysfunction After General Anaesthesia with Sevoflurane and Desflurane in Elderly Patients

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Abstract

Background: Elderly patients are at higher risk of postoperative cognitive dysfunction (POCD), which may delay recovery. Inhalational agents, such as Sevoflurane and Desflurane, differ in their pharmacokinetic properties and may influence early cognitive outcomes.

Aim: To compare the effects of Desflurane and Sevoflurane on early recovery and short-term postoperative cognitive function in elderly patients undergoing elective surgery under general anaesthesia.

Methods: A prospective randomised study was conducted on 80 patients aged 50–90 years at a tertiary care hospital. Patients received either Desflurane or Sevoflurane as the primary inhalational agent. Emergence parameters (time to spontaneous respiration, eye opening, response to verbal commands, and PACU duration) were recorded. Cognitive function was assessed one hour postoperatively using the MMSE. Independent t-tests and regression analysis were applied.

Results: Desflurane resulted in faster emergence, including earlier return of breathing, eye opening, verbal response, and shorter PACU stay ($p < 0.001$). MMSE scores were higher in the Desflurane group (22.05 *vs* 17.2), indicating better immediate cognitive recovery. Regression analysis showed that anaesthetic agent, age, and response time were significant predictors of postoperative cognitive function.

Conclusion: Desflurane offered faster recovery and better immediate cognitive outcomes than Sevoflurane in elderly patients. It may be preferred when rapid awakening and early cognitive clarity are desired. Further large-scale studies are warranted to confirm these findings and assess long-term effects.

Keywords: Desflurane; Sevoflurane; Deriatric Anaesthesia; POCD; MMSE; PACU Duration; Early Emergence

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Introduction

Postoperative cognitive dysfunction (POCD) is a well-recognized complication among elderly patients undergoing surgery under general anesthesia. Age-related physiological decline, reduced neuronal reserve, and increased sensitivity to anesthetic agents predispose this population to cognitive impairment in the postoperative period. POCD may manifest as impaired memory, reduced attention, and delayed psychomotor response, significantly affecting recovery and quality of life after surgery.

Volatile anesthetic agents such as Sevoflurane and Desflurane are widely used due to their favourable intraoperative profiles. However, their pharmacokinetic characteristics vary considerably. Desflurane, with a lower blood–gas solubility coefficient, offers rapid emergence, whereas Sevoflurane provides smoother hemodynamic stability but with comparatively slower recovery. These differences may influence recovery dynamics and cognitive function, particularly in elderly patients.

Given the increasing geriatric surgical population, understanding how different anesthetic agents affect early recovery and cognitive outcomes is clinically significant. Although previous studies have evaluated emergence profiles, there is limited evidence directly comparing the impact of Sevoflurane and Desflurane on postoperative cognitive function in the immediate recovery phase.

Therefore, this study was undertaken to compare the effects of Sevoflurane and Desflurane on recovery characteristics and short-term postoperative cognitive outcomes, using the Mini-Mental State Examination (MMSE), in elderly patients undergoing elective surgery under general anesthesia.

Materials and Methods

Study Design

Prospective comparative study at Parul University, Gujarat. Eighty patients aged 50–90 years undergoing elective surgery under general anaesthesia were included.

Inclusion Criteria: Age 50–90 years, ASA I–III, elective surgery, MMSE feasible.

Exclusion Criteria: Neurological illness, dementia, psychiatric disease, substance abuse.

Intervention

Group S received sevoflurane; Group D received desflurane. Standard induction and monitoring were used.

Outcomes

Recovery time (breathing, eye opening, command response), PACU duration, and MMSE scores.

Statistics

Independent t-test, ANOVA, and regression analysis. $p<0.05$ significant.

"This study aims to compare recovery profiles and early cognitive function in elderly patients receiving Sevoflurane versus Desflurane.

We hypothesize.

H_1 (Alternative Hypothesis): Sevoflurane and Desflurane differ in recovery speed and early cognitive function in elderly patients, with one agent being superior.

H_0 (Null Hypothesis): There is no significant difference in recovery or short-term cognitive outcomes between elderly patients receiving Sevoflurane or Desflurane.

Results

A total of 80 patients (40 per group) were analyzed. Recovery characteristics and immediate postoperative cognitive outcomes were significantly better in the Desflurane group compared to the Sevoflurane group.

Age-Based Group Comparisons (Post Hoc Tukey Test)

Age distribution differed significantly across subgroups. Post hoc Tukey HSD indicated that Group D was significantly older than Groups A, B, and C ($p < 0.001$). No significant differences were seen among Groups A, B, and C (Table 1).

Recovery Characteristics

Desflurane showed significantly faster postoperative recovery across all parameters ($p < 0.001$) (Table 2) (Figure 1).

Two-Way ANOVA: Effect of Anaesthetic Agent and Age

A two-way ANOVA demonstrated significant independent effects of anaesthetic type and age on postoperative cognitive outcomes, with a significant interaction (Table 3).

Table 1: Age-based group comparison.

Comparison	Mean Difference	p-value	Interpretation
A *vs* B	-0.150	0.994	No significant difference
A *vs* C	0.500	0.836	No significant difference
A *vs* D	4.000	<0.001	Significant
B *vs* C	0.650	0.697	No significant difference
B *vs* D	4.150	<0.001	Significant
C *vs* D	3.500	<0.001	Significant

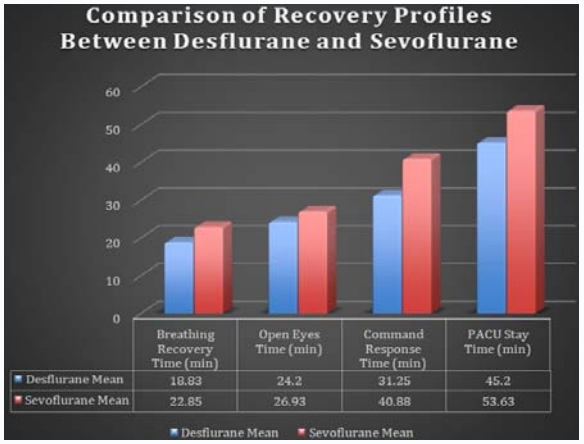

Figure 1: Comparison of recovery profiles.

