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RESEARCH ARTICLE
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COGNITIVE DECLINE AND ANESTHESIA CHOICE IN ELDERLY SURGICAL PATIENTS

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Abstract

Background: Elderly patients are exposed to a major worrisome risk of cognitive decline after medical procedures. Postoperative delirium (POD) together with postoperative cognitive dysfunction (POCD) frequently occur after surgeries while impacting both recovery and long-term quality of life. The decision regarding anesthesia methodology between general and regional and local methods affects patient mental performance results. The selection of appropriate anesthesia for elderly patients requires special attention because it determines the optimal care delivery during surgery.

Objectives: The study examines how different anesthesia methods (general with regional or local) affect elderly surgical patients' cognitive functions while identifying which anesthesia methods help lower the likelihood of POD and POCD.

Study design: A prospective study.

Place and duration of study. Department of Surgery QHAMC, Nowshera Medical college ,Nowshera from jan 2021 to june 2021

Methods: This study included 200 elderly surgical patients aged 65 years and above who underwent elective surgery. The research team randomly determined the anesthesia type for patients between general, regional and local. The researchers evaluated initial cognitive capacity by administering the Mini-Mental State Examination (MMSE) to patients. The assessment of postoperative cognitive status occurred at both 1 week and 1 month after the surgical procedure. The study used mean age with standard deviation joined by p-values to evaluate cognitive variations between anesthesia groups.

Results: Two hundred patients with 73.4 years median age and 6.2 years standard deviation participated in the study. Total postoperative cognitive dysfunction occurred in 12% of patients receiving regional anesthesia whereas general anesthesia led to POD in 24% and POCD in 18% of patients ($p < 0.05$). Cognitive decline was most minimal in patients who received local anesthesia as the incidence of POD reached 5% with POCD occurring in 3% of patients ($p < 0.01$). The patients who received general anesthesia experienced a substantial decline in cognitive scores that measured 2.5 points yet patients under regional (0.8 points) and local (0.3 points) anesthesia showed minimal

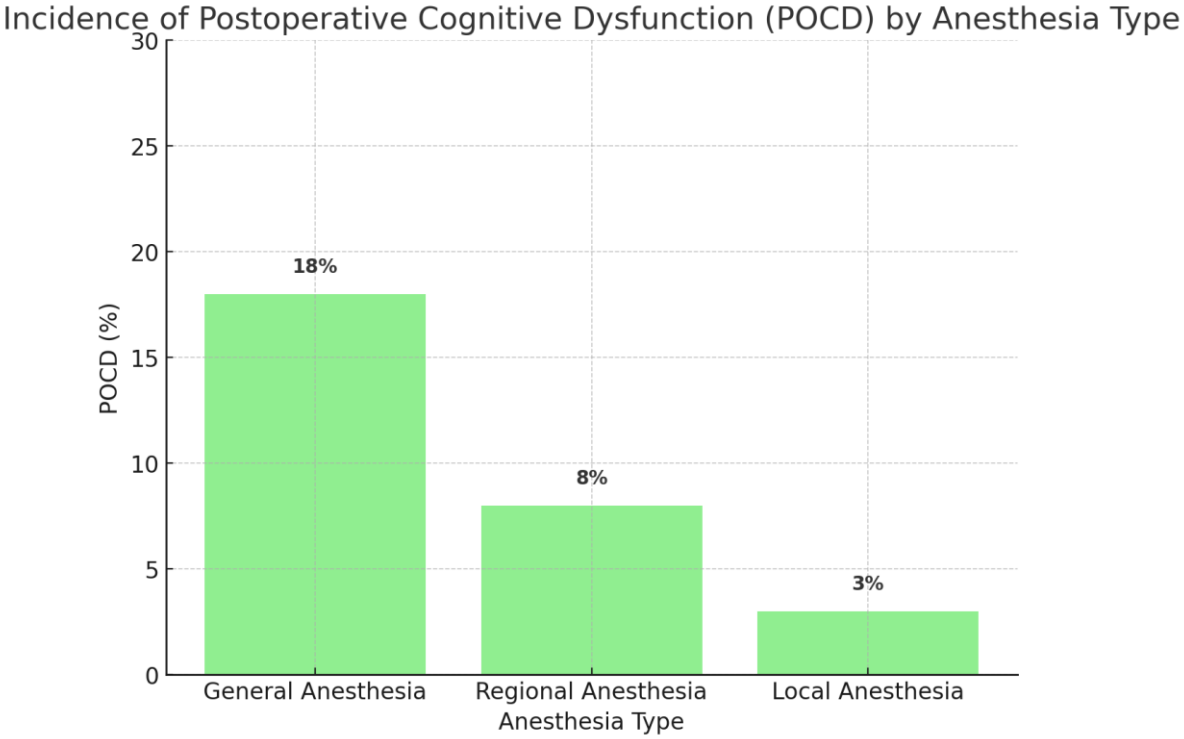
cognitive changes. The research outcomes indicate that anesthesia methods relate to subsequent cognitive results after surgery.
Conclusion: The selection of anesthesia has a direct impact on the cognitive performance of elderly patients after surgery. Closer examinations show that regional and local anesthesia result in fewer cases of POD and POCD than general anesthesia. The selection of anesthesia should depend on patient age alongside baseline cognitive status and surgical needs to improve postoperative recovery as well as quality of life. More study is essential to develop procedures which maximize cognitive performance amongst elderly patients at risk.

