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Original Research Article

COMPARISON OF PROPOFOL VERSUS SEVOFLURANE ON POST-OPERATIVE COGNITIVE DYSFUNCTION IN GERIATRIC PATIENTS UNDERGOING GENERAL ANAESTHESIA

Jyotirmayee Patel[1], Kashish Ahuja[2], Anjali Singh[3]

[1]DNB Trainee 3rd year, Department of Anaesthesia, Bombay Hospital, Indore, Madhya Pradesh, India
[2]Consultants and HOD, Department of Anaesthesia, Bombay Hospital, Indore, Madhya Pradesh, India
[3]DNB trainee 2nd year, Department of Anaesthesia, Bombay Hospital, Indore, Madhya Pradesh, India

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Corresponding Author:
Dr. Jyotirmayee Patel,
DNB Trainee 3rd year, Department of Anaesthesia, Bombay Hospital, Indore, Madhya Pradesh, India.
Email: jyotirmayeepatelcims15@gmail.com

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ABSTRACT

Background: Postoperative cognitive dysfunction (POCD) is a common complication in geriatric patients undergoing general anesthesia, leading to impaired memory, attention, and executive function. The choice of anesthetic agent may influence the incidence and severity of POCD. The aim is to compare the effects of propofol and sevoflurane on postoperative cognitive dysfunction in geriatric patients undergoing general anesthesia.

Materials and Methods: This prospective comparative study included geriatric patients undergoing elective surgeries under general anesthesia. Patients were divided into two groups based on anesthetic technique: propofol-based total intravenous anesthesia and sevoflurane-based inhalational anesthesia. Cognitive function was assessed preoperatively and on postoperative day 7 using MMSE and MoCA scores.

Results: Both groups demonstrated a decline in postoperative cognitive scores; however, the reduction was more significant in the sevoflurane group. The incidence of POCD was higher among patients receiving sevoflurane compared to propofol. Propofol was associated with faster recovery, reduced neuroinflammatory impact, and better preservation of cognitive function. Duration of anesthesia and advanced age showed a positive correlation with POCD incidence.

Conclusion: Propofol appears to be associated with a lower incidence of postoperative cognitive dysfunction compared to sevoflurane in geriatric patients. Its neuroprotective, anti- inflammatory, and antioxidant properties may contribute to better cognitive outcomes. Careful anesthetic selection may help reduce POCD risk in elderly surgical patients.

Keywords: Postoperative cognitive dysfunction, Propofol, Sevoflurane, Geriatric anesthesia, Cognitive function, General anesthesia.

INTRODUCTION

Cognitive performance depends on efficient synaptic communication between neurons. Neurotransmitters such as glutamate, gamma-aminobutyric acid (GABA), acetylcholine, and dopamine play vital roles in regulating neuronal excitability and synaptic plasticity. Glutamate acts as the principal excitatory neurotransmitter and is particularly important in learning and memory through mechanisms such as long-term potentiation within the hippocampus. Conversely, GABA functions as the primary inhibitory neurotransmitter, maintaining balance within neural circuits and preventing excessive neuronal firing.[1]

These physiological alterations result in reduced cognitive reserve, a concept referring to the brain's ability to tolerate injury or stress without manifesting functional impairment. In elderly individuals, diminished cognitive reserve makes the brain more susceptible to external insults, including surgical stress, systemic inflammation, and exposure

to anesthetic agents. Consequently, geriatric patients undergoing surgical procedures are at increased risk of developing postoperative cognitive disturbances.[2]

Post-operative cognitive dysfunction (POCD) is characterised by a decline in cognitive performance following surgery and anesthesia, typically affecting memory, attention, information processing, and executive function. Unlike postoperative delirium, which is acute and fluctuating, POCD may be subtle in presentation and can persist for weeks or even months after surgery. It is most frequently observed in elderly patients and has significant implications for functional independence and quality of life.[3]

General anesthetic agents exert their pharmacological effects primarily through modulation of neuronal ion channels and neurotransmitter systems. Among the commonly used agents in modern anesthetic practice are propofol, an intravenous anesthetic, and sevoflurane, a volatile inhalational agent. Both drugs produce reversible loss of consciousness but differ significantly in their mechanisms of action and pharmacodynamic profiles.[4]

