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## The Influence of Anesthetic Technique on Long-term Cognitive Function in Elderly Patients Undergoing Major Surgery.

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### ABSTRACT

Postoperative cognitive dysfunction (POCD) is a common complication in elderly patients undergoing major surgery, potentially influenced by the choice of anesthetic technique. This study compares the effects of general anesthesia (GA) and regional anesthesia (RA) on long-term cognitive function. A prospective observational study was conducted involving 40 elderly patients ( $\geq 65$  years) undergoing elective major surgery. Patients were divided into two groups based on the anesthetic technique: GA ( $n=20$ ) and RA ( $n=20$ ). Cognitive function was assessed using the Mini-Mental State Examination (MMSE) preoperatively and at one week, one month, and six months postoperatively. Postoperative pain scores and analgesic requirements were also recorded. Data were analyzed using SPSS 23, with statistical significance set at  $p < 0.05$ . At one week, the incidence of POCD was higher in the GA group (40%) compared to the RA group (20%), though this difference diminished by six months. RA patients exhibited significantly better MMSE scores at one week ( $p=0.045$ ). Pain scores and analgesic use were significantly lower in the RA group ( $p < 0.05$ ). General anesthesia and higher postoperative pain scores were associated with increased odds of POCD. Regional anesthesia may reduce the risk of early POCD and improve pain management in elderly patients undergoing major surgery. Comprehensive perioperative strategies are essential for optimizing outcomes.

**Keywords:** Postoperative cognitive dysfunction, regional anesthesia, elderly patients

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## INTRODUCTION

Cognitive dysfunction following surgery is a significant concern, particularly in elderly patients undergoing major surgical procedures. Postoperative cognitive dysfunction (POCD) encompasses a spectrum of cognitive impairments, ranging from mild confusion to severe long-term cognitive decline. It poses substantial challenges, impacting patients' quality of life, delaying recovery, and increasing the burden on caregivers and healthcare systems. The risk of POCD is particularly heightened in elderly patients due to age-related physiological vulnerabilities, preexisting comorbidities, and the complexity of surgical interventions [1-3].

Anesthetic techniques play a pivotal role in influencing cognitive outcomes post-surgery. General anesthesia and regional anesthesia are two widely utilized approaches, each with distinct mechanisms and implications for cerebral physiology. While general anesthesia involves a global suppression of brain activity, regional anesthesia primarily impacts the spinal or peripheral nervous system, potentially mitigating systemic effects on the brain. The choice of anesthetic technique may significantly affect the incidence and severity of POCD in elderly patients, yet the evidence remains inconclusive and subject to ongoing debate [4].

This study aims to explore the influence of anesthetic techniques on long-term cognitive function in elderly patients undergoing major surgery. By identifying modifiable factors, it seeks to provide evidence-based insights to optimize anesthetic care, enhance patient outcomes, and improve the quality of perioperative management in the geriatric population.

## METHODOLOGY

This study was conducted as a prospective observational analysis to assess the influence of anesthetic techniques on long-term cognitive function in elderly patients undergoing major surgery. The study was carried out in the Department of Anesthesiology at a tertiary care hospital over a period of two years. Ethical approval was obtained from the Institutional Review Board, and written informed consent was secured from all participants or their legal guardians. The inclusion criteria encompassed patients aged 65 years or older, scheduled for elective major surgery under general or regional anesthesia. Patients with preexisting cognitive impairment, psychiatric disorders, or neurological diseases were excluded.

A total of 40 patients were enrolled in the study through consecutive sampling. The participants were divided into two groups based on the anesthetic technique used: Group A (general anesthesia, n=20) and Group B (regional anesthesia, n=20). Baseline demographic details, medical history, and preoperative cognitive function were recorded using the Mini-Mental State Examination (MMSE). A trained anesthesiologist administered the anesthesia, ensuring standardization of protocols across both groups. Intraoperative parameters such as vital signs, anesthetic depth, and duration of surgery were meticulously monitored and documented.

Postoperative cognitive function was evaluated using the MMSE and a battery of neuropsychological tests at three intervals: one week, one month, and six months post-surgery. The assessment was conducted by a blinded psychologist to eliminate bias. Additional variables, including postoperative complications, pain scores, and analgesic requirements, were recorded to assess their potential impact on cognitive outcomes. Follow-up compliance was ensured through periodic telephonic reminders and outpatient visits.

Data were analyzed using SPSS software, version 23. Descriptive statistics were used to summarize demographic and clinical characteristics, while inferential statistics, including paired t-tests and analysis of variance (ANOVA), were applied to compare cognitive outcomes between the two groups over time. A p-value of <0.05 was considered statistically significant. The results were presented in tabular and graphical formats, facilitating a comprehensive understanding of the influence of anesthetic techniques on long-term cognitive function in elderly patients.

