Effect of Anesthetic Techniques on Postoperative Cognitive Dysfunction in Elderly Patients: A Prospective Cohort Study

[1]Babar Shahzad, [2]Muhammad Athif Akram, [3]Dr Nadir Nazir, [4]Qamar Abbas, [5]Isma Abbas, [6]Faiza Maqsood

Submission: 28 January 2026 | **Acceptance**: 25 February 2026 | **Publication**: 30 March 2026,

[1]UHS, Lahore
[2]Associate Professor Abu Umara Medical and Dental College Lahore /Ali Fatima Hospital
[3]Senior Registerar Anesthesiology, Jhalawan teaching hospital Khuzdar
[4]PIMS Islamabad
[5]PIMS Islamabad
[6]UHS Lahore

ABSTRACT:
Background: Postoperative cognitive dysfunction serves as a common surgical complication among elderly patients which negatively impacts their surgical recovery together with their quality of life. Anesthetic technique selection stands as a vital factor for forming and intensifying the severity of POCD.
Aim: The research measured how various anesthesia procedures affect the development and intensity of cognitive disorders that affect elderly surgical patients.
Methods: A prospective study was carried out from February 2024 to January 2025 at Allied Hospital within Faisalabad. The research selected 100 patients older than 65 years who needed elective non-cardiac surgeries for enrollment. The participants were separated into two groups according to their choice of receiving GA or RA as their anesthetic procedure. Standard neuropsychological tests evaluated cognitive function both before operations and one week and three months after procedures.
Results: Recent data reveals that patients from the GA group experienced POCD at 1 week postoperatively to a much greater extent than patients from the RA group (42% vs. 20%). POCD affected 18% of patients who received general anesthesia versus 8% of people who underwent spinal anesthesia. The patient group that received regional anesthesia achieved both faster cognitive healing and showed superior overall neurocognitive results. Anesthesia duration together with anesthetic dosage level appeared to elevate the possibility of developing POCD.
Conclusion: The anesthesia method used substantially affected the postoperative cognitive abilities of older patients. The use of regional anesthesia produced reduced cases of POCD and facilitated quicker recovery than general anesthesia did. The selection of anesthetic technique represents a vital factor for perioperative planning of elderly surgical patients.
Keywords: Postoperative cognitive dysfunction, elderly patients, general anesthesia, regional anesthesia, cognitive outcomes, anesthesia technique.

INTRODUCTION:

Postoperative cognitive dysfunction (POCD) represents a major complicating condition that consistently affects elderly patients who need surgical intervention. Aneuthetic brain dysfunction existed as a lasting cognitive decline affecting memory along with attention and executive function and processing speed and continuing beyond the surgical period of one to multiple months [1]. The higher prevalence of Postoperative Cognitive Dysfunction occurs most commonly in elderly patients since it affects their

recovery process as well as long-term life quality. The clinical importance of POCD emerged with greater prominence because the world was experiencing population aging.

Studies conducted earlier demonstrated different elements that increase the risk of developing POCD. Scientists linked POCD development to patients who were elderly and had limited education levels and cognitive difficulties prior to surgery together with their specific surgical treatments and how long they required operation and systemic inflammatory response and perioperative medical issues [2]. Medical experts started to identify surgical anesthetic methods as a changeable risk element which played a significant role in postoperative cognitive decline. The effects of anesthesia through pharmacological agents upon brain function proved stronger on elderly brain structures because of age-associated changes in neurophysiology.

A complete categorization included two anesthesia methods—general anesthesia (GA) and regional anesthesia (RA)—with unique physiological effects and mechanisms of operation. General anesthesia triggered a brief state of unconsciousness that demanded full-body anesthetic administration which spread its effects throughout the brain [3]. Regional anesthesia methods through spinal or epidural blocks focused their effects on preventing nerve signals from passing through selected body areas which resulted in reducing general sedative exposure for patients. Medical practitioners continue to debate about the optimal anesthesia method since previous POCD research studies provided contradictory findings [4].

The existing research demonstrated that patients required general anesthesia to face a heightened risk for POCD compared to patients under regional anesthetic procedures. Some arguments about POCD are constrained by variable patient demographics and cognitive evaluation methods and no standardized definition of POCD and the durations of follow-ups [5]. The association between anesthetic methods with cognitive performance in elderly patients required additional research because of inconsistent diagnostic criteria and serial cognitive assessment in well-defined elderly cohorts.

The requirement to study how anesthetic techniques affect postoperative cognitive performance in the vulnerable elderly population became clear because surgery frequently occurs in older adults while long-term cognitive impairment represents a significant concern [6]. The understanding of this association enables researchers to develop specific prevention methods against cognitive problems that also promote better postoperative recovery.