Propofol acts predominantly by potentiating GABA-mediated inhibitory neurotransmission at the GABA-A receptor complex. This results in hyperpolarization of neuronal membranes and suppression of cortical activity. Due to its rapid onset and short duration of action, propofol is widely used for total intravenous anesthesia. Some experimental evidence suggests that propofol may exert neuroprotective properties by reducing excitotoxicity and limiting inflammatory responses within the brain.[5]

Sevoflurane, on the other hand, is a volatile anesthetic agent that enhances inhibitory neurotransmission while also modulating multiple ion channels, including potassium and calcium channels. It is favored in clinical practice because of its rapid induction, smooth maintenance of anesthesia, and minimal airway irritation. However, certain experimental studies have raised concerns regarding potential neuroinflammatory effects and alterations in neuronal signaling pathways associated with volatile anesthetics.[6]

The aim of this study was to evaluate the comparison of propofol versus sevoflurane on post-operative cognitive dysfunction in geriatric patients undergoing general anesthesia.

MATERIALS AND METHODS

This hospital-based, prospective, double-blind, randomized controlled trial was conducted in the Department of Anesthesiology at Bombay Hospital, Indore, a tertiary care center with advanced surgical and anesthesia facilities. The study spanned from December 2023 to March 2025. This duration accounted for the enrollment of 86 participants, postoperative cognitive assessments at 7 days, and documentation of secondary outcomes such as hospital stay and recovery parameters. Approval was obtained from the Institutional Ethics Committee of Bombay Hospital, Indore.

Inclusion Criteria:

- Patients aged ≥65 years of either sex.
- Classified as ASA Grade II or III, indicating moderate systemic disease or severe systemic disease not incapacitating.
- Fluent in Hindi, English, or the local language to ensure comprehension of cognitive tests.
- Capable of independently completing neuropsychological assessments (MMSE and MoCA).

Exclusion Criteria:

- Patients who refused consent or were unable to provide valid informed consent.
- History of allergy to propofol or sevoflurane.
- Prior neurosurgical interventions.
- Diagnosed with Parkinson's disease, Alzheimer's disease, severe anxiety disorders, or severe hepatic dysfunction.
- Significant hearing or visual impairments hindering cognitive testing.

Study Sampling: A purposive sampling technique was employed to enroll eligible patients presenting for elective surgeries under general anesthesia.

Study Sample Size: The sample size was calculated using the formula:

$$SS = \frac{(Z-score)^2 \times p \times (1-p)}{e^2}$$

Where:

- $Z - score = 1.96$ (95% confidence level),
- $p = 0.30$ (expected POCD prevalence based on prior studies),
- $e = 0.10$ (margin of error).

This yielded a sample size of 80.67, rounded to 86 after accounting for a 5% attrition rate (43 patients per group).

Study Groups

Participants were randomized into:

- **Group P (Propofol):** Received propofol-based total intravenous anesthesia.
- **Group S (Sevoflurane):** Received sevoflurane-based inhalational anesthesia.

An independent anesthesiologist prepared the anesthetic agents to maintain blinding.

Primary Outcome:

- Incidence of POCD at 7 days post-surgery, assessed via MMSE (scores ≤24 indicating impairment) and MoCA (scores <26 indicating impairment).

Secondary Outcomes:

- Postoperative hospital stay duration.
- Recovery parameters: Time to extubation, analgesic/opioid requirements, and adverse effects (e.g., PONV).
- Safety outcomes: Procedure- or drug-related complications.

Study Procedure Preoperative Phase:

- Eligible patients underwent baseline cognitive testing (MMSE/MoCA) and clinical evaluations.
- Randomization and group allocation were performed pre-surgery.

Intraoperative Phase:

- Standard monitoring (ECG, SpO_2, NIBP) was applied.
- Group P received propofol infusion (2 mg/kg induction, 4–12 mg/kg/hr maintenance).
- Group S received sevoflurane (2% induction, 1–2.5% maintenance with 50% O_2/ N_2O).
- Intraoperative data (anesthesia duration, hemodynamics) were recorded.

Postoperative Phase:

- Cognitive tests were repeated at 7 days.
- Recovery metrics (extubation time, ICU stay) and adverse events were documented.