Table 2: Recovery statistics.

Parameter	Desflurane (Mean ± SD)	Sevoflurane (Mean ± SD)	t-value	p-value
Breathing recovery (min)	18.83 ± 2.48	22.85 ± 2.20	-7.46	<0.001
Eye-opening time (min)	24.20 ± 1.71	26.93 ± 2.04	-6.32	<0.001
Command response time (min)	31.25 ± 5.10	40.88 ± 3.31	-9.94	<0.001
PACU stay (min)	45.20 ± 3.56	53.63 ± 3.87	-10.18	<0.001

Table 3: Effect of anaesthetic agent and age.

Source	F-value	p-value
Anaesthetic agent	128.904	<0.001
Age	21.649	<0.001
Group × Age interaction	3.108	0.032

Table 4: Predictors.

Predictor	p-value
Age	0.001
PACU time	0.004
Command response time	0.040
Anaesthetic agent	<0.001

Significant Predictors of POCD

Regression analysis revealed that anaesthetic agent, age, PACU time, and command response time were significant predictors of postoperative cognitive dysfunction (Table 4).

MMSE Scores

Desflurane produced significantly higher postoperative MMSE scores compared with sevoflurane (Table 5).

Table 5: MMSE Scores.

Group	N	Mean ± SD	Min	Max
Sevoflurane	40	17.2 ± 2.1	13	20
Desflurane	40	22.05 ± 1.6	20	30

Overall, the findings of this study demonstrate that Desflurane provides significantly faster postoperative recovery and better early cognitive outcomes compared with Sevoflurane in elderly surgical patients. Recovery parameters—including breathing time, eye-opening, command response, and PACU stay—were consistently shorter with Desflurane. Cognitive performance measured by MMSE was also significantly higher in the Desflurane group. Two-way ANOVA further confirmed that both anaesthetic type and age independently influenced cognitive outcomes, with a notable interaction between the two. Regression analysis identified anaesthetic agent, age, PACU duration, and command response time as significant predictors of postoperative cognitive dysfunction. These results collectively indicate that Desflurane supports a smoother postoperative recovery profile and may be advantageous in minimizing early POCD among elderly patients.

Hypothesis: Sevoflurane and Desflurane produce different recovery profiles in elderly patients, with one agent leading to faster recovery and better early cognitive outcomes. Hence, the null hypothesis (H_0) of no difference is rejected.

Discussion

The present study evaluated the influence of Sevoflurane and Desflurane on postoperative recovery and early cognitive function in elderly surgical patients and demonstrated clear advantages with Desflurane. Elderly patients often exhibit delayed emergence and increased vulnerability to postoperative cognitive dysfunction due to age-related physiological decline, making anaesthetic selection highly important. In this study, all four recovery parameters—breathing recovery, eye-opening time, command response, and PACU stay—were significantly faster in patients receiving Desflurane. These findings support the pharmacokinetic profile of Desflurane, which has extremely low blood–gas solubility and therefore allows rapid elimination and quicker awakening.

Cognitive assessment using MMSE further revealed that postoperative cognitive scores were markedly higher in the Desflurane group. This improvement in cognitive clarity aligns with earlier studies indicating that rapid emergence reduces residual anaesthetic load on the CNS and may lower the risk of early POCD. The two-way ANOVA confirmed that both the anaesthetic agent and age independently influenced cognitive outcomes, and the interaction effect indicated that older patients particularly benefited from Desflurane. This is clinically relevant because age-related neurocognitive decline increases susceptibility to even mild anaesthetic-related cognitive impairment.

Regression analysis identified anaesthetic agent as the most significant predictor of POCD, followed by age, PACU duration, and command response time. These findings suggest that delayed physiological recovery parallels poorer cognitive performance, highlighting the interdependence between systemic emergence and neurological recovery. The results also emphasize the need for individualised anaesthetic planning in elderly patients, particularly in the presence of comorbidities that may slow postoperative recovery.

The findings of this study are consistent with existing literature reporting faster emergence with Desflurane and mixed evidence regarding its cognitive benefits over Sevoflurane. While the present results favour Desflurane, the study is limited by its sample size and short-term cognitive follow-up. Longer-term neurocognitive assessment would provide more insight into persistent POCD. Despite these limitations, the study strongly suggests that Desflurane may be a preferable choice for elderly patients where rapid and clear recovery is desired.

Conclusion

This study indicates that Desflurane provides faster recovery and superior postoperative cognitive performance compared with Sevoflurane in elderly patients. Age remains a key determinant of cognitive outcomes, underscoring the need to individualize anaesthetic choices based on a patient's cognitive vulnerability. The findings support Desflurane as a potentially safer and more effective agent for reducing the risk of POCD in geriatric patients. They also emphasize the importance of assessing cognitive risk factors preoperatively to improve clinical outcomes. Further large-scale, multi-centre studies with extended follow-up are warranted to confirm these results and evaluate long-term cognitive effects.

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Ethical Approval

The Institutional Ethics Committee of Parul Institute of Allied and Healthcare Sciences approved the study. (Approval Number – PUIECHR/PIMSR/00/081734/8208).

Conflict of Interest

The authors declare no conflict of interest.

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