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Postoperative Cognitive Dysfunction: Incidence and Predictors in Elderly Patients Under General Anaesthesia

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Abstract

Aim: To ascertain the prevalence of postoperative cognitive dysfunction (POCD) and identify its predictors in elderly patients undergoing surgery under general anaesthesia.

Methodology: A prospective observational study was performed from January 2023 to December 2024 involving elderly patients undergoing surgery with general anaesthesia. Cognitive function was evaluated preoperatively and postoperatively utilising standardised instruments, while potential predictors, including age, comorbidities, type and duration of surgery, and anaesthesia specifics, were documented. The incidence of postoperative cognitive dysfunction (POCD) was computed, and statistical analysis was conducted to ascertain significant predictors.

Results: In the examined cohort, X% of patients manifested POCD. Individuals over 70 years of age, undergoing extended surgical procedures, and possessing comorbid conditions exhibited a significantly elevated risk of postoperative cognitive dysfunction ($p<0.05$). Early detection and monitoring facilitated prompt intervention in affected patients.

Conclusion: POCD is a prevalent complication in elderly patients undergoing general anaesthesia, with advanced age, extended surgical duration, and comorbidities identified as significant predictors. Preoperative evaluation and perioperative interventions can mitigate cognitive deterioration and enhance postoperative results.

Keywords: Postoperative cognitive dysfunction, POCD, elderly patients, general anesthesia, incidence, predictors, perioperative risk factors.

Introduction

Postoperative cognitive dysfunction (POCD) is a prevalent yet frequently unacknowledged complication in elderly patients undergoing surgery with general anaesthesia. POCD is marked by a quantifiable deterioration in cognitive functions, encompassing memory, attention, executive functions, and information processing speed, which may endure from days to months post-surgery [1]. This condition has a big effect on patients' quality of life, independence, and long-term functional outcomes. It is also linked to more illness, longer hospital stays, and higher healthcare costs [2,3]. The elderly are especially susceptible to POCD owing to age-associated structural and functional modifications in the brain, such as decreased neuronal plasticity, alterations in cerebral blood flow, and a reduced cognitive reserve [4]. Research indicates that the incidence of POCD in older adults varies significantly, ranging from 10% to over 50%, contingent upon the type of surgery, anaesthetic technique, timing of assessment, and the cognitive domains assessed [2,5]. Cardiac surgery, particularly those utilising cardiopulmonary bypass, has traditionally exhibited a greater prevalence of postoperative cognitive dysfunction (POCD); nevertheless, evidence suggests that non-cardiac major surgeries performed under general anaesthesia may also induce considerable cognitive deterioration in elderly patients [3,6].

Multiple preoperative, intraoperative, and postoperative factors influence the onset of POCD. Age is a well-known risk factor, and patients over 65 years old are much more likely to be affected [4]. Cognitive impairment that existed before, like mild cognitive impairment (MCI) or early dementia, has been consistently linked to a higher risk [5]. Hypertension, diabetes mellitus, cerebrovascular disease, and metabolic disorders can make the risk worse by affecting cerebral perfusion and neuronal function [7]. Intraoperative factors are also very important for POCD. The type, duration, and depth of anaesthesia, along with variations in blood pressure, hypoxia, or microembolic events, can affect the incidence of postoperative cognitive decline [6,8]. Research indicates that volatile anaesthetics may exhibit neurotoxic effects in elderly patients, potentially worsening cognitive dysfunction [9]. Intraoperative stress, systemic inflammatory responses, and perioperative complications like infection, hypotension, or hypoglycemia may also make the ageing brain more vulnerable [10].

Postoperative factors, such as pain, sleep disturbances, medications (particularly sedatives and opioids), and postoperative complications, may also influence cognitive recovery. It is important to find POCD early because timely treatments like cognitive rehabilitation, improving perioperative care, and changing anaesthetic techniques may help slow down long-term cognitive decline [11]. Even though more people are aware of it, POCD is still not diagnosed enough. This is partly because most surgical settings don't routinely test for cognitive problems. Standardised neuropsychological testing and the utilisation of validated instruments are essential for the precise diagnosis of POCD. Moreover, comprehending the predictors of POCD in elderly patients enables clinicians to stratify risk, customise anaesthetic plans, and execute preventive strategies [12].

Due to the ageing global population and the rising frequency of surgical procedures in elderly patients, it is essential to conduct a systematic investigation of the incidence, risk factors, and outcomes of POCD. This study seeks to assess the incidence and predictors of POCD in elderly patients undergoing surgery with general anaesthesia, offering significant insights for the enhancement of perioperative care,

the mitigation of postoperative complications, and the improvement of long-term cognitive and functional outcomes in this susceptible demographic.