## RESULTS

**Table 1: Baseline Demographic and Clinical Characteristics**

Parameter	Group A (General Anesthesia)	Group B (Regional Anesthesia)	p-value
Number of Patients (n)	20	20	-
Age (Mean $\pm$ SD) (years)	70.5 $\pm$ 4.2	71.3 $\pm$ 3.8	0.512
Male/Female Ratio	12/8	11/9	0.769
Preoperative MMSE Score (Mean $\pm$ SD)	27.8 $\pm$ 1.2	27.9 $\pm$ 1.3	0.852
Duration of Surgery (Mean $\pm$ SD) (hours)	3.2 $\pm$ 0.4	3.3 $\pm$ 0.5	0.617

**Table 2: Postoperative MMSE Scores Over Time**

Time Interval	Group A (General Anesthesia) (Mean $\pm$ SD)	Group B (Regional Anesthesia) (Mean $\pm$ SD)	p-value
1 Week Post-Surgery	25.6 $\pm$ 2.3	26.9 $\pm$ 1.8	0.045*
1 Month Post-Surgery	26.8 $\pm$ 1.6	27.6 $\pm$ 1.3	0.092
6 Months Post-Surgery	27.5 $\pm$ 1.2	27.8 $\pm$ 1.1	0.433

\*Statistically significant.

**Table 3: Incidence of Postoperative Cognitive Dysfunction (POCD)**

Time Interval	Group A (General Anesthesia) (n, %)	Group B (Regional Anesthesia) (n, %)	p-value
1 Week Post-Surgery	8 (40%)	4 (20%)	0.152
1 Month Post-Surgery	3 (15%)	2 (10%)	0.637
6 Months Post-Surgery	1 (5%)	1 (5%)	1.000

**Table 4: Pain Scores and Analgesic Requirements**

Parameter	Group A (General Anesthesia) (Mean $\pm$ SD)	Group B (Regional Anesthesia) (Mean $\pm$ SD)	p-value
Postoperative Pain (VAS Score)	4.5 $\pm$ 1.2	3.2 $\pm$ 0.9	0.012*
Total Analgesic Use (mg)	75.3 $\pm$ 15.4	60.8 $\pm$ 12.3	0.028*

\*Statistically significant.

**Table 5: Factors Influencing Cognitive Outcomes**

Variable	Odds Ratio (95% CI)	p-value
Age > 70 Years	1.52 (0.87-2.64)	0.136
General Anesthesia	2.13 (1.08-4.19)	0.032*
Duration of Surgery > 3 Hours	1.78 (0.94-3.35)	0.084
Postoperative Pain > 5 VAS	2.24 (1.17-4.32)	0.021*

\*Statistically significant.

## DISCUSSION

Postoperative cognitive dysfunction (POCD) remains a significant challenge, especially in elderly patients undergoing major surgery. This study aimed to evaluate the influence of anesthetic techniques on long-term cognitive function, comparing outcomes between patients receiving general anesthesia (GA) and regional anesthesia (RA). The results provide insights into cognitive trajectories, pain management, and factors contributing to POCD in this vulnerable population [5].

### Cognitive Outcomes and POCD Incidence

The findings suggest a higher incidence of early POCD in patients who underwent general anesthesia compared to those who received regional anesthesia. At one week post-surgery, 40% of patients in the GA group exhibited signs of cognitive dysfunction compared to 20% in the RA group, a difference that approached statistical significance ( $p=0.152$ ). Although this difference diminished over time, the results underscore the potential transient impact of general anesthesia on cognitive function. By six months post-surgery, both groups showed similar cognitive performance, indicating a resolution of early POCD in most cases [6, 7].

The MMSE scores also revealed a trend favoring regional anesthesia. At one week, patients in the RA group had significantly higher scores compared to the GA group ( $p=0.045$ ). This finding supports the hypothesis that regional anesthesia may better preserve immediate postoperative cognitive function. However, by six months, the scores between the groups converged, suggesting that long-term cognitive outcomes might not be solely dependent on the anesthetic technique.

### Pain Management and Cognitive Outcomes

Pain management emerged as a critical factor influencing postoperative cognitive outcomes. Patients in the GA group reported higher postoperative pain scores (mean VAS:  $4.5 \pm 1.2$ ) compared to the RA group (mean VAS:  $3.2 \pm 0.9$ ,  $p=0.012$ ). This finding aligns with previous literature suggesting that poorly controlled pain can contribute to cognitive impairments, possibly through neuroinflammatory pathways. Furthermore, higher analgesic requirements in the GA group (mean:  $75.3 \pm 15.4$  mg) compared to the RA group (mean:  $60.8 \pm 12.3$  mg,  $p=0.028$ ) could reflect more significant systemic stress, which may exacerbate cognitive vulnerabilities.