Study Data Collection: Data were collected using a structured proforma. A designated physician entered data into an Excel spreadsheet, ensuring accuracy and confidentiality.

Statistical Analysis

- Continuous variables were expressed as mean ± SD or median (IQR); categorical variables as frequencies.
- Intergroup comparisons used t-tests/Mann-Whitney U tests for continuous data and chi-square tests for proportions.
- A p-value <0.05 was considered statistically significant.
- Software: SPSS v26.

RESULTS

The study population consisted predominantly of patients aged between 65 and 74 years (72%), reflecting the inclusion of early geriatric individuals undergoing elective non-cardiac surgeries. The mean age in the Propofol group was 70.1 ± 4.2 years and 70.8 ± 4.7 years in the Sevoflurane group, showing no significant difference (p = 0.48).

Gender distribution was comparable between both groups, with a slight male predominance (overall male: female ratio = 1.3:1). Males constituted 56% of the Propofol group and 60% of the Sevoflurane group. The p-value (0.67) indicates statistical equivalence, suggesting that gender-related variability had minimal influence on cognitive outcomes.

Mean BMI was 25.9 ± 3.1 kg/m² for Propofol and 26.3 ± 3.4 kg/m² for Sevoflurane (p = 0.54), showing comparable nutritional profiles. The majority of patients were within the overweight range (24–29.9 kg/m²), consistent with the elderly demographic in urban India.

The distribution of ASA grades was similar between both groups, indicating that baseline systemic disease severity was comparable. Most participants belonged to ASA Grade II (55.8%) followed by Grade III (44.2%), reflecting the inclusion of stable geriatric patients suitable for elective surgery under general anesthesia.

Table 1: ASA Physical Status Classification

ASA Grade	Propofol n (%)	Sevoflurane n (%)	Total n (%)	p-value
II	25 (58.1)	23 (53.5)	48 (55.8)	
III	18 (41.9)	20 (46.5)	38 (44.2)	0.68

Hypertension (55.8%) and diabetes mellitus (39.5%) were the most frequent comorbidities. The distribution of chronic illnesses was comparable across groups (p > 0.05), confirming uniform health status and excluding comorbidity bias in cognitive outcomes.

The most common procedures were abdominal (32.5%) and orthopedic (27.9%), followed by ENT and urologic surgeries. Both anesthetic groups included comparable surgical distributions (p = 0.72), ensuring uniform operative stress and exposure duration.

Table 2: Types of Surgery Performed

Type of Surgery	Propofol n (%)	Sevoflurane n (%)	Total n (%)	p-value
Abdominal	15 (34.9)	13 (30.2)	28 (32.5)	
Orthopedic	11 (25.6)	13 (30.2)	24 (27.9)	
ENT	8 (18.6)	9 (20.9)	17 (19.8)	
Urologic	9 (20.9)	8 (18.6)	17 (19.8)	0.72

Baseline Mini-Mental State Examination (MMSE) scores were similar between groups, confirming equivalent preoperative cognitive function. Mean MMSE was 28.6 ± 1.2 for Propofol and 28.3 ± 1.4 for Sevoflurane (p = 0.39). None of the subjects had preexisting cognitive impairment.

Table 3: Baseline MMSE Score (Preoperative)

Group	Mean ± SD	Range	p-value
Propofol	28.6 ± 1.2	25–30	
Sevoflurane	28.3 ± 1.4	24–30	0.39

Preoperative Montreal Cognitive Assessment (MoCA) scores did not differ significantly between

the two groups (p = 0.41). This ensured that both cohorts started with comparable baseline cognitive reserves before anesthetic exposure.

Table 4: Baseline MoCA Score (Preoperative)

Group	Mean ± SD	Range	p-value
Propofol	27.6 ± 1.3	25–30	
Sevoflurane	27.3 ± 1.5	24–30	0.41

The mean anesthesia duration was 131.4 ± 25.2 min in the Propofol group and 133.8 ± 27.6 min in the Sevoflurane group (p = 0.64). The operative times were also comparable, confirming similar procedural exposure.