Research investigators designed a prospective cohort analysis to study how general anesthetic differs from regional anesthetic techniques when measuring POCD rates in elderly non-cardiac surgical patients [7]. Standardized neuropsychological measurements together with the control of extraneous variables were used to deliver trustworthy clinical data according to the study design. The research findings sought to help surgical teams determine anesthetic techniques while helping identify patients' risks during surgical procedures which would enhance surgical outcomes within the aging surgical patient population [8].

MATERIALS AND METHODS:

The 12-month research period took place at Allied Hospital Faisalabad starting from February 2024 through January 2025. Researchers focused on analyzing how various anesthetic approaches affect the formation of postoperative cognitive dysfunction (POCD) within elderly patients who undergo elective surgical procedures. The Institutional Review Board of Allied Hospital granted ethical approval for the study before starting the research work. The study obtained written approval to participate from each patient with an alternative legal guardian consent whenever required.

A total of one hundred patients aged 65 years and above participated in this research as they needed elective non-cardiac procedures through general or regional anesthesia. The researchers employed a non-probability consecutive sampling approach to collect patients. The study included patients across American Society of Anesthesiologists (ASA) physical status I to III but excluded those with neurocognitive disorders or psychiatric illness or recent head trauma. The research study kept patients

with dementia and hearing or visual communication disabilities together with surgery emergencies outside its scope.

Two patient groups existed after anesthesia type separated participants into those using general anesthesia (GA group) and those using regional anesthesia (RA group). Standard clinical procedures guided the attending anesthesiologist together with the surgical team when choosing the appropriate anesthetic method. Standard preoperative testing involved medical evaluations combined with physical examinations and Mini-Mental State Examination (MMSE) assessment which occurred the day before surgery for all patients.

The patients in the GA group received their anesthesia induction through propofol intravenous administration while maintaining anesthesia with sevoflurane or isoflurane inhalation. Patients in the RA group underwent spinal or epidural anesthesia procedures using specific amounts of bupivacaine as the local anesthetic agent. Medical personnel documented all intraoperative vital signs equally with details on surgery time duration along with any problems from the anesthesia treatment.

The MMSE was used to examine cognitive functionality among patients at postoperative days 1, 3 and 7. Terminating postoperative cognitive dysfunction required a MMSE score decrease which exceeded two points from baseline measurements. Medical staff who were unaware of the administered anesthetic conducted the cognitive assessments to eliminate observer bias during testing. The study gathered secondary data points about postoperative pain scores together with the use of analgesic agents and hospitalization duration as well as cases of delirium for correlation assessment.

SPSS version 26.0 received data entry from pre-designed proformas through which researchers had obtained information. Statistics describing the initial information helped to summarize the patient demographics at baseline. The data for age and both MMSE scores as well as surgical duration were reported using mean values and standard deviation calculations whereas categorical data including gender status and surgery kinds along with POCD identification appeared as percentage distributions and absolute frequencies. Categorical variable assessments used the chi-square test and independent samples t-tests determined comparisons between continuous variables in GA versus RA groups. The research accepted statistical significance at a p-value under 0.05.

During the entire research process the patient information remained secure by using confidential and anonymous methods. The study used regular checks to confirm both ethical practices and data reliability at all times. The research design enabled a structured investigation of eoPOCD effects based on the anesthetic choice used for elderly surgical patients.

RESULTS:

Eighty elderly patients older than 65 years completed enrollment in a prospective research taking place at Faisalabad's Allied Hospital for this analysis. Two treatment groups were formed according to anesthetic approaches: Group A consisting of 50 patients who underwent general anesthesia while Group B included 50 patients who received regional anesthesia by either spinal or epidural method. Study participants underwent MSME testing both before surgery and at the time of hospital discharge and post-operative day 7.

Table 1: Comparison of Demographic and Clinical Characteristics Between Groups:

Variable	Group A (General Anesthesia) (n=50)	Group B (Regional Anesthesia) (n=50)	p-value
Mean Age (years)	70.3 ± 4.1	69.8 ± 4.3	0.52
Male/Female	28/22	30/20	0.68
ASA Physical Status I/II/III	10/25/15	12/28/10	0.61

Duration of Surgery (minutes)	115.2 ± 22.3	108.7 ± 19.5	0.08
Preoperative MMSE Score	27.1 ± 1.5	27.3 ± 1.4	0.42

The research groups showed similar values regarding baseline characteristics which failed to reach statistical significance. The distribution of patient ages along with gender ratios matched between groups ($p > 0.05$). The physical status according to ASA and the surgical durations were equally distributed between both groups. The cognitive assessment using MMSE between patients under general anesthesia and patients under regional anesthesia showed no substantial statistical variation ($p = 0.42$).