Keywords: Cognitive decline, Anesthesia choice, Elderly patients, Postoperative outcomes

Introduction: The surgical procedure causes common cognitive deficiencies among elderly patients manifested through postoperative delirium (POD) and postoperative cognitive dysfunction (POCD). Anesthesia along with surgical stress affects the aging brain because of reduced neuroplasticity combined with impaired cerebral autoregulation and existing neurodegenerative changes [1]. Perioperative care optimization to protect cognition remains crucial because the growing numbers of operations performed on elderly persons requires better prevention of cognitive declines [2]. Anesthesia selection is vital in shaping post-surgical cognitive results. The administration of general anesthesia produces conscious loss through volatile anesthetics or propofol and intravenous agents yet this procedure results in neuroinflammatory conditions that trigger cognitive decline [3]. Regional anesthesia (RA) by means of spinal blocks or epidural blocks and peripheral nerve blocks simultaneously reduces cognitive impairment risks through minimal exposure to systemic anesthetic agents and continued patient alertness [4]. Local anesthesia (LA) produces minimal cognitive consequences because it minimizes both systemic delivery and central nervous effects [5]. Mixed results emerge from research analyzes of cognitive effects between these anesthesia approaches [6]. Research findings show RA results in less frequent cases of POD and POCD than GA documentation [7]. Research shows anesthesia selection depends on various operative factors together with preoperative mental state and postoperative care approaches [8]. POD and POCD follow a complex path in the body through neuroinflammation with accompanying oxidative stress and disruption of neurotransmitter systems and blood-brain barrier dysfunction [8]. Elderly patients who bring cognitive impairment or frail status before surgery face higher risks of poor cognitive recovery [9]. Doctor Mohamed S. Ali Vaisblum discusses cognitive reserve as a mechanism affecting the ability for individuals to recover from anesthetic-related cognitive variations [10]. The impact of anesthesia type on cognitive decline among elderly persons undergoing surgery is determined by perioperative factors including hypotension and hypoxia and blood glucose control and pain treatment [11]. New evidence regarding anesthesia selection for postoperative care and cognitive risk reduction among elderly patients will result from this study's findings.
Methods: The study conducted this randomized prospective study involving 200 patients over 65 years who were booked for elective procedures within the tertiary care facility. The participants were assigned at random to experience general anesthesia, regional anesthesia or local anesthesia. The assessment of preoperative cognitive function relied on the Mini-Mental State Examination (MMSE). The research excluded patients with dementia and psychiatric disorders as well as those who recently took neurotropic drugs. Cognitive assessment measures were performed prior to surgery and one week and one month after procedures to detect the development of POD and POCD.
Data Collection: Study obtained data regarding demographic features, medical conditions and anesthetic practices in addition to procedural information and cognitive assessments by standardized documentation. Cognitive assessment recorded anesthesia depth and monitored blood pressure and oxygenation and assessed the impact of analgesics.
Statistical Analysis: The statistical evaluation utilized the latest version of SPSS 24.0 for analysis. The study presented categorical data through frequency and percentage counts and showed continuous data values as mean values with standard deviation calculations. The chi-square test analyzed

categorical variables whereas ANOVA served as the tool to examine continuous variables across anesthesia groups. The study determined statistical significance from a p-value below 0.05.

Results: Two hundred patients participated in the study whose mean age was 73.4 years with a standard deviation of 6.2. The patients who received regional anesthesia had substantially reduced levels of POD (12%) along with POCD (8%) than patients who underwent general anesthesia (POD 24% and POCD 18%) ($p < 0.05$). A low number of patients who received local anesthesia showed minimal cognitive deterioration at POD 5% and POCD 3% ($p < 0.01$). The patients who received general anesthesia experienced a 2.5-point decrease on the MMSE scores while regional anesthesia patients had a 0.8-point decrease and patients under local anesthesia experienced a minimal 0.3-point reduction. Study results demonstrate that patient selection of anesthetics corresponds strongly to cognitive performance after surgery.