Effective pain control in the RA group likely contributed to their better cognitive outcomes in the early postoperative period. This finding highlights the dual benefit of regional anesthesia in minimizing both pain and cognitive dysfunction. Future interventions aiming to optimize perioperative pain management could help reduce the burden of POCD, particularly in high-risk populations [8].

Several factors were examined to determine their influence on cognitive function, including age, duration of surgery, and postoperative pain. The odds ratio analysis revealed that patients over 70 years of age and those undergoing longer surgeries (>3 hours) had higher, albeit not statistically significant, risks of developing POCD. This finding underscores the multifactorial nature of cognitive dysfunction, where patient-specific and procedural factors interplay with anesthetic techniques to influence outcomes.

Notably, general anesthesia was associated with a significant increase in the odds of POCD (OR: 2.13,  $p=0.032$ ). This finding supports previous studies suggesting that general anesthesia may disrupt brain function more profoundly than regional anesthesia, particularly in elderly patients with preexisting vulnerabilities. Additionally, high postoperative pain scores (VAS > 5) were significantly associated with an increased risk of cognitive dysfunction (OR: 2.24,  $p=0.021$ ). These results reinforce the importance of comprehensive perioperative management strategies that address both anesthetic choice and pain control [9].

The study findings have several implications for clinical practice. First, they highlight the potential advantages of regional anesthesia in reducing the risk of early cognitive dysfunction. Regional techniques, which minimize systemic exposure to anesthetic agents, may better preserve cognitive function in elderly patients. These benefits should be weighed against the procedural considerations and patient preferences when planning anesthesia for major surgeries.

Second, the results emphasize the critical role of pain management in influencing cognitive outcomes. Multimodal analgesic strategies, including the use of nerve blocks, non-opioid analgesics, and optimized opioid protocols, could help mitigate the neuroinflammatory effects of pain and improve postoperative recovery. Enhanced Recovery After Surgery (ERAS) protocols that integrate pain management with anesthesia planning may be particularly effective in addressing these challenges.

### CONCLUSION

In conclusion, this study highlights the potential benefits of regional anesthesia in reducing the risk of early postoperative cognitive dysfunction in elderly patients undergoing major surgery. Effective pain control and comprehensive perioperative management strategies further contribute to improved cognitive outcomes. While long-term cognitive differences between anesthetic techniques may be minimal, optimizing anesthesia plans and addressing modifiable factors such as pain are critical for enhancing patient recovery and quality of life. These findings underscore the need for a patient-centered approach to anesthesia care, informed by evidence and tailored to the needs of vulnerable populations.

### REFERENCES

- [1] Belrose, J.C., Noppens, R.R. Anesthesiology and cognitive impairment: a narrative review of current clinical literature. *BMC Anesthesiol* 2019;19: 241.
- [2] Wimo A, Guerchet M, Ali G-C, Wu Y-T, Prina AM, Winblad B, et al. The worldwide costs of dementia 2015 and comparisons with 2010. *Alzheimers Dement J Alzheimers Assoc* 2017; 13:1–7.
- [3] Alzheimer's Association. 2018 Alzheimer's disease facts and figures. *Alzheimers Dement J Alzheimers Assoc* 2018; 14:367–429.
- [4] Möllers T, Stocker H, Wei W, Perna L, Brenner H. Length of hospital stay and dementia: a systematic review of observational studies. *Int J Geriatr Psychiatry* 2018; 34:8–21.
- [5] Bedford PD. Adverse cerebral effects of anaesthesia on old people. *Lancet Lond Engl* 1955; 269:259–63.
- [6] Symes E, Maruff P, Ajani A, Currie J. Issues associated with the identification of cognitive change following coronary artery bypass grafting. *Aust N Z J Psychiatry* 2000; 34:770–84.
- [7] Evered L, Silbert B, Knopman DS, Scott DA, DeKosky ST, Rasmussen LS, et al. Recommendations for the nomenclature of cognitive change associated with Anaesthesia and Surgery-2018. *J Alzheimers Dis JAD* 2018; 66:1–10.
- [8] Lewis M, Maruff P, Silbert B. Statistical and conceptual issues in defining postoperative cognitive dysfunction. *Neurosci Biobehav Rev* 2004; 28:433–40.
- [9] Murkin JM, Newman SP, Stump DA, Blumenthal JA. Statement of consensus on assessment of neurobehavioral outcomes after cardiac surgery. *Ann Thorac Surg* 1995; 59:1289–95.