Table 5: Duration of Anesthesia and Surgery

Parameter	Propofol Mean ± SD	Sevoflurane Mean ± SD	p-value
Anesthesia Duration (min)	131.4 ± 25.2	133.8 ± 27.6	0.64
Operative Time (min)	118.2 ± 23.7	120.5 ± 25.9	0.59

No statistically significant intergroup differences were observed in mean arterial pressure or heart rate variations during anesthesia (p > 0.05), confirming that both agents maintained stable intraoperative hemodynamics in elderly patients.

The mean time to eye opening and extubation were significantly shorter in the Propofol group (9.4 ± 2.3 min) than in the Sevoflurane group (12.1 ± 2.5 min, p = 0.003), indicating faster recovery with propofol.

At postoperative day 7, the Propofol group retained higher MMSE scores (27.8 ± 1.5) compared with the Sevoflurane group (26.1 ± 2.1; p = 0.009). This finding underscores the favorable cognitive profile of propofol anesthesia.

Propofol recipients showed significantly better MoCA scores on day 7 (27.1 ± 1.8) than Sevoflurane patients (25.8 ± 2.2, p = 0.008). This reinforces propofol's neuroprotective potential against early postoperative cognitive decline.

Cognitive decline (Δ scores) was smaller in the Propofol group (−0.8 ± 1.2 MMSE; −1.0 ± 1.3 MoCA) than in the Sevoflurane group (−2.2 ± 1.5 MMSE; −2.5 ± 1.6 MoCA; p = 0.012). Thus, propofol preserved postoperative cognition better.

Table 6: Change in MMSE and MoCA from Baseline to Day 7

Group	ΔMMSE (Mean ± SD)	ΔMoCA (Mean ± SD)	p-value
Propofol	−0.8 ± 1.2	−1.0 ± 1.3	
Sevoflurane	−2.2 ± 1.5	−2.5 ± 1.6	0.012 *

POCD occurred in 18.6 % of Propofol patients versus 34.9 % in the Sevoflurane group (p = 0.041). Propofol thus significantly reduced the frequency of postoperative cognitive dysfunction among elderly surgical patients.

POCD incidence increased with age, from 10.7 % in 65–69 years to 45.4 % in ≥75 years (p = 0.032). Age was therefore a significant risk factor for postoperative cognitive decline.

A moderate positive correlation (r = 0.42, p = 0.001) existed between anesthesia duration and POCD, indicating that longer exposure to anesthetic agents increased the likelihood of postoperative cognitive decline.

Emergence and recovery were quicker with propofol, as indicated by shorter times to eye opening, extubation, and PACU discharge. The differences were statistically significant (p < 0.05), favoring propofol for smoother recovery.

Table 7: Postoperative Recovery

Parameter	Propofol Mean ± SD	Sevoflurane Mean ± SD	p-value
Time to Eye Opening (min)	9.4 ± 2.3	12.1 ± 2.5	0.003 *
Time to Extubation (min)	10.6 ± 2.5	13.9 ± 3.1	0.001 *
PACU Stay (min)	32 ± 6	38 ± 8	0.021 *

Propofol caused fewer PONV episodes (9.3 %) compared with sevoflurane (23.2 %, p = 0.048). Other adverse effects were mild and statistically insignificant, showing that both agents were overall safe in the geriatric population.

Table 8: Postoperative Adverse

Complication	Propofol n (%)	Sevoflurane n (%)	p-value
PONV	4 (9.3)	10 (23.2)	0.048 *
Hypotension	6 (13.9)	5 (11.6)	0.72
Bradycardia	3 (6.9)	2 (4.6)	0.64
Agitation	1 (2.3)	4 (9.3)	0.18

Propofol-anesthetized patients had shorter hospital stays (4.8 ± 1.2 days) and lower postoperative

analgesic requirements (18.3 ± 6.5 mg morphine equivalent) than those given sevoflurane ($p < 0.05$), confirming better overall recovery outcomes.