Methodology

This prospective observational study aimed to assess the incidence and predictors of postoperative cognitive dysfunction (POCD) in elderly patients undergoing elective surgery under general anaesthesia at a government hospital from January 2023 to December 2024. The Institutional Ethics Committee granted ethical approval, and all participants provided written informed consent. The study included patients aged 65 years and older, categorised as ASA physical status I–III, and scheduled for elective non-cardiac surgery under general anaesthesia. Individuals with pre-existing dementia, significant cognitive impairment (MMSE <24), major psychiatric or neurological disorders, severe sensory deficits, or those undergoing emergency surgery were excluded. Before the operation, we recorded demographic information, medical history, comorbidities, and baseline cognitive function using the Montreal Cognitive Assessment (MoCA) and the Mini-Mental State Examination (MMSE). Standard anaesthesia protocols were adhered to, encompassing induction with intravenous agents (propofol and fentanyl), muscle relaxation using atracurium, and maintenance with inhalational anaesthetics (sevoflurane or desflurane) in an oxygen/air mixture. During the operation, the patient's heart rate, pulse oximetry, non-invasive blood pressure, and capnography were all monitored. Blood pressure was kept within 20% of the baseline level. The length of the anaesthesia and surgery was recorded, as well as any problems that happened during the surgery. After surgery, cognitive tests were done again on day 1, day 7, and 1 month later. POCD was defined as a drop of 2 or more standard deviations in one or more cognitive areas compared to the baseline. We used SPSS version 25 to look at data like demographics, comorbidities, the type of anaesthesia used, and events that happened during and after surgery. Continuous variables were represented as mean ± standard deviation, while categorical variables were denoted as frequencies and percentages. The paired t-test or Wilcoxon signed-rank test was utilised to compare preoperative and postoperative cognitive scores, while univariate and multivariate logistic regression analyses were conducted to ascertain predictors of postoperative cognitive dysfunction (POCD). A p-value of less than 0.05 was deemed statistically significant**.**

Results

A total of **150 elderly patients** (≥65 years) undergoing elective non-cardiac surgery under general anesthesia between January 2023 and December 2024 were included. Among these, **82 (54.7%) were male** and **68 (45.3%) were female**, with a mean age of **71.3 ± 4.8 years** (Table 1).

Incidence of POCD: Cognitive assessment using MMSE and MoCA was performed preoperatively, on postoperative day 1, and at 1-week follow-up. Postoperative cognitive dysfunction was observed in **38 patients (25.3%)** on day 1, and in **21 patients (14%)** at 1-week follow-up (Table 2).

Cognitive Scores: The mean MMSE score decreased from **27.8 ± 1.9 preoperatively** to **25.6 ± 2.3 on postoperative day 1**, and partially recovered to **26.8 ± 2.1 at 1-week follow-up**. The MoCA score decreased from **25.3 ± 2.1 preoperatively** to **22.7 ± 2.5** on day 1 and improved to **24.1 ± 2.3** at 1 week (Table 3).

Predictors of POCD: Univariate analysis revealed that **advanced age (>75 years), longer duration of anesthesia (>3 hours), higher ASA physical status (III–IV), and presence of comorbidities (diabetes, hypertension)** were associated with higher incidence of POCD ($p < 0.05$). Multivariate logistic regression identified **age >75 years (OR 2.4, 95% CI 1.3–4.5)** and **duration of anesthesia >3 hours (OR 2.1, 95% CI 1.1–4.0)** as independent predictors (Table 4).

The **25.3% incidence of early POCD** observed in this study (Table 2) aligns with previous research reporting rates of 20–30% in elderly patients under general anesthesia. Advanced age likely increases susceptibility due to **age-related neuronal vulnerability, reduced cerebral perfusion, and lower**

cognitive reserve (Table 1). Prolonged anesthesia contributes to neuroinflammation and oxidative stress, transiently impairing cognition (Table 4). The partial recovery of cognitive scores at 1-week follow-up (Table 3) indicates that early POCD may often be transient, while persistent dysfunction in a subset underscores the need for perioperative cognitive monitoring.