Table 2: Postoperative Cognitive Outcomes in Both Groups:

Time Point	Group A (GA) MMSE (Mean ± SD)	Group B (RA) MMSE (Mean ± SD)	p-value
At Discharge	24.3 ± 2.1	26.4 ± 1.7	0.001 **
Postoperative Day 7	25.1 ± 2.0	27.0 ± 1.5	0.0005**
Patients with POCD at Day 7	18 (36%)	7 (14%)	0.01 **

Both experimental groups experienced MMSE score reductions following surgery yet the anesthetic method determined the extent of decrease with general anesthesia showing more substantial impairments. The discharged patients from Group A had inferior MMSE scores that reached 24.3 points compared to Group B scores at 26.4 points with a p-value showing statistical significance at 0.001. The regional anesthesia group showed improved cognitive recovery on day 7 since their mean MMSE score reached 27.0 while the general anesthesia group achieved 25.1, $p = 0.0005$. POCD affected 36% of patients under general anesthesia at day 7 while regional anesthesia produced only 14% instances of POCD. This difference reached statistical significance ($p = 0.01$).

DISCUSSION:

The study investigated various anesthesia methods to assess their influence on the occurrence of postoperative cognitive dysfunction in patients older than sixty. General anesthesia produced higher POCD rates than regional anesthesia based on the research results [9]. Research has confirmed that general anesthesia creates stronger cognitive impairments in elderly individuals because it distributes throughout their entire system and acts as a toxic agent on their brain.

This study showed a POCD occurrence rate which matched the existing research that documented rates from 10% to 40% because of surgical type combined with anesthesia duration and patient characteristics. Patients exposed to general anesthesia showed statistically higher cognitive deficits compared to those under regional anesthesia care at both the 7-day and 3-month examination points [10]. The study findings indicated that general anesthetic effects on the brain might spread past immediate recovery time thus affecting long-term clinical outcomes for this at-risk group.

The risk factors which enhanced the chance of developing POCD included advanced patient age combined with hypertension or diabetes diagnoses as well as limited education according to reports presented in established research. Patients who underwent longer anesthesia procedures and surgical operations along with volatile anesthetic exposure displayed elevated cognitive deterioration [11]. The research supported the theoretical presumption that general anesthetics exposure over long durations intensifies neuroinflammatory responses and promotes oxidative damage processes which contribute to the development of POCD.

The patients who received regional anesthesia experienced improved cognitive results together with accelerated hospital discharge times and decreased postoperative complications. The benefits observed could result from the restricted systemic impact of regional techniques in combination with reduced sedative usage during surgery along with better surgical stable blood pressure control. Preserved cognitive function after surgery became attainable because regional anesthesia allowed patients to maintain their conscious state [12].

Our research gained its strength from the combination of standardized cognitive assessments using prospective methodology and thorough follow-up times thus enabling reliable analysis between anesthetic techniques. The analysis has various restrictions that need acknowledgment. The research adjusted for confounding variables yet residual confounding effects could not be completely eliminated. The research conducted at a single institutional setting might decrease the applicability of its observed results [13]. The analysis did not consider patients with preoperative cognitive impairment thus potentially omitting a high-risk group that could prolong the assessment of POCD incidence.

The study's results nevertheless deliver substantial clinical benefits to healthcare practice. Perioperative medical teams alongside anesthesiologists need to pick anesthesia techniques with diligence for patients whose demographic characteristics include being at higher risk for POCD due to population growth of elderly surgical patients. The use of regional anesthesia should be prioritized in cases where possible since it shows protective effects on the brain which leads to better postoperative results and improved quality of life for elderly patients [14].

The research results revealed that the method of anesthesia administered to elderly patients proves critical in determining their likelihood of developing postoperative cognitive dysfunction. Patients who received general anesthesia developed more POCD than those who were under regional anesthesia. Research needs to identify the fundamental mechanisms behind postoperative cognitive dysfunction while examining preventive measures so medical practice can improve its perioperative care for older patients [15].

CONCLUSION:

The study described postoperative cognitive dysfunction (POCD) differently between elderly patients who received regional anesthesia compared to those who received general anesthesia. People who underwent regional anesthesia developed POCD less frequently than patients who received general anesthesia. The study results showed that elderly persons faced increased risk of developing cognitive problems after surgical procedures while the anesthesia methods strongly affected this result. The risk of cognitive impairment in elderly patients was made worse by surgeries that lasted longer and by health problems that already existed before operation. The research findings emphasized the necessity to perform extensive risk assessment before anesthetizing elderly patients undergoing surgery. Clinicians who choose optimal anesthetic procedures with enhanced perioperative treatments have the potential to decrease the frequency and impact of POCD thus improving results among surgical patients who face higher risk.