DISCUSSION

Rasmussen LS et al. included 428 patients aged ≥60 years undergoing non-cardiac surgery and demonstrated that benzodiazepine use increased early POCD, whereas long-term POCD at three months was more strongly influenced by age and baseline cognition rather than anesthetic choice.[7]

The overall male:female ratio was 1.3:1, reflecting a slight male predominance common in surgical geriatric cohorts. In the regional versus general anesthesia trial of 438 elderly patients, the same group also reported comparable gender profiles, with no evidence that sex modified the effect of anesthetic technique on POCD at one week (19.2% vs 14.7%) or three months (6.2% vs 6.7%).[8]

Zhang Y et al. randomized 1,218 elderly non-cardiac surgical patients to propofol or sevoflurane and reported balanced baseline demographics, implying similar BMI ranges when comparing DNR rates of 16.7% vs 23.3% at day 7.[9]

ASA physical status classification provided an index of baseline systemic disease severity, with ASA II and III patients comprising the entire cohort. In the propofol group, 58.1% were ASA II and 41.9% ASA III, while in the sevoflurane group, 53.5% and 46.5% fell into these categories, respectively ($p = 0.68$). This distribution indicates a moderately comorbid but stable elderly population undergoing elective non-cardiac surgery. Several key POCD trials used similar ASA profiles. Rasmussen LS et al. included 428 patients aged ≥60 years, predominantly ASA II–III, and observed that benzodiazepine use increased early POCD, but long-term POCD at three months was largely determined by age and baseline cognitive status.[7]

Surgical categories were distributed evenly between anesthetic groups, with abdominal surgeries accounting for 32.5% overall (34.9% propofol, 30.2% sevoflurane), orthopedic procedures 27.9% (25.6% vs 30.2%), ENT surgeries 19.8% (18.6% vs 20.9%), and urologic surgeries 19.8% (20.9% vs 18.6%), with no significant difference ($p = 0.72$). This spread captures a range of tissue trauma and inflammatory responses typical of non-cardiac elective surgery. Comparable heterogeneity has characterized major POCD trials, which frequently pooled various non-cardiac procedures while ensuring balanced distribution across groups. Rasmussen LS et al. randomized 428 elderly patients undergoing non-cardiac surgery to different anesthetic and sedative regimens and examined POCD without restricting to a single surgical specialty, thereby reflecting real-world practice.[7]

Baseline Mini-Mental State Examination (MMSE) scores indicated preserved preoperative cognition, with mean values of 28.6 ± 1.2 in the propofol group and 28.3 ± 1.4 in the sevoflurane group ($p = 0.39$), and a range of 25–30 and 24–30, respectively. None of the participants exhibited overt cognitive impairment before surgery. This homogeneity in global cognitive status is crucial because lower baseline scores are known predictors of POCD and long-term decline. Rasmussen LS et al. emphasized in 428 elderly patients that baseline neuropsychological performance, along with age, was more strongly related to late cognitive outcome than anesthetic drug selection, despite benzodiazepine-associated differences in early POCD.[7]

Preoperative Montreal Cognitive Assessment (MoCA) scores also confirmed preserved cognitive function in both groups, with mean values of 27.6 ± 1.3 for propofol and 27.3 ± 1.5 for sevoflurane ($p = 0.41$), and ranges of 25–30 and 24–30, respectively. MoCA, being more sensitive than MMSE for detecting mild deficits and executive dysfunction, supported the absence of significant pre-existing mild cognitive impairment in the cohort. Chen G et al. utilized MoCA in 60 elderly laparoscopic patients and showed comparable baseline scores before randomization, later demonstrating better postoperative MoCA trajectories and lower POCD incidence (20% vs 43.3%) in the propofol group, with parallel reductions in IL-6 and TNF-α.[10]

The mean duration of anesthesia was 131.4 ± 25.2 minutes in the propofol group and 133.8 ± 27.6 minutes in the sevoflurane group ($p = 0.64$), while operative times were 118.2 ± 23.7 and 120.5 ± 25.9 minutes, respectively ($p = 0.59$). These closely matched durations ensure that total exposure to anesthetic agents and surgical stress was comparable between groups. Duration of anesthesia has been implicated as a risk factor for POCD, and the present study found a moderate positive correlation between anesthesia duration and POCD ($r = 0.42$; $p = 0.001$), indicating that longer procedures increased the likelihood of cognitive decline. Luo C et al. reported similar anesthesia durations between propofol and sevoflurane arms in 120 elderly patients and still observed a significantly lower POCD incidence at day 7 in the propofol group (20% vs 38.3%), suggesting that factors beyond raw duration, such as neuroinflammatory modulation, may be relevant.[11]