Table 1: Demographic Characteristics of Patients

Characteristic	Number (n=150)	Percentage (%)
Age (years)		
65–74	98	65.3
≥75	52	34.7
Gender		
Male	82	54.7
Female	68	45.3
ASA Physical Status		
I–II	92	61.3
III–IV	58	38.7
Comorbidities		
None	46	30.7
≥1 (Diabetes/HTN/Other)	104	69.3

Table 2: Incidence of POCD

Time Point	Number of Patients	Percentage (%)
Postoperative Day 1	38	25.3
1-Week Follow-up	21	14.0

Table 3: Mean Cognitive Scores (MMSE & MoCA)

Assessment Time	MMSE (Mean ± SD)	MoCA (Mean ± SD)
Preoperative	27.8 ± 1.9	25.3 ± 2.1
Postoperative Day 1	25.6 ± 2.3	22.7 ± 2.5
1-Week Follow-up	26.8 ± 2.1	24.1 ± 2.3

Table 4: Multivariate Analysis of Risk Factors for POCD

Predictor	OR	95% CI	p-value
Age >75 years	2.4	1.3–4.5	0.004
Duration of anesthesia >3h	2.1	1.1–4.0	0.021
ASA III–IV	1.5	0.8–2.8	0.14
Presence of comorbidities	1.3	0.7–2.5	0.21

Discussion

Postoperative cognitive dysfunction (POCD) is a prevalent complication in elderly patients undergoing surgery with general anaesthesia, marked by transient or enduring impairments in memory, attention, and executive function. The current study sought to assess the incidence and predictors of POCD in elderly patients from January 2023 to December 2024. The study demonstrated that a considerable percentage of elderly patients experienced varying levels of cognitive impairment postoperatively, thereby affirming that increasing age continues to be a significant risk factor for POCD, in alignment with prior research (13,14). Changes in the brain that happen with age, such as lower synaptic density, loss of neurones, and lower cerebral perfusion, lead to a lower cognitive reserve. This makes older patients more vulnerable to the neurotoxic and inflammatory effects of general anaesthesia (15). In the present study, patients over 70 years exhibited a greater prevalence of POCD, consistent with previous research indicating a gradual escalation in risk with advancing age (13,16). Extended duration of anaesthesia and surgery emerged as significant predictors in our cohort. Prolonged exposure to anaesthetic agents may exacerbate systemic inflammatory responses, oxidative stress, and neurodegeneration, all of which can adversely affect cognitive function postoperatively (17). This finding corroborates previous research indicating a correlation between prolonged operative durations and a heightened prevalence of postoperative cognitive dysfunction (POCD) in elderly patients undergoing significant surgical interventions.

In our study, pre-existing comorbidities, especially cardiovascular disease, diabetes mellitus, and hypertension, were linked to elevated rates of POCD. These conditions may worsen perioperative cerebral hypoperfusion, microvascular injury, and oxidative stress, all of which undermine neuronal integrity and cognitive function (16). This finding aligns with previous studies that highlighted the impact of systemic disease as a major factor in postoperative cognitive decline (17). The findings of this study also underscored the temporary nature of cognitive impairment in numerous patients. While some individuals displayed transient deficits that resolved within days to weeks, a minority experienced enduring cognitive dysfunction, highlighting the necessity for prolonged monitoring and follow-up in high-risk populations. The results indicate that perioperative evaluation of cognitive function, meticulous selection of anaesthetic methods, reduction of operative duration, and enhancement of medical comorbidities are essential strategies to diminish the prevalence of POCD. Moreover, the present findings underscore the significance of personalised anaesthetic management for geriatric patients. Adjusting the depth of anaesthesia, using multimodal analgesia, keeping haemodynamic stability, and reducing stress during and after surgery may all work together to lower neuroinflammatory responses and protect cognitive function. Early identification of patients at risk for POCD facilitates preventive strategies, including cognitive prehabilitation, postoperative orientation protocols, and structured rehabilitation programs, to enhance postoperative outcomes and quality of life. In summary, this study shows that age, long periods of anaesthesia, and other health problems are the most important factors that can lead to POCD in older people who are having general anaesthesia. The elevated prevalence of POCD in this demographic underscores the necessity of preoperative risk evaluation, intraoperative vigilance, and postoperative cognitive surveillance. These findings have substantial

implications for clinical practice, underscoring the necessity for strategies to prevent, identify, and manage cognitive dysfunction in elderly surgical patients to enhance overall recovery and functional outcomes (13–17).

Conclusion

Postoperative cognitive dysfunction (POCD) is a notable complication in elderly patients undergoing general anaesthesia. Older age, longer surgery time, and other health problems were found to be important risk factors. To reduce cognitive decline and speed up recovery after surgery in this group, it is important to find them early and use targeted perioperative strategies.

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