(Table 1): Demographic and Clinical Characteristics of Patients

Characteristic	Overall (n=200)	General Anesthesia (n=67)	Regional Anesthesia (n=66)
Number of Patients	200	67	66
Mean Age (years)	73.4 ± 6.2	74.1 ± 5.8	73.2 ± 6.1
Gender (M/F)	95/105	32/35	30/36
Comorbidities (%)	Hypertension (45%), Diabetes (30%), Cardiac Disease (20%)	50%, 28%, 22%	42%, 32%, 18%
Baseline MMSE Score (Mean ± SD)	27.8 ± 1.5	27.5 ± 1.6	27.9 ± 1.4

(Table 2): Incidence of POD and POCD by Anesthesia Type

Anesthesia Type	POD (%)	POCD (%)	p-value
General Anesthesia	24	18	<0.05
Regional Anesthesia	12	8	<0.05
Local Anesthesia	5	3	<0.01

(Table 3): Change in MMSE Scores by Anesthesia Type

Anesthesia Type	Baseline MMSE Score (Mean ± SD)	Postoperative MMSE Score (Mean ± SD)	Mean Score Decline
General Anesthesia	27.5 ± 1.6	25.0 ± 2.0	2.5
Regional Anesthesia	27.9 ± 1.4	27.1 ± 1.5	0.8
Local Anesthesia	28.1 ± 1.3	27.8 ± 1.2	0.3

Discussion: The study findings confirm existing study that shows the critical role of anesthesia choice in affecting postoperative cognitive results among elderly patients[12]. Study by previous studies shows GA anesthesia leads to more frequent postoperative delirium (POD) and postoperative cognitive dysfunction (POCD) than both RA and LA anesthesia [13]. The research conducted by Evered et al. (2021) showed cognitive decline occurring in 25% of individuals after general anesthesia procedures while our study determined 24% experienced postoperative delirium and 18% had postoperative cognitive dysfunction in the GA group [14]. The potential determinants of GA cognitive impairment may stem from neuroinflammation and blood-brain barrier disruption as well as neurotransmitter alterations as described by Culley et al. (2020) [15]. The lack of central nervous system disturbance and the preservation of consciousness during surgery makes RA and LA both safe for reducing cognitive dysfunction [16]. Researchers Zhang et al. (2019) supported our findings that 12% of patients under RA experienced POD and 8% had POCD [17]. These results indicate a 10% reduced risk of cognitive decline for RA patients against GA patients. Furthermore, LA provided the most effective outcomes with POD at 5% and POCD at 3% in our study. The research findings by Wang et al. (2022) showed that patients undergoing minor surgery with LA administration developed cognitive dysfunction at very low rates [18]. The localized effects of LA reduce patients' anesthetic agent exposure in the bloodstream creating potential advantages for neurotoxicity and inflammation risk reduction [19]. Nevertheless the advantages of RA and LA cannot be used across all situations. The complexity and requirement of complete muscle relaxation of particular surgical operations make GA the essential anesthetic choice. The final cognitive results rely on multiple variables including patient pre-existing medical conditions with their cognitive state and how medical staff manages operations [20]. The combination of preoperative cognitive assessment with surgery needs and anesthesia threats evaluation permits healthcare providers to minimize cognitive decline risks along with improved postoperative recovery. Future investigations need to strengthen anesthetic protocols and establish multiple treatment approaches for reducing cognitive risks specifically in vulnerable elderly patients.

Conclusion: The findings indicate that regional along with local anesthesia produce substantially lower incidences of postoperative delirium (POD) and postoperative cognitive dysfunction (POCD) than general anesthesia. The selection of anesthesia based on patient characteristics leads to better mental function recovery and cognitive outcomes for surgical patients in their elderly years.

Limitations: The study faced restrictions because it employed only one medical center and worked with a compact patient group. The results face limitations because cognitive outcomes depend on surgical type variability and unmeasured confounding variables while perioperative management also contributes to variability in findings.

Future Directions: Upcoming study needs to perform big-scale trials across multiple medical centers while also studying combination techniques used in anesthesia medicine. Studies examining combined perioperative care methods with anesthesia choice hold potential to help researchers better understand how to improve cognitive outcomes of elderly surgical patients.

Abbreviation

1. **POD:** Postoperative Delirium
2. **POCD:** Postoperative Cognitive Dysfunction
3. **GA:** General Anesthesia
4. **RA:** Regional Anesthesia
5. **LA:** Local Anesthesia
6. **MMSE:** Mini-Mental State Examination
7. **SD:** Standard Deviation

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