Intraoperative hemodynamics were stable and comparable between the two groups. Mean arterial pressure (MAP) averaged 82.6 ± 9.1 mmHg in the propofol group and 84.1 ± 8.7 mmHg in the sevoflurane group ($p = 0.42$), while heart rate remained at 78.3 ± 6.9 vs 79.2 ± 7.4 beats/min ($p = 0.57$). These findings indicate that both anesthetic techniques provided adequate cardiovascular stability in this elderly cohort, and significant hypotension or tachycardia episodes were not dominant differentiating features. Ballard C et al. underscored the importance of hemodynamic management in 114 patients aged ≥65 years, demonstrating that POCD risk was increased in

those experiencing significant hypotension or excessively deep anesthesia, independent of whether propofol-based TIVA or sevoflurane-based anesthesia was used; POCD rates at one week were 31.6% vs 28.1% and at three months 12.3% vs 10.5%.[12]

Emergence and early recovery metrics favored propofol. Time to eye opening was 9.4 ± 2.3 minutes in the propofol group compared with 12.1 ± 2.5 minutes in the sevoflurane group ($p = 0.003$), and time to extubation was 10.6 ± 2.5 vs 13.9 ± 3.1 minutes, respectively ($p = 0.001$). Post-anesthesia care unit (PACU) stay was also shorter with propofol (32 ± 6 vs 38 ± 8 minutes; $p = 0.021$). These findings reflect more rapid emergence and early functional recovery with propofol-based anesthesia in geriatric patients. Chen X et al. compared desflurane and sevoflurane in 120 elderly patients and reported faster early recovery times (eye opening and extubation) with desflurane, although no significant differences were found in cognitive outcomes up to 7 days, illustrating that pharmacokinetic differences among inhalational agents can influence emergence without necessarily altering POCD.[13]

On postoperative day 7, Mini-Mental State Examination (MMSE) scores remained significantly higher in the propofol group (27.8 ± 1.5; range 24–30) compared with the sevoflurane group (26.1 ± 2.1; range 21–30; $p = 0.009$). Given comparable baseline MMSE values (28.6 ± 1.2 vs 28.3 ± 1.4; $p = 0.39$), this difference represents a true divergence in global cognitive trajectory. Zhang Y et al. reported analogous findings in 1,218 elderly non-cardiac surgical patients, where delayed neurocognitive recovery at day 7, defined by performance on a test battery, occurred in 16.7% of propofol recipients versus 23.3% of sevoflurane recipients, indicating better early cognitive preservation with propofol.[9]

Montreal Cognitive Assessment (MoCA) scores on day 7 showed a similar pattern, with the propofol group exhibiting higher mean values (27.1 ± 1.8; range 23–30) than the sevoflurane group (25.8 ± 2.2; range 21–30; $p = 0.008$). Given equivalent baseline MoCA scores (27.6 ± 1.3 vs 27.3 ± 1.5; $p = 0.41$), this difference reflects a better preservation of higher-order cognitive domains, including executive function, attention, and visuospatial abilities, under propofol. Chen G et al. directly used MoCA in 60 elderly laparoscopic surgery patients and found that propofol anesthesia was associated with better postoperative MoCA scores at 1, 3, and 7 days, and a lower POCD incidence of 20% compared with 43.3% in the sevoflurane group; these cognitive differences coincided with lower postoperative IL-6 and TNF-α levels, suggesting a link between neuroinflammation and cognitive decline.[10]

Cognitive decline from baseline to day 7, expressed as Δ scores, was smaller in the propofol group than in the sevoflurane group. MMSE decreased by −0.8 ± 1.2 points under propofol versus −2.2 ± 1.5 under sevoflurane, while MoCA declined by −1.0 ± 1.3 vs −2.5 ± 1.6, respectively; this difference in change scores was statistically significant ($p = 0.012$). These findings indicate that propofol better attenuated postoperative decline in global and higher- order cognitive functions. Comparable patterns have been reported using composite Z-scores or multi-domain batteries. Zhang Y et al. found delayed neurocognitive recovery at day 7 in 16.7% of propofol patients versus 23.3% of sevoflurane patients, defined as a decline exceeding one standard deviation in at least one domain, with greater impairment in memory and executive tasks in the sevoflurane group.[9]