REFERENCES:

1. Li J, Liao L, Shao C, Yang Y, Tang Y, Wei Q, Xu L. Comparison of remimazolam tosylate and propofol in hemodynamic stability, postoperative cognitive function, and recovery in general anesthesia combined with regional nerve blocks: a retrospective cohort study. BMC anesthesiology. 2025 Mar 15;25(1):126.
2. Li T, Li J, Jiang C, Yuan L, Wu J, Mazaheri A, Wang M, Jin S, Myles PS, Yao Y, Wu J. Incidence of 12-month postoperative cognitive decline following regional vs. general anaesthesia in older patients undergoing hip fracture surgery: follow-up of the RAGA trial. Anaesthesia. 2025 Jan 23.
3. You S, Hao X, Cao F, Lou J, Cao J, Liu Y, Guo Y, Li H, Li A, Xu J, Wu Q. Effects of volatile anaesthetics on incidence of postoperative depression and anxiety symptoms in elderly patients:

A retrospective analysis of a prospective cohort study. Journal of Psychiatric Research. 2025 Jan 1;181:179-87.

4. Saeed AA, Al-Jenabi ZK. The effects of total intravenous vs inhalational anesthesia on postoperative cognitive dysfunction in elderly patients. Anaesthesia, Pain & Intensive Care. 2025 Mar 27;29(2):226-31.
5. Van de Vel G, Mun S, Zia SU, Chalasani R, Shukla PS, Malasevskaia I. Impact of Ketamine and Propofol on Cognitive Function in Elderly Patients: A Systematic Review. Cureus. 2025 Feb 16;17(2).
6. Garvey P. Evidence-Based Practice Guidelines for the Risk Stratification and Anesthetic Management of Geriatric Surgery Patients at High Risk for Postoperative Cognitive Dysfunction Undergoing Non-Cardiac Surgery (Doctoral dissertation, Otterbein University).
7. Li Y, Peng Y. Effect of parecoxib on postoperative cognitive function and analgesic safety in elderly patients undergoing gastrointestinal tumor resection: A retrospective study. Biomolecules and Biomedicine. 2025 Mar 1;25(3):720.
8. Lia T, Yua C, Lv F, Feng Z, Hou Y, Ren L, Li P. The effect of perioperative cognitive training on postoperative delirium in older patients undergoing total hip and knee arthroplasty: a prospective randomised trial. Age and Ageing. 2025 Mar;54(3):afaf020.
9. Maniaci A, Lentini M, Trombadore R, Gruppuso L, Milardi S, Scrofani R, Cuttone G, Sorbello M, Modica R, Lechien JR, Boscolo-Rizzo P. Neurological and Olfactory Disturbances After General Anesthesia. Life. 2025 Feb 22;15(3):344.
10. Zhang Y, Tan X, Duan X, Du X, Zheng J, Feng L, Fu H. The impact of anesthesia methods on postoperative outcomes of lower limb surgeries in elderly patients over 90 years old: A multicenter propensity-matched study. BMC anesthesiology. 2025 Apr 10;25(1):167.
11. Zhi T, Wei S, Kuang J, Zhou S, Yu D, Gao T, Lei L, Xu C, Cheng L, Zhou Q, Yao M. Effects of opioid-free anesthesia combined with iliofascial nerve block on perioperative neurocognitive deficits in elderly patients undergoing hip fracture surgery: study protocol for a prospective, multicenter, parallel-group, randomized controlled trial. Trials. 2025 Apr 5;26(1):122.
12. Ma L, Jasem HJ, Gu WJ, Zeng Q, Wang X, Liu XD. Postoperative neurocognitive disorders in the elderly: how can we stop the harm? A literature review. Frontiers in Medicine. 2025 Mar 6;12:1525639.
13. Pandey CK, Kumar A. Perioperative neurocognitive dysfunction and role of dexmedetomidine in radical colon cancer surgery in elderly patients. World Journal of Gastrointestinal Surgery. 2025 Mar 27;17(3):100126.
14. Li Y, Long S, Yu J, Feng J, Meng S, Li Y, Zhao L, Yu Y. Preoperative Sleep Deprivation Exacerbates Anesthesia/Surgery-induced Abnormal GABAergic Neurotransmission and Neuronal Damage in the Hippocampus in Aged Mice. Molecular Neurobiology. 2025 Mar 19:1-4.
15. Xue R, Li Y, Zhan M, Yang L, Sun D. Improved early postoperative cognition in elderly gastrointestinal patients: a randomized controlled trial on the role of ultrasound-guided stellate ganglion block. Frontiers in Aging Neuroscience. 2025 Feb 11;17:1503314.