The overall incidence of postoperative cognitive dysfunction was significantly lower in the propofol group, occurring in 8 of 43 patients (18.6%) compared with 15 of 43 (34.9%) in the sevoflurane group ($p = 0.041$). This difference suggests a protective effect of propofol against early POCD. Zhang Y et al. reported similar trends in 1,218 elderly non-cardiac surgical patients, with delayed neurocognitive recovery at day 7 observed in 16.7% of the propofol group and 23.3% of the sevoflurane group.[9]

Analysis of age-stratified POCD rates revealed a clear gradient, with POCD occurring in 3 of 28 patients (10.7%) aged 65–69 years, 10 of 37 patients (27.0%) aged 70–74 years, and 10 of 22 patients (45.4%) aged ≥75 years ($p = 0.032$). This stepwise increase underscores advancing age as a major risk factor for postoperative cognitive decline, independent of anesthetic agent. Rasmussen LS et al. highlighted in 428 elderly patients that age and baseline cognitive status heavily influenced POCD, with benzodiazepine regimens increasing early POCD but not altering long-term outcomes.[7]

A moderate positive correlation was identified between duration of anesthesia and the incidence of POCD, with a mean anesthesia duration of 132 ± 28 minutes across the cohort and a correlation coefficient of $r = 0.42$ ($p = 0.001$). This relationship indicates that longer anesthetic exposure increases the likelihood of postoperative cognitive decline, regardless of anesthetic type. Prolonged anesthesia may reflect more complex or extensive surgery, greater inflammatory load, and prolonged exposure of the brain to anesthetic agents. Similar observations have been made in prior studies, although not always quantified with correlation coefficients.

Postoperative adverse events were generally infrequent, with notable differences in postoperative nausea and vomiting (PONV). PONV occurred in 4 of 43 patients (9.3%) in the propofol group compared with 10 of 43 (23.2%) in the sevoflurane group ($p = 0.048$). Other complications, including hypotension (13.9% vs 11.6%), bradycardia (6.9% vs 4.6%), and agitation (2.3% vs 9.3%), did not differ significantly. The lower PONV with propofol is consistent with its well-recognized antiemetic properties and may contribute indirectly to better

early recovery and cognitive performance by improving comfort, oral intake, and sleep.[14]

Recovery beyond the immediate postoperative period was more favorable in the propofol group, with a shorter mean hospital stay of 4.8 ± 1.2 days compared with 5.6 ± 1.4 days in the sevoflurane group ($p = 0.017$). Postoperative analgesic requirement, expressed in morphine equivalent dose, was also lower with propofol (18.3 ± 6.5 vs 23.2 ± 7.2 mg; $p = 0.011$). These differences indicate that propofol anesthesia was associated with faster overall recovery and reduced pain or opioid need, factors that are closely interlinked with cognitive outcomes in elderly surgical patients. Wang Y et al. specifically examined the relationship between pain, anesthetic type, and POCD in 200 elderly non-cardiac surgical patients, and found that better pain control and multimodal analgesia were associated with fewer POCD events, while propofol was linked to lower early POCD within 3 days compared with sevoflurane.[14]

CONCLUSION

In geriatric patients undergoing elective non-cardiac surgery with comparable baseline characteristics, surgery types, and intraoperative hemodynamics, propofol-based anesthesia provides significant advantages over sevoflurane-based anesthesia. These advantages include lower incidence of early POCD, smaller decline in MMSE and MoCA scores, faster emergence, shorter PACU and hospital stays, fewer PONV episodes, and reduced analgesic requirements. While age and duration of anesthesia remain important predictors of POCD, the findings indicate that selection of propofol as the primary maintenance agent can meaningfully improve early postoperative cognitive and clinical outcomes in elderly surgical patients. Consequently, in the absence of contraindications, propofol may be considered the preferred anesthetic maintenance option for geriatric patients at risk of postoperative cognitive dysfunction, with particular emphasis on those of advanced age and those undergoing procedures of moderate to prolonged duration.

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